DaimlerChrysler Corporation

SERVICE MANUAL

2000
DAKOTA

To order the special service tools used and illustrated, please refer to the instructions on inside back cover.

DaimlerChrysler Corporation reserves the right to make changes in design or to make additions to or improvements in its products without imposing any obligations upon itself to install them on its products previously manufactured.

15M0699

Paper Content
50% Recycled

FOREWORD

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information describing the operation and use of standard and optional equipment is included in the Owner's Manual provided with the vehicle.

Information in this manual is divided into groups. These groups contain general information, diagnosis, testing, adjustments, removal, installation, disassembly, and assembly procedures for the systems and components. To assist in locating a group title page, use the Group Tab Locator on the following page. The solid bar after the group title is aligned to a solid tab on the first page of each group. The first page of the group has a contents section that lists major topics within the group. If you are not sure which Group contains the information you need, look up the Component/System in the alphabetical index located in the rear of this manual.

A Service Manual Comment form is included at the rear of this manual. Use the form to provide DaimlerChrysler Corporation with your comments and suggestions.

Tightening torques are provided as a specific value throughout this manual. This value represents the midpoint of the acceptable engineering torque range for a given fastener application. These torque values are intended for use in service assembly and installation procedures using the correct OEM fasteners. When replacing fasteners, always use the same type (part number) fastener as removed.

DaimlerChrysler Corporation reserves the right to change testing procedures, specifications, diagnosis, repair methods, or vehicle wiring at any time without prior notice or incurring obligation.

GROUP TAB LOCATOR

	Introduction
0	Lubrication and Maintenance
2	Suspension
3	Differential and Driveline
5	Brakes
6	Clutch
7	Cooling System
8A	Battery
8B	Starting Systems
8C	Charging System
8D	Ignition System
8E	Instrument Panel Systems
8F	Audio Systems
8G	Horn Systems
8H	Speed Control System
8J	Turn Signal and Hazard Warning Systems
8K	Wiper and Washer Systems
8L	Lamps
8M	Passive Restraint Systems
8N	Electrically Heated Systems
8O	Power Distribution System
8P	Power Door Systems
8Q	Vehicle Theft/Security Systems
8R	Power Seat System
8S	Power Window Systems
8T	Power Mirror Systems
8U	Chime/Buzzer Warning Systems
8V	Overhead Console Systems
8W	Wiring Diagrams
9	Engine
11	Exhaust System
13	Frame and Bumpers
14	Fuel System
19	Steering
21	Transmission
22	Tires and Wheels
23	Body
24	Heating and Air Conditioning
25	Emission Control Systems
	Component and System Index

INTRODUCTION

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
BODY CODE PLATE 2
EQUIPMENT IDENTIFICATION PLATE. 3
INTERNATIONAL SYMBOLS 3
FASTENER IDENTIFICATION 4
FASTENER USAGE 7
THREADED HOLE REPAIR 7
METRIC SYSTEM 7
TORQUE REFERENCES 7
VEHICLE IDENTIFICATION NUMBER (VIN)
PLATE 1

DESCRIPTION AND OPERATION

VEHICLE IDENTIFICATION NUMBER (VIN) PLATE

The Vehicle Identification Number (VIN) plate is attached to the top left side of the instrument panel (Fig. 1). The VIN contains 17 characters that provide data concerning the vehicle. Refer to the decoding chart to determine the identification of a vehicle.

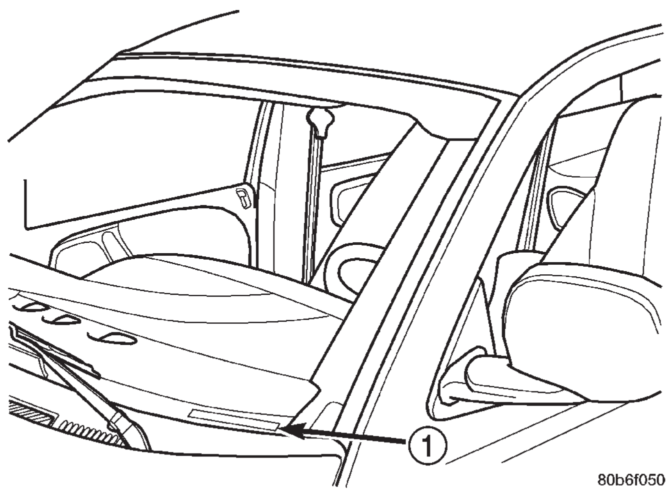


Fig. 1 Vehicle Identification Number (VIN)

1 – VIN

VIN DECODING INFORMATION

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1= USA
2	Make	B = Dodge
3	Vehicle Type	7 = Truck
4	Gross Vehicle Weight Rating	F = 4001-5000 lbs. G = 5001-6000 lbs. H = 6001-7000 lbs.
5	Vehicle Line	G = Dakota Dakota Sport Dakota 4x4 L = Dakota Dakota Sport Dakota 4x2

DESCRIPTION AND OPERATION (Continued)

POSITION	INTERPRETATION	CODE = DESCRIPTION
6	Series	2 = Dakota Dakota Sport Dakota SLT
7	Body Style	2 = Club Cab 6 = Conventional Cab
8	Engine	P = 2.5L X = 3.9L N=4.7L Y = 5.2L Z = 5.9L
9	Check Digit	
10	Model Year	Y=2000
11	Assembly Plant	S = Dodge City Assembly
12 Thru 17	Vehicle Build Sequence	Assembly Sequence

BODY CODE PLATE

LOCATION AND DECODING

A metal body code plate is attached to the floor pan under the passenger seat. Remove the passenger seat, door sill scuff plate and pull back the carpet to access the body code plate. There are seven lines of information on the body code plate. Lines 5, 6, and 7 are not used to define service information. Information reads from left to right, starting with line 4 in the center of the plate to line 1 at the bottom of the plate (Fig. 2).

The last code imprinted on a vehicle code plate will be followed by the imprinted word END. When two vehicle code plates are required, the last available spaces on the first plate will be imprinted with the letters CTD (for continued).

When a second vehicle code plate is necessary, the first four spaces on each row will not be used because of the plate overlap.

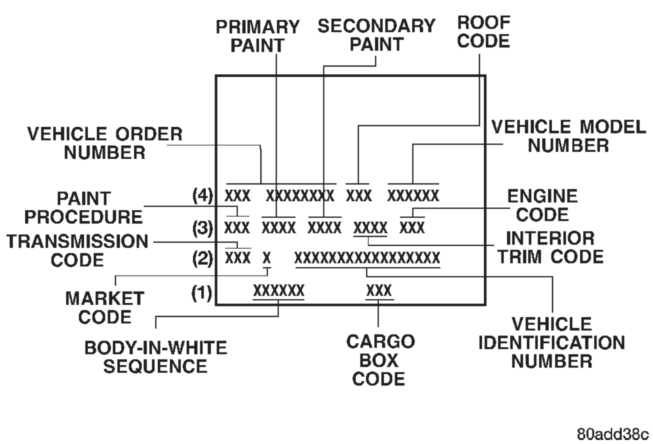


Fig. 2 Body Code Plate Decoding

BODY CODE PLATE—LINE 4

DIGITS 1 THROUGH 12

Vehicle Order Number

DIGITS 13, 14, AND 15

Open Space

DIGITS 16, 17, AND 18

Car Line Shell

- AN1 = Dakota 4 X 2
- AN5 = Dakota 4 X 4

DIGIT 19

Price Class

- L = Dakota (All)

DIGITS 20 AND 21

Body Type

- 31 = Dakota Club Cab (130.9 in. Wheel Base)
- 61 = Dakota (111.9 in. Wheel Base)
- 62 = Dakota (123.9 in. Wheel Base)

BODY CODE PLATE—LINE 3

DIGITS 1,2, AND 3

Paint Procedure

DIGIT 4

Open Space

DIGITS 5 THROUGH 8

Primary Paint

Refer to Group 23, Body for color codes.

DIGIT 9

Open Space

DESCRIPTION AND OPERATION (Continued)

DIGITS 10 THROUGH 13

Secondary Paint

DIGIT 14

Open Space

DIGITS 15 THROUGH 18

Interior Trim Code

DIGIT 19

Open Space

DIGITS 20, 21, AND 22

Engine Code
- EPE = 2.5 L 4 cyl. MPI Gasoline
- EHC = 3.9 L 6 cyl. MPI Gasoline
- ELF = 5.2 L 8 cyl. MPI Gasoline
- ELM = 5.9 L 8 cyl. MPI Gasoline

BODY CODE PLATE—LINE 2

DIGITS 1, 2, AND 3

Transmission Codes
- DDK = 5–Speed Manual (NVG 1500)
- DDQ = 5–Speed Manual (AX15)
- DDC = 5–Speed Manual (NVG 3500)
- DGK = 4–Speed Automatic (42RE)
- DGW = 4–Speed Automatic (44RE)
- DGT = 4–Speed Automatic (46RE)

DIGIT 4

Open Space

DIGIT 5

Market Code
- B = International
- C = Canada
- M = Mexico
- U = United States

DIGIT 6

Open Space

DIGITS 7 THROUGH 23

Vehicle Identification Number (VIN)

Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

BODY CODE PLATE—LINE 1

DIGITS 1 THROUGH 6

Body-in-white assembly sequence.

DIGITS 7 THROUGH 9

Open Space

DIGITS 10 THROUGH 12

Cargo box code
- XBS = Sweptline

DIGITS 13 THROUGH 16

Open Space

EQUIPMENT IDENTIFICATION PLATE

The Equipment Identification Plate (Fig. 3) is located at the left, front of the inner hood panel. The plate lists information concerning the vehicle as follows:
- The model.
- The wheelbase.
- The VIN (Vehicle Identification Number).
- The T. O. N. (order number).
- The optional and special equipment installed on the vehicle.

Refer to the information listed on the plate when ordering replacement parts.

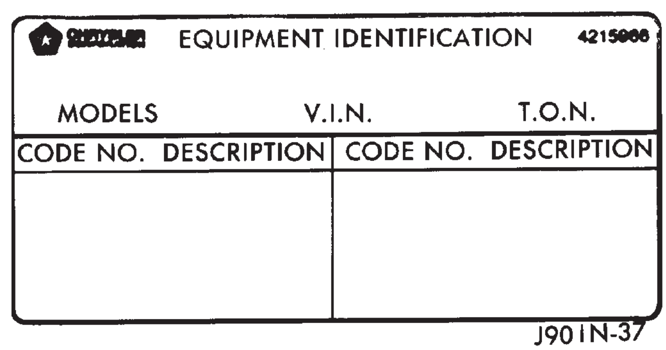


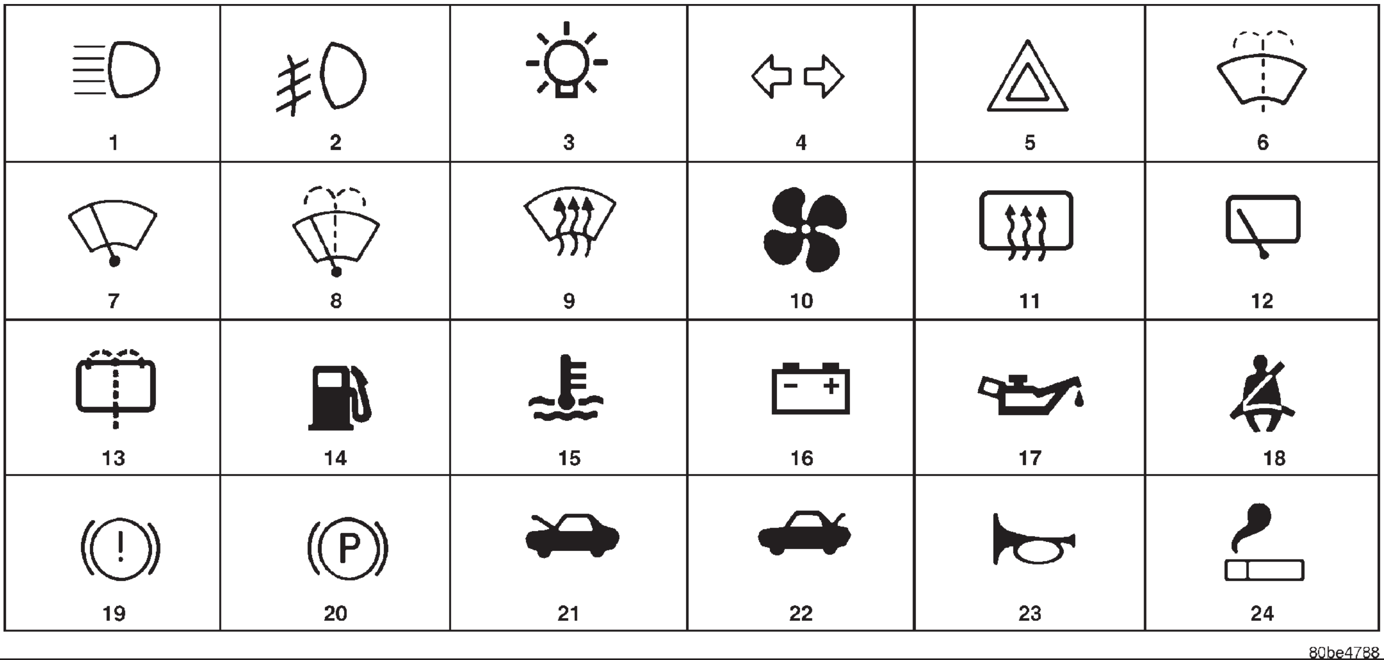
Fig. 3 Equipment Identification Plate—Typical

INTERNATIONAL SYMBOLS

DESCRIPTION

The graphic symbols illustrated in the following International Control and Display Symbols Chart are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

DESCRIPTION AND OPERATION (Continued)



1	High Beam	13	Rear Window Washer
2	Fog Lamps	14	Fuel
3	Headlamp, Parking Lamps, Panel Lamps	15	Engine Coolant Temperature
4	Turn Warning	16	Battery Charging Condition
5	Hazard Warning	17	Engine Oil
6	Windshield Washer	18	Seat Belt
7	Windshield Wiper	19	Brake Failure
8	Windshield Wiper and Washer	20	Parking Brake
9	Windscreen Demisting and Defrosting	21	Front Hood
10	Ventilating Fan	22	Rear hood (Decklid)
11	Rear Window Defogger	23	Horn
12	Rear Window Wiper	24	Lighter

FASTENER IDENTIFICATION

DESCRIPTION

GRADE/CLASS IDENTIFICATION

The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

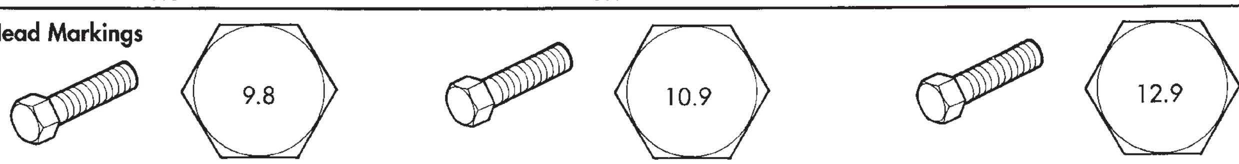
DESCRIPTION AND OPERATION (Continued)

FASTENER IDENTIFICATION

Bolt Markings and Torque - Metric

Commercial Steel Class: 9.8, 10.9, 12.9

Bolt Head Markings

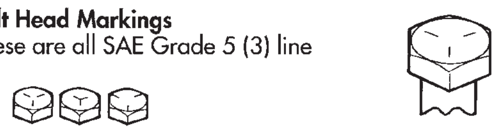


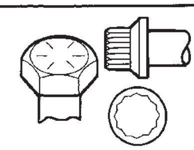
Body Size Diam. mm	9.8 Torque Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb	10.9 Torque Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb	12.9 Torque Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	25	60	45	45	35	70	50	55	40
12	70	55	55	40	105	75	80	60	125	95	100	75
14	115	85	90	65	160	120	125	95	195	145	150	110
16	180	130	140	100	240	175	190	135	290	210	220	165
18	230	170	180	135	320	240	250	185	400	290	310	230

Bolt Markings and Torque Values - U.S. Customary

SAE Grade Number: 5, 8

Bolt Head Markings
These are all SAE Grade 5 (3) line



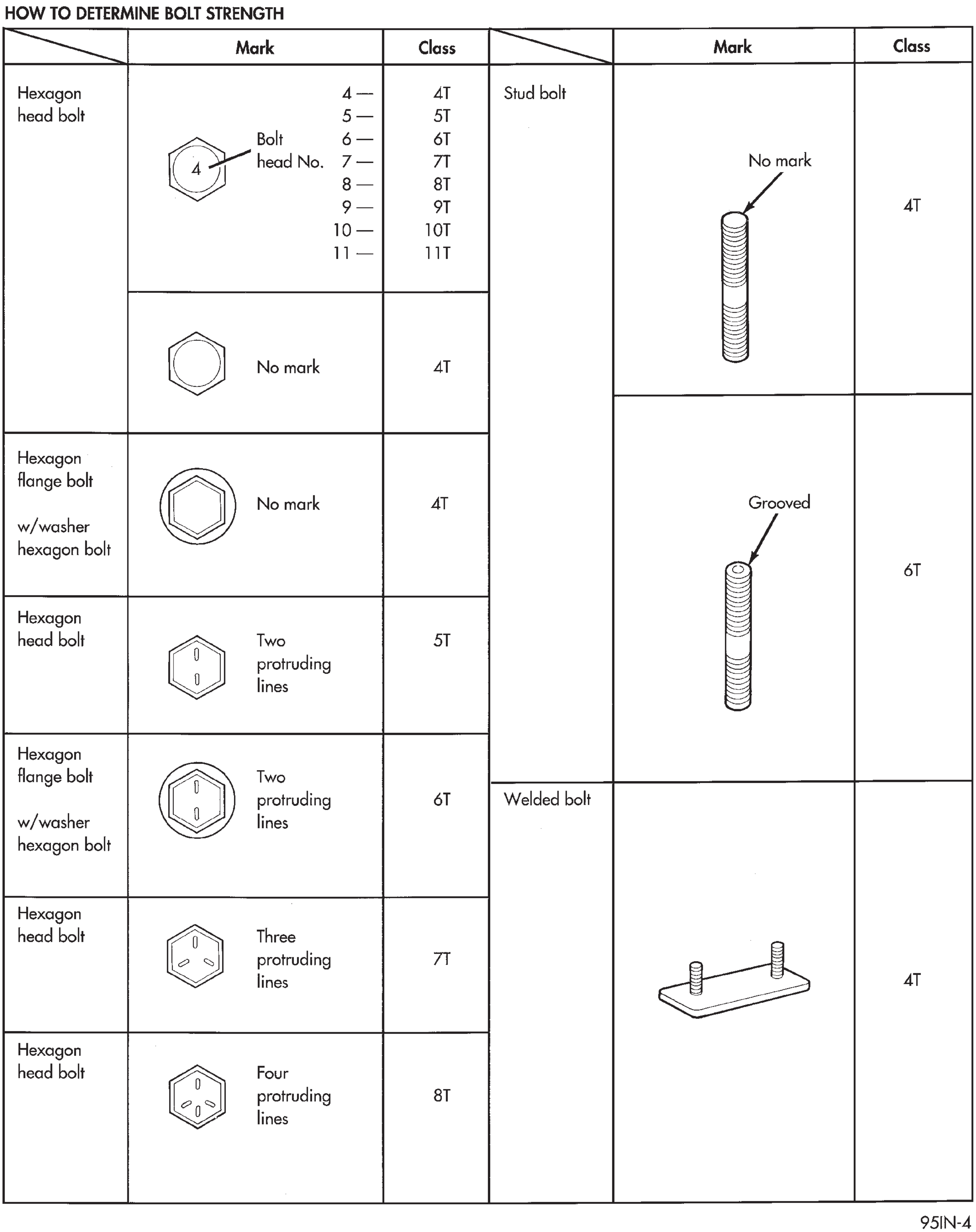


Body Size	Bolt Torque - Grade 5 Bolt Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb	Bolt Torque - Grade 8 Bolt Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	12	9
- 28	12	9	9	7	18	13	14	10
5/16 - 18	20	15	16	12	30	22	24	18
- 24	23	17	19	14	33	24	25	19
3/8 - 16	40	30	25	20	55	40	40	30
- 24	40	30	35	25	60	45	45	35
7/16 - 14	60	45	45	35	90	65	65	50
- 20	65	50	55	40	95	70	75	55
1/2 - 13	95	70	75	55	130	95	100	75
- 20	100	75	80	60	150	110	120	90
9/16 - 12	135	100	110	80	190	140	150	110
- 18	150	110	115	85	210	155	170	125
5/8 - 11	180	135	150	110	255	190	205	150
- 18	210	155	160	120	290	215	230	170
3/4 - 10	325	240	255	190	460	340	365	270
- 16	365	270	285	210	515	380	410	300
7/8 - 9	490	360	380	280	745	550	600	440
- 14	530	390	420	310	825	610	660	490
1 - 8	720	530	570	420	1100	820	890	660
- 14	800	590	650	480	1200	890	960	710

80bdbd8c

DESCRIPTION AND OPERATION (Continued)

FASTENER STRENGTH



HOW TO DETERMINE BOLT STRENGTH

	Mark	Class
Hexagon head bolt	Bolt head No. 4 —	4T
	5 —	5T
	6 —	6T
	7 —	7T
	8 —	8T
	9 —	9T
	10 —	10T
	11 —	11T
	No mark	4T
Hexagon flange bolt w/washer hexagon bolt	No mark	4T
Hexagon head bolt	Two protruding lines	5T
Hexagon flange bolt w/washer hexagon bolt	Two protruding lines	6T
Hexagon head bolt	Three protruding lines	7T
Hexagon head bolt	Four protruding lines	8T
Stud bolt	No mark	4T
	Grooved	6T
Welded bolt		4T

95IN-4

DESCRIPTION AND OPERATION (Continued)

FASTENER USAGE

WARNING: USE OF AN INCORRECT FASTENER MAY RESULT IN COMPONENT DAMAGE OR PERSONAL INJURY.

Figure art, specifications and torque references in this Service Manual are identified in metric and SAE format.

During any maintenance or repair procedures, it is important to salvage all fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification must be used.

THREADED HOLE REPAIR

Most stripped threaded holes can be repaired using a Helicoil®. Follow the manufactures recommendations for application and repair procedures.

METRIC SYSTEM

DESCRIPTION

The metric system is based on quantities of one, ten, one hundred, one thousand and one million.

The following chart will assist in converting metric units to equivalent English and SAE units, or vise versa.

CONVERSION FORMULAS AND EQUIVALENT VALUES

MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
in-lbs	x 0.11298	= Newton Meters (N·m)	N·m	x 8.851	= in-lbs
ft-lbs	x 1.3558	= Newton Meters (N·m)	N·m	x 0.7376	= ft-lbs
Inches Hg (60° F)	x 3.377	= Kilopascals (kPa)	kPa	x 0.2961	= Inches Hg
psi	x 6.895	= Kilopascals (kPa)	kPa	x 0.145	= psi
Inches	x 25.4	= Millimeters (mm)	mm	x 0.03937	= Inches
Feet	x 0.3048	= Meters (M)	M	x 3.281	= Feet
Yards	x 0.9144	= Meters	M	x 1.0936	= Yards
mph	x 1.6093	= Kilometers/Hr. (Km/h)	Km/h	x 0.6214	= mph
Feet/Sec	x 0.3048	= Meters/Sec (M/S)	M/S	x 3.281	= Feet/Sec
mph	x 0.4470	= Meters/Sec (M/S)	M/S	x 2.237	= mph
Kilometers/ Hr. (Km/h)	x 0.27778	= Meters/Sec (M/S)	M/S	x 3.600	Kilometers/Hr. (Km/h)

COMMON METRIC EQUIVALENTS

1 inch = 25 Millimeters	1 Cubic Inch = 16 Cubic Centimeters
1 Foot = 0.3 Meter	1 Cubic Foot = 0.03 Cubic Meter
1 Yard = 0.9 Meter	1 Cubic Yard = 0.8 Cubic Meter
1 Mile = 1.6 Kilometers	

Refer to the Metric Conversion Chart to convert torque values listed in metric Newton- meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.)

TORQUE REFERENCES

DESCRIPTION

Individual Torque Charts appear at the end of many Groups. Refer to the Standard Torque Specifications Chart for torque references not listed in the individual torque charts.

DESCRIPTION AND OPERATION (Continued)

METRIC CONVERSION CHART

in-lbs to N•m

in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m
2	.2260	42	4.7453	82	9.2646	122	13.7839	162	18.3032
4	.4519	44	4.9713	84	9.4906	124	14.0099	164	18.5292
6	.6779	46	5.1972	86	9.7165	126	14.2359	166	18.7552
8	.9039	48	5.4232	88	9.9425	128	14.4618	168	18.9811
10	1.1298	50	5.6492	90	10.1685	130	14.6878	170	19.2071
12	1.3558	52	5.8751	92	10.3944	132	14.9138	172	19.4331
14	1.5818	54	6.1011	94	10.6204	134	15.1397	174	19.6590
16	1.8077	56	6.3270	96	10.8464	136	15.3657	176	19.8850
18	2.0337	58	6.5530	98	11.0723	138	15.5917	178	20.1110
20	2.2597	60	6.7790	100	11.2983	140	15.8176	180	20.3369
22	2.4856	62	7.0049	102	11.5243	142	16.0436	182	20.5629
24	2.7116	64	7.2309	104	11.7502	144	16.2696	184	20.7889
26	2.9376	66	7.4569	106	11.9762	146	16.4955	186	21.0148
28	3.1635	68	7.6828	108	12.2022	148	16.7215	188	21.2408
30	3.3895	70	7.9088	110	12.4281	150	16.9475	190	21.4668
32	3.6155	72	8.1348	112	12.6541	152	17.1734	192	21.6927
34	3.8414	74	8.3607	114	12.8801	154	17.3994	194	21.9187
36	4.0674	76	8.5867	116	13.1060	156	17.6253	196	22.1447
38	4.2934	78	8.8127	118	13.3320	158	17.8513	198	22.3706
40	4.5193	80	9.0386	120	13.5580	160	18.0773	200	22.5966

N•m to in-lbs

N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb
.2	1.7702	4.2	37.1747	8.2	72.5792	12.2	107.9837	16.2	143.3882
.4	3.5404	4.4	38.9449	8.4	74.3494	12.4	109.7539	16.4	145.1584
.6	5.3107	4.6	40.7152	8.6	76.1197	12.6	111.5242	16.6	146.9287
.8	7.0809	4.8	42.4854	8.8	77.8899	12.8	113.2944	16.8	148.6989
1	8.8511	5	44.2556	9	79.6601	13	115.0646	17	150.4691
1.2	10.6213	5.2	46.0258	9.2	81.4303	13.2	116.8348	17.2	152.2393
1.4	12.3916	5.4	47.7961	9.4	83.2006	13.4	118.6051	17.4	154.0096
1.6	14.1618	5.6	49.5663	9.6	84.9708	13.6	120.3753	17.6	155.7798
1.8	15.9320	5.8	51.3365	9.8	86.7410	13.8	122.1455	17.8	157.5500
2	17.7022	6	53.1067	10	88.5112	14	123.9157	18	159.3202
2.2	19.4725	6.2	54.8770	10.2	90.2815	14.2	125.6860	18.5	163.7458
2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	19	168.1714
2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	19.5	172.5970
2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	20	177.0225
3	26.5534	7	61.9579	11	97.3624	15	132.7669	20.5	181.4480
3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	21	185.8736
3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	22	194.7247
3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	23	203.5759
3.8	33.6342	7.8	69.0388	11.8	104.4433	15.8	139.8478	24	212.4270
4	35.4045	8	70.8090	12	106.2135	16	141.6180	25	221.2781

ft-lbs to N•m

ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m
1	1.3558	21	28.4722	41	55.5885	61	82.7049	81	109.8212
2	2.7116	22	29.8280	42	56.9444	62	84.0607	82	111.1770
3	4.0675	23	31.1838	43	58.3002	63	85.4165	83	112.5328
4	5.4233	24	32.5396	44	59.6560	64	86.7723	84	113.8888
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2446
6	8.1349	26	35.2513	46	62.3676	66	89.4840	86	116.6004
7	9.4907	27	36.6071	47	63.7234	67	90.8398	87	117.9562
8	10.8465	28	37.9629	48	65.0793	68	92.1956	88	119.3120
9	12.2024	29	39.3187	49	66.4351	69	93.5514	89	120.6678
10	13.5582	30	40.6745	50	67.7909	70	94.9073	90	122.0236
11	14.9140	31	42.0304	51	69.1467	71	96.2631	91	123.3794
12	16.2698	32	43.3862	52	70.5025	72	97.6189	92	124.7352
13	17.6256	33	44.7420	53	71.8583	73	98.9747	93	126.0910
14	18.9815	34	46.0978	54	73.2142	74	100.3316	94	127.4468
15	20.3373	35	47.4536	55	74.5700	75	101.6862	95	128.8026
16	21.6931	36	48.8094	56	75.9258	76	103.0422	96	130.1586
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5144
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8702
19	25.7605	39	52.8769	59	79.9933	79	107.1196	99	134.2260
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820

N•m to ft-lbs

N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1	.7376	21	15.9888	41	30.2400	61	44.9913	81	59.7425
2	1.4751	22	16.2264	42	30.9776	62	45.7289	82	60.4801
3	2.2127	23	16.9639	43	31.7152	63	46.4664	83	61.2177
4	2.9502	24	17.7015	44	32.4527	64	47.2040	84	61.9552
5	3.6878	25	18.4391	45	33.1903	65	47.9415	85	62.6928
6	4.4254	26	19.1766	46	33.9279	66	48.6791	86	63.4303
7	5.1629	27	19.9142	47	34.6654	67	49.4167	87	64.1679
8	5.9005	28	20.6517	48	35.4030	68	50.1542	88	64.9545
9	6.6381	29	21.3893	49	36.1405	69	50.8918	89	65.6430
10	7.3756	30	22.1269	50	36.8781	70	51.6293	90	66.3806
11	8.1132	31	22.8644	51	37.6157	71	52.3669	91	67.1181
12	8.8507	32	23.6020	52	38.3532	72	53.1045	92	67.8557
13	9.5883	33	24.3395	53	39.0908	73	53.8420	93	68.5933
14	10.3259	34	25.0771	54	39.8284	74	54.5720	94	69.3308
15	11.0634	35	25.8147	55	40.5659	75	55.3172	95	70.0684
16	11.8010	36	26.5522	56	41.3035	76	56.0547	96	70.8060
17	12.5386	37	27.2898	57	42.0410	77	56.7923	97	71.5435
18	13.2761	38	28.0274	58	42.7786	78	57.5298	98	72.2811
19	14.0137	39	28.7649	59	43.5162	79	58.2674	99	73.0187
20	14.7512	40	29.5025	60	44.2537	80	59.0050	100	73.7562

in. to mm

in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
.01	.254	.21	5.334	.41	10.414	.61	15.494	.81	20.574
.02	.508	.22	5.588	.42	10.668	.62	15.748	.82	20.828
.03	.762	.23	5.842	.43	10.922	.63	16.002	.83	21.082
.04	1.016	.24	6.096	.44	11.176	.64	16.256	.84	21.336
.05	1.270	.25	6.350	.45	11.430	.65	16.510	.85	21.590
.06	1.524	.26	6.604	.46	11.684	.66	16.764	.86	21.844
.07	1.778	.27	6.858	.47	11.938	.67	17.018	.87	22.098
.08	2.032	.28	7.112	.48	12.192	.68	17.272	.88	22.352
.09	2.286	.29	7.366	.49	12.446	.69	17.526	.89	22.606
.10	2.540	.30	7.620	.50	12.700	.70	17.780	.90	22.860
.11	2.794	.31	7.874	.51	12.954	.71	18.034	.91	23.114
.12	3.048	.32	8.128	.52	13.208	.72	18.288	.92	23.368
.13	3.302	.33	8.382	.53	13.462	.73	18.542	.93	23.622
.14	3.556	.34	8.636	.54	13.716	.74	18.796	.94	23.876
.15	3.810	.35	8.890	.55	13.970	.75	19.050	.95	24.130
.16	4.064	.36	9.144	.56	14.224	.76	19.304	.96	24.384
.17	3.318	.37	9.398	.57	14.478	.77	19.558	.97	24.638
.18	4.572	.38	9.652	.58	14.732	.78	19.812	.98	24.892
.19	4.826	.39	9.906	.59	14.986	.79	20.066	.99	25.146
.20	5.080	.40	10.160	.60	15.240	.80	20.320	1.00	25.400

mm to in.

mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189
.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228
.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268
.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307
.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346
.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386
.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425
.08	.00315	.28	.01102	.48	.01890	.68	.02677	.88	.03465
.09	.00354	.29	.01142	.49	.01929	.69	.02717	.89	.03504
.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543
.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583
.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622
.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661
.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701
.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740
.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780
.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819
.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858
.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.03898
.20	.00787	.40	.01575	.60	.02362	.80	.03150	1.00	.03937

J901N-10

DESCRIPTION AND OPERATION (Continued)

TORQUE SPECIFICATIONS

SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque: Hexagon head bolt N•m	Hexagon head bolt kgf-cm	Hexagon head bolt ft-lbf	Hexagon flange bolt N•m	Hexagon flange bolt kgf-cm	Hexagon flange bolt ft-lbf
4T	6	1	5	55	48 in.-lbf	6	60	52 in.-lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.-lbf	7.5	75	65 in.-lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.-lbf	9	90	78 in.-lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130

LUBRICATION AND MAINTENANCE

TABLE OF CONTENTS

page page

LUBRICANTS AND CAPACITIES 1
MAINTENANCE SCHEDULES 4
JUMP STARTING, TOWING AND HOISTING 10

LUBRICANTS AND CAPACITIES

TABLE OF CONTENTS

page page

SERVICE PROCEDURES
DESCRIPTION 1
PARTS AND LUBRICANT RECOMMENDATIONS 1
INTERNATIONAL SYMBOLS 1
CLASSIFICATION OF LUBRICANTS. 1
FLUID CAPACITIES 2

SERVICE PROCEDURES

DESCRIPTION

Service and maintenance procedures for components and systems listed in Schedule "A" or "B" can be found by using the Group Tab Locator index at the front of this manual. If it is not clear which group contains the information needed, refer to the index at the back of this manual.

There are two maintenance schedules that show proper service based on the conditions that the vehicle is subjected to.

Schedule **"A"**, lists scheduled maintenance to be performed when the vehicle is used for general transportation.

Schedule **"B"**, lists maintenance intervals for vehicles that are operated under the conditions listed at the beginning of that schedule section.

Use the schedule that best describes the driving conditions.

Where time and mileage are listed, follow the interval that occurs first.

PARTS AND LUBRICANT RECOMMENDATIONS

RECOMMENDATIONS

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

INTERNATIONAL SYMBOLS

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid inspection and fill locations (Fig. 1).

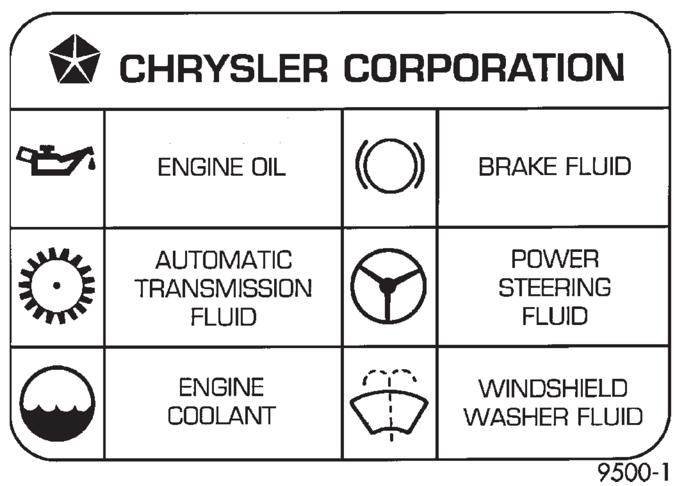


Fig. 1 International Symbols

CLASSIFICATION OF LUBRICANTS

Only lubricants bearing designations defined by the following organization should be used to service a DaimlerChrysler Corporation vehicle.

- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API) (Fig. 2)

SERVICE PROCEDURES (Continued)

- National Lubricating Grease Institute (NLGI) (Fig. 3)

ENGINE OIL

SAE VISCOSITY RATING INDICATES ENGINE OIL VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 30 specifies a single viscosity engine oil. Engine oils also have multiple viscosities. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range.

- SAE 30 = single grade engine oil.
- SAE 10W-30 = multiple grade engine oil.

DaimlerChrysler Corporation only recommends multiple grade engine oils.

API QUALITY CLASSIFICATION

This symbol (Fig. 2) on the front of an oil container means that the oil has been certified by the American Petroleum Institute (API) to meet all the lubrication requirements specified by DailmlerChrysler Corporation.

Refer to Group 9, Engine for gasoline engine oil specification.

Fig. 2 API Symbol

GEAR LUBRICANTS

SAE ratings also apply to multiple grade gear lubricants. In addition, API classification defines the lubricants usage.

LUBRICANTS AND GREASES

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol (Fig. 3) on the label. At the bottom NLGI symbol is the usage and quality identification letters. Wheel bearing lubricant is identified by the letter “G”. Chassis lubricant is identified by the latter “L”. The letter following the usage letter indicates the quality of the lubricant. The following symbols indicate the highest quality.

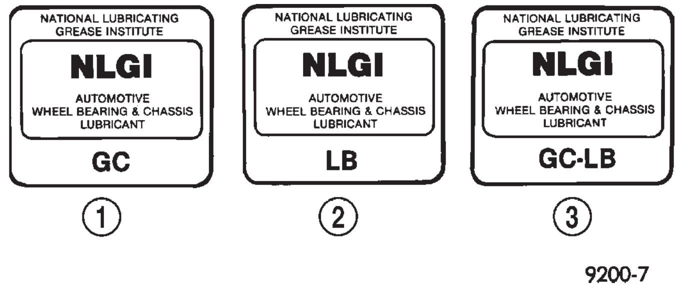


Fig. 3 NLGI Symbol

1 – WHEEL BEARINGS
2 – CHASSIS LUBRICATION
3 – CHASSIS AND WHEEL BEARINGS

SPECIALIZED LUBRICANTS AND OILS

Some maintenance or repair procedures may require the use of specialized lubricants or oils. Consult the appropriate sections in this manual for the correct application of these lubricants.

FLUID CAPACITIES

Fuel Tank

Standard	57 L (15 gal.)
Optional	83 L (22 gal.)

Engine Oil W/Filter change

2.5L	4.3 L (4.5 qts.)
3.9L	4.3 L (4.5 qts.)
4.7L	5.7L (6.0 qts.)
5.9L	4.7 L (5.0 qts.)

Cooling System

2.5L	9.3 L (9.8 qts.)
3.9L	13.2 L (14.0 qts.)
4.7L	16.0 L (17.0 qts.)
5.9L	13.5 L (14.3 qts.)

Automatic Transmission

Dry fill capacity. *

42RE	9.1-9.5 L (19–20 pts.)
45RFE	13.33 L (28.0pts.)
46RE	9.1-9.5 L (19–20pts.)

* Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary. Refer to Group 21, Transmission for proper fluid fill procedure.

SERVICE PROCEDURES (Continued)

Manual Transmission

NV3500	2.0 L (4.2 pts.)
AX15	3.1 L (6.6 pts.)
*NV1500HD	2.2 L (4.7pts.)

* Include 0.1 L (0.22 pts.) Friction Modifier.

Transfer Case

NP231	1.2 L (2.5 pts.)
NP231–HD	1.2 L (2.5 pts.)
NP242	1.2 L (2.5 pts.)

Front Axle

Model 194	1.4 L (3.0 pts.)

Rear Axle

8-1/4 in	2.1 L (4.4 pts.)
9-1/4 in	2.3 L (4.8 pts.)

Power Steering

Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to Section 19 of the service manual for proper fill and bleed procedures.

MAINTENANCE SCHEDULES

TABLE OF CONTENTS

page

SERVICE PROCEDURES
MAINTENANCE SCHEDULES 4

SERVICE PROCEDURES

MAINTENANCE SCHEDULES

There are two maintenance schedules that show proper service for the Dakota.

First is Schedule **"A"**. It lists all the scheduled maintenance to be performed under "normal" operating conditions.

Second is Schedule **"B"**. It is a schedule for vehicles that are operated under the conditions listed at the beginning of that schedule.

Use the schedule that best describes the driving conditions.

Where time and mileage are listed, follow the interval that occurs first.

At Each Stop For Gasoline

- Check engine oil level, add as required.
- Check windshield washer solvent and add if required.
- Clean windshield and wiper blades as required.

Once A Month

- Check tire pressure and look for unusual wear or damage.
- Inspect battery and clean and tighten terminals as required.
- Check fluid levels of coolant reservoir, power steering and transmission and add as needed.
- Check all lights and all other electrical items for correct operation.
- Inspect and clean wiper blades. Replace if required.

At Each Oil Change

- Inspect exhaust system.
- Inspect brake hoses.
- Rotate the tires at each oil change interval shown on Schedule "A": (7,500 miles) or every other interval shown on Schedule "B" (6,000 miles).
- Check engine coolant level, hoses, and clamps.

EMISSION CONTROL SYSTEM MAINTENANCE

The scheduled emission maintenance listed in **bold type** on the Maintenance Schedules, must be done at the mileage specified to assure the continued proper functioning of the emission control system. These, and all other maintenance services included in this manual, should be done to provide the best vehicle performance and reliability. More frequent maintenance may be needed for vehicles in severe operating conditions such as dusty areas and very short trip driving.

FLUID FILL LOCATIONS AND LUBRICATION POINTS

The fluid fill/check locations and lubrication points are located in each applicable group.

SCHEDULE "A"

7,500 Miles (12 000 km) or at 6 months

- Change engine oil.
- Replace engine oil filter.

15,000 Miles (24 000 km) or at 12 months

- Change engine oil.
- Replace engine oil filter.

22,500 Miles (36 000 km) or at 18 months

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints if required.
- Inspect front wheel bearings.
- Inspect brake linings.

30,000 Miles (48 000 km) or at 24 months

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- Drain and refill automatic transmission fluid and change filter (4.7L only).

SERVICE PROCEDURES (Continued)

37,500 Miles (60 000 km) or at 30 months

- Change engine oil.
- Replace engine oil filter.
- Drain and refill transfer case fluid.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L, and 5.9L only).

45,000 Miles (72 000 km) or at 36 months

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints if required.
- Inspect front wheel bearings.
- Inspect brake linings.
- Flush and replace engine coolant at 36 months, regardless of mileage.

52,500 Miles (84 000 km) or at 42 months

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant if not done at 36 months.

60,000 Miles (96 000 km) or at 48 months

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace ignition cables (2.5L, 3.9L, 5.9L).**
- **Inspect PCV valve, replace as necessary. (3.9L, 4.7L, and 5.9L)***
- **Replace spark plugs.**
- Inspect auto tension drive belt and replace if required (3.9L, & 5.9L).
- Inspect and adjust tension on drive belt (2.5L).
- Drain and refill automatic transmission fluid and change filter (4.7L only).

67,500 Miles (108 000 km) or at 54 months

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints if required.
- Inspect front wheel bearings.
- Inspect brake linings.

75,000 Miles (120 000 km) or at 60 months

- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).
- Drain and refill transfer case.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.
- Inspect auto tension drive belt and replace if required (3.9L, & 5.9L).

82,500 Miles (132 000 km) or at 66 months

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

90,000 Miles (144 000 km) or at 72 months

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Inspect PCV valve, replace as necessary. (3.9L, 4.7L, and 5.9L)***
- **Replace spark plugs.**
- Lubricate front suspension ball joints if required.
- Inspect front wheel bearings.
- Inspect brake linings.
- Inspect auto tension drive belt and replace if required (3.9L, 4.7L, & 5.9L).Δ

97,500 Miles (156 000 km) or at 78 months

- Change engine oil.
- Replace engine oil filter.

105,000 Miles (168 000 km) or at 84 months

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant if it has been 30,000 Miles (48 000km) or 24 months since last change.
- Inspect auto tension drive belt and replace if required (3.9L, 4.7L, & 5.9L).Δ

112,500 Miles (181 000 km) or at 90 months

- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L only).
- Drain and refill transfer case fluid.
- Lubricate front suspension ball joints if required.
- Inspect front wheel bearings.
- Inspect brake linings.
- Flush and replace engine coolant if it has been 30,000 Miles (48 000km) or 24 months since last change.

120,000 Miles (192 000 km) or at 96 months

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace ignition cables (2.5L, 3.9L & 5.9L).**
- **Inspect PCV valve, replace as necessary. (3.9L, 4.7L, and 5.9L)***
- **Replace spark plugs.**

SERVICE PROCEDURES (Continued)

• Inspect auto tension drive belt and replace if required (3.9L, 4.7L, & 5.9L).Δ

• Drain and refill automatic transmission fluid and change filter (4.7L only).

*This maintenance is recommended by Daimler-Chrysler Corporation to the owner but is not required to maintain the warranty on the PCV valve.

ΔThis maintenance is not required if the belt was previously replaced.

Important: Inspection and service should also be performed any time a malfunction is observed or suspected.

SCHEDULE “B”

Use schedule “B” if the vehicle is usually operated under the following conditions:

• Frequent short trip driving less than 5 miles (8 km)
• Frequent driving in dusty conditions
• Trailer towing
• Extensive idling
• More than 50% of the driving is at sustained high speeds during hot weather, above 90°F (32°C)

3,000 Miles (5 000 km)

• Change engine oil.
• Replace engine oil filter.

6,000 Miles (10 000 km)

• Change engine oil.
• Replace engine oil filter.

9,000 Miles (14 000 km)

• Change engine oil.
• Replace engine oil filter.

12,000 Miles (19 000 km)

• Change engine oil.
• Replace engine oil filter.
• Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
• Drain and refill automatic transmission fluid and change filter (4.7L only).
• Lubricate front suspension ball joints if required.
• Change rear axle fluid.
• Change front axle fluid (4x4).
• Inspect brake linings.

15,000 Miles (24 000 km)

• Change engine oil.
• Replace engine oil filter.
• **Inspect engine air cleaner element, replace as necessary.**

18,000 Miles (29 000 km)

• Change engine oil.
• Replace engine oil filter.
• Drain and refill manual transmission fluid (3.9L only).

21,000 Miles (34 000 km)

• Change engine oil.
• Replace engine oil filter.
• Inspect front wheel bearings.

24,000 Miles (38 000 km)

• Change engine oil.
• Replace engine oil filter.
• Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
• Drain and refill automatic transmission fluid and change filter (4.7L only).
• Lubricate front suspension ball joints if required.
• Change rear axle fluid.
• Change front axle fluid (4x4).
• Inspect brake linings.

27,000 miles (43 000 km)

• Change engine oil.
• Replace engine oil filter.

30,000 Miles (48 000 km)

• Change engine oil.
• Replace engine oil filter.
• **Replace engine air cleaner element.**
• **Replace spark plugs.**
• **Inspect PCV valve, replace as necessary. (3.9L, 4.7L and 5.9L)***
• Inspect and adjust drive tension on drive belt (2.5L).

33,000 Miles (53,000 km)

• Change engine oil.
• Replace engine oil filter.

36,000 Miles (58 000 km)

• Change engine oil.
• Replace engine oil filter.
• Lubricate front suspension ball joints if required.
• Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
• Drain and refill automatic transmission fluid and change filter (4.7L only).
• Drain and refill transfer case fluid.
• Change rear axle fluid.
• Change front axle fluid (4x4).
• Inspect brake linings.

SERVICE PROCEDURES (Continued)

39,000 Miles (62 000 km)

- Change engine oil.
- Replace engine oil filter.

42,000 Miles (67 000 km)

- Change engine oil.
- Replace engine oil filter.
- Inspect front wheel bearings.

45,000 Miles (72 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Inspect engine air cleaner element, replace as necessary.**

48,000 Miles (77 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints if required.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
- Drain and refill automatic transmission fluid and change filter (4.7L only).
- Change rear axle fluid.
- Change front axle fluid (4x4).
- Inspect brake linings.

51,000 Miles (82 000 km)

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.

54,000 Miles (86 000 km)

- Change engine oil.
- Replace engine oil filter.
- Drain and refill manual transmission fluid (3.9L only).

57,000 Miles (91 000 km)

- Change engine oil.
- Replace engine oil filter.

60,000 Miles (96 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace ignition cables.**
- **Inspect PCV valve, replace as necessary. (3.9L, 4.7L, and 5.9L)***
- **Replace spark plugs.**
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
- Drain and refill automatic transmission fluid and change filter (4.7L only).
- Lubricate front suspension ball joints if required.
- Change rear axle fluid.
- Change front axle fluid (4x4).
- Inspect brake linings.
- Inspect auto tension drive belt and replace if required (3.9L & 5.9L).

63,000 Miles (101 000 km)

- Change engine oil.
- Replace engine oil filter.
- Inspect front wheel bearings.

66,000 Miles (106,000 km)

- Change engine oil.
- Replace engine oil filter.

69,000 Miles (110 000 km)

- Change engine oil.
- Replace engine oil filter.

72,000 Miles (115 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints if required.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
- Drain and refill automatic transmission fluid and change filter (4.7L only).
- Drain and refill transfer case fluid.
- Change rear axle fluid.
- Change front axle fluid (4x4).
- Inspect brake linings.

75,000 Miles (120 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Inspect engine air cleaner element, replace as necessary.**
- Inspect auto tension drive belt and replace if required (3.9L, 4.7L & 5.9L).Δ

78,000 Miles (125 000 km)

- Change engine oil.
- Replace engine oil filter.

81,000 Miles (130 000 km)

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) since last change.

84,000 Miles (134 000 km)

- Change engine oil.
- Replace engine oil filter.
- Inspect front wheel bearings.
- Lubricate front suspension ball joints if required.

SERVICE PROCEDURES (Continued)

- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
- Drain and refill automatic transmission fluid and change filter (4.7L only).
- Change rear axle fluid.
- Change front axle fluid (4x4).
- Inspect brake linings.

87,000 Miles (139 000 km)

- Change engine oil.
- Replace engine oil filter.

90,000 Miles (144 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- **Inspect PCV valve, replace as necessary. (3.9L, 4.7L, and 5.9L)***
- Inspect auto tension drive belt and replace if required (3.9L, 4.7L, & 5.9L).Δ
- Inspect and adjust tension on drive belt (2.5L).

93,000 Miles (149 000 km)

- Change engine oil.
- Replace engine oil filter.

96,000 Miles (154 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints if required.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
- Drain and refill automatic transmission fluid and change filter (4.7L only).
- Change rear axle fluid.
- Change front axle fluid (4x4).
- Inspect brake linings.

99,000 Miles (158 000 km)

- Change engine oil
- Replace engine oil filter.

102,000 Miles (163 000 km)

- Change engine oil.
- Replace engine oil filter.

105,000 Miles (168 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Inspect engine air cleaner element, replace as necessary.**
- Inspect front wheel bearings.
- Inspect auto tension drive belt and replace if required (3.9L, 4.7L, & 5.9L).Δ

108,000 Miles (173 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate front suspension ball joints if required.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
- Drain and refill automatic transmission fluid and change filter (4.7L only).
- Drain and refill transfer case fluid.
- Change rear axle fluid.
- Change front axle fluid (4x4).
- Inspect brake linings.

111,000 Miles (178 000 km)

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) since last change.

114,000 Miles (182 000 km)

- Change engine oil.
- Replace engine oil filter.

117,000 Miles (187 000 km)

- Change engine oil.
- Replace engine oil filter.

120,000 Miles (192 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace ignition cables.**
- **Inspect PCV valve, replace as necessary. (3.9L, 4.7L, and 5.9L)***
- **Replace spark plugs.**
- Lubricate front suspension ball joints if required.
- Drain and refill automatic transmission fluid. Replace filter and adjust bands (3.9L & 5.9L).‡
- Drain and refill automatic transmission fluid and change filter (4.7L only).
- Change rear axle fluid.
- Change front axle fluid (4x4).
- Inspect brake linings.
- Inspect auto tension drive belt and replace if required (3.9L, 4.7L, & 5.9L).Δ
- Inspect and adjust tension on drive belt (2.5L).

*This maintenance is recommended by Chrysler Corporation to the customer but is not required to maintain warranty on the PCV valve.

ΔThis maintenance is not required if the belt was previously replaced.

‡Prolonged operation with heavy loading, especially in hot weather, use of vehicle for off-the-highway operation, and trailer towing require the more

SERVICE PROCEDURES (Continued)

frequent transmission service indicated with a ‡ in Schedule “B”. Perform these services if the vehicle is usually operated under these conditions.

Important: Inspection and service should also be performed any time a malfunction is observed or suspected.

JUMP STARTING, TOWING AND HOISTING

TABLE OF CONTENTS

	page
SERVICE PROCEDURES	
JUMP STARTING PROCEDURE	10
TOWING RECOMMENDATIONS	11
TWO WHEEL DRIVE VEHICLE TOWING	12
FOUR-WHEEL-DRIVE VEHICLE TOWING	12
HOISTING RECOMMENDATIONS	13

SERVICE PROCEDURES

JUMP STARTING PROCEDURE

WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN GROUP 8A, BATTERY/STARTING/CHARGING SYSTEMS DIAGNOSTICS. DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT. DO NOT JUMP START WHEN MAINTENANCE FREE BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR. DO NOT JUMP START A VEHICLE WHEN THE BATTERY FLUID IS BELOW THE TOP OF LEAD PLATES. DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE. DO NOT USE OPEN FLAME NEAR BATTERY. REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT. WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW BATTERY VOLTAGE TO EXCEED 16 VOLTS. REFER TO INSTRUCTIONS PROVIDED WITH DEVICE BEING USED.

CAUTION: When using another vehicle as a booster, do not allow vehicles to touch. Electrical systems can be damaged on either vehicle.

TO JUMP START A DISABLED VEHICLE:

(1) Raise hood on disabled vehicle and visually inspect engine compartment for:

- Battery cable clamp condition, clean if necessary.
- Frozen battery.
- Yellow or bright color test indicator, if equipped.
- Low battery fluid level.
- Generator drive belt condition and tension.
- Fuel fumes or leakage, correct if necessary.

CAUTION: If the cause of starting problem on disabled vehicle is severe, damage to booster vehicle charging system can result.

(2) When using another vehicle as a booster source, park the booster vehicle within cable reach. Turn off all accessories, set the parking brake, place the automatic transmission in PARK or the manual transmission in NEUTRAL and turn the ignition OFF.

(3) On disabled vehicle, place gear selector in park or neutral and set park brake. Turn off all accessories.

(4) Connect jumper cables to booster battery. RED clamp to positive terminal (+). BLACK clamp to negative terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result. Review all warnings in this procedure.

(5) On disabled vehicle, connect RED jumper cable clamp to positive (+) terminal. Connect BLACK jumper cable clamp to engine ground as close to the ground cable attaching point as possible (Fig. 1).

(6) Start the engine in the vehicle which has the booster battery, let the engine idle a few minutes, then start the engine in the vehicle with the discharged battery.

CAUTION: Do not crank starter motor on disabled vehicle for more than 15 seconds, starter will overheat and could fail.

(7) Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 seconds, stop cranking engine and allow starter to cool (15 min.), before cranking again.

DISCONNECT CABLE CLAMPS AS FOLLOWS:

- Disconnect BLACK cable clamp from engine ground on disabled vehicle.
- When using a Booster vehicle, disconnect BLACK cable clamp from battery negative terminal. Disconnect RED cable clamp from battery positive terminal.
- Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

SERVICE PROCEDURES (Continued)

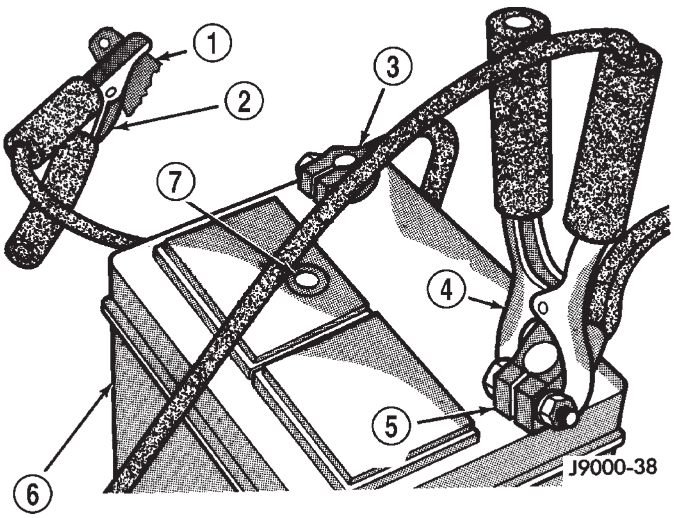


Fig. 1 Jumper Cable Clamp Connections

1 – ENGINE GROUND
2 – NEGATIVE JUMPER CABLE
3 – BATTERY NEGATIVE CABLE
4 – POSITIVE JUMPER CABLE
5 – BATTERY POSITIVE CABLE
6 – BATTERY
7 – TEST INDICATOR

TOWING RECOMMENDATIONS

A vehicle equipped with an SAE approved Wheel-lift towing device can be used to tow all **Short Bed DAKOTA** vehicles. Long Bed vehicles must be towed with a Flat-bed device (Fig. 2). When towing a 4WD vehicle, use tow dollies under the opposite end of the vehicle.

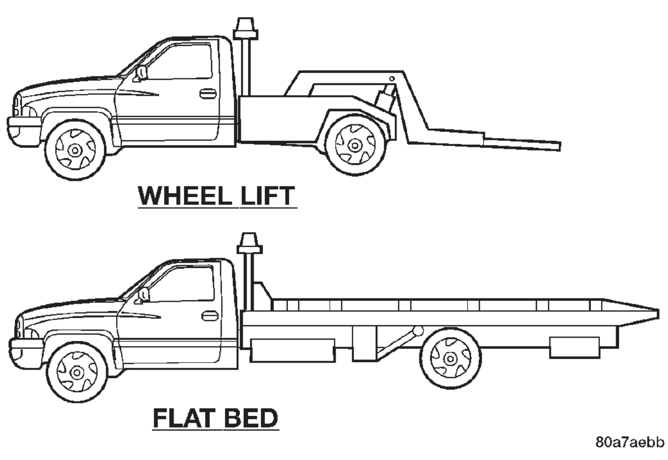


Fig. 2 Tow Vehicles With Approved Equipment

SAFETY PRECAUTIONS

NOTE: The following safety precautions must be observed when towing a vehicle.

- Secure loose and protruding parts.
- Always use a safety chain system that is independent of the lifting and towing equipment.
- Do not allow towing equipment to contact the disabled vehicle's fuel tank.
- Do not allow anyone under the disabled vehicle while it is lifted by the towing device.
- Do not allow passengers to ride in a vehicle being towed.
- Always observe state and local laws regarding towing regulations.
- Do not tow a vehicle in a manner that could jeopardize the safety of the operator, pedestrians or other motorists.
- Do not attach tow chains, T-hooks, or J-hooks to a bumper, steering linkage, drive shafts or a non-reinforced frame hole.
- Do not tow a heavily loaded vehicle. Damage to the cab, cargo box or frame may result. Use a flat bed device to transport a loaded vehicle.

GROUND CLEARANCE

CAUTION: If vehicle is towed with wheels removed, install lug nuts to retain brake drums.

A towed vehicle should be raised until lifted wheels are a minimum 100 mm (4 in) from the ground. Be sure there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or steep rises in the road. If necessary, remove the wheels from the lifted end of the vehicle and lower the vehicle closer to the ground, to increase the ground clearance at the opposite end of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums.

RAMP ANGLE

If a vehicle with flat bed towing equipment is used, the approach ramp angle should not exceed 15 degrees.

TOWING WHEN KEYS ARE NOT AVAILABLE

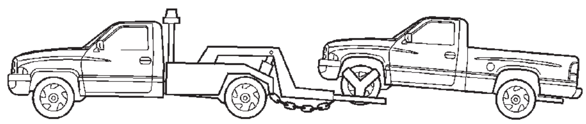
When the vehicle is locked and keys are not available, use a flat bed hauler. A Sling-type device can be used on 4WD vehicles provided **all the wheels are lifted off the ground using tow dollies.**

SERVICE PROCEDURES (Continued)

TWO WHEEL DRIVE VEHICLE TOWING

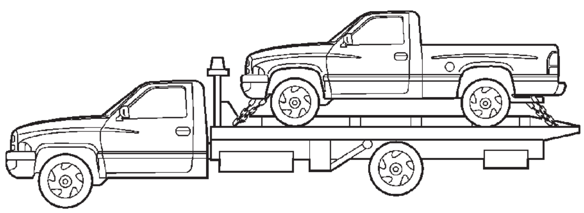
TOWING-REAR END LIFTED

CAUTION: Short bed vehicles must be towed with a Wheel-lift device (Fig. 3) or transported on a flat bed (Fig. 4). Long bed vehicles must be transported on a flat bed.



80a7aeae

Fig. 3 Short Bed Vehicle Towing—Typical



80a7aeaf

Fig. 4 Long Bed Vehicle Towing—Typical

2WD vehicles can be towed with the front wheels on the surface for extended distances at speeds not exceeding 48 km/h (30 mph).

(1) Attach wheel lift device to rear wheels.

(2) Attach safety chains to frame rails. Route chains so not to interfere with tail pipe when vehicle is lifted.

(3) Turn the ignition switch to the OFF position to unlock the steering wheel.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(4) Secure steering wheel in straight ahead position with a clamp device designed for towing.

(5) Verify that steering components are in good condition.

(6) Shift the transmission to NEUTRAL.

TOWING-FRONT END LIFTED

When lifting from the front end, all vehicles must be towed with a Wheel-lift device or transported on a flat bed.

(1) Attach Wheel-lift device to front wheels.

(2) Attach the safety chains to the disabled vehicle at the frame rails.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(3) Turn the ignition switch to the OFF position to unlock the steering wheel.

TWO WHEEL DRIVE—MANUAL AND AUTOMATIC TRANSMISSION

Provided the transmission is operable, tow only in **NEUTRAL** at speeds not to exceed 30 mph (50 km/h) and distances less than 15 miles (25km/h).

If the vehicle is to be towed more than 15 miles, the propeller shaft should be disconnected or place tow dollies under rear wheels.

FOUR-WHEEL-DRIVE VEHICLE TOWING

FOUR WHEEL DRIVE TOWING—REAR END LIFTED

CAUTION: Short bed vehicles must be towed with a Wheel-lift device (Fig. 3) or transported on a flat bed. Long bed vehicles must be transported on a flat bed (Fig. 4). When using a Wheel-lift device, all wheels must be lifted off the ground using tow dollies.

(1) Raise the front of the vehicle off the ground and install tow dollies under front wheels.

(2) Attach wheel lift device to rear wheels.

(3) Attach safety chains to frame rails. Route chains so not to interfere with tail pipe when vehicle is lifted.

(4) Turn the ignition switch to the OFF position to unlock the steering wheel.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

(5) Secure steering wheel in straight ahead position with a clamp device designed for towing.

(6) Shift the transfer case to NEUTRAL.

FOUR WHEEL DRIVE TOWING—FRONT END LIFTED

When lifting from the front end, all vehicles must be towed with a wheel-lift device or transported on a flat bed.

(1) Raise the rear of the vehicle off the ground and install tow dollies under rear wheels.

(2) Attach wheel lift device to front wheels.

(3) Attach the safety chains to the disabled vehicle at the frame rails.

CAUTION: Do not use steering column lock to secure steering wheel during towing operation.

SERVICE PROCEDURES (Continued)

(4) Turn the ignition switch to the OFF position to unlock the steering wheel.

(5) Shift the transfer case to NEUTRAL.

HOISTING RECOMMENDATIONS

FLOOR JACK

When properly positioned, a floor jack can be used to lift a Dakota vehicle (Fig. 5). Support the vehicle in the raised position with jack stands at the front and rear ends of the frame rails.

CAUTION: Do not attempt to lift a vehicle with a floor jack positioned under:
- **An axle tube.**
- **Aluminum differential.**
- **A body side sill.**
- **A steering linkage component.**
- **A drive shaft.**
- **The engine or transmission oil pan.**
- **The fuel tank.**
- **A front suspension arm.**

HOIST

A vehicle can be lifted with:
- A single-post, frame-contact hoist.
- A twin-post, chassis hoist.
- A ramp-type, drive-on hoist.

NOTE: When a frame-contact type hoist is used, verify that the lifting pads are positioned properly (Fig. 5).

CAUTION: DO NOT LET THE REAR WHEELS/AXLE HANG UNSUPPORTED WHEN THE VEHICLE IS LIFTED WITH THE PARKING BRAKE APPLIED.

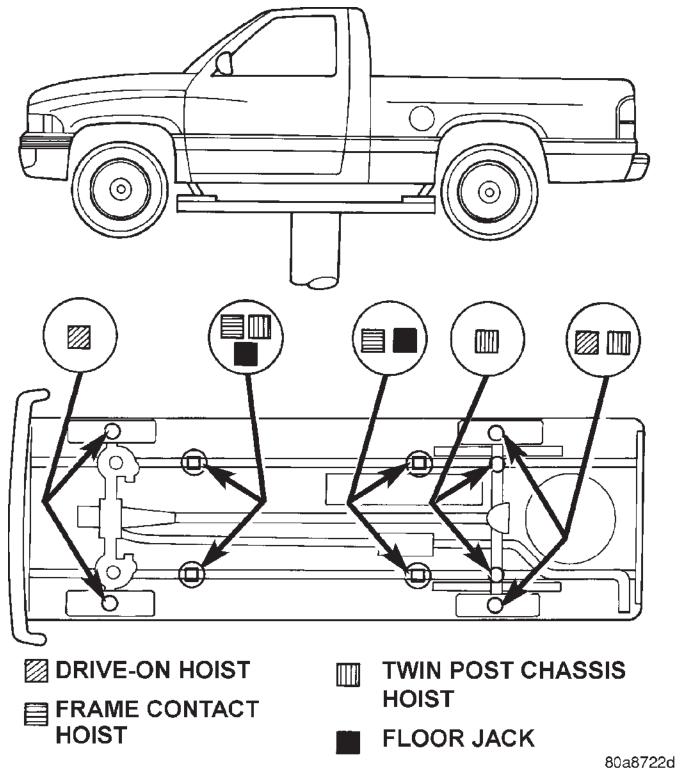


Fig. 5 Correct Vehicle Lifting Locations—Typical

WARNING: THE HOISTING AND JACK LIFTING POINTS PROVIDED ARE FOR A COMPLETE VEHICLE. WHEN A CHASSIS OR DRIVETRAIN COMPONENT IS REMOVED FROM A VEHICLE, THE CENTER OF GRAVITY IS ALTERED MAKING SOME HOISTING CONDITIONS UNSTABLE. PROPERLY SUPPORT OR SECURE VEHICLE TO HOISTING DEVICE WHEN THESE CONDITIONS EXIST.

SUSPENSION

TABLE OF CONTENTS

page	page
ALIGNMENT 1	FRONT SUSPENSION - 4x4 14
FRONT SUSPENSION - 4x2 6	REAR SUSPENSION 23

ALIGNMENT

TABLE OF CONTENTS

page	page
DESCRIPTION AND OPERATION	WHEEL ALIGNMENT 4
WHEEL ALIGNMENT 1	SPECIFICATIONS
DIAGNOSIS AND TESTING	ALIGNMENT 5
PRE-ALIGNMENT INSPECTION 2	
SERVICE PROCEDURES	
SUSPENSION HEIGHT- 4x4 3	

DESCRIPTION AND OPERATION

WHEEL ALIGNMENT

DESCRIPTION

Wheel alignment involves the correct positioning of the wheels in relation to the vehicle. The positioning is accomplished through suspension and steering linkage adjustments. An alignment is considered essential for efficient steering, good directional stability and to minimize tire wear. The most important measurements of an alignment are caster, camber and toe (Fig. 1).

CAUTION: Never attempt to modify suspension or steering components by heating or bending.

NOTE: Periodic lubrication of the front suspension/steering system components may be required. Rubber bushings must never be lubricated. Refer to Group 0, Lubrication And Maintenance for the recommended maintenance schedule.

OPERATION

- **CASTER** is the forward or rearward tilt of the steering knuckle from vertical. Tilting the top of the knuckle forward provides negative caster. Tilting the top of the knuckle rearward provides positive caster. Positive caster promotes directional stability. This angle enables the front wheels to return to a straight ahead position after turns.
- **CAMBER** is the inward or outward tilt of the wheel relative to the center of the vehicle. Tilting the top of the wheel inward provides negative camber. Tilting the top of the wheel outward provides positive camber. Incorrect camber will cause wear on the inside or outside edge of the tire.
- **TOE** is the difference between the leading inside edges and trailing inside edges of the front tires. Wheel toe position out of specification cause's unstable steering, uneven tire wear and steering wheel off- center. The wheel toe position is the **final** front wheel alignment adjustment.
- **THRUST ANGLE** is the angle of the rear axle relative to the centerline of the vehicle. Incorrect thrust angle can cause off-center steering and excessive tire wear. This angle is not adjustable, damaged component(s) must be replaced to correct the thrust angle.

DESCRIPTION AND OPERATION (Continued)

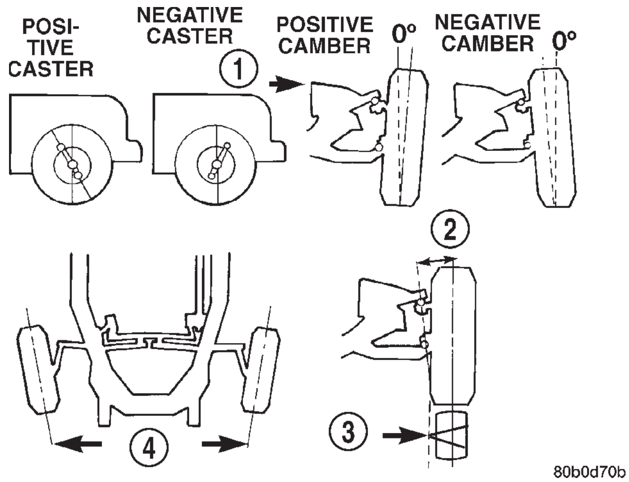


Fig. 1 Wheel Alignment Measurements

1 – FRONT OF VEHICLE
2 – STEERING AXIS INCLINATION
3 – PIVOT POINT
4 – TOE-IN

DIAGNOSIS AND TESTING

PRE-ALIGNMENT INSPECTION

Before starting wheel alignment, the following inspection and necessary corrections must be completed. Refer to Suspension and Steering System Diagnosis Chart for additional information.

(1) Inspect tires for size, air pressure and tread wear.

(2) Inspect front wheel bearings for wear.

(3) Inspect front wheels for excessive radial or lateral runout and balance.

(4) Inspect ball studs, linkage pivot points and steering gear for looseness, roughness or binding.

(5) Inspect suspension components for wear and noise.

(6) On 4x4 vehicles check suspension height.

(7) Road test the vehicle.

SUSPENSION AND STEERING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT END NOISE	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Lower ball joint (4x4).	3. Gease joint and perform diagnosis and testing.
EXCESSIVE PLAY IN STEERING	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering gear.	3. Adjust or replace steering gear.
FRONT WHEELS SHIMMY	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tires worn or out of balance.	3. Replace or balance tires.
	4. Alignment.	4. Align vehicle to specifications.
VEHICLE INSTABILITY	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE STEERING EFFORT	1. Loose or worn steering gear.	1. Adjust or replace steering gear.
	2. Column coupler binding.	2. Replace coupler.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.
VEHICLE PULLS TO ONE SIDE	1. Tire pressure.	1. Adjust tire pressure.
	2. Alignment.	2. Align vehicle to specifications.
	3. Loose or worn steering or suspension components.	3. Tighten or replace components as necessary.
	4. Radial tire lead.	4. Rotate or replace tire as necessary.
	5. Brake pull.	5. Repair brake as necessary.
	6. Weak or broken spring.	6. Replace spring.
	7. Ride height 4WD only.	7. Measure and adjust ride height.

SERVICE PROCEDURES

SUSPENSION HEIGHT- 4x4

The vehicle suspension height must be measured and adjusted if necessary before performing wheel alignment on a 4x4 vehicle. Also when front suspension components have be replaced. This measure must be performed with the vehicle supporting it's own weight and taken on both sides of the vehicle.

HEIGHT MEASUREMENT

(1) Inspect tires for the correct size and air pressure.

(2) Jounce the front of the vehicle.

(3) Measure and record the distance between the ground and the center of the lower suspension arm rear mounting bolt head (Fig. 2).

(4) Measure and record the distance between the ground and the center of the front wheel (Fig. 2).

(5) Subtract the first measurement from the second measurement. The difference between the two measurement should be 47 mm (1.85 inches) ± 3.25 mm (0.125 inches).

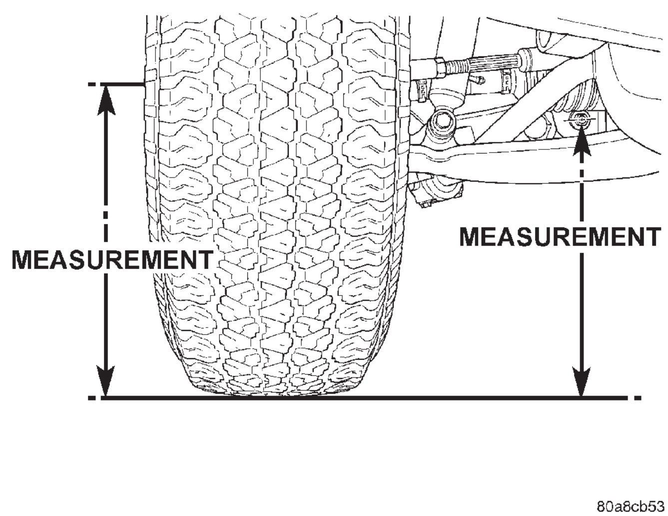


Fig. 2 Height Measurement

HEIGHT ADJUSTMENT

To adjust the vehicle height turn the torsion bar adjustment bolt CLOCKWISE to raise the vehicle and COUNTER CLOCKWISE to lower the vehicle.

CAUTION: ALWAYS raise the vehicle to the correct suspension height, NEVER lower the vehicle to obtain the correct suspension height. If the vehicle suspension height is too high, lower the vehicle below the height specification. Then raise the vehicle to the correct suspension height specification. This will insure the vehicle maintains the proper suspension height.

NOTE: If a height adjustment has been made, perform height measurement again on both sides of the vehicle.

SERVICE PROCEDURES (Continued)

WHEEL ALIGNMENT

NOTE: 4x4 suspension height measurement must be performed before alignment.

CAMBER AND CASTER ADJUSTMENT

Camber and caster angle adjustments involve changing the position of the upper suspension arm pivot bar (Fig. 3).

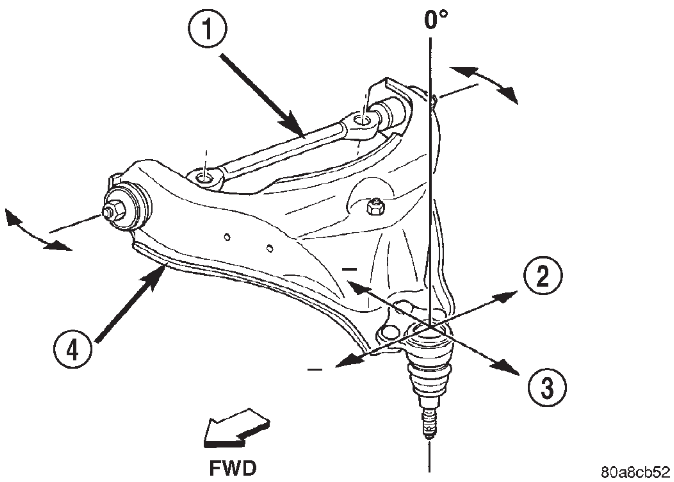


Fig. 3 Caster & Camber Adjustment-Typical

1 – PIVOT BAR
2 – + CASTER
3 – + CAMBER
4 – UPPER ARM SUSPENSION

NOTE: On 4x2 vehicles use Alignment Tool 8393 for alignment. The tool attaches to the pivot bar on the upper control arm.

CASTER

Moving the rear position of the pivot bar in or out, will change the caster angle significantly and camber angle only slightly. To maintain the camber angle while adjusting caster, move the rear of the pivot bar in or out. Then move the front of the pivot bar slightly in the opposite direction.

For example, to increase a positive caster angle, move the rear position of the pivot bar inward (toward the engine). Move the front of pivot bar outward (away from the engine) slightly until the original camber angle is obtained.

CAMBER

Move the front of the pivot bar in or out. This will change the camber angle significantly and caster angle slightly.

After adjustment is made tighten the pivot bar nuts to proper torque specification.

TOE ADJUSTMENT

The wheel toe position adjustment is the final adjustment.

(1) Start the engine and turn wheels both ways before straightening the wheels. Secure the steering wheel with the front wheels in the straight-ahead position.

(2) Loosen the tie rod jam nuts.

NOTE: Each front wheel should be adjusted for one-half of the total toe position specification. This will ensure the steering wheel will be centered when the wheels are positioned straight-ahead.

(3) Adjust the wheel toe position by turning the tie rod as necessary (Fig. 4).

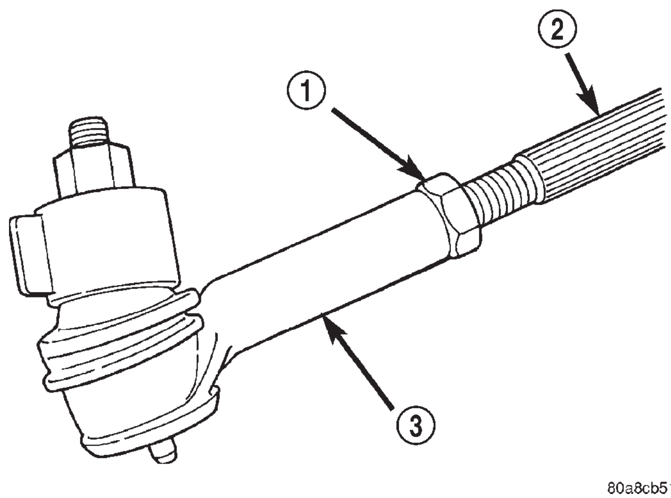


Fig. 4 Toe Adjustment

1 – JAM NUT
2 – TIE ROD
3 – TIE ROD END

(4) Tighten the tie rod jam nut to 75 N·m (55 ft. lbs.).

(5) Verify the specifications.

(6) Turn off engine.

SPECIFICATIONS

ALIGNMENT

VEHICLE	WHEEL BASE	CASTER (± 0.50°)	CAMBER (± 0.50°)	TOTAL TOE (± 0.06°)
4x2	111.9	2.99°	−0.25°	0.10°
	130.9	3.13°	−0.25°	0.10°
4x4	111.9	3.16°	−0.25°	0.10°
	130.9	3.27°	−0.25°	0.10°
MAXIMUM RT to LT DIFFERENCE		0.50°	0.50°	0.06

DAKOTA RT

VEHICLE	WHEEL BASE	CASTER (± 0.50°)	CAMBER (± 0.50°)	TOTAL TOE (± 0.06°)
4x2	111.9	3.67°	−0.34°	0.10°
	130.9	3.81°	−0.34°	0.10°
MAXIMUM RT to LT DIFFERENCE		0.50°	0.50°	0.06

NOTE: All alignment specifications are in degrees.

FRONT SUSPENSION - 4x2

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
FRONT SUSPENSION - 4X2	6
SHOCK ABSORBERS	6
COIL SPRINGS	7
STEERING KNUCKLE	7
SUSPENSION ARMS	7
STABILIZER BAR	7
DIAGNOSIS AND TESTING	
LOWER BALL JOINT	7
UPPER BALL JOINT	8
SHOCK DIAGNOSIS	8
REMOVAL AND INSTALLATION	
SHOCK ABSORBER	8
COIL SPRING	8
STEERING KNUCKLE	9
LOWER SUSPENSION ARM	10
UPPER SUSPENSION ARM	10
STABILIZER BAR	11
HUB/BEARING	11
WHEEL MOUNTING STUDS	12
SPECIFICATIONS	
TORQUE CHART	12
SPECIAL TOOLS	
FRONT SUSPENSION	13

DESCRIPTION AND OPERATION

FRONT SUSPENSION - 4X2

DESCRIPTION

The front suspension is designed to allow each wheel to adapt to different road surfaces independently. The wheels are mounted to hub bearings on the cast iron steering knuckle spindles. The double-row hub bearings are sealed and lubricated for life. The steering knuckles turn (pivot) on ball joints riveted to the outboard portion of the suspension arms. The ball joints are lubricated for life.

The 4x2 front suspension is comprised of (Fig. 1) :

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

CAUTION: Suspension components with rubber/ urethane bushings (except stabilizer bar) should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

- Shock absorbers
- Coil springs
- Suspension arms
- Stabilizer bar
- Jounce/Rebound Bumpers
- Steering Knuckle

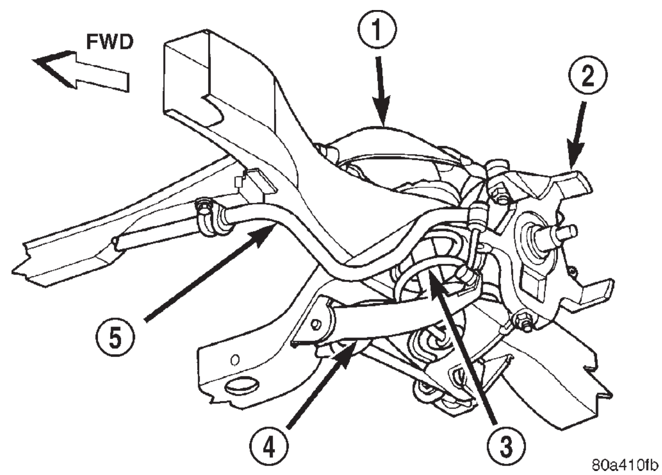


Fig. 1 Front Suspension - 4X2

1 – UPPER SUSPENSION ARM
2 – STEERING KNUCKLE
3 – COIL SPRING
4 – LOWER SUSPENSION ARM
5 – STABILIZER BAR

SHOCK ABSORBERS

DESCRIPTION

The top of the low-pressure gas charged shock are bolted to the frame. The bottom of the shock are bolted to the lower suspension arm.

OPERATION

The shock absorbers dampen jounce and rebound of the vehicle over various road conditions.

DESCRIPTION AND OPERATION (Continued)

COIL SPRINGS

DESCRIPTION

The springs mount between the lower suspension arms and frame rail spring seats. A rubber isolator seats on top off the spring to help prevent noise.

OPERATION

The coil springs control ride quality and maintain proper ride height.

STEERING KNUCKLE

DESCRIPTION

The knuckle is a single casting with legs machined for the upper and lower ball joints. The knuckle also has machined mounting locations for the front brake calipers and hub bearing.

OPERATION

The steering knuckle pivot between the upper and lower ball joint. Steering linkage attached to the knuckle allows the vehicle to be steered.

SUSPENSION ARMS

DESCRIPTION

The upper suspension arm bolts on frame brackets through the arm pivot shaft. The frame brackets have slotted holes which allow the arms to be adjusted for caster and camber. Pivot shaft bushings are not replaceable.

The lower suspension arms bolt to the lower frame brackets and pivot through bushings, these bushings are not replaceable.

The suspension arms have lube for life riveted ball studs. The suspension arm travel (jounce) is limited through the use of urethane bumpers. Rebound travel is limited by the shock absorber.

STABILIZER BAR

DESCRIPTION

The bar extends across the front underside of the chassis and mounts on the frame rails. Links connected the bar to the lower suspension arms. Stabilizer bar mounts are isolated by rubber bushings. Links are isolated with rubber grommets.

OPERATION

The stabilizer bar is used to minimize vehicle front sway during turns. The spring steel bar helps to control the vehicle body in relationship to the suspension.

DIAGNOSIS AND TESTING

LOWER BALL JOINT

(1) Raise the front of the vehicle. Place safety floor stands under both lower suspension arms as far outboard as possible. Lower the vehicle to allow the stands to support some or all of the vehicle weight.

NOTE: The upper suspension arms must not contact the rebound bumpers.

(2) Remove the tire and wheel assemblies.

(3) Mount a dial indicator solidly under the lower suspension arm.

(4) Position indicator plunger against the bottom of the steering knuckle lower ball joint boss.

NOTE: The dial indicator plunger must be perpendicular to the machined surface of the steering knuckle lower ball joint boss (Fig. 2).

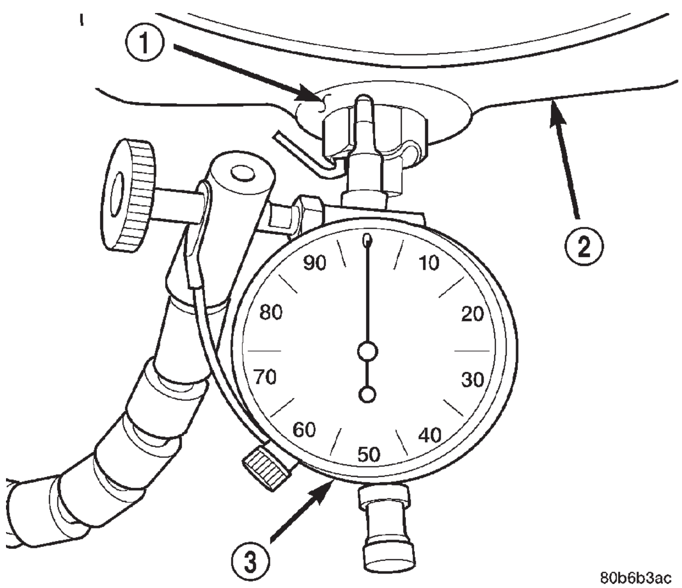


Fig. 2 Lower Ball Joint Boss

1 – BALL JOINT BOSS
2 – STEERING KNUCKLE
3 – DIAL INDICATOR

(5) Position a pry bar over the top of the upper suspension arm and under the pivot bar of the upper suspension arm. Pry down on the upper suspension arm and then zero the dial indicator.

(6) Reposition the pry bar under the upper suspension arm and on top of the frame rail. Pry up on the upper suspension arm and record the dial indicator reading.

(7) If the travel exceeds 1.52 mm (0.060 in.), replace the lower suspension arm.

DIAGNOSIS AND TESTING (Continued)

UPPER BALL JOINT

(1) Position a floor jack under the lower suspension arm. Raise the wheel and allow the tire to lightly contact the floor (vehicle weight relieved from the tire).

(2) Mount a dial indicator solidly on the upper suspension arm.

(3) Position the indicator plunger against the upper ball joint boss of the steering knuckle.

(4) Grasp the top of the tire and apply force in and out. Look for movement at the ball joint between the upper suspension arm and steering knuckle.

(5) If lateral movement is greater than 1.52 mm (0.060 in.), replace upper suspension arm.

SHOCK DIAGNOSIS

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

REMOVAL AND INSTALLATION

SHOCK ABSORBER

REMOVAL

(1) Remove the upper shock nut, retainer and grommet from the shock absorber stud (Fig. 3).

(2) Raise and support the vehicle.

(3) Remove the lower mounting bolts and remove shock absorber through the lower suspension arm (Fig. 3).

INSTALLATION

NOTE: Upper shock nut must be replaced or use Mopar Lock ’N Seal or Loctite® 242 on existing nut.

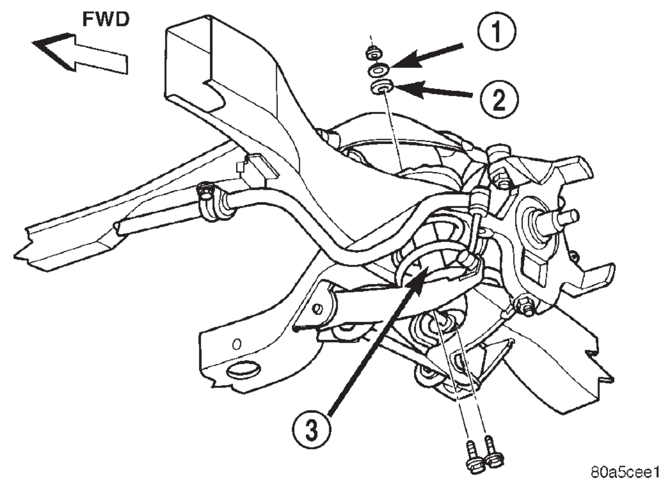


Fig. 3 Front Shock Absorber

1 – RETAINER
2 – GROMMET
3 – SHOCK ABSORBER

(1) Install the lower retainer **(lower retainer is stamped with a L)** and grommet on the shock absorber stud and extend the shock. Insert the shock absorber through the lower suspension arm and upper mounting hole.

(2) Install the lower mounting bolts and tighten to 28 N·m (21 ft. lbs.).

(3) Remove support and lower the vehicle.

(4) Install the upper grommet and retainer **(upper retainer is stamped with a U)** on the shock absorber stud. Install a new nut or use Mopar Lock ’N Seal or Loctite® 242 on existing nut and tighten to 26 N·m (19 ft. lbs.).

COIL SPRING

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assembly.

(3) Remove the stabilizer bar link from the lower suspension arm.

(4) Remove the shock absorber.

(5) Install Spring Compressor DD-1278 up through the lower suspension arm, coil spring and upper shock mounting hole (Fig. 4).

(6) Tighten the tool lower nut to compress the coil spring.

(7) Remove the lower ball joint nut and separate the ball joint from the knuckle with Remover C-4150A (Fig. 5).

(8) Loosen the spring compressor lower nut to relieve spring tension.

(9) Remove the tool and pull down on the lower suspension arm to remove the spring.

REMOVAL AND INSTALLATION (Continued)

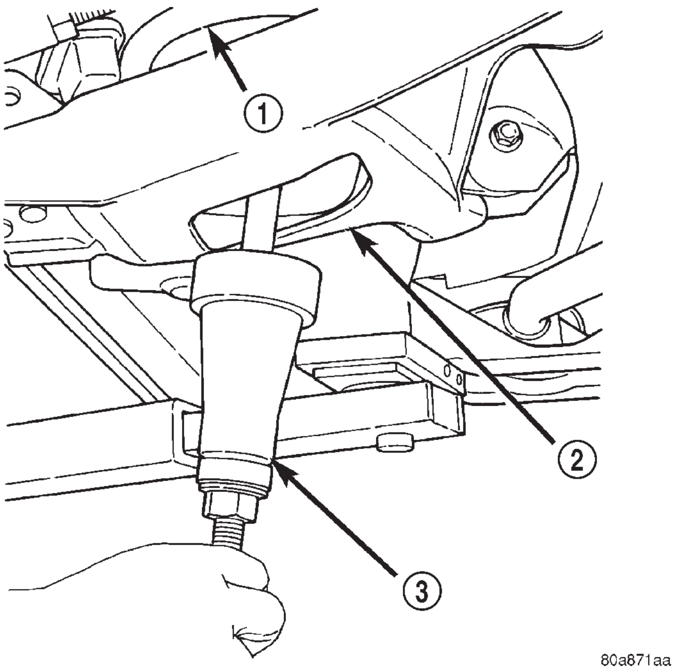


Fig. 4 Spring Compressor

1 – COIL SPRING
2 – LOWER SUSPENSION ARM
3 – SPRING COMPRESSOR

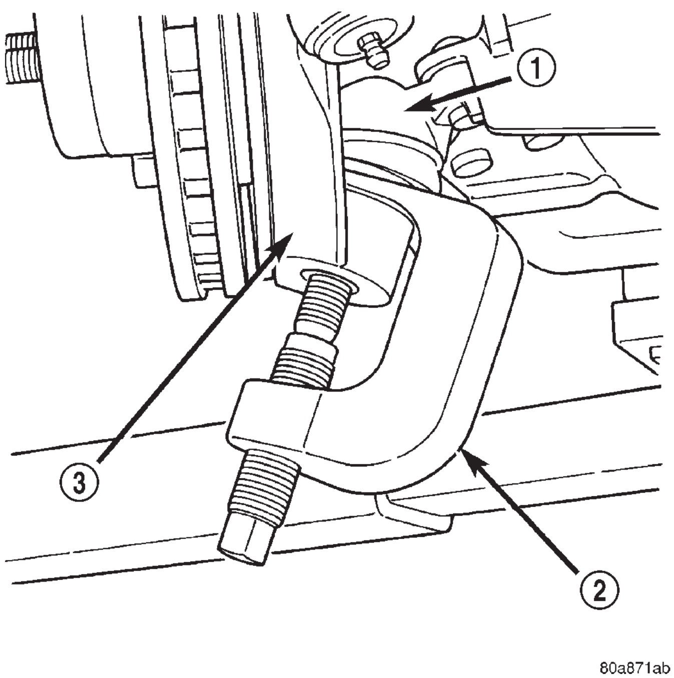


Fig. 5 Lower Ball Joint

1 – LOWER BALL JOINT
2 – REMOVER
3 – STEERING KNUCKLE

INSTALLATION

NOTE: The ramped or open end of the coil spring is the bottom of the spring.

(1) Tape the isolator pad to the top of the coil spring. Position the spring in the lower suspension arm pocket. Be sure that the coil spring is seated in the pocket.
(2) Install Spring Compressor DD-1278 up through the lower suspension arm, coil spring upper shock mounting hole.
(3) Tighten the tool nut to compress the coil spring.
(4) Install the lower ball joint into the knuckle and tighten the nut to 127 N·m (94 ft. lbs.). Install cotter pin.
(5) Remove the spring compressor tool.
(6) Install the stabilizer bar link to the lower suspension arm and tighten nut to 47 N·m (35 ft. lbs.).
(7) Install the shock absorber.
(8) Install the wheel and tire assembly.
(9) Remove support and lower the vehicle.

STEERING KNUCKLE

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the wheel and tire assembly.
(3) Remove disc brake caliper, rotor, shield and ABS speed sensor, refer to Group 5 Brakes.
(4) Remove tie-rod from steering knuckle arm, refer to Group 19 Steering.
(5) Remove the hub/bearing.
(6) Remove the shock absorber.
(7) Install Spring Compressor DD-1278 up through the lower suspension arm, coil spring and upper shock mounting hole (Fig. 4).
(8) Tighten the tool lower nut to compress the coil spring.
(9) Remove the lower ball joint nut and separate the ball joint from the knuckle with Remover C-4150A (Fig. 5).
(10) Remove the upper ball joint nut and separate the ball joint from the knuckle with Remover MB-991113 (Fig. 6).

CAUTION: When install Remover MB-991113 to separate the ball joint, be careful not to damage the ball joint seal.

(11) Remove steering knuckle.

REMOVAL AND INSTALLATION (Continued)

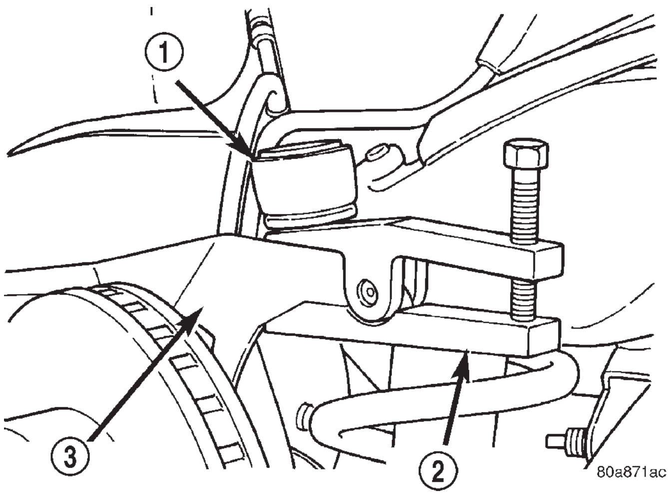


Fig. 6 Upper Ball Joint

1 – UPPER BALL JOINT
2 – REMOVER
3 – KNUCKLE

INSTALLATION

(1) Position steering knuckle on upper and lower ball joints and install nuts. Tighten lower nut to 127 N·m (94 ft. lbs.). Tighten upper nut to 81 N·m (60 ft. lbs.) and install new cotter pins.
(2) Remove the spring compressor.
(3) Install the shock absorber.
(4) Install the hub/bearing.
(5) Install ABS speed sensor, brake dust shield, rotor and caliper, refer to Group 5 Brakes.
(6) Install tie rod to steering knuckle arm, refer to Group 19 Steering.
(7) Install the wheel and tire assembly.
(8) Remove support and lower the vehicle

LOWER SUSPENSION ARM

REMOVAL

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Remove disc brake caliper and rotor from steering knuckle, refer to Group 5 Brakes.
(4) Remove shock absorber.
(5) Remove stabilizer bar link from the lower suspension arm.
(6) Remove the coil spring.
(7) Remove lower suspension arm mounting bolts (Fig. 7) from the frame mounts and remove the arm.

INSTALLATION

CAUTION: Frame mounting bolts must be installed to their original location and orientation to avoid damaging the steering rack boots.

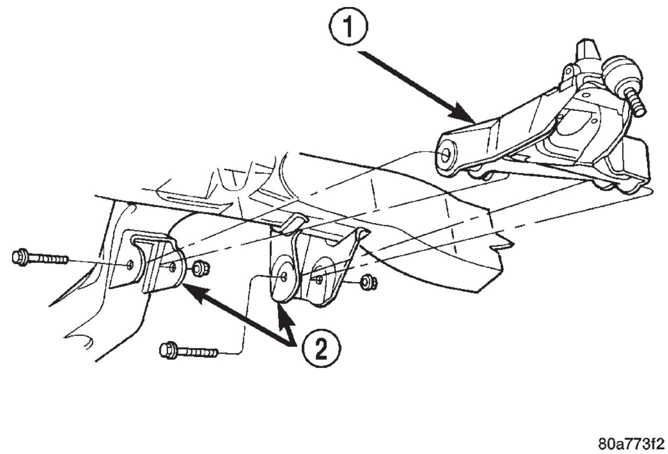


Fig. 7 Lower Suspension Arm

1 – LOWER SUSPENSION ARM
2 – FRAME MOUNTS

(1) Loosely attach suspension arm to frame mounts.
(2) Install the coil spring.
(3) Install the shock absorber.
(4) Install stabilizer bar link to the lower suspension arm and tighten nut to 47 N·m (35 ft. lbs.)
(5) Install brake rotor and caliper, refer to Group 5 Brakes.
(6) Install wheel and tire assembly.
(7) Remove support and lower the vehicle.
(8) Tighten the front suspension arm mounting nut to 175 N·m (130 ft. lbs.) and the rear nut to 108 N·m (80 ft. lbs.).

UPPER SUSPENSION ARM

REMOVAL

(1) Raise and support the vehicle.
(2) Remove wheel and tire assembly.
(3) Remove brake hose bracket from the arm.
(4) Position a hydraulic jack under the arm and raise the jack to unload the rebound bumper.
(5) Remove cotter pin and nut from upper ball joint.
(6) Separate upper ball joint from steering knuckle with Remover MB-991113 (Fig. 6).

CAUTION: When installing Remover MB-991113 to separate the ball joint, be careful not to damage the ball joint seal.

(7) Remove suspension arm pivot bar mounting nuts and remove suspension arm (Fig. 8).

INSTALLATION

NOTE: Before installation, insure pivot bar adjustment bolts are in their original location (Fig. 8).

REMOVAL AND INSTALLATION (Continued)

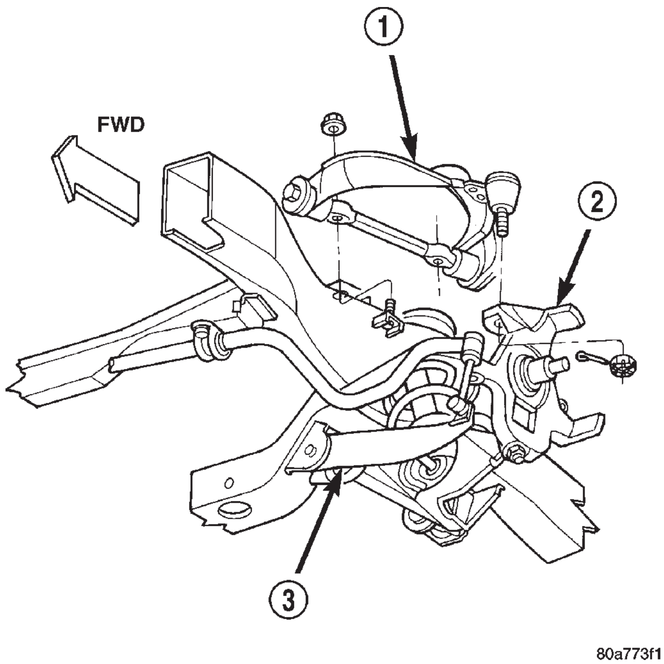


Fig. 8 Upper Suspension Arm

1 – UPPER SUSPENSION ARM
2 – STEERING KNUCKLE
3 – LOWER SUSPENSION ARM

(1) Position suspension arm pivot bar on adjustment bolts. Install nuts and tighten to 210 N·m (155 ft. lbs.).

(2) Position steering knuckle on upper ball joint. Tighten the upper ball joint nut to 81 N·m (60 ft. lbs.) and install a new cotter pin.

(3) Install the wheel and tire assembly.

(4) Remove support and lower vehicle.

(5) Align front end to specifications.

STABILIZER BAR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the upper link nut, retainer and grommet from each link.

(3) Remove the lower link nut from the lower suspension arm on each side (Fig. 9).

(4) Remove the stabilizer bar retainer bolts and remove the retainers and stabilizer bar from the vehicle.

(5) Remove the bushings from the stabilizer bar.

INSTALLATION

(1) Install the bushings on the stabilizer bar.

(2) Install the stabilizer bar on the frame and install the retainers and the bolts.

(3) Tighten the bolts to 60 N·m (45 ft. lbs.).

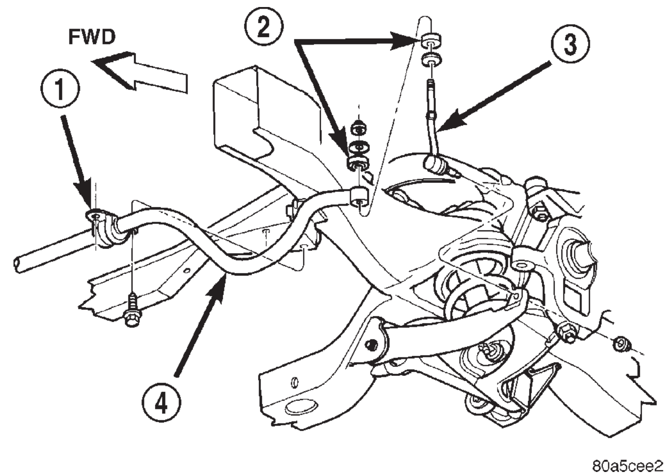


Fig. 9 Stabilizer Bar

1 – RETAINER
2 – GROMMET
3 – STABILIZER LINK
4 – STABILIZER BAR

NOTE: Ensure the bar is center with equal spacing on both sides.

(4) Install the link lower retainer and grommet on the links.

(5) Install the links into the stabilizer bar and lower suspension arm on each side.

(6) Install the lower link mounting nut and tighten to 47 N·m (35 ft. lbs.).

NOTE: Ensure both link end caps are facing straight forward.

(7) Install the upper link grommet, retainer and nut and tighten to 37 N·m (27 ft. lbs.).

(8) Remove support and lower vehicle.

HUB/BEARING

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Remove brake caliper, rotor, and ABS wheel speed sensor if equipped, refer to Group 5 Brakes.

(4) Remove hub/bearing spindle nut and discard nut (Fig. 10).

CAUTION: The hub/bearing spindle nut can not be re-used.

(5) Slide hub/bearing off spindle.

INSTALLATION

(1) Slide hub/bearing on spindle.

REMOVAL AND INSTALLATION (Continued)

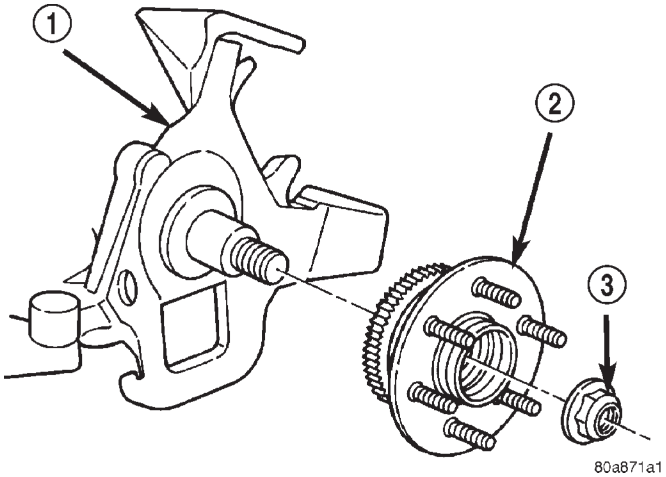


Fig. 10 Hub/Bearing

1 – KNUCKLE
2 – HUB/BEARING
3 – SPINDLE NUT

(2) Install **new** spindle nut and tighten to 251 N·m (185 ft. lbs.).

(3) Install brake rotor, caliper, and ABS wheel speed sensor if equipped, refer to Group 5 Brakes.

(4) Install wheel and tire assembly.

(5) Remove support and lower vehicle.

WHEEL MOUNTING STUDS

CAUTION: Do not use a hammer to remove wheel studs.

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Remove brake caliper, caliper adapter and rotor, refer to Group 5 Brakes for procedure.

(4) Remove stud from hub with Remover C-4150A (Fig. 11).

INSTALLATION

(1) Install new stud into hub flange.

(2) Install three washers onto stud, then install lug nut with the flat side of the nut against the washers.

(3) Tighten lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.

(4) Remove lug nut and washers.

(5) Install the brake rotor, caliper adapter, and caliper, refer to Group 5 Brakes for procedure.

(6) Install wheel and tire assembly, use new lug nut on stud or studs that were replaced.

(7) Remove support and lower vehicle.

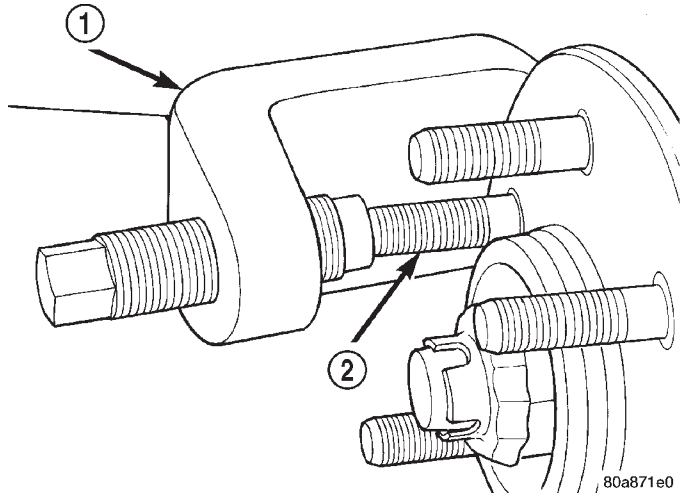


Fig. 11 Wheel Stud Removal

1 – REMOVER
2 – WHEEL STUD

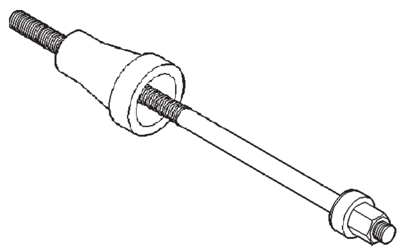
SPECIFICATIONS

TORQUE CHART

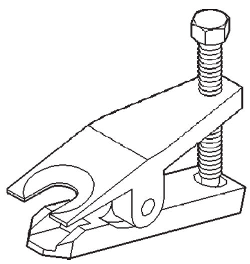
DESCRIPTION	TORQUE
Shock Absorber	
Upper Nut	26 N·m (19 ft. lbs.)
Lower Bolts	28 N·m (21 ft. lbs.)
Lower Suspension Arm	
Front Nut	175 N·m (130 ft. lbs.)
Rear Nut	108 N·m (80 ft. lbs.)
Ball Joint Nut	127 N·m (94 ft. lbs.)
Upper Suspension Arm	
Pivot Shaft Nuts	167 N·m (130 ft. lbs.)
Pivot Shaft to Frame Nuts	210 N·m (155 ft. lbs.)
Ball Joint Nut	81 N·m (60 ft. lbs.)
Stabilizer Bar	
Link Upper Nut	37 N·m (27 ft. lbs.)
Link Ball Stud Nut	47 N·m (35 ft. lbs.)
Retainer Bolts	60 N·m (45 ft. lbs.)
Hub/Bearing	
Spindle Nut	251 N·m (185 ft. lbs.)

SPECIAL TOOLS

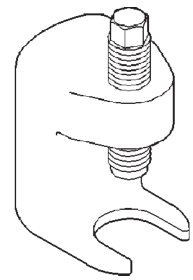
FRONT SUSPENSION



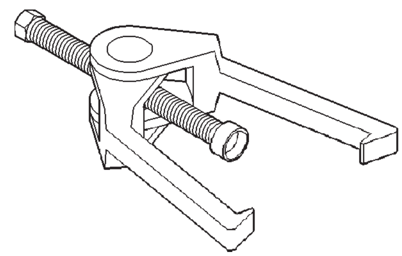
Compressor, Coil Spring DD-1278



Remover Ball Joint MB-991113



Remover Ball Joint C-4150A



Puller Tie Rod C-3894-A

FRONT SUSPENSION - 4x4

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
FRONT SUSPENSION - 4x4 14
SHOCK ABSORBERS 14
TORSION BARS 15
STEERING KNUCKLE 15
SUSPENSION ARMS 15
STABILIZER BAR 15
DIAGNOSIS AND TESTING
LOWER BALL JOINT 15
UPPER BALL JOINT 15
SHOCK DIAGNOSIS 16
SERVICE PROCEDURES
LUBRICATION 16
REMOVAL AND INSTALLATION
SHOCK ABSORBER 16
TORSION BAR 17
STEERING KNUCKLE 17
LOWER SUSPENSION ARM 18
UPPER SUSPENSION ARM 19
STABILIZER BAR 20
HUB/BEARING 21
WHEEL MOUNTING STUDS 21
SPECIFICATIONS
TORQUE CHART 22
SPECIAL TOOLS
FRONT SUSPENSION 22

DESCRIPTION AND OPERATION

FRONT SUSPENSION - 4x4

DESCRIPTION

The front suspension is designed to allow each wheel to adapt to different road surfaces independently. The wheels are mounted to hub/bearings units bolted to cast steering knuckle. The double-row hub bearings are sealed and lubricated for life. The steering knuckles turn (pivot) on ball joints. The upper ball joint is riveted to the outboard portion of the suspension arm and lubricated for life. The lower ball joint is pressed into the lower suspension arm and requires lubrication.

The 4x4 front suspension is comprised of (Fig. 1) :

- Shock absorbers
- Torsion-bar springs
- Suspension arms
- Steering knuckles
- Stabilizer bar
- Jounce/Rebound bumpers

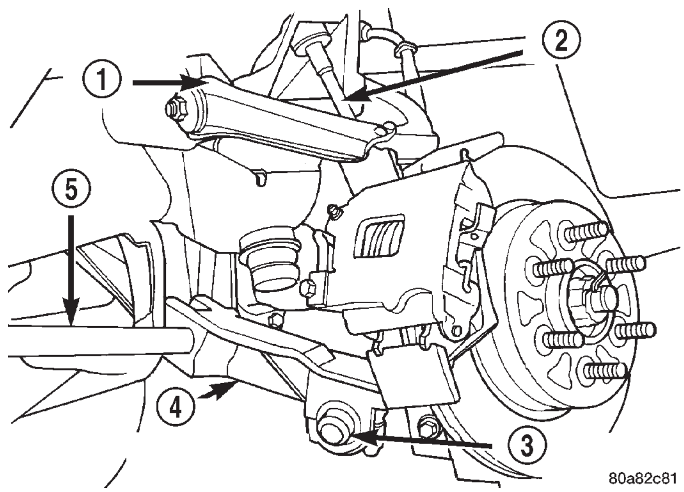


Fig. 1 Front Suspension - 4x4

1 – UPPER SUSPENSION ARM
2 – SHOCK ABSORBER
3 – STABILIZER BAR
4 – LOWER SUSPENSION ARM
5 – TORSION BAR

CAUTION: Components attached with a nut and cotter pin must be torqued to specification. Then if the slot in the nut does not line up with the cotter pin hole, tighten nut until it is aligned. Never loosen the nut to align the cotter pin hole.

CAUTION: Suspension components with rubber/urethane bushings (except stabilizer bar) should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

SHOCK ABSORBERS

DESCRIPTION

The top of the low-pressure gas charged shock are bolted to the frame. The bottom of the shock are bolted to the lower suspension arm.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The shock absorbers dampen jounce and rebound of the vehicle over various road conditions.

TORSION BARS

DESCRIPTION

The front of the bar mounts to the back side of the lower suspension arm. The rear end of the bar is mounted in a anchor that rests in the frame crossmember.

OPERATION

The torsion bars are used to control ride height and ride quality. The vehicle height is adjusted through an anchor adjustment bolt that increases or decreases the angle of the torsion bar. Increasing or decreasing the bar angle changes the angle of the suspension arms.

STEERING KNUCKLE

DESCRIPTION

The knuckle is a single casting with legs machined for the upper and lower ball joints. The knuckle also has machined mounting locations for the front brake calipers and hub bearing.

OPERATION

The steering knuckle pivot between the upper and lower ball joint. Steering linkage attached to the knuckle allows the vehicle to be steered.

SUSPENSION ARMS

DESCRIPTION

The upper suspension arm bolts on frame brackets through the arm pivot shaft. The frame brackets have slotted holes which allow the arms to be adjusted for caster and camber. Pivot shaft bushings are not replaceable.

The lower suspension arms bolt to the lower frame brackets and pivot through bushings, these bushings are not replaceable.

The suspension arms have lube for life riveted ball studs. The suspension arm travel (jounce) is limited through the use of urethane bumpers. Rebound travel is limited by the shock absorber.

STABILIZER BAR

DESCRIPTION

The bar extends across the front underside of the chassis and connects to the frame crossmember. The ends of the bar mount to the lower suspension arm. All mounting points of the stabilizer bar are isolated by bushings.

OPERATION

The stabilizer bar is used to minimize vehicle front sway during turns. The bar helps to maintain a flat attitude to the road surface.

DIAGNOSIS AND TESTING

LOWER BALL JOINT

NOTE: If the ball joint is equipped with a lubrication fitting, grease the joint then road test the vehicle before performing test.

(1) Raise the front of the vehicle. Place safety floor stands under both lower suspension arms as far outboard as possible. Lower the vehicle to allow the stands to support some or all of the vehicle weight.

NOTE: The upper suspension arms must not contact the rebound bumpers.

(2) Remove the tire and wheel assemblies.

(3) Mount a dial indicator solidly to the underside of the lower suspension arm.

(4) Position indicator plunger against the bottom surface of the steering knuckle lower ball joint boss.

NOTE: The dial indicator plunger must be perpendicular to the machined surface of the steering knuckle lower ball joint boss (Fig. 2).

(5) Position a pry bar over the top of the upper suspension arm and under the pivot bar of the upper suspension arm. Pry down on the upper suspension arm and then zero the dial indicator.

(6) Reposition the pry bar under the upper suspension arm and on top of the jounce/rebound bracket. Pry up on the upper suspension arm and record the dial indicator reading.

(7) If the travel exceeds 1.52 mm (0.060 in.), replace the lower control arm.

UPPER BALL JOINT

(1) Position a floor jack under the lower suspension arm. Raise the wheel and allow the tire to lightly contact the floor (vehicle weight relieved from the tire).

(2) Mount a dial indicator solidly on the upper suspension arm.

(3) Position the indicator plunger against the back side of the upper ball joint boss of the steering knuckle (Fig. 3).

DIAGNOSIS AND TESTING (Continued)

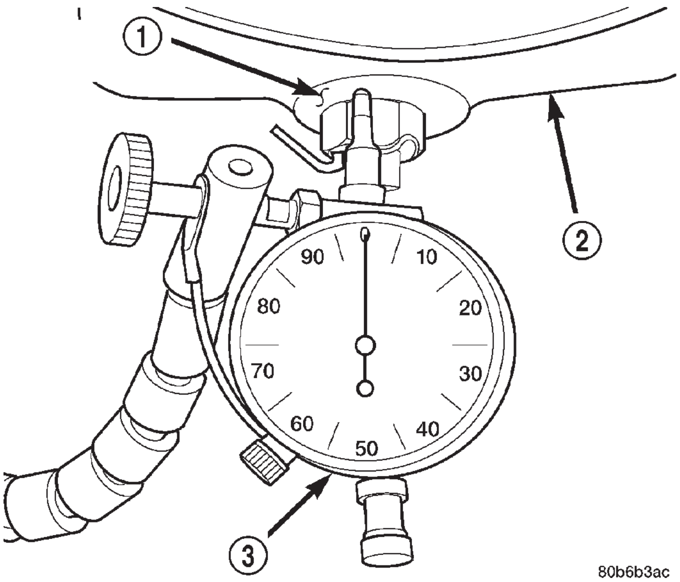


Fig. 2 Lower Ball Joint Boss

1 – BALL JOINT BOSS
2 – STEERING KNUCKLE
3 – DIAL INDICATOR

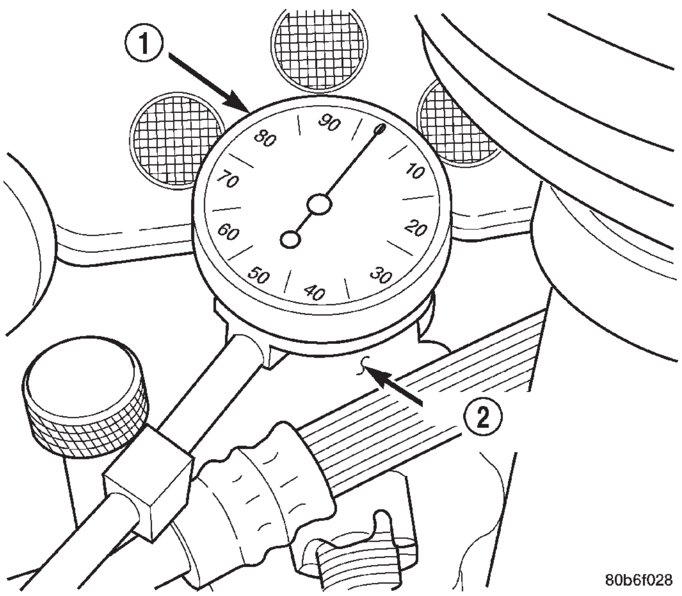


Fig. 3 Upper Ball Joint Boss

1 – DIAL INDICATOR
2 – BALL JOINT BOSS

(4) Grasp the top of the tire and pull outward, then zero the dial indicator.

(5) Grasp the top of the tire and push inward and record the dial indicator reading.

(6) If lateral movement is greater than 1.52 mm (0.060 in.), replace upper suspension arm.

SHOCK DIAGNOSIS

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

SERVICE PROCEDURES

LUBRICATION

Periodic lubrication of the suspension system may be required. Refer to Group 0, Lubrication And Maintenance for the recommended maintenance schedule.

REMOVAL AND INSTALLATION

SHOCK ABSORBER

REMOVAL

(1) Raise and support vehicle.

(2) Remove the upper shock absorber nut, retainer and grommet (Fig. 4).

(3) Remove the lower bolt and remove the shock absorber.

INSTALLATION

NOTE: Upper shock nut must be replaced or use Mopar Lock 'N Seal or Loctite® 242 on existing nut.

(1) Install the lower retainer **(lower retainer is stamped with a L)** and grommet on the shock absorber stud. Insert the shock absorber through the frame bracket hole.

(2) Install the lower bolt and tighten the bolt to 108 N·m (80 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

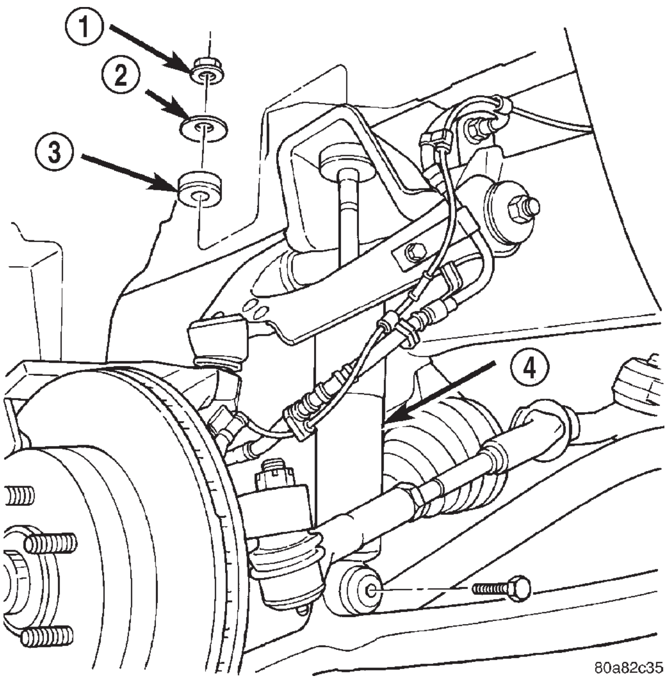


Fig. 4 Shock Absorber

1 – NUT
2 – RETAINER
3 – GROMMET
4 – SHOCK

(3) Install the upper grommet, retainer **(upper retainer is stamped with a U)** and new nut or use Mopar Lock 'N Seal or Loctite® 242 on existing nut, on the shock absorber stud. Tighten nut to 26 N·m (19 ft. lbs.).

TORSION BAR

CAUTION: The left and right side torsion bars are NOT interchangeable. The bars are identified and stamped R or L, for right or left. The bars do not have a front or rear end and can be installed with either end facing forward.

REMOVAL

(1) Raise and support the vehicle with the front suspension hanging.

(2) Turn the adjustment bolt counterclockwise to release spring load (Fig. 5).

NOTE: Count and record the number of turns for installation reference.

(3) Remove the adjustment bolt from swivel.

(4) Remove torsion bar and anchor. Remove anchor from torsion bar.

(5) Remove all foreign material from torsion bar mounting in anchor and suspension arm.

(6) Inspect adjustment bolt, bearing and swivel for damage.

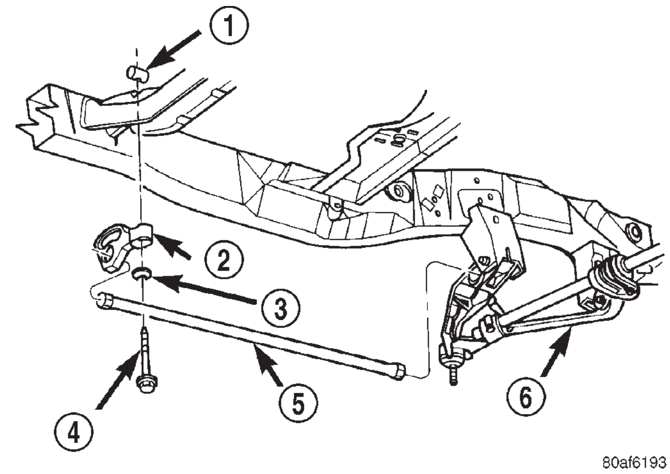


Fig. 5 Torsion Bar

1 – SWIVEL
2 – ANCHOR
3 – BEARING
4 – ADJUSTMENT BOLT
5 – TORSION BAR
6 – LOWER SUSPENSION ARM

INSTALLATION

(1) Insert torsion bar ends into anchor and suspension arm.

(2) Position anchor and bearing in frame cross-member. Install adjustment bolt through bearing, anchor and into the swivel.

(3) Turn adjustment bolt clockwise the recorded amount of turns.

(4) Lower vehicle and adjust the front suspension height. Refer to Suspension Height service procedure.

STEERING KNUCKLE

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Remove brake caliper, rotor, shield and ABS wheel speed sensor if equipped. Refer to Group 5 Brakes.

(4) Remove front driveshaft, refer to Group 3 Differential and Driveline.

(5) Remove tie rod end cotter pin and nut. Separate the tie rod from the knuckle with Remover MB-991113 (Fig. 6).

(6) Support the lower suspension arm with a hydraulic jack and raise the jack to unload the rebound bumper.

(7) Remove the upper ball joint cotter pin and nut. Separate the ball joint from the knuckle with Remover MB-991113 (Fig. 7).

REMOVAL AND INSTALLATION (Continued)

CAUTION: When installing Remover MB-991113 to separate the ball joint, be careful not to damage the ball joint seal.

(8) Remove the lower ball joint cotter pin and nut. Separate the ball joint from the knuckle with Remover C-4150A (Fig. 8) and remove the knuckle.

(9) Remove the hub/bearing from the steering knuckle.

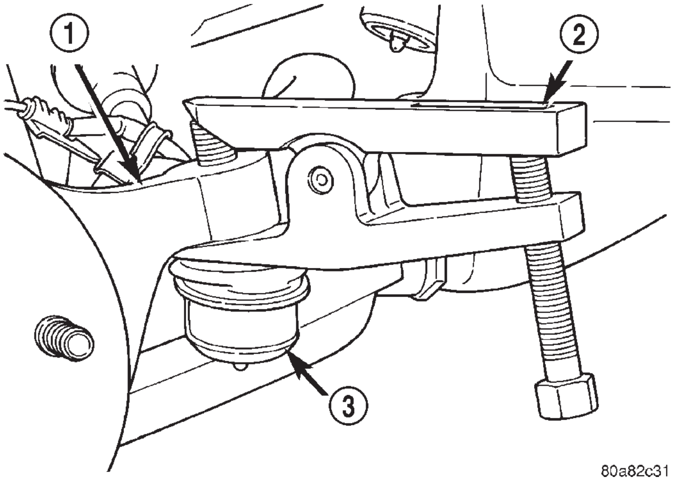


Fig. 6 Tie Rod End

1 – STEERING KNUCKLE
2 – REMOVER
3 – TIE ROD END

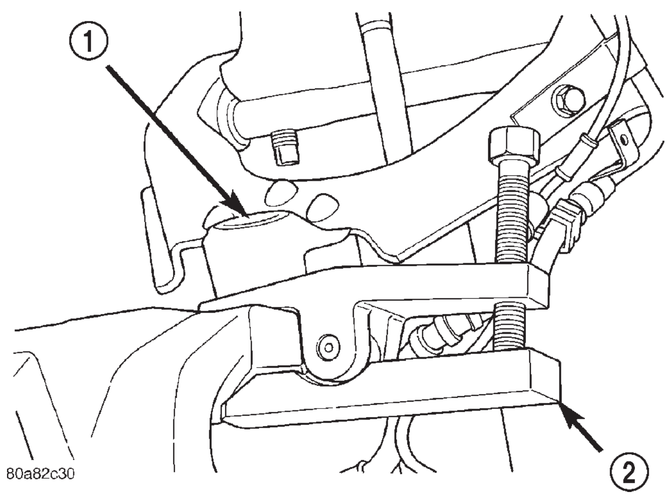


Fig. 7 Upper Ball Joint

1 – UPPER BALL STUD
2 – REMOVER

INSTALLATION

(1) Install the hub/bearing to the steering knuckle and tighten the bolts to 166 N·m (123 ft. lbs.).

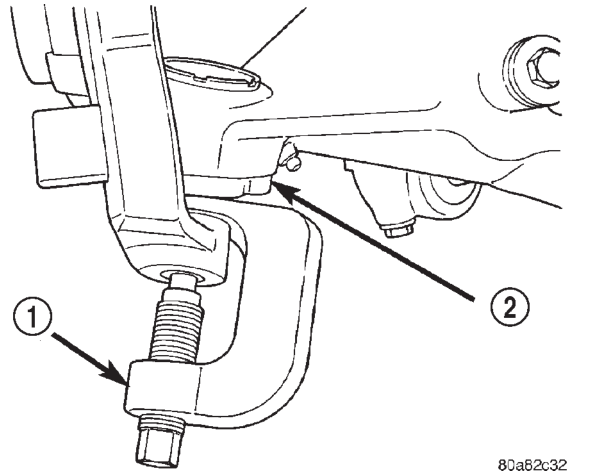


Fig. 8 Lower Ball Joint

1 – REMOVER
2 – LOWER BALL STUD

NOTE: When installing hub/bearing with ABS brakes, position the speed sensor opening towards the front of the vehicle.

CAUTION: The ball joint stud tapers must be CLEAN and DRY before installing the knuckle. Clean the stud tapers with mineral spirits to remove dirt and grease.

(2) Install the knuckle onto the upper and lower ball joint.

(3) Install the upper and lower ball joint nuts. Tighten the upper ball joint nut to 81 N·m (60 ft. lbs.) and the lower ball joint nut to 183 N·m (135 ft. lbs.) then install cotter pins. Grease the lower ball joint.

(4) Remove the hydraulic jack from the lower suspension arm.

(5) Install the tie rod end and tighten the nut to 88 N·m (65 ft. lbs.). Install the cotter pin.

(6) Install the front driveshaft, refer to Group 3 Differential and Driveline.

(7) Install the ABS wheel speed sensor if equipped and brake shield, rotor and caliper. Refer to Group 5 Brakes.

(8) Install the wheel and tire assembly.

(9) Remove support and lower the vehicle.

LOWER SUSPENSION ARM

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assembly.

(3) Remove front driveshaft, refer to Group 3 Differential & Driveline.

(4) Remove torsion bar.

REMOVAL AND INSTALLATION (Continued)

(5) Remove shock absorber lower bolt.
(6) Remove stabilizer bar.
(7) Remove the cotter pin and nut from lower ball joint. Separate ball joint from the steering knuckle with Remover C-4150A (Fig. 9).
(8) Remove suspension arm pivot bolts and suspension arm from frame rail brackets (Fig. 10).
(9) Inspect lower ball joint seal and replace if damaged. Pry off old seal with screw driver if necessary.

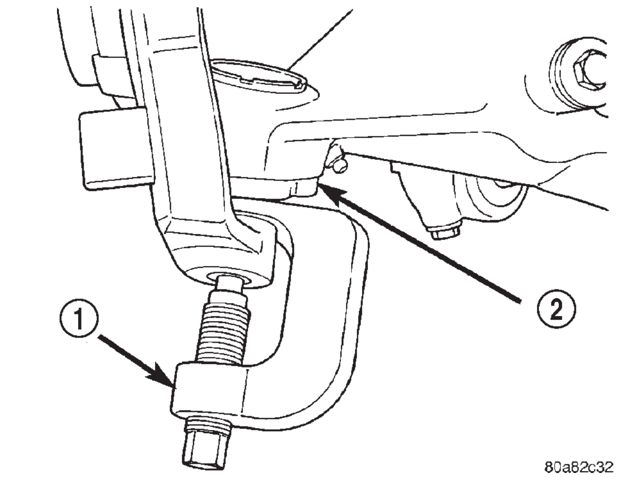


Fig. 9 Lower Ball Joint

1 – REMOVER
2 – LOWER BALL STUD

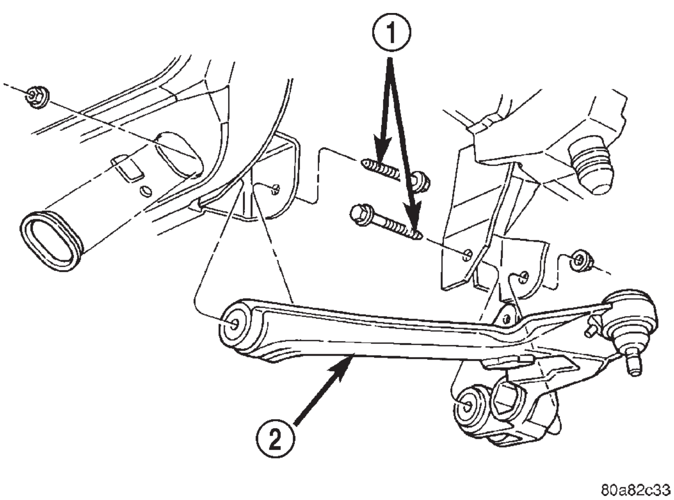


Fig. 10 Lower Suspension Arm

1 – PIVOT BOLTS
2 – LOWER SUSPENSION ARM

INSTALLATION

(1) Install new lower ball joint seal by tapping on around the seal flange lightly with a hammer.
(2) Position the lower suspension arm at the frame rail brackets. Install the pivot bolts and nuts. Tighten the nuts finger-tight.

CAUTION: The ball joint stud taper must be CLEAN and DRY before installing the knuckle. Clean the stud taper with mineral spirits to remove dirt and grease.

(3) Insert the ball joint into steering knuckle. Install and tighten the retaining nut to 183 N·m (135 ft. lbs.) and install a new cotter pin.
(4) Install the torsion bar.
(5) Install shock absorber lower bolt and tighten to 108 N·m (80 ft. lbs.).
(6) Install the front driveshaft. Refer to Group 3 Differential & Driveline.
(7) Install the wheel and tire assembly.
(8) Remove support and lower the vehicle.
(9) Install the stabilizer bar.
(10) Tighten the lower suspension front pivot nut to 108 N·m (80 ft. lbs.). Tighten rear pivot bolt to 190 N·m (140 ft. lbs.).
(11) Adjust the front suspension height.

UPPER SUSPENSION ARM

REMOVAL

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Remove brake hose brackets from suspension arm, refer to Group 5 Brakes.
(4) Position hydraulic jack under lower suspension arm and raise jack to unload rebound bumper.
(5) Remove shock absorber.
(6) Remove the cotter pin and nut from upper ball joint.
(7) Separate upper ball joint from the steering knuckle with Remover MB-991113 (Fig. 11).

CAUTION: When installing Remover MB-991113 to separate the ball joint, be careful not to damage the ball joint seal.

(8) Remove suspension arm pivot bar bolts and remove suspension arm (Fig. 12).

INSTALLATION

(1) Position suspension arm pivot bar on mounting bracket. Install bolts and tighten (temporarily) to 136 N·m (100 ft. lbs.).
(2) Insert ball joint in steering knuckle and tighten ball joint nut to 81 N·m (60 ft. lbs.) then install a new cotter pin.
(3) Install shock absorber.

NOTE: Upper shock nut must be replaced or use Mopar Lock ’N Seal or Loctite ® 242 on existing nut.

(4) Remove hydraulic jack.

REMOVAL AND INSTALLATION (Continued)

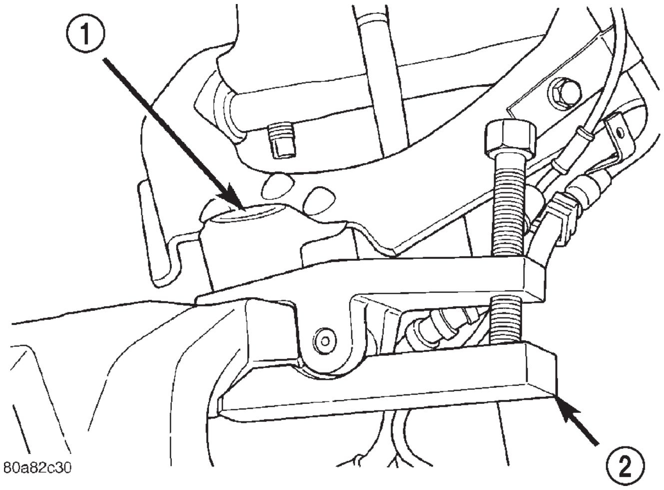


Fig. 11 Separate Upper Ball Joint

1 – UPPER BALL STUD
2 – REMOVER

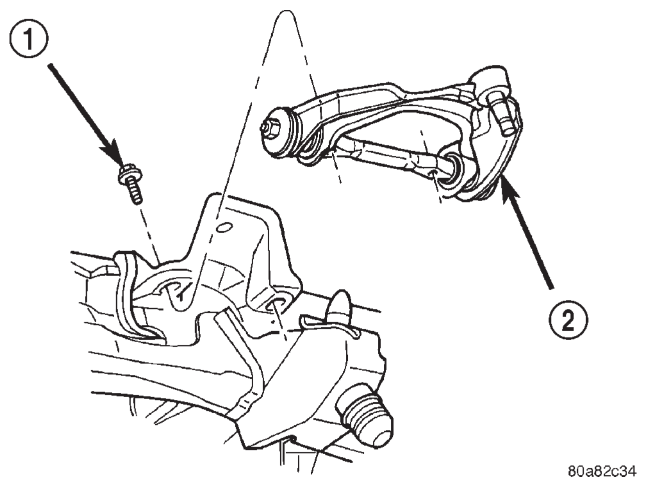


Fig. 12 Upper Suspension Arm

1 – PIVOT BAR BOLT
2 – UPPER SUSPENSION ARM

(5) Attach brake hose brackets to suspension arm, refer to Group 5 Brakes.
(6) Tighten upper suspension arm pivot bolts to 224 N·m (165 ft. lbs.).
(7) Install the wheel and tire assembly.
(8) Remove support and lower vehicle.
(9) Align front suspension.

STABILIZER BAR

NOTE: To service the stabilizer bar the vehicle must be on a drive on hoist. The vehicle suspension must be at curb height for stabilizer bar installation.

REMOVAL

(1) Remove the stabilizer bar retainer bolts from the lower suspension arms (Fig. 13) and remove the retainers.
(2) Remove the stabilizer bar retainer nuts, bolts and retainers from the frame crossmember (Fig. 13) and remove the bar.
(3) If necessary, remove the bushings from the stabilizer bar.

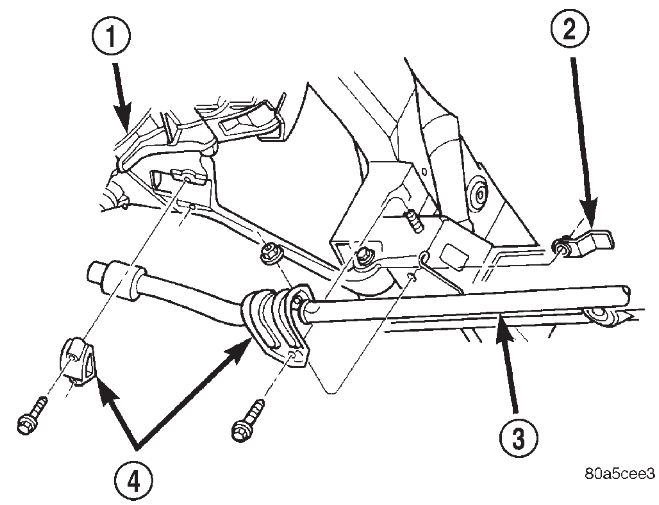


Fig. 13 Stabilizer Bar

1 – LOWER SUSPENSION ARM
2 – FLAG NUT
3 – STABILIZER BAR
4 – RETAINER

INSTALLATION

(1) If removed, install the bushings on the stabilizer bar.
(2) Position the stabilizer bar on the frame crossmember brackets and install the retainers and nuts and bolts finger-tight (Fig. 13).

NOTE: Check the alignment of the bar to ensure there is no interference with the either frame rail or chassis component. Spacing should be equal on both sides.

(3) Install the stabilizer bar to the lower suspension arm.
(4) Install the retainers and bolts to the lower suspension arm and tighten to 34 N·m (25 ft. lbs.).
(5) Tighten the frame retainer nuts to 190 N·m (140 ft. lbs.).
(6) Tighten the frame retainer bolts to 108 N·m (80 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

HUB/BEARING

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Remove axle nut.

(4) Remove ABS wheel speed sensor if equipped, refer to Group 5 Brakes.

(5) Remove the brake caliper and rotor, refer to Group 5 Brakes.

(6) Remove hub/bearing mounting bolts from the steering knuckle (Fig. 14).

(7) Slid hub/bearing out of the steering knuckle and off the axle.

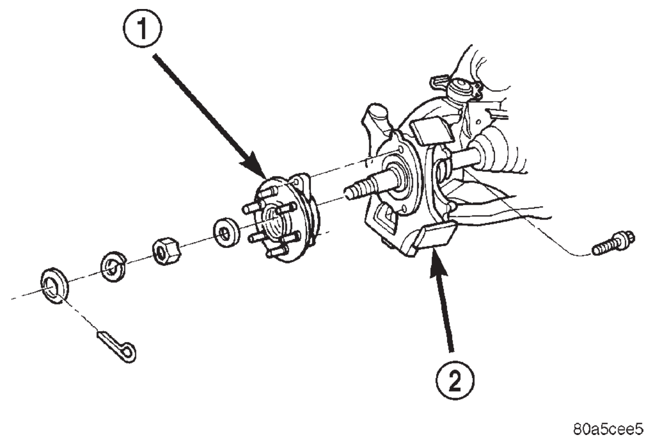


Fig. 14 Hub/Bearing

1 – HUB BEARING
2 – STEERING KNUCKLE

INSTALLATION

(1) Install the hub/bearing into the steering knuckle and tighten the bolts to 166 N·m (123 ft. lbs.).

(2) Install the brake rotor and caliper.

(3) Install ABS wheel speed sensor if equipped.

(4) Install axle nut and tighten to 235 N·m (173 ft. lbs.).

(5) Install wheel and tire assembly.

(6) Remove support and lower vehicle.

WHEEL MOUNTING STUDS

CAUTION: Do not use a hammer to remove wheel studs.

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Remove brake caliper, caliper adapter and rotor, refer to Group 5 Brakes for procedure.

(4) Remove stud from hub with Remover C-4150A (Fig. 15).

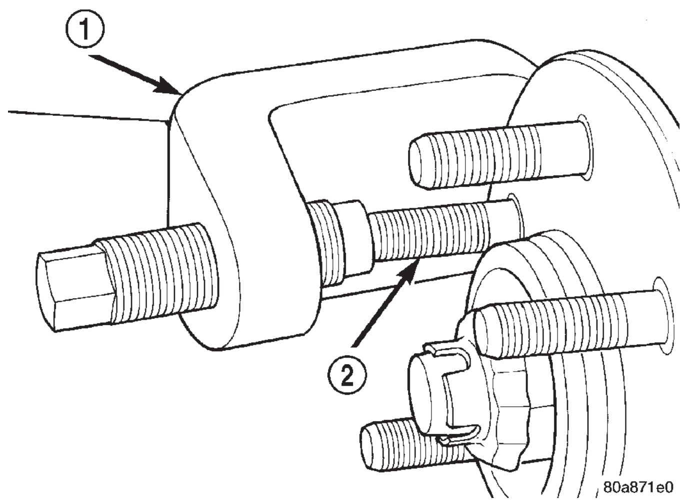


Fig. 15 Wheel Stud Removal

1 – REMOVER
2 – WHEEL STUD

INSTALLATION

(1) Install new stud into hub flange.

(2) Install three washers onto stud, then install lug nut with the flat side of the nut against the washers.

(3) Tighten lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.

(4) Remove lug nut and washers.

(5) Install the brake rotor, caliper adapter, and caliper, refer to Group 5 Brakes for procedure.

(6) Install wheel and tire assembly, use new lug nut on stud or studs that were replaced.

(7) Remove support and lower vehicle.

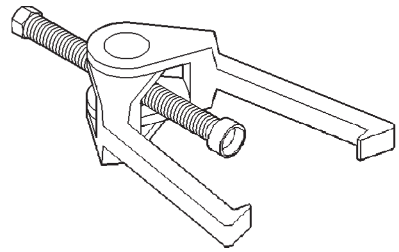
SPECIFICATIONS

TORQUE CHART

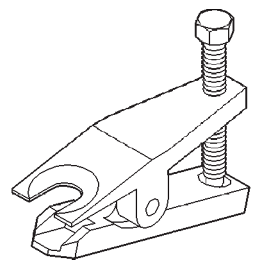
DESCRIPTION	TORQUE
Shock Absorber	
Upper Nut	26 N·m (19 ft. lbs.)
Lower Bolt	108 N·m (80 ft. lbs.)
Lower Suspension Arm	
Front Bolt	108 N·m (80 ft. lbs.)
Rear Bolt	190 N·m (140 ft. lbs.)
Ball Joint Nut	183 N·m (135 ft. lbs.)
Upper Suspension Arm	
Pivot Shaft Nuts	129 N·m (95 ft. lbs.)
Pivot Shaft to Frame Bolts	224 N·m (165 ft. lbs.)
Ball Joint Nut	81 N·m (60 ft. lbs.)
Stabilizer Bar	
Frame Retainer Bolt	108 N·m (80 ft. lbs.)
Frame Retainer Nut	190 N·m (140 ft. lbs.)
Control Arm Retainer Bolts	34 N·m (25 ft. lbs.)
Hub/Bearing	
Bolts	166 N·m (123 ft. lbs.)

SPECIAL TOOLS

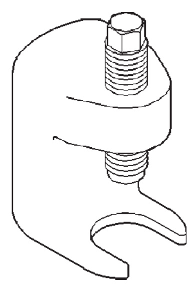
FRONT SUSPENSION



Puller Tie Rod C-3894-A



Remover MB-991113



Remover C-4150A

REAR SUSPENSION

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
REAR SUSPENSION	23
SHOCK ABSORBERS	23
STABILIZER BAR	23
LEAF SPRINGS	23
DIAGNOSIS AND TESTING	
SPRING AND SHOCK	24
REMOVAL AND INSTALLATION	
SHOCK ABSORBER	24
STABILIZER BAR	24
LEAF SPRINGS	25
SPECIFICATIONS	
TORQUE CHART	26

DESCRIPTION AND OPERATION

REAR SUSPENSION

DESCRIPTION

The rear suspension is comprised of:

- Drive Axle
- Shock Absorbers
- Stabilizer Bar (optional)
- Leaf Springs

CAUTION: A vehicle should always be loaded so the vehicle weight center-line is located immediately forward of the rear axle. Correct vehicle loading provides proper front tire-to-road contact. This results in maximum vehicle handling stability and safety. Incorrect vehicle weight distribution can cause excessive tire tread wear, spring fatigue or failure, and erratic steering.

CAUTION: Suspension components with rubber/urethane bushings should be tightened with the vehicle at normal ride height. It is important to have the springs supporting the weight of the vehicle when the fasteners are torqued. This will maintain vehicle ride comfort and prevent premature bushing wear.

SHOCK ABSORBERS

DESCRIPTION

The top of the shock absorbers are bolted to the body crossmember. The bottom of the shocks are bolted to the axle brackets. The axle brackets are staggered one ahead of the axle and one befind.

OPERATION

Ride control is accomplished through the use of dual-action shock absorbers. The shocks dampen the jounce and rebound as the vehicle travels over various road conditions.

STABILIZER BAR

DESCRIPTION

The stabilizer bar (optional) extends across the underside of the vehicle and is bolted to the top of the axle. Links at the end of the bar are bolted to frame brackets.

OPERATION

The stabilizer bar is used to minimize vehicle body roll. The spring steel bar helps to control the vehicle body in relationship to the suspension.

LEAF SPRINGS

DESCRIPTION

The 4x2 rear suspension system uses a 4-leaf two stage or 5-leaf single stage springs and a solid drive axle. The 4x4 rear suspension system uses only a 4-leaf two stage spring and solid drive axle. The forward end of the springs are mounted to the body rail hangers through rubber bushings. The rearward end of the springs are attached to the body by the use of shackles. The spring and shackles use rubber bushings. The bushing help to isolate road noise.

OPERATION

The springs control ride quality and maintain vehicle ride height. The shackles allow the springs to change their length as the vehicle moves over various road conditions.

DIAGNOSIS AND TESTING

SPRING AND SHOCK

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

The shock absorbers are not refillable or adjustable. If a malfunction occurs, the shock absorber must be replaced. To test a shock absorber, hold it in an upright position and force the piston in and out of the cylinder four or five times. The action throughout each stroke should be smooth and even.

The spring eye and shock absorber bushings do not require any type of lubrication. Do not attempt to stop spring bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing rubber.

If the vehicle is used for severe, off-road operation, the springs should be examined periodically. Check for broken and shifted leafs, loose and missing clips, and broken center bolts. Refer to Spring and Shock Absorber Diagnosis chart for additional information.

SPRING AND SHOCK ABSORBER

CONDITION	POSSIBLE CAUSES	CORRECTION
SPRING SAGS	1. Broken leaf. 2. Spring fatigue.	1. Replace spring. 2. Replace spring.
SPRING NOISE	1. Loose spring clamp bolts. 2. Worn bushings. 3. Worn or missing spring tip inserts.	1. Tighten to specification. 2. Replace bushings. 3. Replace spring tip inserts.
SHOCK NOISE	1. Loose mounting fastener. 2. Worn bushings. 3. Leaking shock.	1. Tighten to specification. 2. Replace shock. 3. Replace shock.

REMOVAL AND INSTALLATION

SHOCK ABSORBER

REMOVAL

(1) Raise vehicle and support rear axle.

(2) Remove shock absorber lower nut and bolt from the axle bracket (Fig. 1).

(3) Remove shock absorber upper nut and bolt from the frame bracket and remove the shock absorber.

INSTALLATION

(1) Install shock absorber and upper mounting bolt and nut. Tighten nut to 95 N·m (70 ft. lbs.).

(2) Install shock absorber into the axle bracket. Install the bolt and nut and tighten nut to 95 N·m (70 ft. lbs.).

(3) Remove axle support and lower vehicle.

STABILIZER BAR

REMOVAL

(1) Raise and support vehicle.

(2) Remove nuts and bolts from the links at the stabilizer bar.

(3) Remove stabilizer bar retainer bolts and retainers (Fig. 2).

(4) Remove stabilizer bar and replace worn, cracked or distorted bushings.

(5) Remove links upper mounting nuts and bolts and remove links.

INSTALLATION

(1) Install the stabilizer bar and center it with equal spacing on both sides. Install stabilizer bar retainers and tighten bolts to 54 N·m (40 ft. lbs.).

(2) Install link into frame brackets and the stabilizer bar. Install mounting nuts and bolts.

(3) Remove support and lower vehicle.

REMOVAL AND INSTALLATION (Continued)

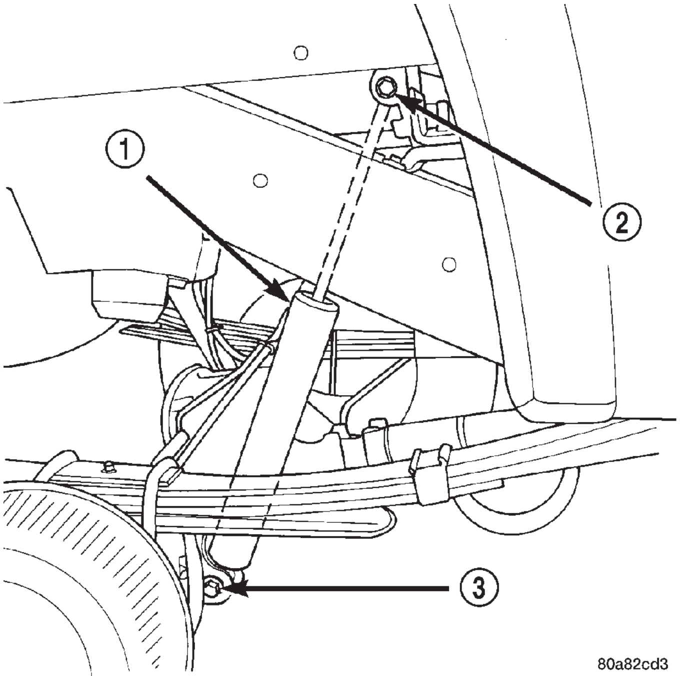


Fig. 1 Shock Absorber

1 – SHOCK ABSORBER
2 – MOUNTING BOLT
3 – MOUNTING BOLT

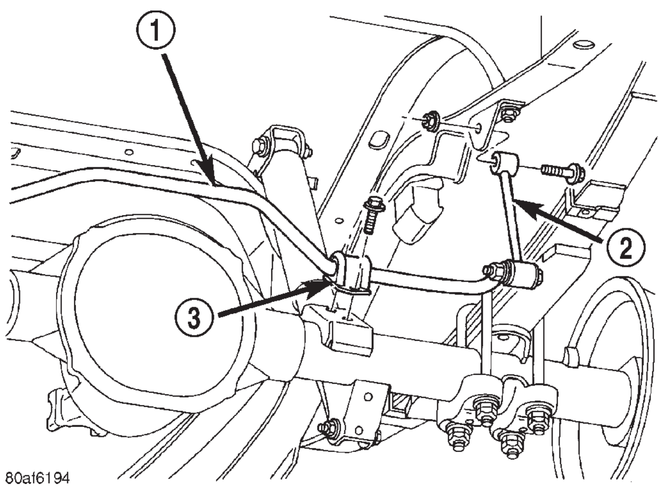


Fig. 2 Stabilizer Bar Mounting

1 – STABILIZER BAR
2 – LINK
3 – RETAINER

(4) Tighten stabilizer link nuts to 54 N·m (40 ft. lbs.).

LEAF SPRINGS

CAUTION: The rear of the vehicle must be lifted only with a jack or hoist. The lift must be placed under the frame rail crossmember located aft of the rear axle. Use care to avoid bending the side rail flange.

REMOVAL

(1) Raise the vehicle at the frame.
(2) Use a hydraulic jack to relieve the axle weight.
(3) Remove the wheel and tire assemblies.
(4) Remove the nuts, the U-bolts and spring plate from the axle (Fig. 3) and (Fig. 4).
(5) Remove the nut and bolt from the spring front eye.
(6) Remove the nut and bolt that attaches the spring shackle to the rear frame bracket.
(7) Remove the spring from the vehicle.
(8) Remove the shackle from the spring.

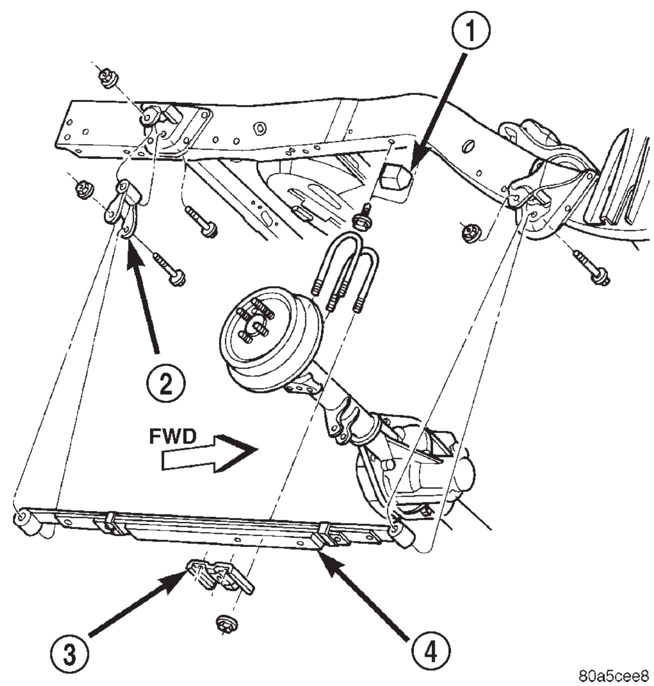


Fig. 3 Leaf Spring - 4x2

1 – JOUNCE BUMPER
2 – SHACKLE
3 – PLATE
4 – LEAF SPRING

REMOVAL AND INSTALLATION (Continued)

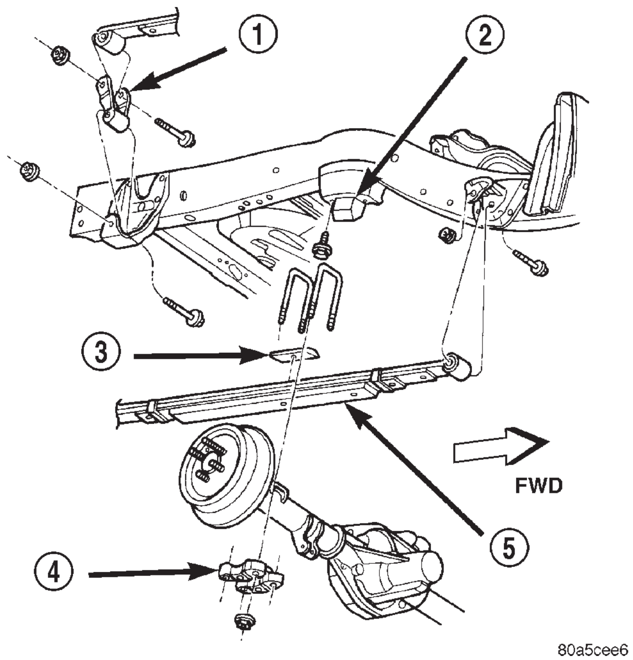


Fig. 4 Leaf Spring - 4x4

1 – SHACKLE
2 – JOUNCE BUMPER
3 – SEAT
4 – PLATE
5 – LEAF SPRING

INSTALLATION

(1) Install the spring shackle on the spring finger tight.

(2) Position the spring on the rear axle pad. Make sure the spring center bolt is inserted in the pad locating hole.

(3) Align front spring eye with the bolt hole in the front frame bracket. Install the spring eye bolt and nut and tighten the spring eye nut finger-tight.

(4) Align spring shackle eye with the bolt hole in the rear frame bracket. Install the bolt and nut and tighten the spring shackle eye nut finger-tight.

(5) Install the spring seat (4x4 only), U-bolts, spring plate and nuts.

(6) Tighten the U-bolt nuts to 149 N·m (110 ft. lbs.).

(7) Install the wheel and tire assemblies.

(8) Remove the support stands from under the frame rails. Lower the vehicle until the springs are supporting the weight of the vehicle.

(9) Tighten the spring eye pivot bolt nut and all shackle nuts to 163 N·m (120 ft. lbs.).

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Shock Absorber	
Lower Bolt	95 N·m (70 ft. lbs.)
Upper Bolt	95 N·m (70 ft. lbs.)
Stabilizer Bar	
Frame Bracket Nuts	54 N·m (40 ft. lbs.)
Link Nuts	54 N·m (40 ft. lbs.)
Retainer Bolts	54 N·m (40 ft. lbs.)
Spring U-Bolt Nuts	
2WD	149 N·m (110 ft. lbs.)
4WD	149 N·m (110 ft. lbs.)
Spring	
Spring Eye Nut	163 N·m (120 ft. lbs.)
Spring Shackle Nuts	163 N·m (120 ft. lbs.)
Jounce Bumper	
Bolts	61 N·m (45 ft. lbs.)

DIFFERENTIAL AND DRIVELINE

TABLE OF CONTENTS

	page		page
PROPELLER SHAFTS	**1**	**C205F AXLE**	**31**
FRONT AXLE DRIVESHAFTS	**18**	**8 1/4 AND 9 1/4 AXLE**	**59**

PROPELLER SHAFTS

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
PROPELLER SHAFT 1
CENTER BEARING 2
PROPELLER SHAFT JOINTS 4
PROPELLER SHAFT JOINT ANGLE 4
DIAGNOSIS AND TESTING
VIBRATION 5
UNBALANCE 6
RUNOUT 6
SERVICE PROCEDURES
DRIVELINE ANGLE MEASUREMENT PREPARATION 7
PROPELLER SHAFT ANGLE MEASUREMENT 7
REMOVAL AND INSTALLATION
FRONT PROPELLER SHAFT 10
REAR PROPELLER SHAFT 10
CENTER BEARING 11
DISASSEMBLY AND ASSEMBLY
SINGLE CARDAN UNIVERSAL JOINT 11
DOUBLE CARDAN JOINT 13
CLEANING AND INSPECTION
PROPELLER SHAFT 17
ADJUSTMENTS
ADJUSTMENT AT AXLE WITH LEAF SPRINGS . . 17
CENTER BEARING ADJUSTMENT 17
SPECIFICATIONS
TORQUE 17
SPECIAL TOOLS
PROPELLER SHAFT 17

DESCRIPTION AND OPERATION

PROPELLER SHAFT

DESCRIPTION

A propeller shaft (Fig. 2), (Fig. 3), and (Fig. 4) is the shaft which connects the transmission/transfer case to the axle differential. This is the link through which the engine power is transmitted to the axle.

The propeller shaft is designed and built with the yoke lugs in line with each other which is called zero phasing. This design produces the smoothest running condition, an out-of-phase shaft can cause a vibration.

Tubular propeller shafts are balanced by the manufacturer with weights spot welded to the tube.

PRECAUTIONS

Use the exact replacement parts when installing the propeller shafts. The use of the correct replacement parts helps to ensure safe operation. All fasteners must be torqued to the specified values for safe operation.

Also make alignment reference marks (Fig. 1) on the propeller shaft yoke and axle, or transmission, yoke prior to servicing. This helps to eliminate possible vibration.

CAUTION: Do not allow the propeller shaft to drop or hang from any propeller shaft joint during removal. Attach the propeller shaft to the vehicle underside with wire to prevent damage to the joints.

DESCRIPTION AND OPERATION (Continued)

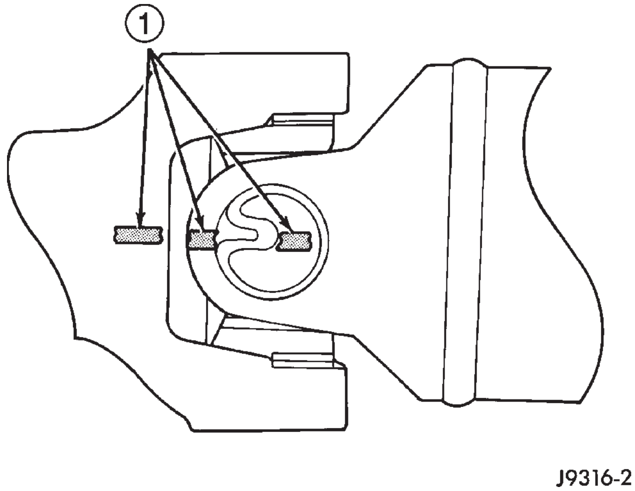


Fig. 1 Reference Marks on Yokes

1 – REFERENCE MARKS

OPERATION

The propeller shaft must operate through constantly changing relative angles between the transmission and axle. It must also be capable of changing length while transmitting torque. The axle rides suspended by springs in a floating motion. The propeller shaft must be able to change operating angles when going over various road surfaces. This is accomplished through universal joints, which permit the propeller shaft to operate at different angles. The slip joints (or yokes) permit contraction or expansion (Fig. 2), (Fig. 3), and (Fig. 4).

Before undercoating a vehicle, the propeller shaft and the U-joints should be covered to prevent an out-of-balance condition and driveline vibration.

CAUTION: Use original equipment replacement parts for attaching the propeller shafts. The specified torque must always be applied when tightening the fasteners.

CENTER BEARING

DESCRIPTION

Vehicles equipped with a two-piece propeller shaft uses a rubber insulated center bearing. The bearing

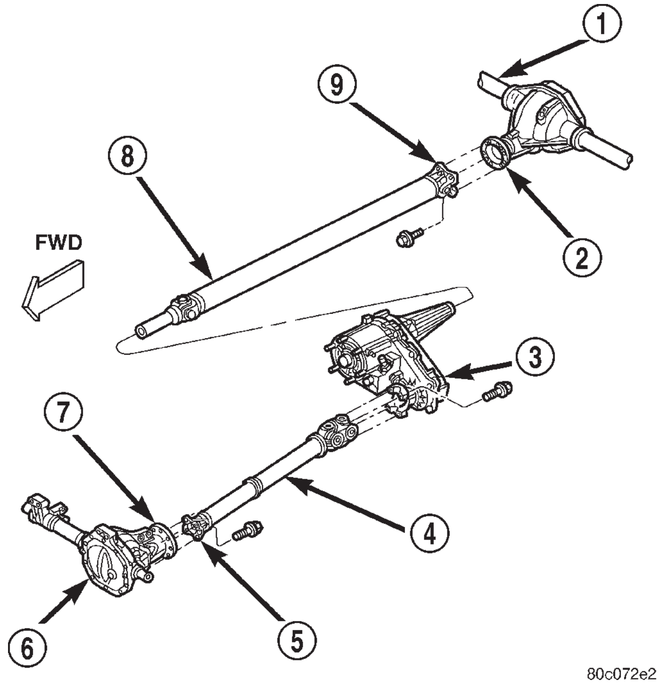


Fig. 2 Front Propeller Shaft

1 – REAR AXLE
2 – COMPANION FLANGE
3 – TRANSFER CASE
4 – FRONT PROPELLER SHAFT
5 – COMPANION YOKE
6 – FRONT AXLE
7 – COMPANION FLANGE
8 – REAR PROPELLER SHAFT
9 – COMPANION YOKE

is used to support the shafts where they are joined together.

OPERATION

The propeller shaft center bearing serves to divide the required propeller shaft length into two smaller shafts, which has several inherent advantages. Having two short propeller shafts instead of one long shaft decreases the chance of unwanted noise and vibrations. The shorter shafts are easier to balance and serve to increase ground clearance while maintaining acceptable driveline angles.

DESCRIPTION AND OPERATION (Continued)

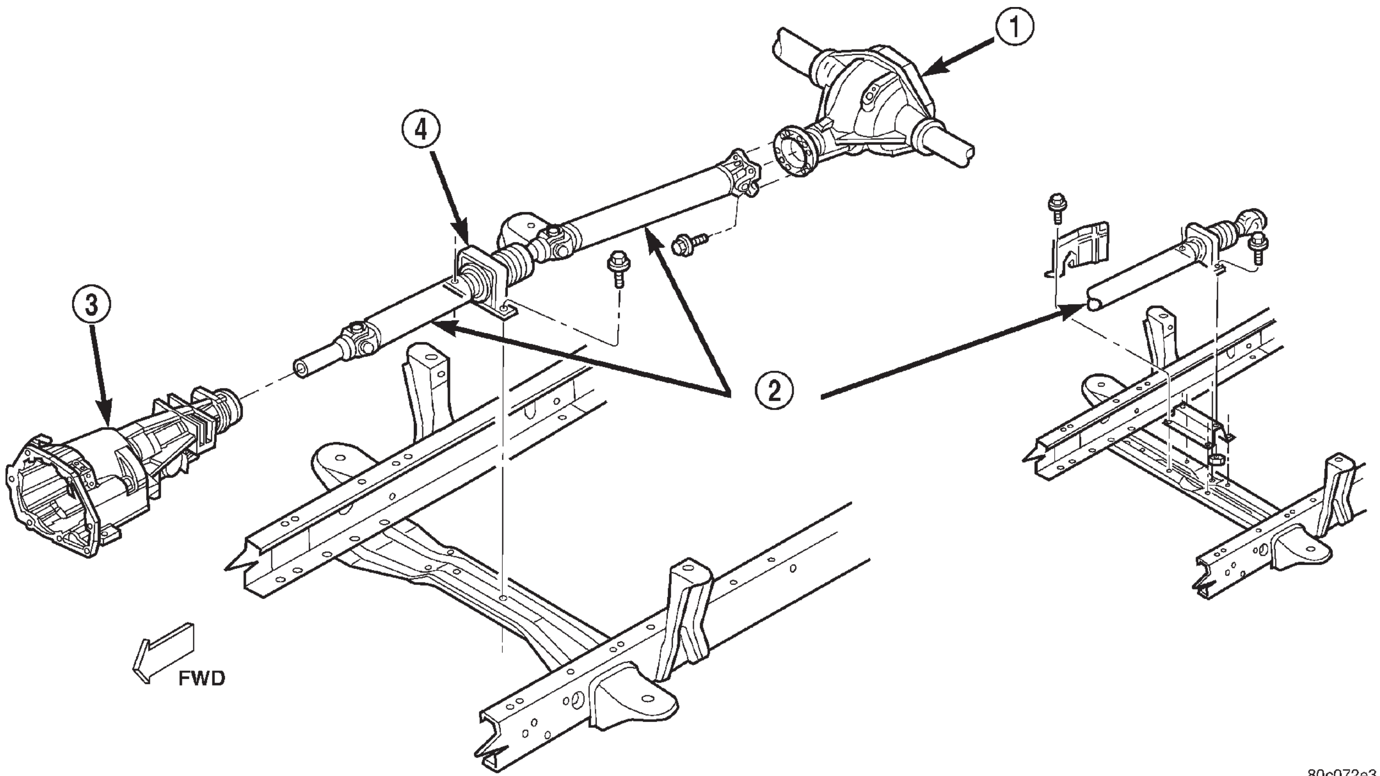


Fig. 3 Rear Propeller Shaft with Center Bearing

1 – REAR AXLE
2 – REAR PROPELLER SHAFT
3 – TRANSMISSION EXTENSION HOUSING
4 – CENTER BEARING

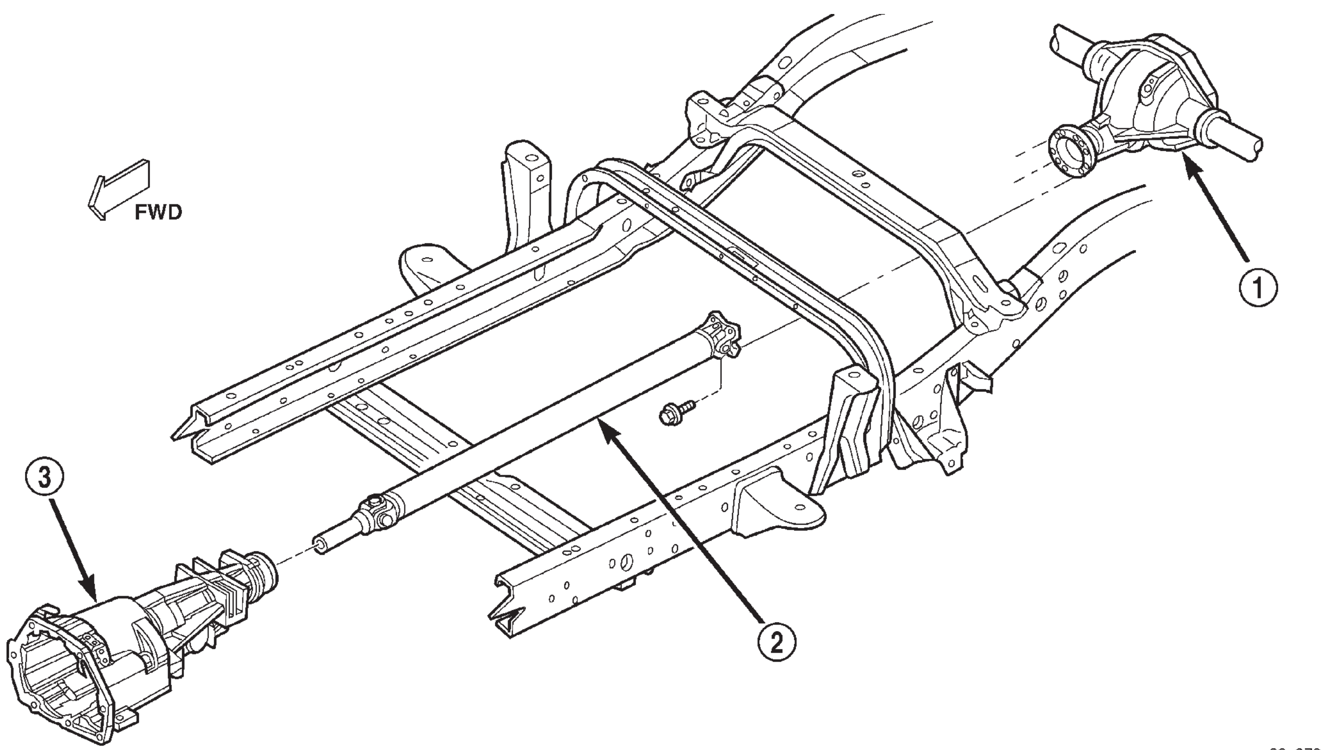


Fig. 4 Rear Propeller Shaft

1 – REAR AXLE
2 – REAR PROPELLER SHAFT
3 – TRANSMISSION EXTENSION HOUSING

DESCRIPTION AND OPERATION (Continued)

PROPELLER SHAFT JOINTS

DESCRIPTION

Two different types of propeller shaft joints are used in AN vehicles (Fig. 5) and (Fig. 6). None of the joints are serviceable. If worn or damaged, they must be replaced as a complete assembly.

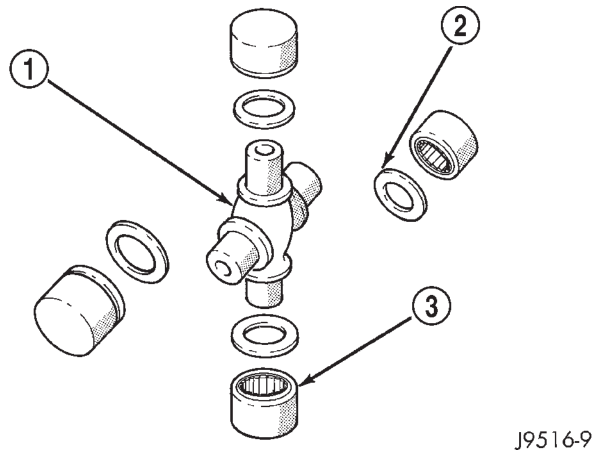


Fig. 5 Single Cardan U-Joint

1 – CROSS
2 – SEAL
3 – CAP AND NEEDLE BEARINGS

LUBRICATION

The factory installed universal joints are lubricated for the life of the vehicle and do not need lubrication. All universal joints should be inspected for leakage and damage each time the vehicle is serviced. If seal leakage or damage exists, the universal joint should be replaced.

PROPELLER SHAFT JOINT ANGLE

DESCRIPTION

When two shafts come together at a common joint, the bend that is formed is called the operating angle. The larger the angle, the larger the amount of angular acceleration and deceleration of the joint. This speeding up and slowing down of the joint must be cancelled to produce a smooth power flow.

OPERATION

This cancellation is done through the phasing of a propeller shaft and ensuring that the proper propeller shaft joint working angles are maintained.

A propeller shaft is properly phased when the yoke ends are in the same plane, or in line. A twisted shaft will make the yokes out of phase and cause a noticeable vibration.

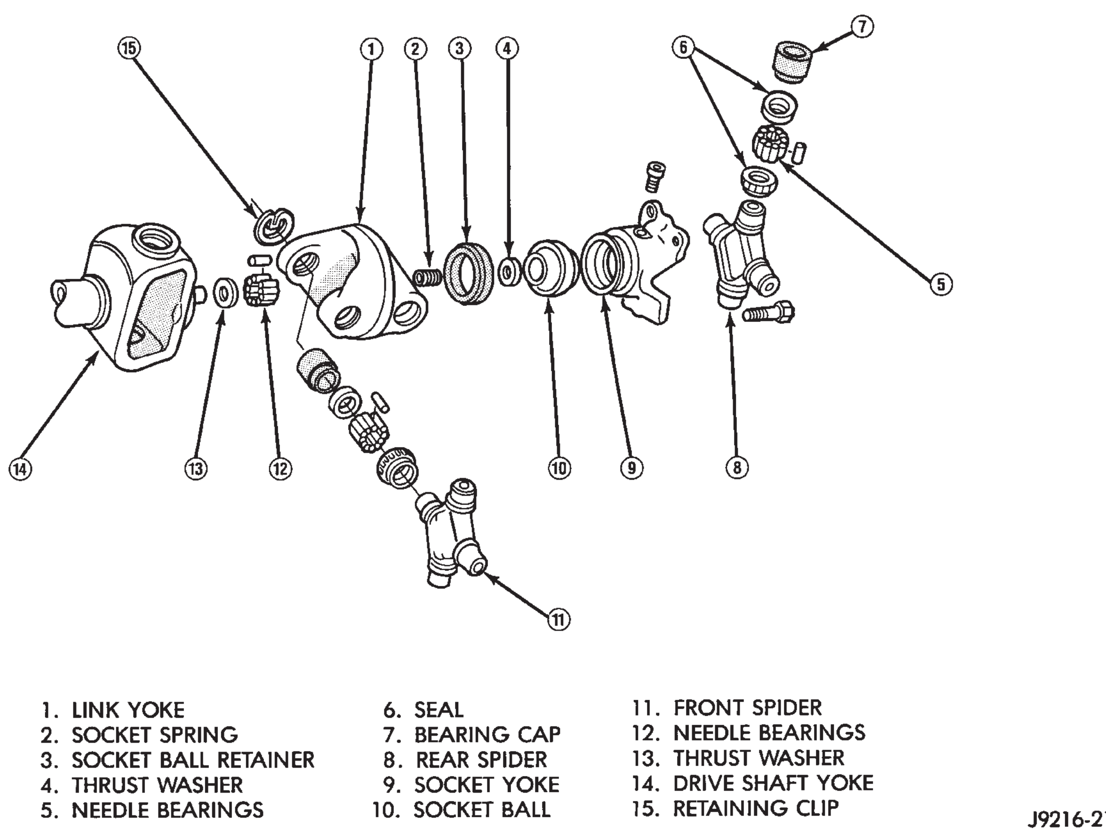


Fig. 6 Double Cardan U-Joint

DESCRIPTION AND OPERATION (Continued)

When taking propeller shaft joint angle measurements, or checking the phasing, of two piece shafts, consider each shaft separately.

Ideally the driveline system should have;

- Angles that are equal or opposite within 1 degree of each other.
- Have a 3 degree maximum operating angle.
- Have at least a 1/2 degree continuous operating (propeller shaft) angle.

Propeller shaft speed (rpm) is the main factor in determining the maximum allowable operating angle. As a guide to the maximum normal operating angles refer to (Fig. 7).

PROPELLER SHAFT R. P. M.	MAX. NORMAL OPERATING ANGLES
5000	3°
4500	3°
4000	4°
3500	5°
3000	5°
2500	7°
2000	8°
1500	11°

Fig. 7 Maximum Angles And Propeller Shaft Speed

DIAGNOSIS AND TESTING

VIBRATION

Tires that are out-of-round, or wheels that are unbalanced, will cause a low frequency vibration. Refer to Group 22, Tires and Wheels, for additional information.

Brake drums that are unbalanced will cause a harsh, low frequency vibration. Refer to Group 5, Brakes, for additional information.

Driveline vibration can also result from loose or damaged engine mounts. Refer to Group 9, Engines, for additional information.

Propeller shaft vibration increases as the vehicle speed is increased. A vibration that occurs within a specific speed range is not usually caused by a propeller shaft being unbalanced. Defective universal joints, or an incorrect propeller shaft angle, are usually the cause of such a vibration.

DRIVELINE VIBRATION

Drive Condition	Possible Cause	Correction
Propeller Shaft Noise	1) Undercoating or other foreign material on shaft.	1) Clean exterior of shaft and wash with solvent.
	2) Loose U-joint clamp screws.	2) Install new clamps and screws and tighten to proper torque.
	3) Loose or bent U-joint yoke or excessive runout.	3) Install new yoke.
	4) Incorrect driveline angularity.	4) Measure and correct driveline angles.
	5) Rear spring center bolt not in seat.	5) Loosen spring u-bolts and seat center bolt.
	6) Worn U-joint bearings.	6) Install new U-joint.
	7) Propeller shaft damaged or out of balance.	7) Installl new propeller shaft.
	8) Broken rear spring.	8) Install new rear spring.
	9) Excessive runout or unbalanced condition.	9) Re-index propeller shaft, test, and evaluate.
	10) Excessive drive pinion gear shaft runout.	10) Re-index propeller shaft and evaluate.
	11) Excessive axle yoke deflection.	11) Inspect and replace yoke if necessary.
	12) Excessive transfer case runout.	12) Inspect and repair as necessary.
Universal Joint Noise	1) Loose U-joint clamp screws.	1) Install new clamps and screws and tighten to proper torque.
	2) Lack of lubrication.	2) Replace as U-joints as necessary.

DIAGNOSIS AND TESTING (Continued)

UNBALANCE

NOTE: Removing and re-indexing the propeller shaft, 45° at a time, relative to the companion flange may eliminate some vibrations.

If propeller shaft is suspected of being unbalanced, it can be verified with the following procedure:

(1) Raise the vehicle.

(2) Clean all the foreign material from the propeller shaft and the universal joints.

(3) Inspect the propeller shaft for missing balance weights, broken welds, and bent areas. **If the propeller shaft is bent, it must be replaced.**

(4) Inspect the universal joints to ensure that they are not worn, are properly installed, and are correctly aligned with the shaft.

(5) Check the companion flange bolts torque.

(6) Remove the wheels and tires. Install the wheel lug nuts to retain the brake drums or rotors.

(7) Mark and number the shaft six inches from the yoke end at four positions 90° apart.

(8) Run and accelerate the vehicle until vibration occurs. Note the intensity and speed the vibration occurred. Stop the engine.

(9) Install a screw clamp at position 1 (Fig. 8).

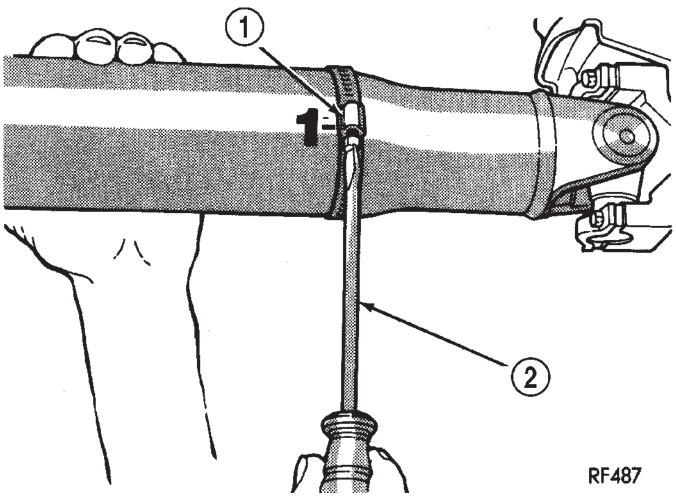


Fig. 8 Clamp Screw At Position 1–Typical

1 – CLAMP
2 – SCREWDRIVER

(10) Start the engine and re-check for vibration. If there is little or no change in vibration, move the clamp to one of the other three positions. Repeat the vibration test.

(11) If there is no difference in vibration at the other positions, the source of the vibration may not be propeller shaft.

(12) If the vibration decreased, install a second clamp (Fig. 9) and repeat the test.

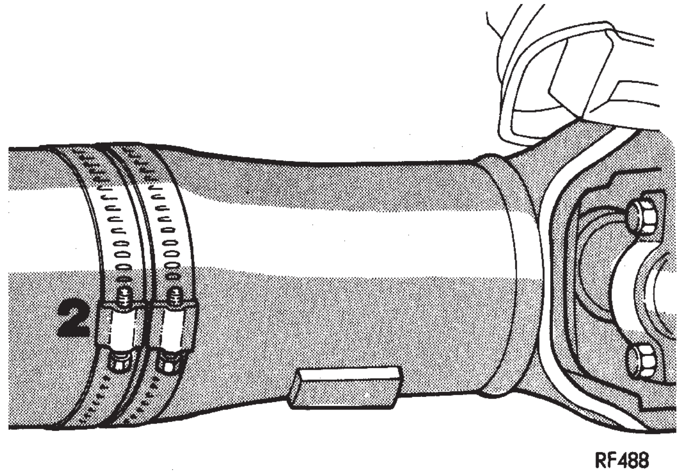


Fig. 9 Two Clamp Screws At The Same Position–Typical

(13) If the additional clamp causes an additional vibration, separate the clamps (1/4 inch above and below the mark). Repeat the vibration test (Fig. 10).

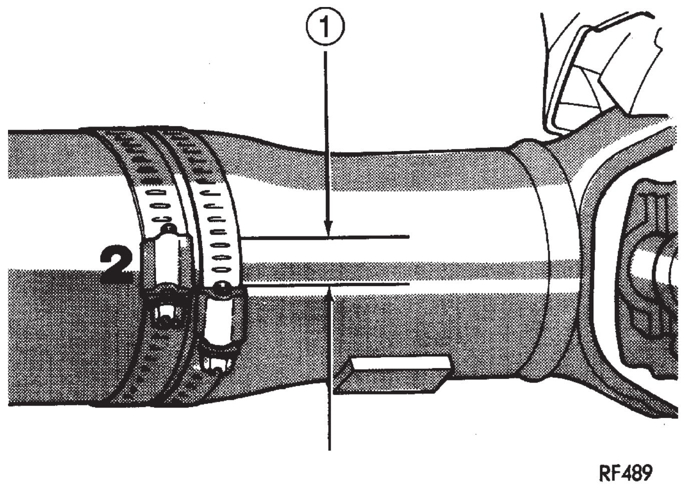


Fig. 10 Clamp Screws Separated–Typical

1 – ½ INCH

(14) Increase distance between the clamp screws and repeat the test until the amount of vibration is at the lowest level. Bend the slack end of the clamps so the screws will not loosen.

(15) If the vibration remains unacceptable, apply the same steps to the front end of the propeller shaft.

(16) Install the wheel and tires. Lower the vehicle.

RUNOUT

(1) Remove dirt, rust, paint, and undercoating from the propeller shaft surface where the dial indicator will contact the shaft.

(2) The dial indicator must be installed perpendicular to the shaft surface.

(3) Measure runout at the center and ends of the shaft sufficiently far away from weld areas to ensure

DIAGNOSIS AND TESTING (Continued)

that the effects of the weld process will not enter into the measurements.

(4) Refer to Runout Specifications chart.

(5) If the propeller shaft runout is out of specification, remove the propeller shaft, index the shaft 45°, and re-install the propeller shaft. Measure shaft runout again.

(6) If the propeller shaft runout is now within specifications, mark the shaft and yokes for proper orientation.

(7) If the propeller shaft runout is not within specifications, verify that the runout of the transmission/transfer case and axle are within specifications. Correct as necessary and re-measure propeller shaft runout.

(8) Replace the propeller shaft if the runout still exceeds the limits.

RUNOUT SPECIFICATIONS

Front of Shaft	0.020 in. (0.50 mm)
Center of Shaft	0.025 in. (0.63 mm)
Rear of Shaft	0.020 in. (0.50 mm)
Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube.	

SERVICE PROCEDURES

DRIVELINE ANGLE MEASUREMENT PREPARATION

Before measuring universal joint angles, the following must be done;

- Inflate all tires to correct pressure.
- Check the angles in the same loaded or unloaded condition as when the vibration occurred. Propeller shaft angles change according to the amount of load in the vehicle.
- Check the condition of all suspension components and verify all fasteners are torqued to specifications.
- Check the condition of the engine and transmission mounts and verify all fasteners are torqued to specifications.

PROPELLER SHAFT ANGLE MEASUREMENT

NOTE: The following procedure is depicted using an axle equipped with a pinion yoke. The procedure and principles are the same for axles equipped with a companion flange.

ONE-PIECE PROPELLER SHAFT

To accurately check driveline alignment, raise and support the vehicle at the axles as level as possible. Allow the wheels and propeller shaft to turn. Remove any external bearing snap rings (if equipped) from universal joint so that the inclinometer base sits flat.

(1) Rotate the shaft until transmission/transfer case output yoke bearing cap is facing downward.

Always make measurements from front to rear.

(2) Place Inclinometer on yoke bearing cap (A) parallel to the shaft (Fig. 11). Center bubble in sight glass and record measurement.

This measurement will give you the transmission or Output Yoke Angle (A).

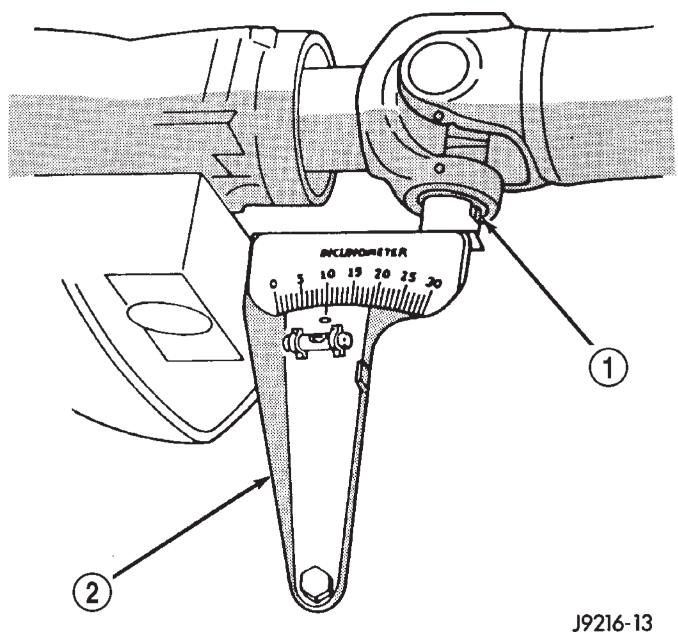


Fig. 11 Front (Output) Angle Measurement (A)

1 – SLIP YOKE BEARING CAP
2 – SPECIAL TOOL 7663 (J-23498A)

SERVICE PROCEDURES (Continued)

(3) Rotate propeller shaft 90 degrees and place Inclinometer on yoke bearing cap parallel to the shaft (Fig. 12). Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft.

This measurement will give you the propeller shaft angle (C).

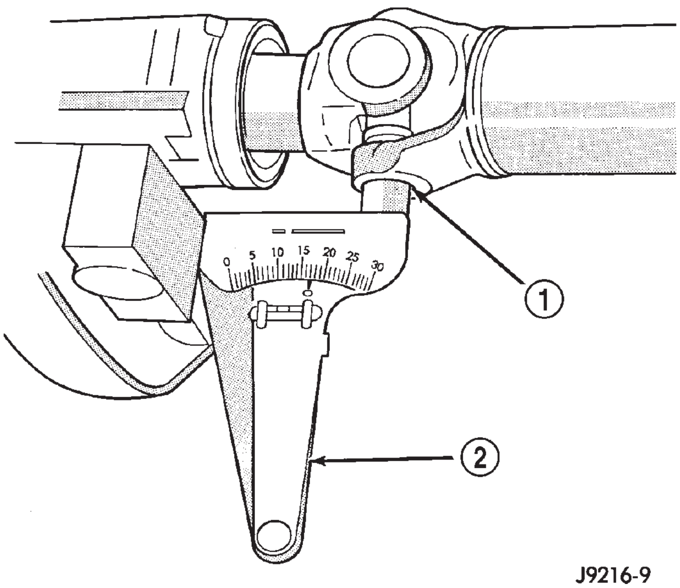


Fig. 12 Propeller Shaft Angle Measurement (C)

1 – SHAFT YOKE BEARING CAP
2 – SPECIAL TOOL 7663 (J23498–A)

(4) Subtract smaller figure from larger (C minus A) to obtain transmission output operating angle.

(5) Rotate propeller shaft 90 degrees and place Inclinometer on pinion yoke bearing cap parallel to the shaft (Fig. 13). Center bubble in sight glass and record measurement.

This measurement will give you the pinion shaft or input yoke angle (B).

(6) Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.

Refer to rules given below and the example in for additional information.

• Good cancellation of U–joint operating angles (within 1°).
• Operating angles less than 3°.
• At least 1/2 of one degree continuous operating (propeller shaft) angle.

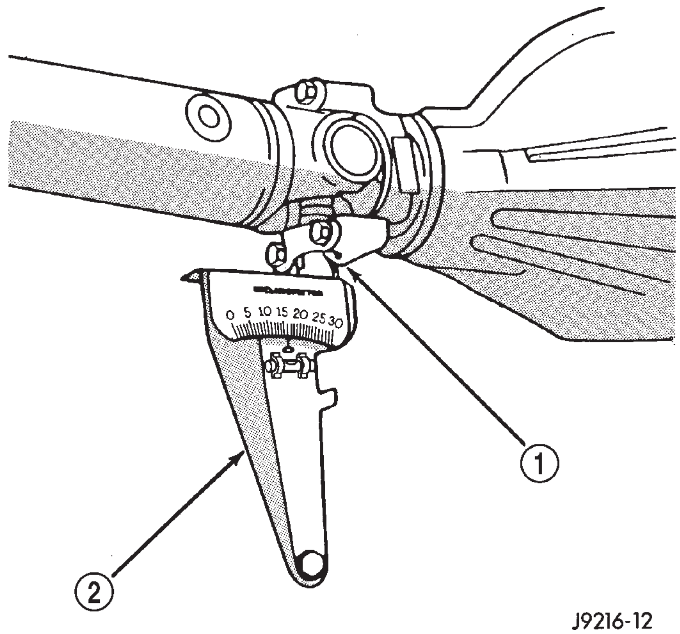


Fig. 13 Rear (Input) Angle Measurement (B)

1 – PINION YOKE BEARING CAP
2 – SPECIAL TOOL 7663 (J-23498A)

TWO-PIECE PROPELLER SHAFT

The procedure to measure the propeller shaft angles involved with a two-piece propeller shaft is the same as those for a one-piece propeller shaft. The following additional conditions also apply:

• The front half-shaft must be parallel to the rear axle pinion shaft.
• The front and rear half-shafts must be offset by a minimum of 1/2 of a degree. From the transmission/transfer case output shaft and from each other.
• Excessive variation in measurement angles of A, B or C indicate propeller mis-alignment.
• Vertical alignment of a two-piece shaft at the yokes should be greater than one-half degree and as close to one degree as possible.

SERVICE PROCEDURES (Continued)

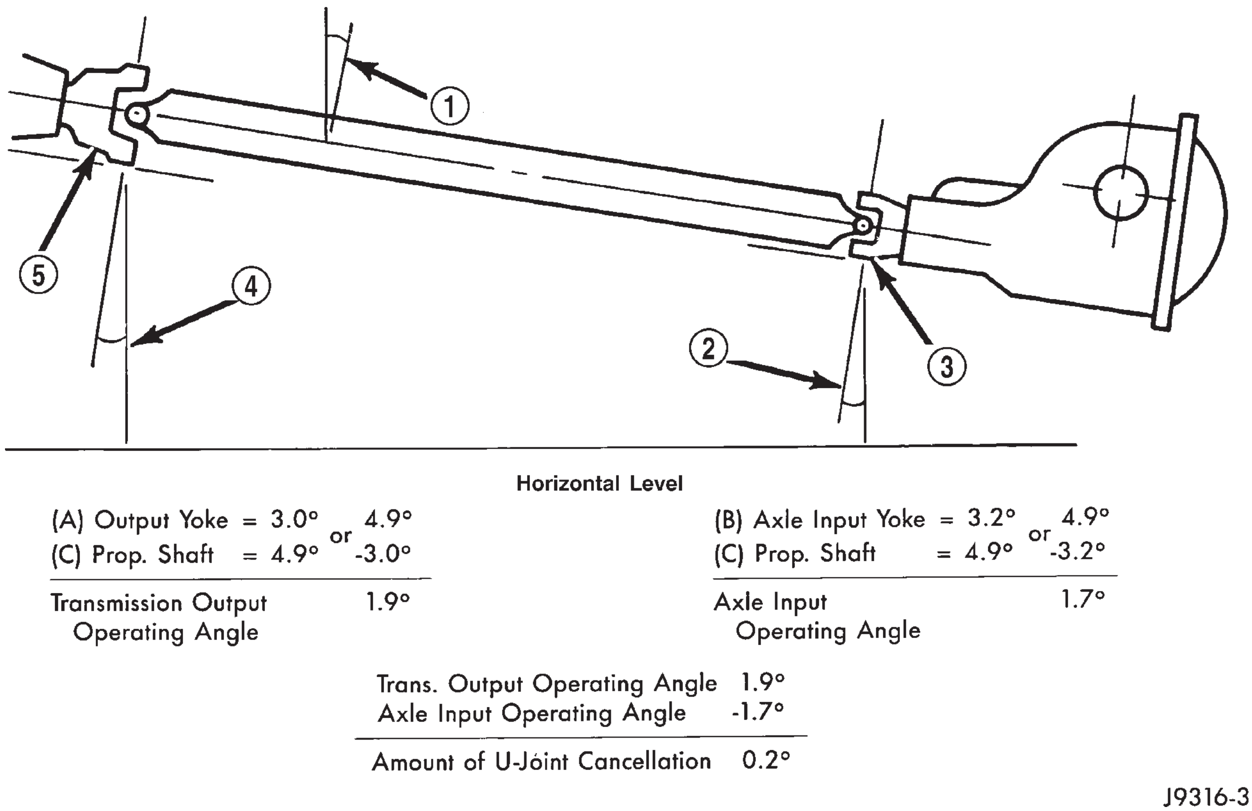


Fig. 14 Universal Joint Angle Example

1 – 4.9° Angle (C)
2 – 3.2° Angle (B)
3 – Input Yoke
4 – 3.0° Angle (A)
5 – Output Yoke

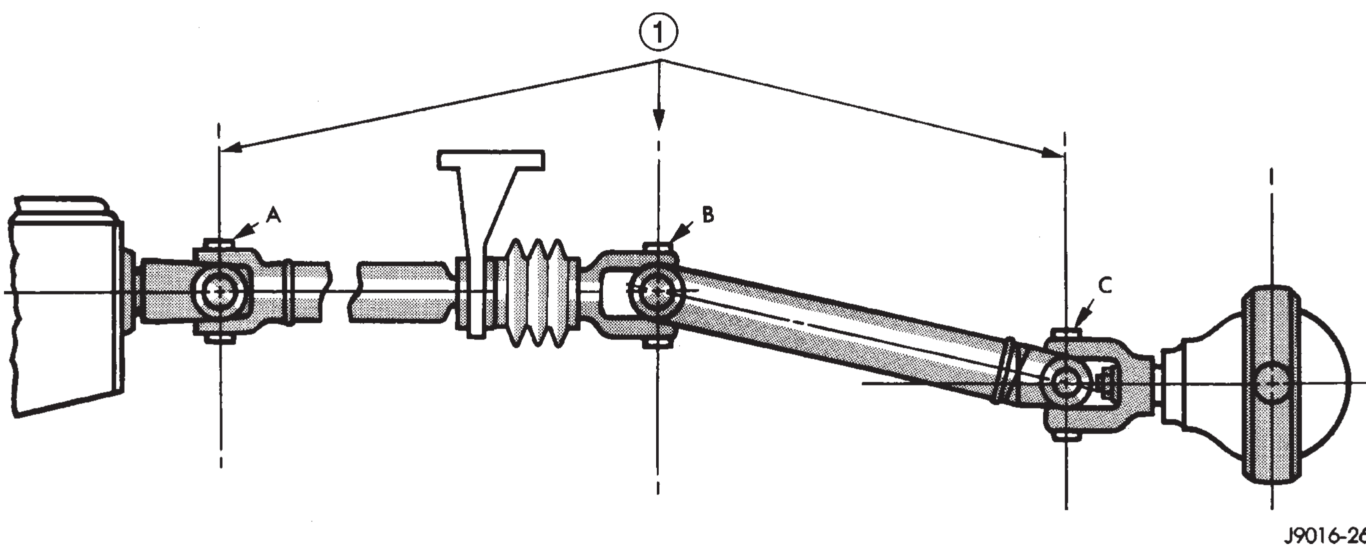


Fig. 15 Universal Joint Angle—Two-Piece Shaft

1 – YOKES MUST BE IN SAME PLANE

REMOVAL AND INSTALLATION

FRONT PROPELLER SHAFT

REMOVAL

(1) Shift the transmission and transfer case to their neutral positions. Raise and support vehicle. Remove skid plate, if equipped.

(2) Using a suitable marker, mark a line across the yoke at the transfer case, the link yoke, and propeller shaft yoke at the rear of the front propeller shaft for installation reference.

(3) Mark a line across the propeller shaft companion yoke and flange at the front axle for installation reference.

(4) Remove the bolts holding the companion yoke to the companion flange (Fig. 16).

(5) Remove the bolts holding the propeller shaft to the transfer case yoke.

(6) Remove the propeller shaft.

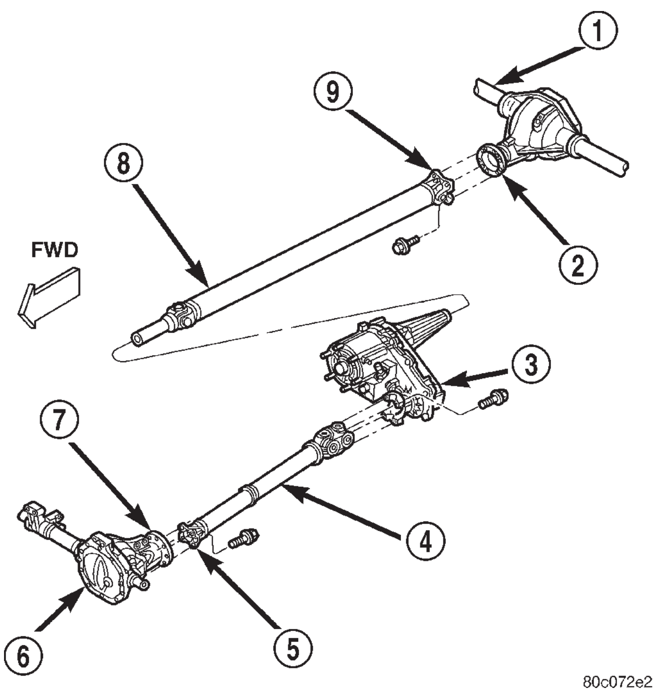


Fig. 16 Front Propeller Shaft

1 – REAR AXLE
2 – COMPANION FLANGE
3 – TRANSFER CASE
4 – FRONT PROPELLER SHAFT
5 – COMPANION YOKE
6 – FRONT AXLE
7 – COMPANION FLANGE
8 – REAR PROPELLER SHAFT
9 – COMPANION YOKE

INSTALLATION

(1) Position front propeller shaft under vehicle with rear universal joint over the transfer case yoke flange.

(2) Place front companion yoke into the axle companion flange.

(3) Align mark on the link yoke and universal joint to the mark on the transfer case yoke flange.

(4) Loosely install bolts to hold universal joint to transfer case yoke.

(5) Align the mark on companion yoke to the mark on the companion flange.

(6) Install bolts to hold the companion yoke to the companion flange. Tighten bolts to 108 N·m (80 ft. lbs.).

(7) Tighten bolts to hold universal joint to transfer case yoke to 27 N·m (20 ft. lbs.).

(8) Install skid plate, if equipped.

(9) Lower vehicle and road test to verify repair.

REAR PROPELLER SHAFT

REMOVAL

(1) Raise and support vehicle on safety stands.

(2) Shift the transmission to the Neutral position.

(3) Using a suitable marker, mark a line across the axle companion flange and yoke for installation reference.

(4) Using a suitable marker, mark the outline of the center bearing on the support bracket for installation reference, if equipped.

(5) Using a suitable marker, mark the outline of the heat shield on the center bearing for installation reference, if equipped.

(6) Remove bolts that attach the center bearing and heat shield to the support bracket, if equipped.

(7) Remove the bolts holding the companion yoke to the companion flange.

(8) Slide the slip yoke off of the transmission, or transfer case, output shaft and remove the propeller shaft (Fig. 17).

INSTALLATION

(1) Slide the slip yoke onto the transmission, or transfer case, output shaft.

(2) Align and install the center bearing and heat shield to the support bracket, if necessary.

(3) Install the bolts and tighten to 68 N·m (50 ft. lbs.) torque.

(4) Align the installation reference marks made on the companion flange and yoke.

(5) Position the companion yoke onto the companion flange.

(6) Install the bolts to hold the companion yoke to the companion flange. Tighten the bolts to 108 N·m (80 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

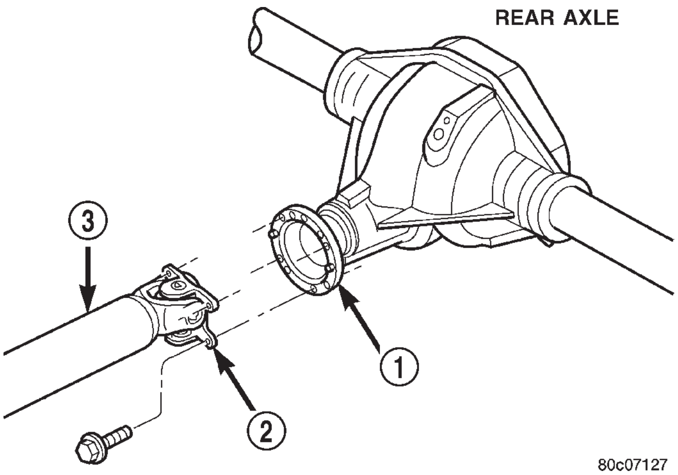


Fig. 17 Rear Propeller Shaft

1 – COMPANION FLANGE
2 – COMPANION YOKE
3 – REAR PROPELLER SHAFT

(7) Lower the vehicle.

CENTER BEARING

REMOVAL

(1) Remove rear propeller shaft.

(2) Remove slip joint boot clamp and separate the two half-shafts.

(3) Use hammer and punch to tap slinger away from shaft to provide room for bearing splitter.

(4) Position Bearing Splitter Tool 1130 between slinger and shaft.

CAUTION: Do not damage shaft spline during removal of center bearing.

(5) Set shaft in press and press bearing off the shaft.

INSTALLATION

(1) Install new slinger on shaft and drive into position with appropriate installer tool.

(2) Install new center bearing on shaft with Bearing Installer Tool 6052. Drive on shaft with hammer until bearing is seated.

(3) Clean shaft splines and apply a coat of multi–purpose grease.

(4) Align master splines and slide front and rear half-shafts together. Reposition slip yoke boot and install new clamp.

(5) Install propeller shaft in vehicle.

DISASSEMBLY AND ASSEMBLY

SINGLE CARDAN UNIVERSAL JOINT

NOTE: The following procedure is described for a propeller shaft equipped with only a cardan joint in the tube yoke. If the propeller shaft is equipped with a companion yoke, simply repeat the following steps to remove the cardan joint from the companion yoke after removing the cardan joint from the tube yoke.

DISASSEMBLY

Individual components of cardan universal joints are not serviceable. If worn or leaking, they must be replaced as an assembly.

(1) Remove the propeller shaft.

(2) Using a soft drift, tap the outside of the bearing cap assembly to loosen snap ring.

(3) Remove snap rings from both sides of yoke (Fig. 18).

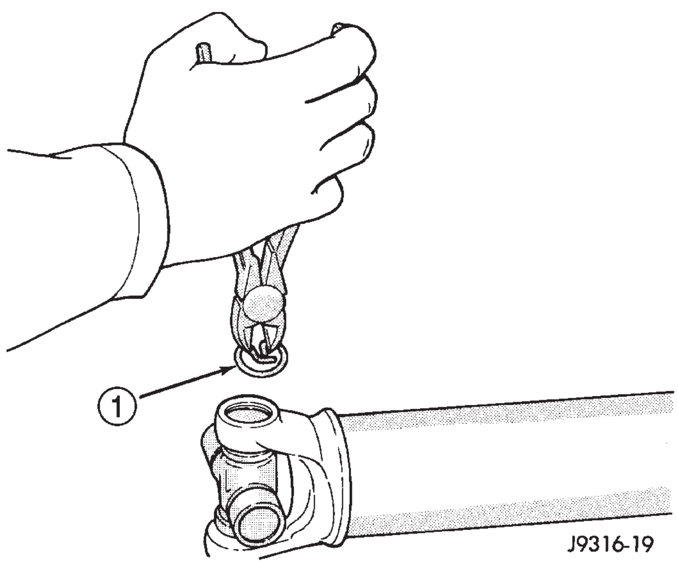


Fig. 18 Remove Snap Ring

1 – SNAP RING

(4) Set the yoke in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the yoke.

(5) Position the yoke with the grease fitting, if equipped, pointing up.

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and press the cap through the yoke to release the lower bearing cap (Fig. 19).

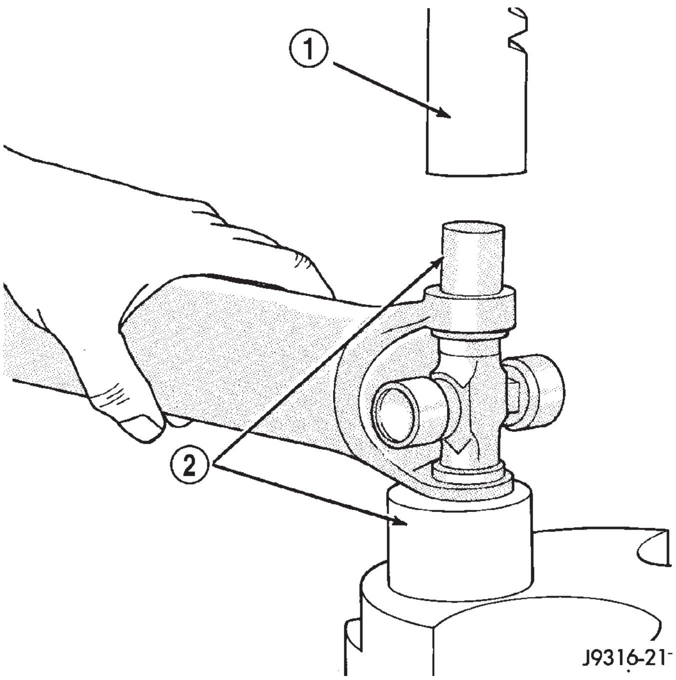


Fig. 19 Press Out Bearing

1 – PRESS
2 – SOCKET

(7) If the bearing cap will not pull out of the yoke by hand after pressing, tap the yoke ear near the bearing cap to dislodge the cap.

(8) To remove the opposite bearing cap, turn the yoke over and straighten the cross in the open hole. Then, carefully press the end of the cross until the remaining bearing cap can be removed (Fig. 20).

CAUTION: If the cross or bearing cap are not straight during installation, the bearing cap will score the walls of the yoke bore and damage can occur.

ASSEMBLY

(1) Apply extreme pressure (EP) N. L. G. I. Grade 1 or 2 grease to inside of yoke bores to aid in installation.

(2) Position the cross in the yoke with its lube fitting, if equipped, pointing up (Fig. 21).

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 22). Keep the needle bearings upright in the bearing assembly. A needle bearing lying at the bottom of the cap will prevent proper assembly.

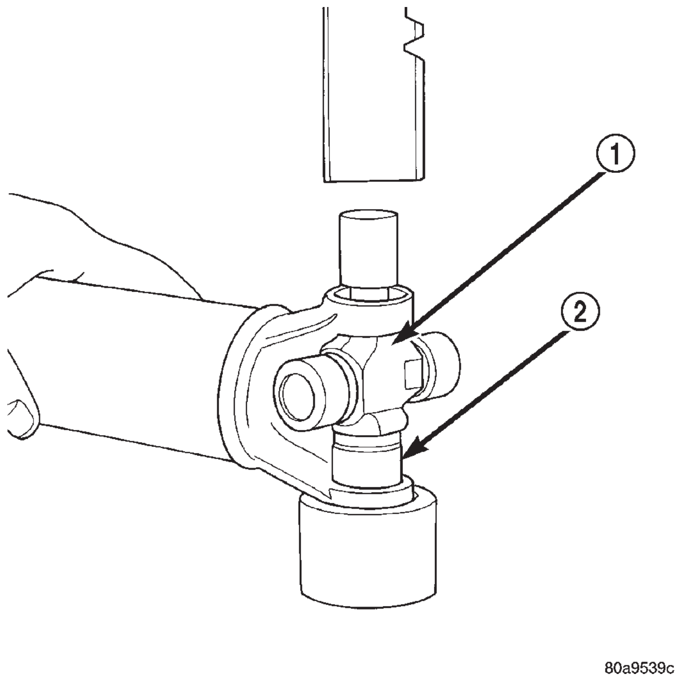


Fig. 20 Press Out Remaining Bearing

1 – CROSS
2 – BEARING CAP

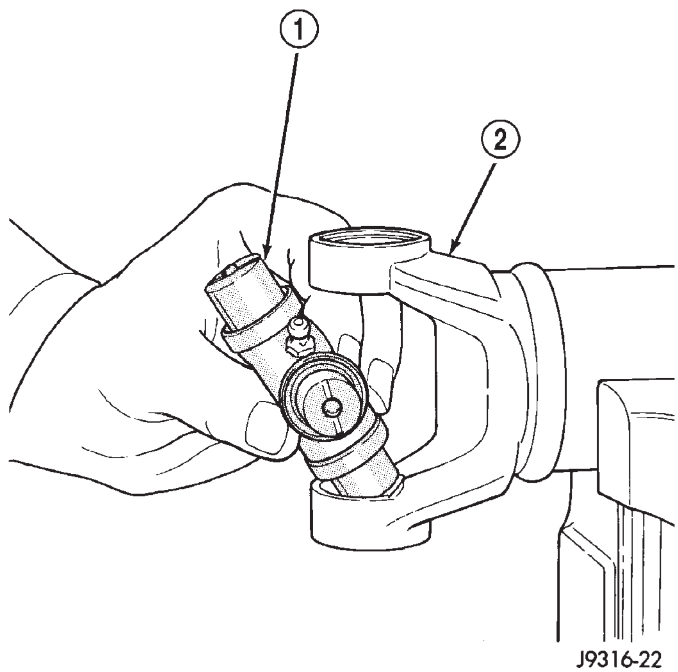


Fig. 21 Install Cross In Yoke

1 – CROSS
2 – YOKE

(4) Press the bearing cap into the yoke bore enough to install a snap ring.

(5) Install a snap ring.

DISASSEMBLY AND ASSEMBLY (Continued)

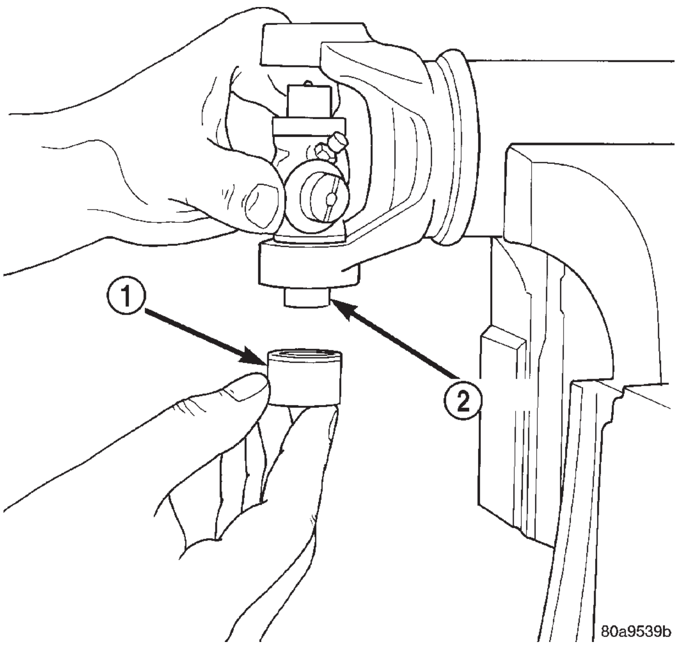


Fig. 22 Install Bearing On Trunnion

1 – BEARING CAP
2 – TRUNNION

(6) Repeat Step 3 and Step 4 to install the opposite bearing cap. If the joint is stiff or binding, strike the yoke with a soft hammer to seat the needle bearings.

(7) Add grease to lube fitting, if equipped.

(8) Install the propeller shaft.

DOUBLE CARDAN JOINT

DISASSEMBLY

Individual components of cardan universal joints are not serviceable. If worn or leaking, they must be replaced as an assembly.

(1) Remove the propeller shaft.

(2) Using a soft drift, tap the outside of the bearing cap assembly to loosen snap ring.

(3) Remove all the bearing cap snap rings (Fig. 23).

(4) Set the joint in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the link yoke.

(5) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and partially press one bearing cap from the outboard side of the link yoke enough to grasp the bearing cap with vise jaws (Fig. 24). Be sure to remove grease fittings that interfere with removal.

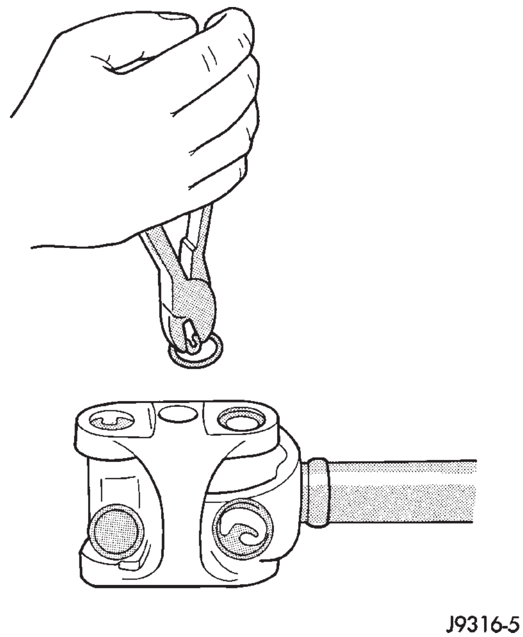


Fig. 23 Remove Snap Rings

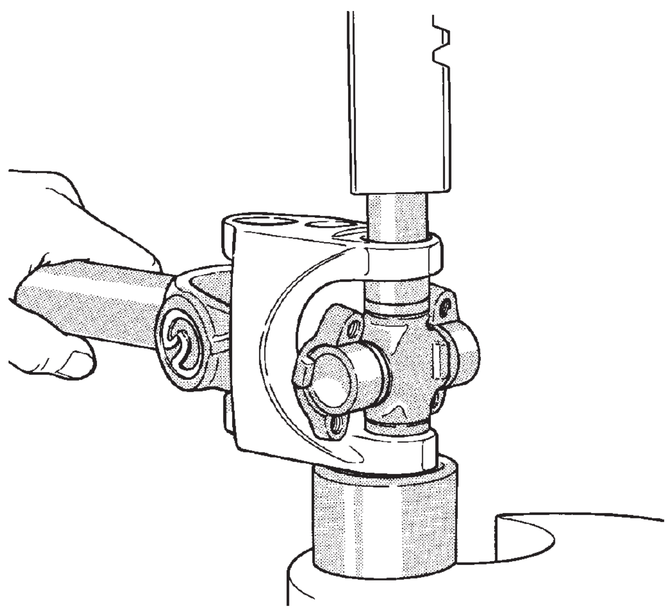


Fig. 24 Press Out Bearing

(6) Grasp the protruding bearing by vise jaws. Tap the link yoke with a mallet and drift to dislodge the bearing cap from the yoke (Fig. 25).

DISASSEMBLY AND ASSEMBLY (Continued)

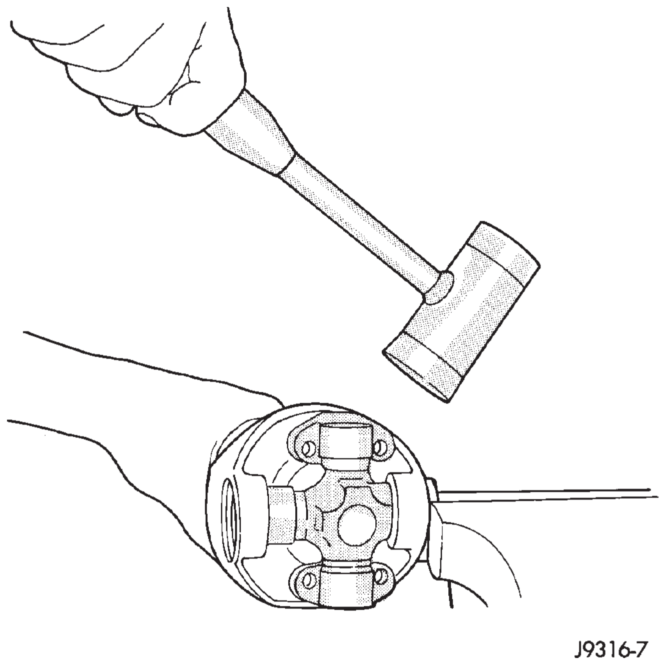


Fig. 25 Remove Bearing From Yoke

(7) Flip assembly and repeat Step 4, Step 5, and Step 6 to remove the opposite bearing cap. This will then allow removal of the cross centering kit assembly and spring (Fig. 26).

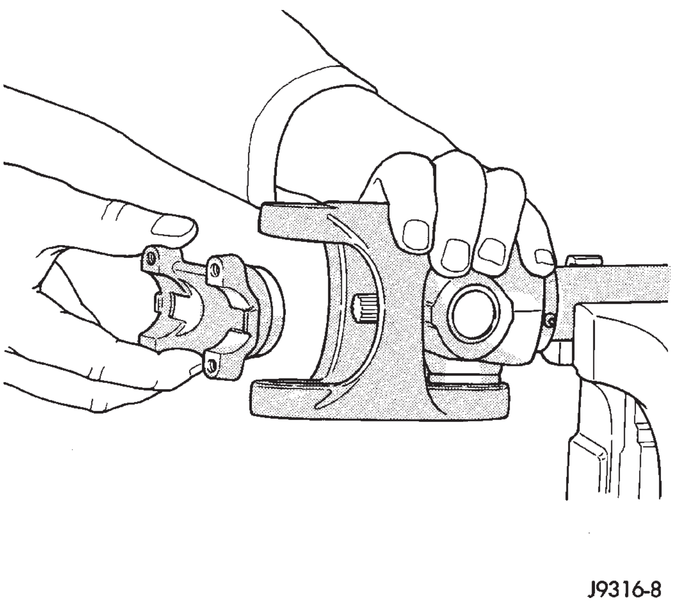


Fig. 26 Remove Centering Kit

(8) Press the remaining bearing caps out the other end of the link yoke as described above to complete the disassembly.

ASSEMBLY

During assembly, ensure that the alignment marks on the link yoke and propeller shaft yoke are aligned.

(1) Apply extreme pressure (EP) N. L. G. I. Grade 1 or 2 grease to inside of yoke bores to aid in installation.

(2) Fit a cross into the propeller shaft yoke (Fig. 27).

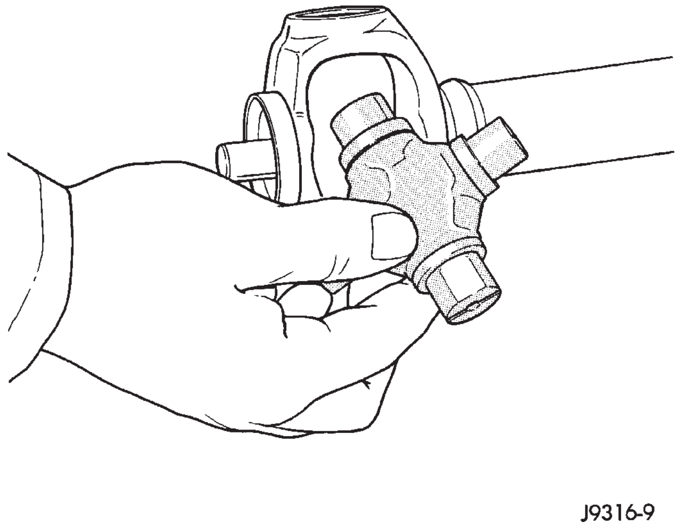


Fig. 27 Install Cross In Yoke

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 28). Keep the needle bearings upright in the bearing assembly. A needle bearing lying at the bottom of the cap will prevent proper assembly.

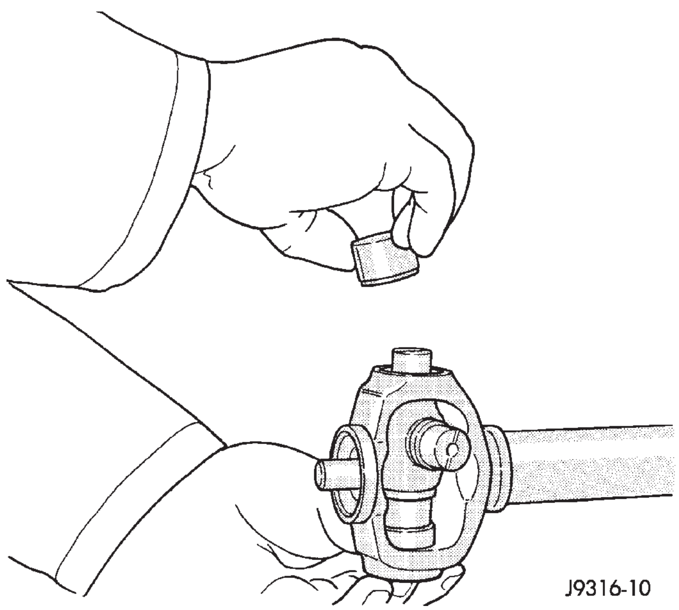


Fig. 28 Install Bearing Cap

(4) Press the bearing cap into the yoke bore enough to install a snap ring (Fig. 29).

(5) Install a snap ring.

(6) Flip the propeller shaft yoke and install the bearing cap onto the opposite trunnion. Install a snap ring (Fig. 30).

DISASSEMBLY AND ASSEMBLY (Continued)

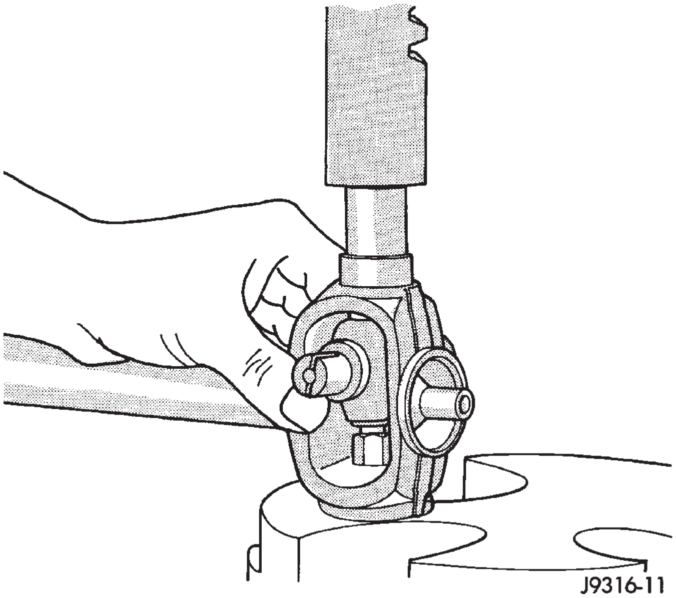


Fig. 29 Press In Bearing Cap

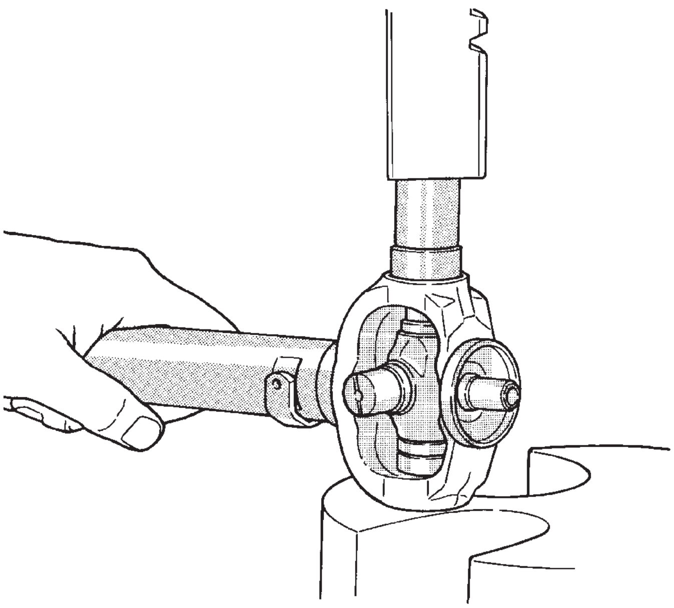


Fig. 30 Press In Bearing Cap

(7) Fit the link yoke on the remaining two trunnions and press both bearing caps into place (Fig. 31).

(8) Install snap rings.

(9) Install the centering kit assembly inside the link yoke making sure the spring is properly positioned (Fig. 32).

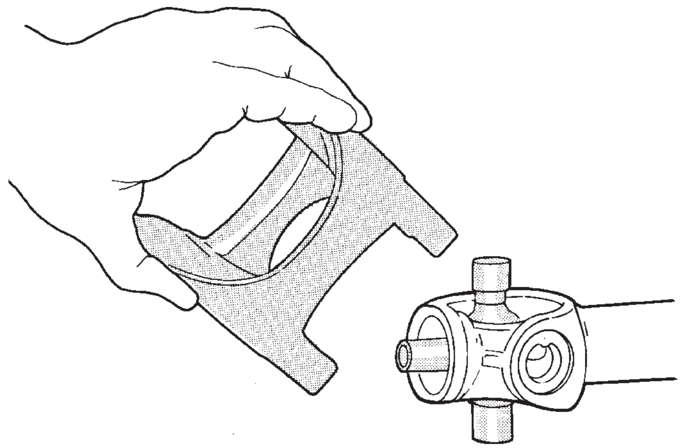


Fig. 31 Install Link Yoke

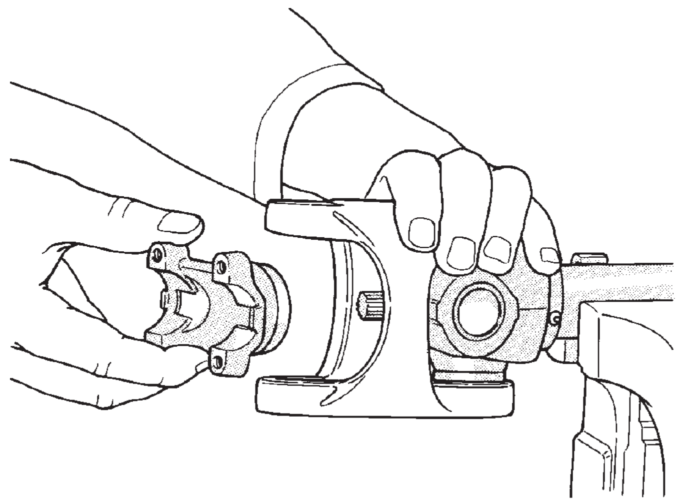


Fig. 32 Install Centering Kit

(10) Place two bearing caps on opposite trunnions of the remaining cross. Fit the open trunnions into the link yoke bores and the bearing caps into the centering kit (Fig. 33).

DISASSEMBLY AND ASSEMBLY (Continued)

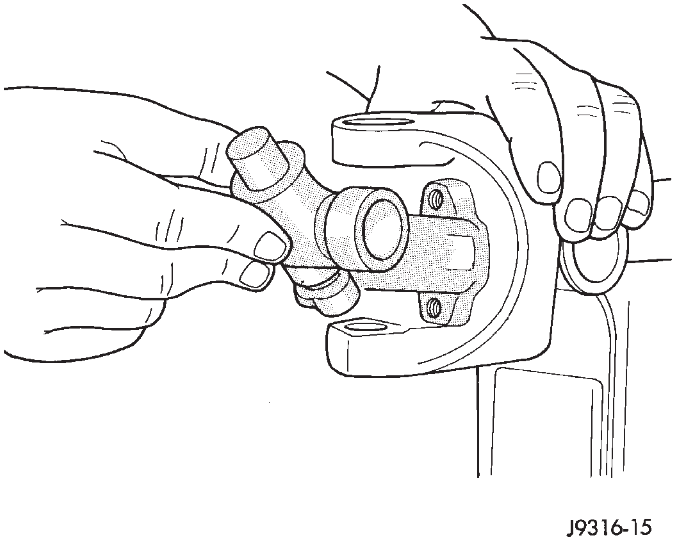


Fig. 33 Install Remaining Cross

(11) Press the remaining two bearing caps into place and install snap rings (Fig. 34).

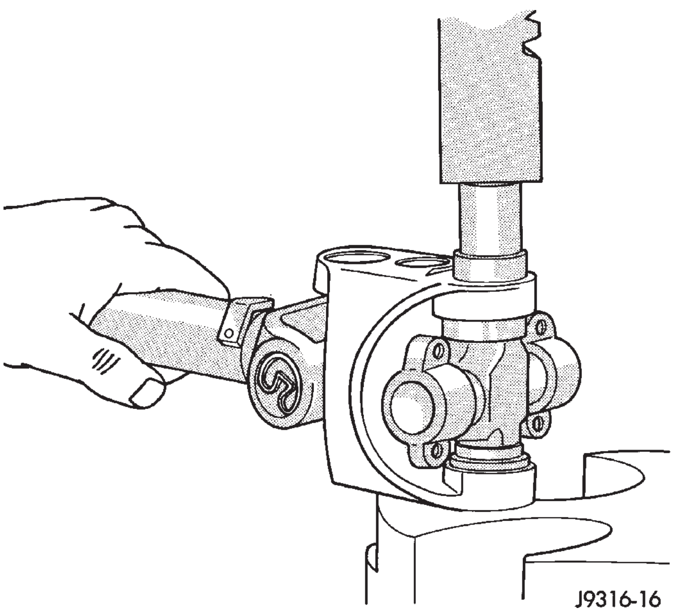


Fig. 34 Press In Bearing Cap

(12) Tap the snap rings to allow them to seat into the grooves (Fig. 35).

(13) Check for proper assembly. Flex the joint beyond center, it should snap over-center in both directions when correctly assembled (Fig. 36).

(14) Install the propeller shaft.

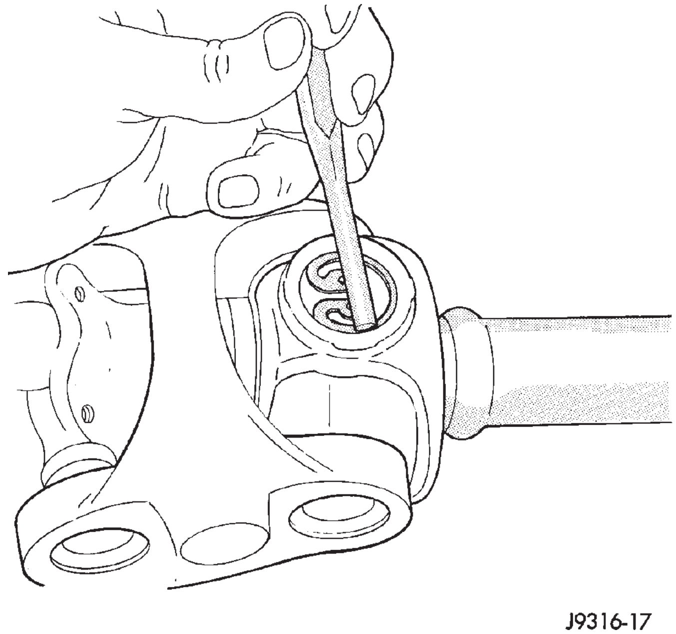


Fig. 35 Seat Snap Rings In Groove

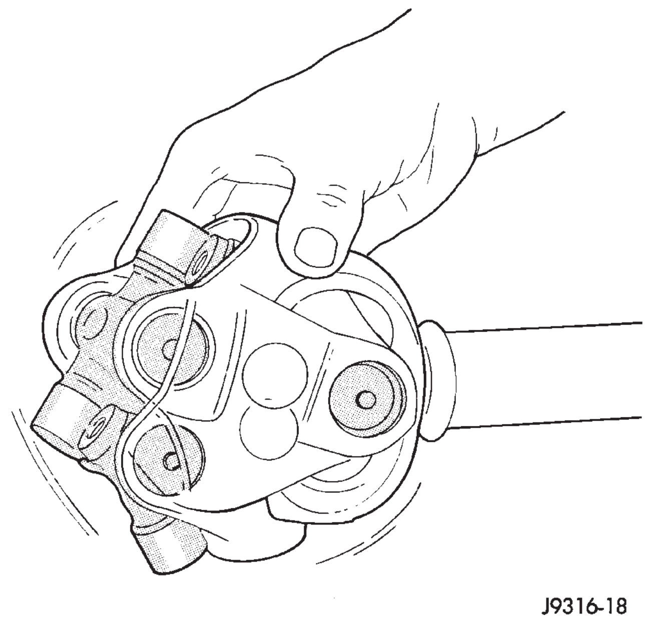


Fig. 36 Check Assembly

CLEANING AND INSPECTION

PROPELLER SHAFT

(1) Clean all universal joint bores with cleaning solvent and a wire brush.

(2) Inspect the yokes for distortion, cracks, and worn bearing cap bores.

ADJUSTMENTS

ADJUSTMENT AT AXLE WITH LEAF SPRINGS

Adjust the pinion shaft angle at the springs with tapered shims (Fig. 37). Install tapered shims between the springs and axle pad to correct the angle. Refer to Group 2, Suspension, for additional information.

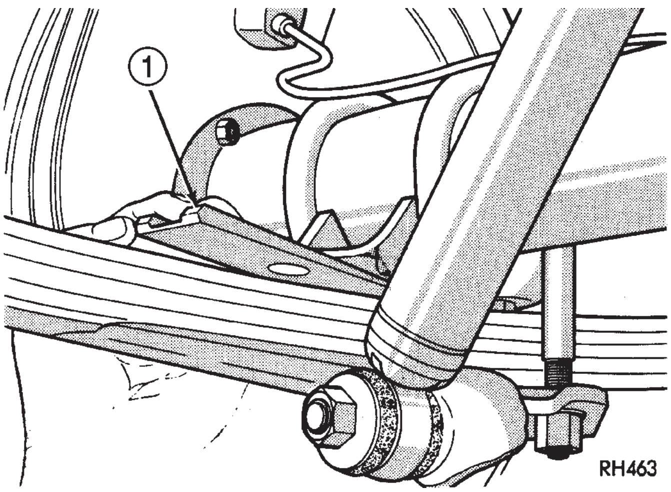


Fig. 37 Angle Adjustment at Leaf Springs

1 – WEDGE

CENTER BEARING ADJUSTMENT

Drive away shudder is a vibration that occurs at first acceleration from a stop. Shudder vibration usually peaks at the engines highest torque output. Shudder is a symptom associated with vehicles using a two-piece propeller shaft. To decrease shudder, lower the center bearing in 1/8 inch increments. Use shim stock or fabricated plates. Plate stock must be used to maintain compression of the rubber insulator around the bearing. Do not use washers. Replace the original bolts with the appropriate increased length bolts.

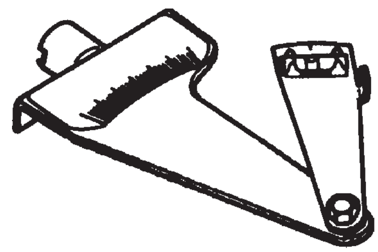
SPECIFICATIONS

TORQUE

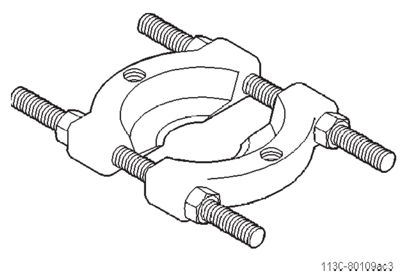
DESCRIPTION	TORQUE
Bolts, Center Bearing	68 N·m (50 ft. lbs.)
Bolts, Transfer Case Yoke	27 N·m (20 ft. lbs.)
Bolts, Companion Flange	108 N·m (80 ft. lbs.)

SPECIAL TOOLS

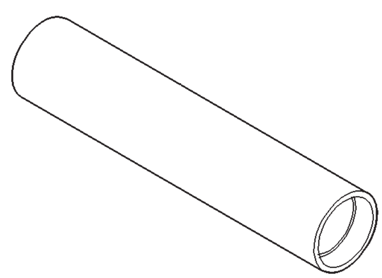
PROPELLER SHAFT



Inclinometer—7663



Bearing Splitter—1130



Installer, Bearing—6052

FRONT AXLE DRIVESHAFTS

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
FRONT AXLE DRIVESHAFTS	18
DIAGNOSIS AND TESTING	
CLUNKING NOISE DURING ACCELERATION	20
NOISE AND/OR VIBRATION IN TURNS	20
SHUDDER OR VIBRATION DURING ACCELERATION	20
VEHICLE INSPECTION	20
VIBRATION AT HIGHWAY SPEEDS	20
REMOVAL AND INSTALLATION	
FRONT DRIVESHAFT	21
C/V JOINT BOOTS	22
DISASSEMBLY AND ASSEMBLY	
INNER C/V JOINT	23
OUTER C/V JOINT	24
CLEANING AND INSPECTION	
C/V JOINT	28
C/V JOINT BOOTS	30
SPECIFICATIONS	
TORQUE	30
SPECIAL TOOLS	
C/V JOINT DRIVESHAFT	30

DESCRIPTION AND OPERATION

FRONT AXLE DRIVESHAFTS

DESCRIPTION

The two constant velocity (C/V) drive shafts are identical and interchangeable. They are comprised of three major components (Fig. 1) :

DESCRIPTION AND OPERATION (Continued)

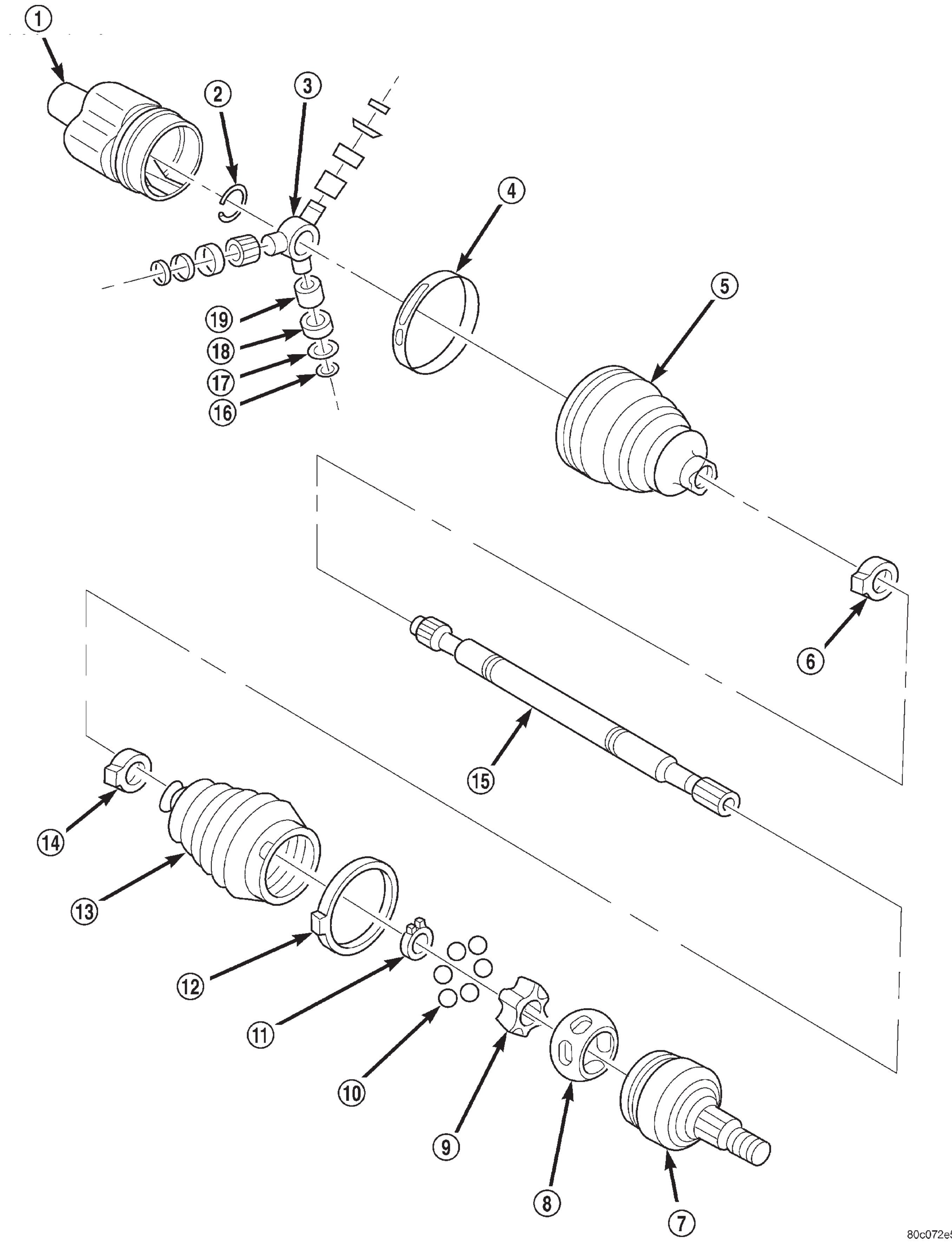


Fig. 1 C/V Drive Shaft Components

DESCRIPTION AND OPERATION (Continued)

1 – RETAINER & HOUSING ASM
2 – C-CLIP
3 – TRIPOD JOINT SPIDER
4 – SEAL RETAINING CLAMP
5 – INNER BOOT
6 – SEAL RETAINING CLAMP
7 – C/V JOINT OUTER RACE
8 – C/V JOINT CAGE
9 – C/V JOINT INNER RACE
10 – CHROME ALLOY BALL
11 – RACE RETAINING RING
12 – SEAL RETAINING CLAMP
13 – DRIVE AXLE OUTBOARD SEAL
14 – SEAL RETAINING CLAMP
15 – AXLE SHAFT
16 – RETAINING RING
17 – BALL & ROLLER RETAINER
18 – TRIPOD JOINT BALL
19 – NEEDLE ROLLER

- An inner, tripod C/V joint
- A short, solid interconnecting shaft
- An outer, Rzeppa C/V joint with stub shaft

The inner tripod-joints are attached to the axle shaft splines (Fig. 1). The outer joint is splined and mates with the hub bearing on the knuckle.

The lubricant amounts included with replacement rubber boots are different for inner and outer C/V joints. Apply only the specified lubricant amount to each C/V joint.

CAUTION: Proper C/V joint boot sealing is critical for retaining the special lubricant. Prevent foreign material from entering and contaminating the C/V joints. Mishandling a C/V drive shaft can cause a boot to be punctured or damage within the joints. Always support both ends of the C/V drive shaft during removal and installation to avoid damage.

When replacing C/V drive shaft components, ensure that only exact replacements parts are installed.

OPERATION

The axle driveshafts are located on either side of the differential and transmits power to the drive wheels, while allowing for vertical movement in the vehicle's suspension.

DIAGNOSIS AND TESTING

VEHICLE INSPECTION

(1) Check for grease in the vicinity of the inboard tripod joint and outboard C/V joint; this is a sign of inner or outer joint seal boot or seal boot clamp damage.

(2) A light film of grease may appear on the right inner tripod joint seal boot; this is considered normal and should not require replacement of the seal boot.

NOISE AND/OR VIBRATION IN TURNS

A clicking noise and/or a vibration in turns could be caused by one of the following conditions:

- Damaged outer C/V or inner tripod joint seal boot or seal boot clamps. This will result in the loss and/or contamination of the joint grease, resulting in inadequate lubrication of the joint.
- Noise may also be caused by another component of the vehicle coming in contact with the driveshafts.

CLUNKING NOISE DURING ACCELERATION

This noise may be a result of one of the following conditions:

- A torn seal boot on the inner or outer joint of the driveshaft assembly which has allowed the C/V joint to become damaged.
- A loose or missing clamp on the inner or outer joint of the driveshaft assembly which has allowed the C/V joint to become damaged.
- A damaged or worn driveshaft C/V joint.

SHUDDER OR VIBRATION DURING ACCELERATION

This problem could be a result of:

- A worn or damaged driveshaft inner tripod joint.
- A sticking tripod joint spider assembly (inner tripod joint only).
- Improper wheel alignment. Refer to Group 2, Suspension, for alignment checking and setting procedures and specifications.

VIBRATION AT HIGHWAY SPEEDS

This problem could be a result of:

- Foreign material (mud, etc.) packed on the backside of the wheel(s).
- Out of balance front tires or wheels. Refer to Group 22, Wheels And Tires, for the required balancing procedure.
- Improper tire and/or wheel runout. Refer to Group 22, Wheels And Tires, for the required runout checking procedure.

REMOVAL AND INSTALLATION

FRONT DRIVESHAFT

REMOVAL

(1) Remove the cotter pin, nut lock, and spring washer from the stub shaft (Fig. 2).

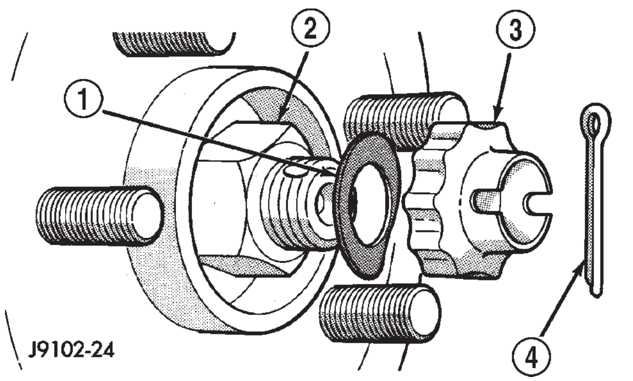


Fig. 2 Cotter Pin, Nut Lock & Spring Washer Removal

1 – SPRING WASHER
2 – HUB NUT
3 – NUT LOCK
4 – COTTER PIN

(2) Loosen the lug nuts and hub nut while the vehicle is on the surface with the brakes applied (Fig. 3).

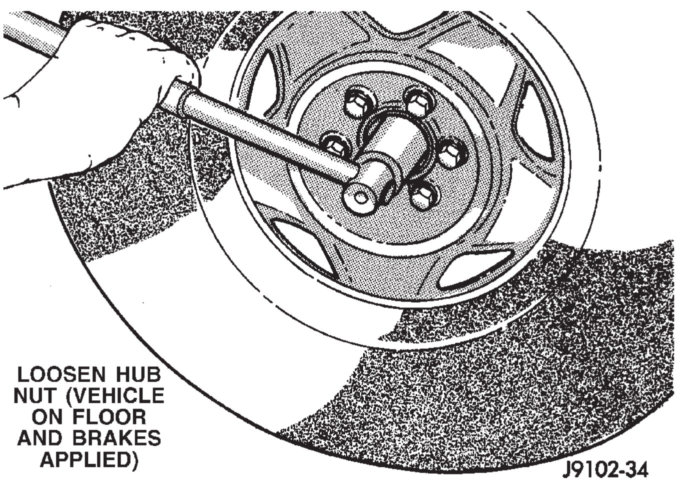


Fig. 3 Loosening Wheel Hub Nut

(3) Raise the vehicle.
(4) Remove the skid plate, if equipped.
(5) Remove the hub nut and washer from the stub shaft (Fig. 4).
(6) Remove the wheel and tire.
(7) Remove the brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.
(8) Remove the ABS wheel speed sensor, if equipped. Refer to Group 5, Brakes, for proper procedures.

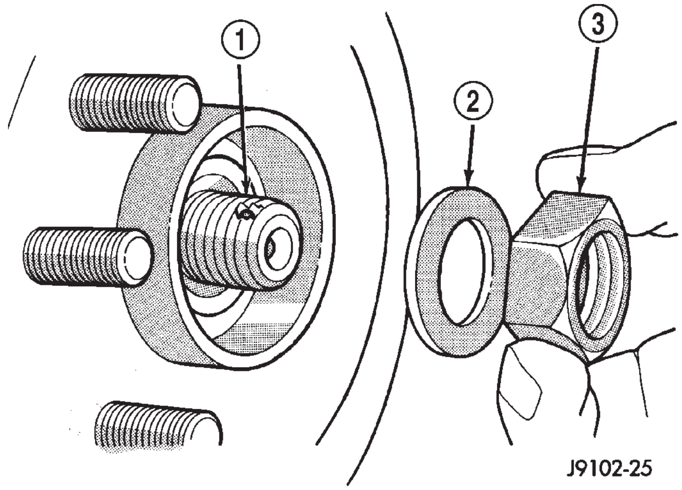


Fig. 4 Hub Nut & Washer

1 – DRIVE SHAFT
2 – HUB WASHER
3 – HUB NUT

(9) Remove the bolts holding the hub bearing to the knuckle.
(10) Remove hub bearing from axle driveshaft and steering knuckle.
(11) Support the drive shaft at the C/V joint housings.
(12) Disengage the inner C/V joint from the axle shaft (Fig. 5). Position two pry bars between the inner C/V housing and the axle housing. Apply pressure away from the differential housing. This will disengage the axle shaft snap-ring from the groove on the inside of the C/V housing.

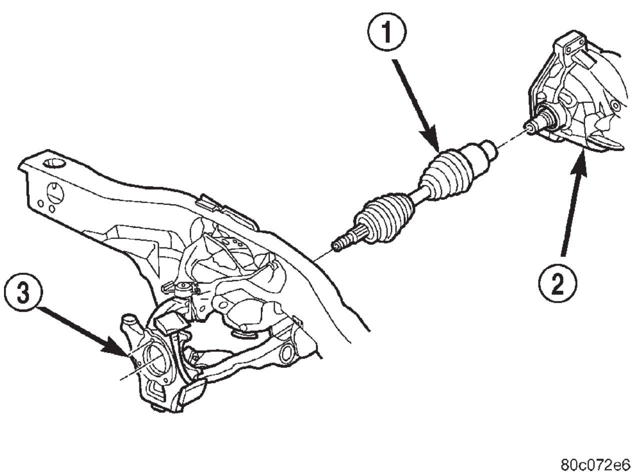


Fig. 5 Front Driveshaft

1 – DRIVESHAFT
2 – FRONT AXLE
3 – STEERING KNUCKLE

(13) Remove the driveshaft from the vehicle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Insert the C/V drive shaft stub into the hub bearing bore of the steering knuckle.

(2) Apply a light coating of wheel bearing grease on the axle shaft splines.

(3) Install the inner C/V joint onto the axle shaft flange. Push firmly on the shaft until the axle shaft snap-ring engages with the groove on the inside of the joint housing.

(4) Clean hub bearing bore, axle driveshaft splines, and hub bearing mating surface of all foreign materials. Apply light coating of grease to all mating surfaces.

(5) Install the hub bearing to the axle driveshaft and the steering knuckle.

(6) Install the bolts to hold the hub bearing to the steering knuckle. Refer to Group 2, Suspension, for the proper torque.

(7) Clean all foreign material from the stub shaft threads. Install the hub nut and washer.

(8) Install the ABS wheel speed sensor, if equipped. Refer to Group 5, Brakes, for proper procedures.

(9) Install the brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.

(10) Apply the brakes and tighten hub nut to 244 N·m (180 ft. lbs.) torque.

(11) Install the spring washer, nut lock and cotter pin on the stub shaft (Fig. 6).

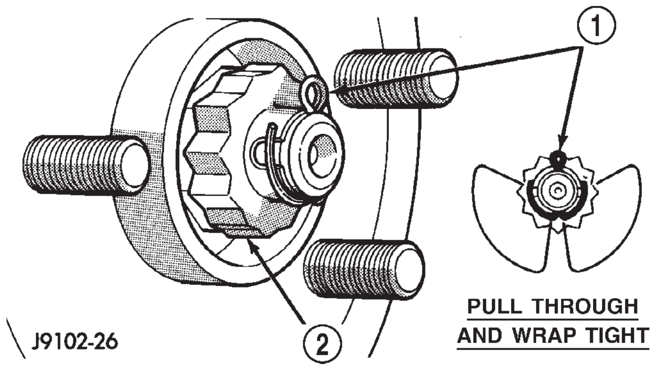


Fig. 6 Cotter Pin Installation

1 – COTTER PIN
2 – NUT LOCK

(12) Install the skid plate, if equipped.

(13) Install the wheel and tire.

C/V JOINT BOOTS

REMOVAL

(1) Remove axle driveshaft from vehicle.

(2) Remove outer C/V joint.

(3) Remove outer C/V joint small clamp and remove boot (Fig. 7).

(4) Remove inner C/V joint boot clamps and remove boot.

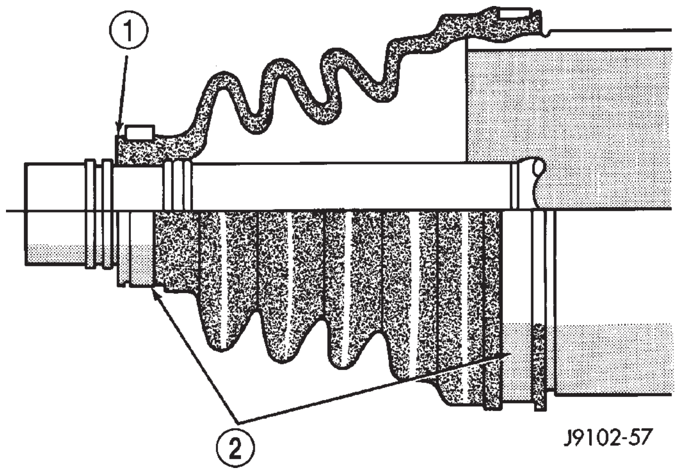


Fig. 7 Boot Retaining Clamp Locations

1 – POSITION ON FLAT BETWEEN LOCATING SHOULDERS
2 – CLAMPS

INSTALLATION

The lubricant amounts included with replacement boots are different for inner and outer C/V joints. Apply only the specified lubricant amount to each C/V joint.

(1) Clean the C/V joints and shaft of all old grease and foreign matter.

(2) Slide the inner C/V joint boot up the shaft and insert the lip located within the small-diameter end of the boot into the shaft groove (Fig. 7).

(3) Retain the small–diameter of the boot on the shaft with a ladder-type clamp in the boot groove (Fig. 7). Verify that the boot and lip are properly positioned on the intermediate shaft. Position the clamp locating tabs in the slots and tighten the clamp.

(4) Compress the clamp bridge with Remover/Installer C-4124. Squeeze the tool handles to complete the tightening of the clamp (Fig. 8). **Care must be exercised when using the tool to avoid cutting through the clamp bridge or damaging the boot.**

(5) Position the large-diameter end of the boot on the C/V joint housing.

(6) After the inner joint boot small clamp is installed, the inboard hub must be set to a service build length.

(a) Compress the inner hub down the connector shaft.

(b) Use a small blunt drift between the large end and the boot seal to relieve the pressure.

(c) The distance edge of the lip to the edge of the flange should be 181.00 mm (7.13 in.). This will eliminate excess air that can cause a ballooning affect and possibly cause damage to the boot.

REMOVAL AND INSTALLATION (Continued)

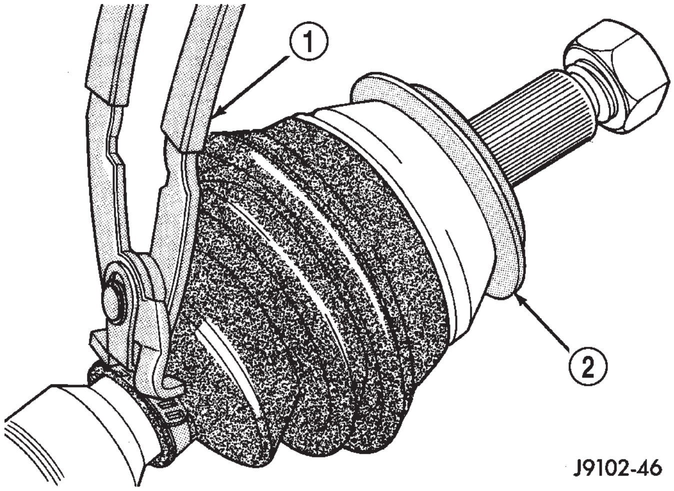


Fig. 8 Compressing Clamp Bridge

1 – TOOL C-4124
2 – SLINGER

(7) Verify that the boot is not twisted and that it is correctly positioned on the housing.

(8) Install the large ladder clamp on the boot and secure as done with the small ladder clamps (Fig. 8).

(9) Slide the outer C/V joint boot small clamp onto shaft.

(10) Slide outer C/V joint boot onto shaft and into position on shaft.

(11) Install small clamp to boot as done above.

(12) Install large boot clamp over outer C/V joint.

(13) Install outer C/V joint to shaft.

(14) Install large boot clamp to boot and C/V joint.

(15) Install the C/V driveshaft.

DISASSEMBLY AND ASSEMBLY

INNER C/V JOINT

DISASSEMBLY

(1) Remove the axle driveshaft.

(2) Place the inner C/V joint housing in a vise.

(3) Remove the inner boot retaining clamps. Pull the inner boot back onto the interconnecting shaft. Discard the retaining clamps.

(4) Pull the tripod and shaft straight out from the inner C/V joint housing.

(5) Remove the snap retaining ring from the groove behind the tripod (Fig. 9). Slide the tripod toward the center of the shaft. Remove the C-clip on the outer end of the shaft (Fig. 10).

(6) Remove the tripod from the shaft. Replace the boot, if necessary.

(7) Remove the lubricant from the interior of the housing and from the tripod.

(8) Inspect the needle bearing raceways in the housing and tripod components for excessive wear and damage. Replace the tripod as a unit only if necessary.

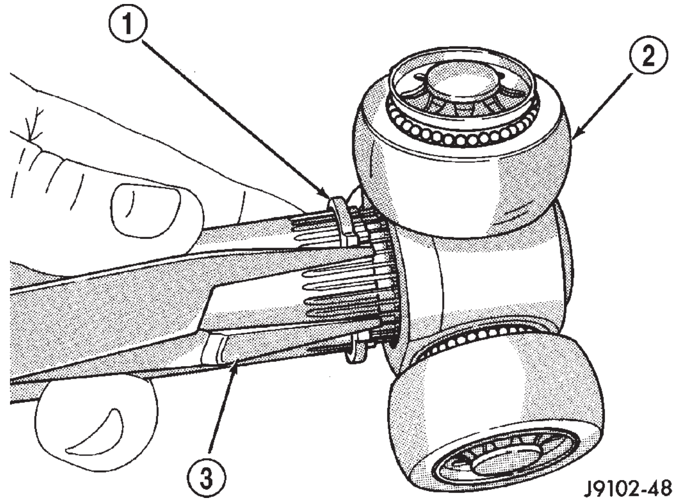


Fig. 9 Snap Retaining Ring Removal

1 – SNAP RING
2 – TRIPOD JOINT
3 – SNAP RING PLIERS

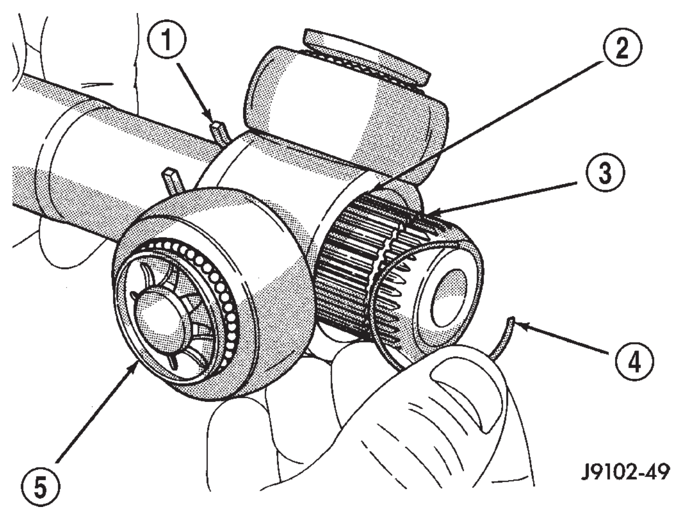


Fig. 10 C-Clip Removal/Installation

1 – SNAP RING
2 – CHAMFERED EDGE
3 – C-CLIP GROOVE
4 – C-CLIP
5 – TRIPOD

ASSEMBLY

(1) Slide the boot down enough for work access.

(2) Install the snap ring past the ring groove (toward the center of the shaft). Slide the tripod onto the end of the interconnecting shaft. Be sure the chamfered end of the tripod is adjacent to the C-clip retaining ring groove (Fig. 10).

(3) Install the C-clip in the groove. Slide the tripod out against the clip. Install the snap ring in the inner groove. Be sure the snap ring and C-clip are seated.

(4) Apply the required quantity of lubricant to the housing and boot. Coat the interior of the joint housing and the tripod.

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Insert and seat the tripod and shaft in the housing.

(6) Position the large-diameter end of the inner C/V joint boot over the edge of the housing. Insert the lip of the boot into the locating groove at the edge of the housing (Fig. 11).

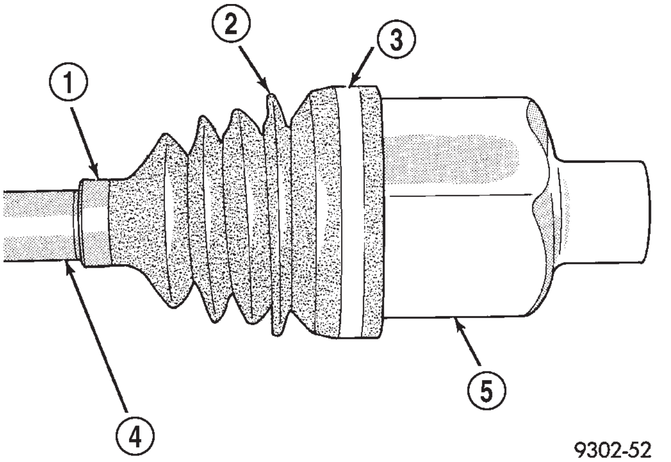


Fig. 11 Inner C/V Joint Boot

1 – SMALL CLAMP
2 – SEALING BOOT
3 – LARGE CLAMP
4 – INTERCONNECTING SHAFT
5 – INNER TRIPOD JOINT

(7) Insert the small lip into the locating groove in the interconnecting shaft.

(8) Retain the small–diameter of the boot on the shaft with a ladder-type clamp in the boot groove. Verify that the boot and lip are properly positioned on the intermediate shaft. Position the clamp locating tabs in the slots and tighten the clamp.

(9) Compress the clamp bridge with Remover/Installer C-4124. Squeeze the tool handles to complete the tightening of the clamp (Fig. 12). **Care must be exercised when using the tool to avoid cutting through the clamp bridge or damaging the boot.**

(10) Position the large-diameter end of the boot on the C/V joint housing.

(11) After the inner joint boot small clamp is installed, the inboard hub must be set to a service build length.

(a) Compress the inner hub down the connector shaft.

(b) Use a small blunt drift between the large end and the boot seal to relieve the pressure.

(c) The distance edge of the lip to the edge of the flange should be 181.00 mm (7.13 in.). This will eliminate excess air that can cause a ballooning affect and possibly cause damage to the boot.

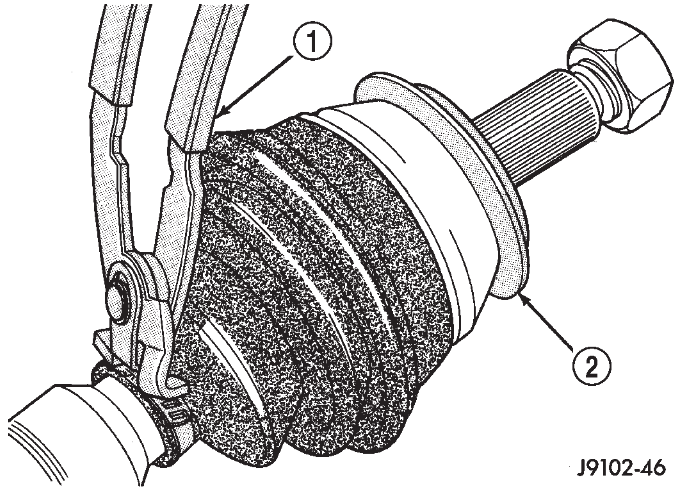


Fig. 12 Compressing Clamp Bridge

1 – TOOL C-4124
2 – SLINGER

(12) Verify that the boot is not twisted and that it is correctly positioned on the housing.

(13) Install the large ladder clamp on the boot and secure as done with the small ladder clamp (Fig. 12).

OUTER C/V JOINT

If the outer C/V joint is excessively worn, replace the entire C/V joint and boot.

DISASSEMBLY

(1) Remove retaining clamps from the outer C/V joint and discard. Slide the boot off the outer joint and down the shaft.

(2) Remove the lubricant to expose the outer C/V joint components (Fig. 13).

(3) Clamp the shaft in a vise (with soft jaws). Support the outer C/V joint.

(4) Use snap ring pliers to release the clip from the groove.

(5) Slide the outer C/V joint from the shaft (Fig. 14).

(6) Remove the slinger, if damaged, from the outer C/V joint. Use a brass drift and a hammer. Tap slinger ring off C/V joint and discard.

(7) Remove the old lubricant. Apply installation alignment marks on the bearing hub, bearing cage and housing with dabs of paint (Fig. 15).

(8) Clamp the outer C/V joint in a vertical position. Place the stub shaft in a soft–jawed vise.

DISASSEMBLY AND ASSEMBLY (Continued)

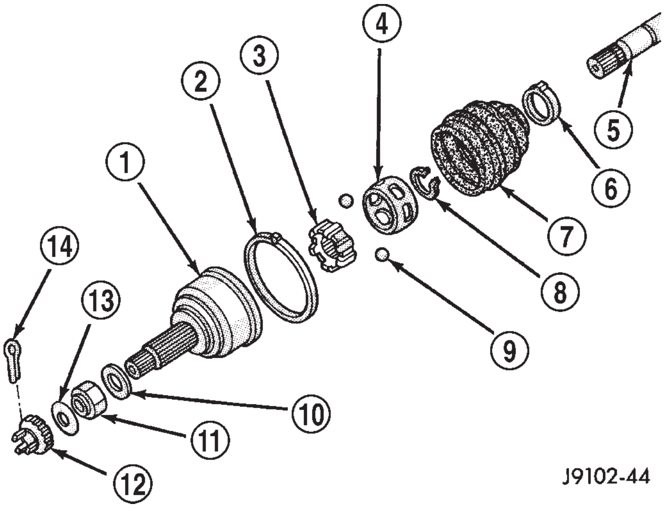


Fig. 13 Outer C/V Joint Components

1 – RZEPPA JOINT HOUSING (OUTER)
2 – CLAMP
3 – BEARING HUB
4 – BEARING CAGE
5 – SHAFT
6 – CLAMP
7 – BOOT
8 – SNAP RING
9 – BALLS (6)
10 – WASHER
11 – HUB NUT
12 – NUT LOCK
13 – SPRING WASHER
14 – COTTER PIN

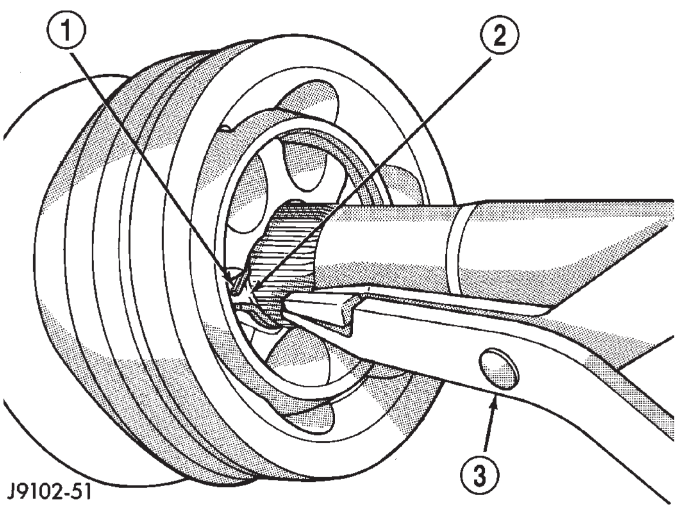


Fig. 14 Outer C/V Joint Removal

1 – SNAP RING
2 – SNAP RING GROOVE
3 – SNAP RING PLIERS

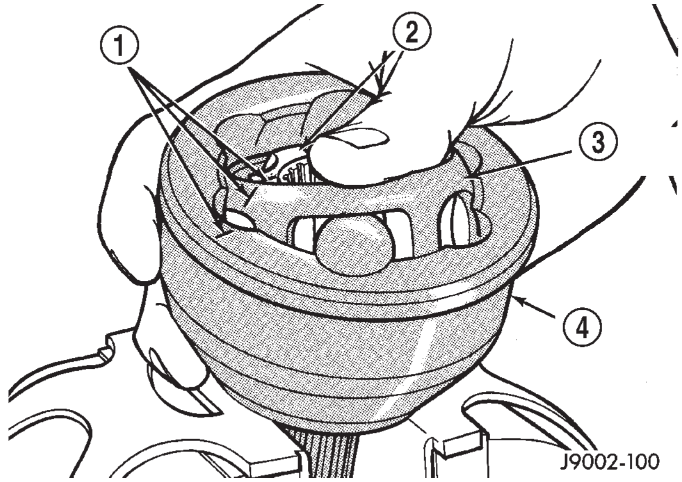


Fig. 15 Ball Access

1 – INSTALLATION ALIGNMENT MARKS
2 – BEARING HUB
3 – BEARING CAGE
4 – CV JOINT HOUSING (OUTER)

(9) Press down on one side of the bearing cage/hub to tilt the cage. This will provide access to a ball at the opposite side of the cage. If the C/V joint is tight, use a hammer and brass drift to loosen the bearing hub. **Do not contact the bearing cage with the drift.**

(10) Remove the ball from the bearing cage (Fig. 16). If necessary, a small pry bar can be used to pry the ball loose from the cage.

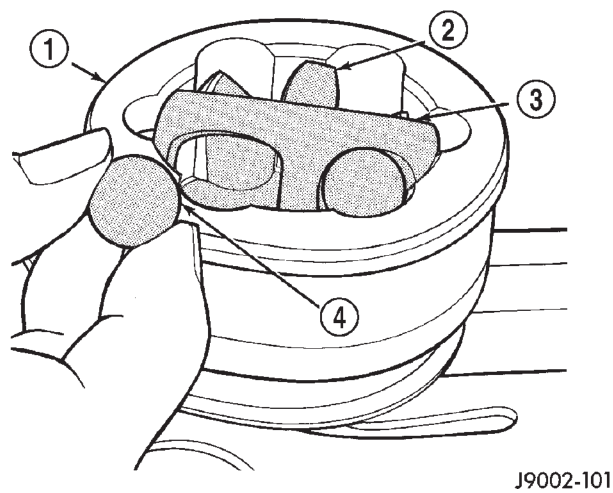


Fig. 16 Ball Removal

1 – CV JOINT HOUSING (OUTER)
2 – BEARING HUB (UP)
3 – BEARING CAGE (UP)
4 – BALL

(11) Repeat the step above until all six balls are removed from the bearing cage.

DISASSEMBLY AND ASSEMBLY (Continued)

(12) Tilt the bearing cage and hub to a vertical position. Remove the cage from the housing. Pull cage upward and away from the housing (Fig. 17).

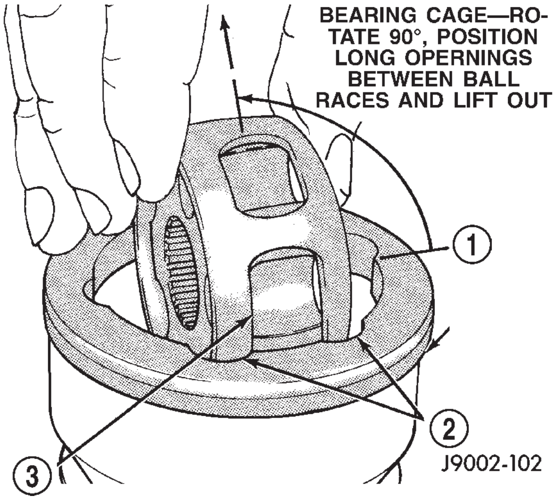


Fig. 17 Bearing Cage & Hub Removal

1 – CV JOINT HOUSING (OUTER)
2 – BALL RACE
3 – BEARING CAGE WINDOW

(13) Turn the bearing hub 90° from the bearing cage. Align one pair of the hub lands with the cage windows. Raise and insert one of the lands into the adjacent cage window. Remove the bearing hub by rolling it out of the cage (Fig. 18).

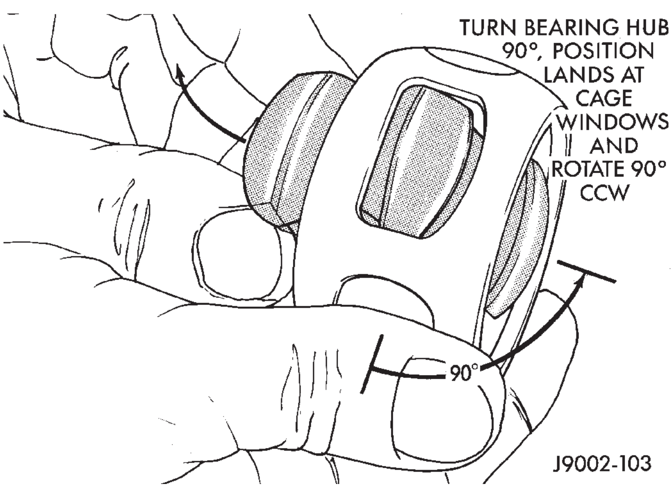


Fig. 18 Bearing Hub Removal

ASSEMBLY

(1) Lightly apply lubricating oil to all the outer C/V joint components before assembling them.

(2) Align the bearing hub, cage and housing (Fig. 15) according to the alignment reference marks.

(3) Insert one of the bearing hub lands into a bearing cage window (Fig. 18). Roll the hub into the cage (Fig. 19). Rotate the bearing hub 90° to complete the installation (Fig. 20).

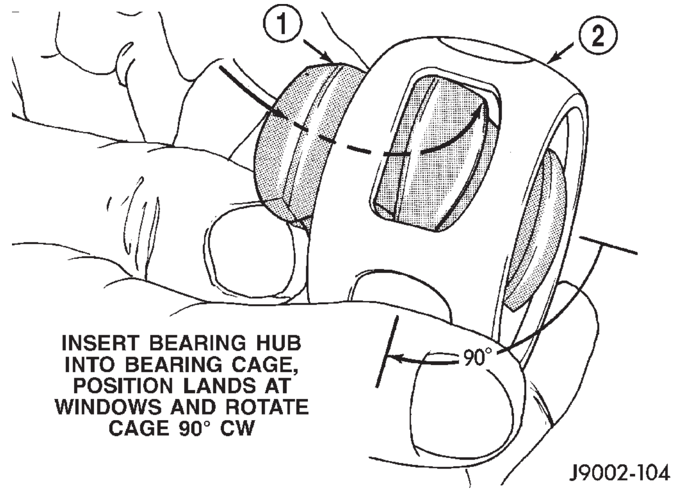


Fig. 19 Bearing Hub Installation

1 – BEARING HUB
2 – BEARING CAGE

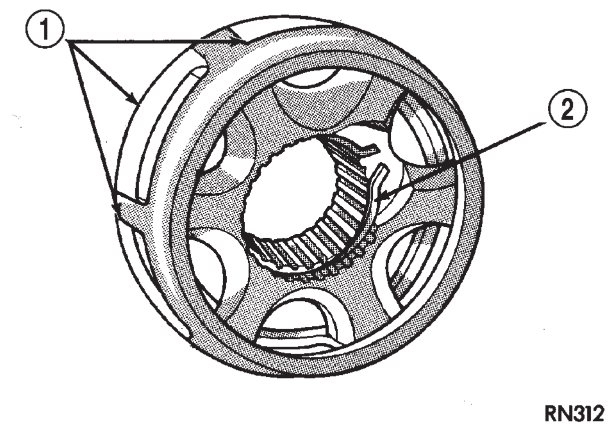


Fig. 20 Assembled Bearing Cage & Hub

1 – CAGE WINDOWS
2 – CIRCLIP RETAINER

(4) Insert bearing cage/hub into the housing (Fig. 21). Rotate the cage/hub 90° to complete the installation (Fig. 22).

(5) Apply the lubricant included with the replacement boot to the ball raceways. Spread the lubricant equally between all the raceways. One packet of lubricant is sufficient to lubricate the complete C/V joint.

(6) Tilt the bearing hub and cage and install the balls in the raceways (Fig. 23).

DISASSEMBLY AND ASSEMBLY (Continued)

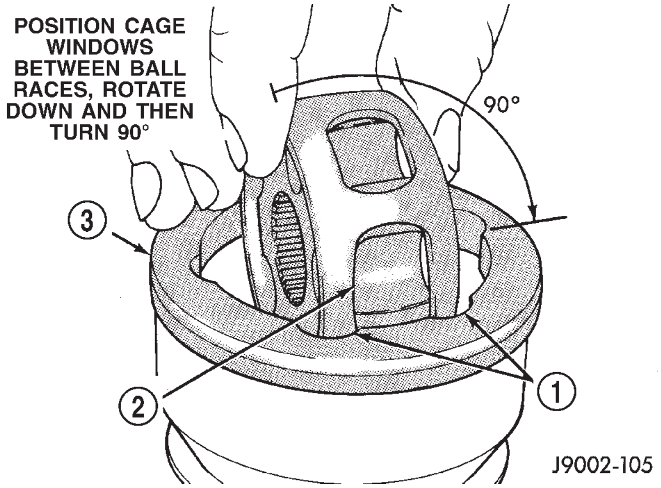


Fig. 21 Bearing Cage & Hub Installation

1 – BALL RACE
2 – BEARING CAGE WINDOW
3 – CV JOINT HOUSING (OUTER)

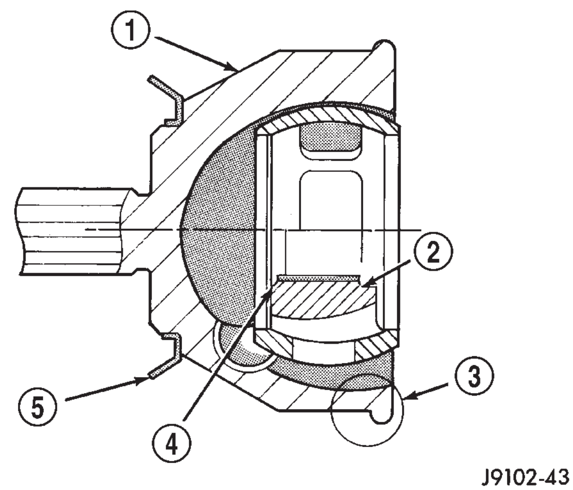


Fig. 22 Bearing Cage & Hub Installed In Housing

1 – CV JOINT HOUSING (OUTER)
2 – BEARING HUB LARGE COUNTERBORE OUTWARD
3 – BOOT RETAINING SHOULDER
4 – BEARING HUB SMALL COUNTERBORE INWARD
5 – SLINGER

(7) Apply a small amount of lubricant to inner diameter of slinger. Place slinger squarely on the outer C/V joint. Use installer tool L-4518-1 from tool set L-4518 and hammer slinger onto joint until it seats (Fig. 24).

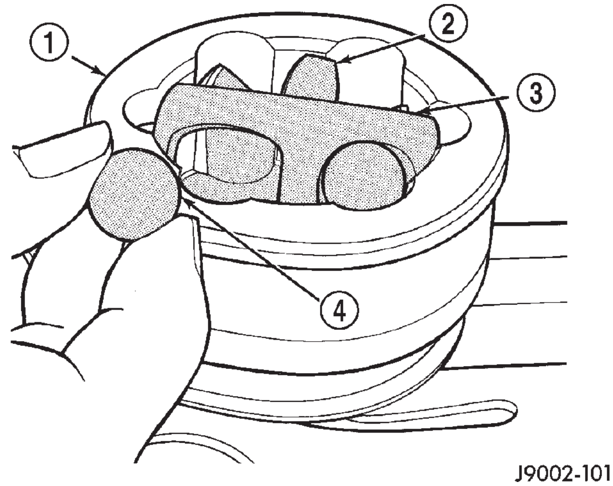


Fig. 23 Ball Installation In Raceway

1 – CV JOINT HOUSING (OUTER)
2 – BEARING HUB (UP)
3 – BEARING CAGE (UP)
4 – BALL

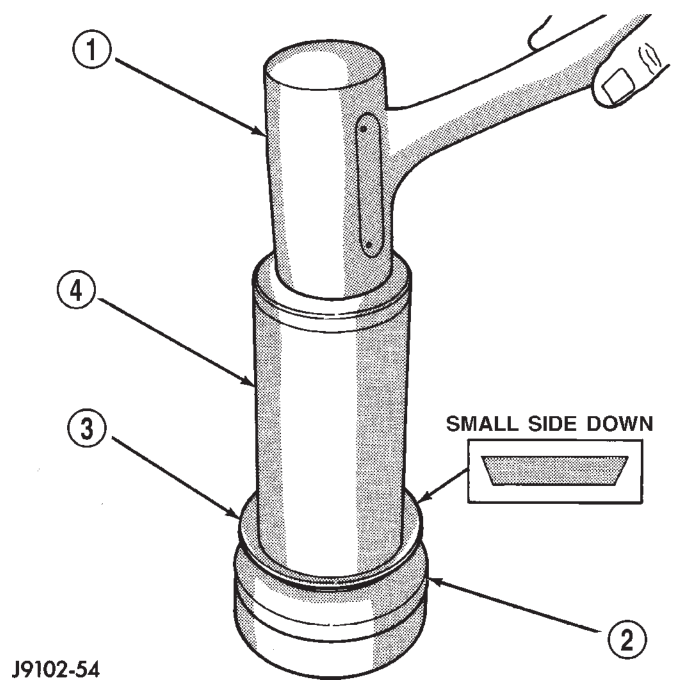


Fig. 24 Slinger Installation

1 – HAMMER
2 – OUTER C. V. JOINT
3 – SLINGER
4 – SPECIAL TOOL L-4518–1

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Prevent damage to the slinger after installation or a when a replacement outer C/V joint is installed.

(8) Position the small-diameter end of the replacement boot on the interconnecting shaft. Retain the boot with a replacement clamp.

(9) Apply the required amount of lubricant to the outer C/V joint and boot.

(10) Align the shaft splines to the outer C/V joint splines. Push the outer C/V joint until the snap ring seats in the groove (Fig. 25).

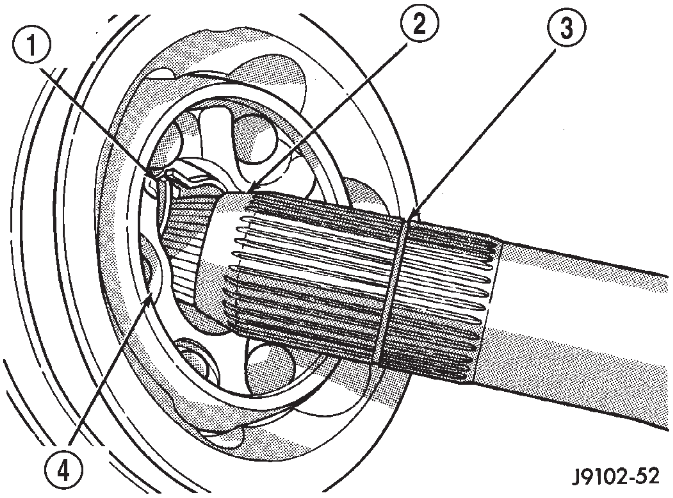


Fig. 25 Outer C/V Joint Installation

1 – SNAP RING
2 – SHAFT TAPER
3 – SNAP RING GROOVE
4 – BEARING HUB

(11) Ensure that the snap ring is properly seated in the housing. Pull the outer C/V joint from the interconnecting shaft to test.

(12) Place the large-diameter end of the replacement boot over the edge of the C/V joint housing. Ensure that the boot is not twisted.

(13) Retain the boot on the housing with a replacement retaining clamps.

CLEANING AND INSPECTION

C/V JOINT

Inspect the lubricant for contamination. Inspect the C/V joint components for defects according to the following instructions.

(1) Clean all the components with an appropriate solvent and dry them with compressed air.

(2) Inspect the ball raceways in the housing for excessive wear and scoring.

(3) Examine the stub shaft splines and threads for damage.

(4) Inspect the balls for pitting, cracks, scoring and excessive wear. A dull exterior surface is normal.

(5) Inspect the bearing cage for wear, grooves, ripples, cracks and chipping.

(6) Inspect the bearing hub (Fig. 26) for excessive wear and scoring on ball raceways.

Polished contact surface areas on the raceways and on the bearing cage spheres are normal. If the joints cause a noise or a vibration, replace them.

CLEANING AND INSPECTION (Continued)

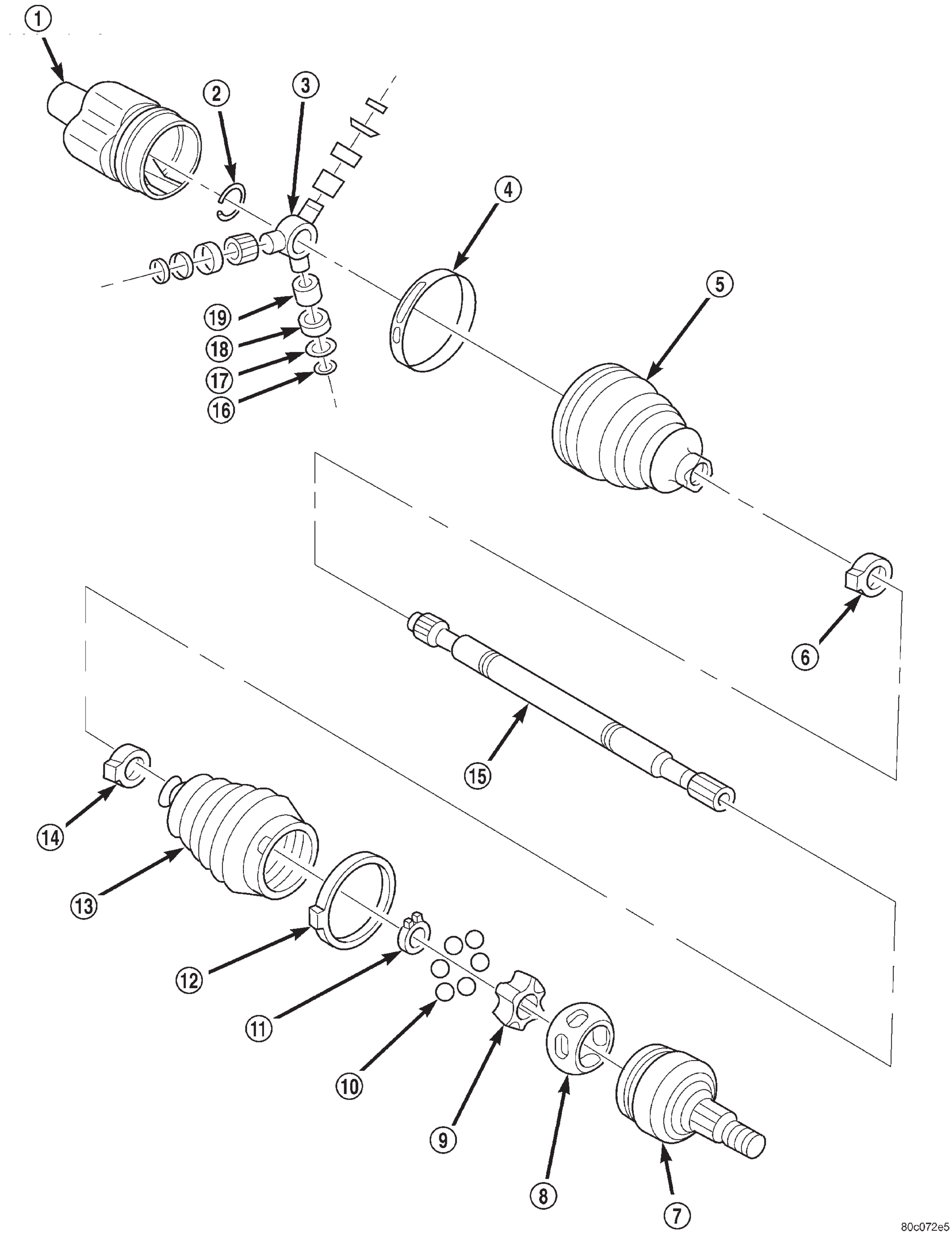


Fig. 26 Drive Shaft Components

CLEANING AND INSPECTION (Continued)

1 – RETAINER & HOUSING ASM
2 – C-CLIP
3 – TRIPOD JOINT SPIDER
4 – SEAL RETAINING CLAMP
5 – INNER BOOT
6 – SEAL RETAINING CLAMP
7 – C/V JOINT OUTER RACE
8 – C/V JOINT CAGE
9 – C/V JOINT INNER RACE
10 – CHROME ALLOY BALL
11 – RACE RETAINING RING
12 – SEAL RETAINING CLAMP
13 – DRIVE AXLE OUTBOARD SEAL
14 – SEAL RETAINING CLAMP
15 – AXLE SHAFT
16 – RETAINING RING
17 – BALL & ROLLER RETAINER
18 – TRIPOD JOINT BALL
19 – NEEDLE ROLLER

C/V JOINT BOOTS

Look for lubricant around the exterior of a boot. When a C/V drive shaft is removed from the vehicle for service, the boot should be properly cleaned. Inspect for cracks, tears and scuffed areas on the surfaces. If any of these conditions exist, boot replacement is recommended.

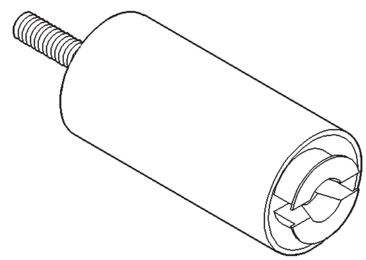
SPECIFICATIONS

TORQUE

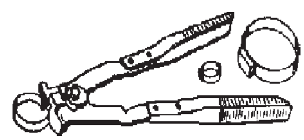
DESCRIPTION	TORQUE
Bolts, Axle Flange	90 N·m (65 ft. lbs.)
Nut, Axle	244 N·m (180 ft. lbs.)

SPECIAL TOOLS

C/V JOINT DRIVESHAFT



Tool Set—L-4518



Remover/Installer—C-4124

C205F AXLE

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
C205F AXLE	31
LUBRICANT	31
STANDARD DIFFERENTIAL	32
DIAGNOSIS AND TESTING	
GENERAL INFORMATION	32
LOW SPEED KNOCK	35
VIBRATION	35
BEARING NOISE	35
GEAR NOISE	35
DRIVELINE SNAP	36
SERVICE PROCEDURES	
LUBRICANT CHANGE	36
REMOVAL AND INSTALLATION	
FRONT AXLE	36
PINION SHAFT SEAL	37
AXLE SHAFT	39
AXLE SHAFT SEAL AND BEARING	39
DIFFERENTIAL	40
RING GEAR	41
DIFFERENTIAL SIDE BEARINGS	41
PINION GEAR	42
FINAL ASSEMBLY	46
DISASSEMBLY AND ASSEMBLY	
STANDARD DIFFERENTIAL	47
CLEANING AND INSPECTION	
AXLE COMPONENTS	48
ADJUSTMENTS	
PINION GEAR DEPTH	48
DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH	50
GEAR CONTACT PATTERN ANALYSIS	53
SPECIFICATIONS	
C205F AXLE	55
C205F AXLE	55
SPECIAL TOOLS	
C205F AXLE	55

DESCRIPTION AND OPERATION

C205F AXLE

DESCRIPTION

The C205F (**C** orporate **205** mm ring gear **F** ront) axle consists of an alumunum center section with an axle tube extending from one side. The tube is pressed into the differential housing.

The integral type housing, hypoid gear design has the centerline of the pinion set below the centerline of the ring gear.

The axle has a fitting for a vent hose used to relieve internal pressure caused by vaporization and internal expansion.

The power is transferred from the axle through two constant velocity (C/V) drive shafts to the wheel hubs. The drive shafts are identical and interchangeable.

The cover provides a means for inspection and service without removing the axle from the vehicle.

The C205F axle has the assembly date and gear ratio listed on a tag. The tag is attached to the housing cover by a cover bolt.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a roll-pin. Differential bearing preload and ring gear backlash is adjusted by the use of shims (select thickness). The shims are located between the differential bearing cups and the axle housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

OPERATION

The axle receives power from the transfer case through the front propeller shaft. The front propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

LUBRICANT

DESCRIPTION

A multi–purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL–L–2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W–90 gear lubricant.

The C205F axle lubricant capacity is 1.66 L (3.5 pts.).

DESCRIPTION AND OPERATION (Continued)

CAUTION: If axle is submerged in water, lubricant must be replaced immediately to avoid possible premature axle failure.

STANDARD DIFFERENTIAL

DESCRIPTION

The differential gear system divides the torque between the axle shafts. It allows the axle shafts to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

OPERATION

In operation, power flow occurs as follows:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The side gears (splined to the axle shafts) rotate the shafts

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 1).

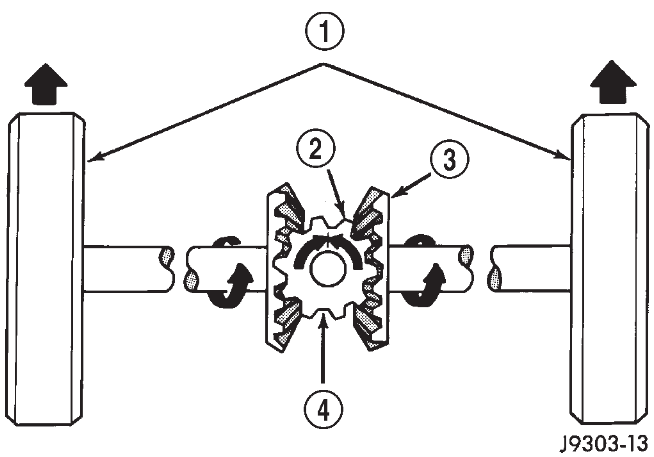


Fig. 1 Differential Operation—Straight Ahead Driving

1 – IN STRAIGHT AHEAD DRIVING EACH WHEEL ROTATES AT 100% OF CASE SPEED
2 – PINION GEAR
3 – SIDE GEAR
4 – PINION GEARS ROTATE WITH CASE

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 2). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

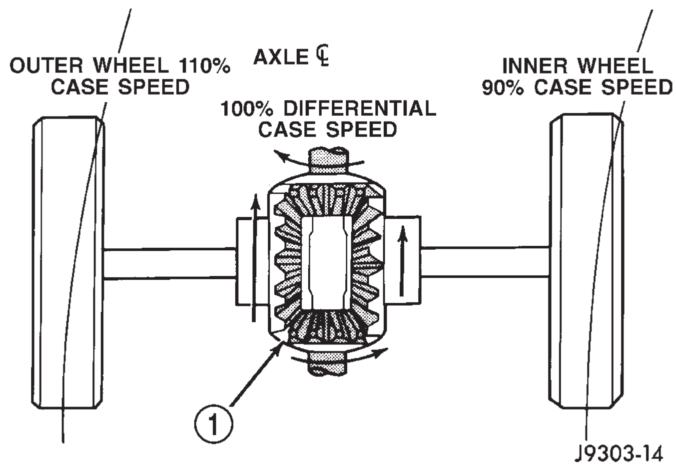


Fig. 2 Differential Operation—On Turns

1 – PINION GEARS ROTATE ON PINION SHAFT

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Axle bearing problem conditions are usually caused by:

- Insufficient or incorrect lubricant.
- Foreign matter/water contamination.
- Incorrect bearing preload torque adjustment.
- Incorrect backlash.

Axle gear problem conditions are usually the result of:

- Insufficient lubrication.
- Incorrect or contaminated lubricant.
- Overloading (excessive engine torque) or exceeding vehicle weight capacity.
- Incorrect clearance or backlash adjustment.

Axle component breakage is most often the result of:

- Severe overloading.
- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.
- Differential housing bores not square to each other.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion companion flange nut.	6. Tighten the pinion companion flange nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Causes	Correction
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored companion flange.	5. Replace companion flange and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Causes	Correction
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak–noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight–ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant–pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the front pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the rear pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U–joint or by worn side–gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out–of–balance wheels.
- Loose wheel lug nuts.
- Worn U–joint(s).
- Loose/broken springs.

DIAGNOSIS AND TESTING (Continued)

- Damaged axle shaft bearing(s).
- Loose pinion nut.
- Excessive companion flange run out.
- Bent axle shaft(s).

Check for loose or damaged front–end components or engine/transmission mounts. These components can contribute to what appears to be a rear–end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels and Tires, for additional vibration information.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U–joints.
- Loose spring mounts.
- Loose pinion nut and companion flange.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

SERVICE PROCEDURES

LUBRICANT CHANGE

(1) Raise and support the vehicle.

(2) Remove the lubricant fill hole plug from the differential housing cover.

(3) Remove the differential housing cover and drain the lubricant from the housing.

(4) Clean the housing cavity with a flushing oil, light engine oil or lint free cloth. **Do not use water, steam, kerosene or gasoline for cleaning.**

(5) Remove the sealant from the housing and cover surfaces. Use solvent to clean the mating surfaces.

(6) Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 3).

Install the housing cover within 5 minutes after applying the sealant.

(7) Install the cover and any identification tag. Tighten the cover bolts in a criss–cross pattern to 41 N·m (30 ft. lbs.) torque.

(8) Refill the differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications in this group for the quantity necessary.

(9) Install the fill hole plug and lower the vehicle. Tighten fill plug to 34 N·m (25 ft. lbs.).

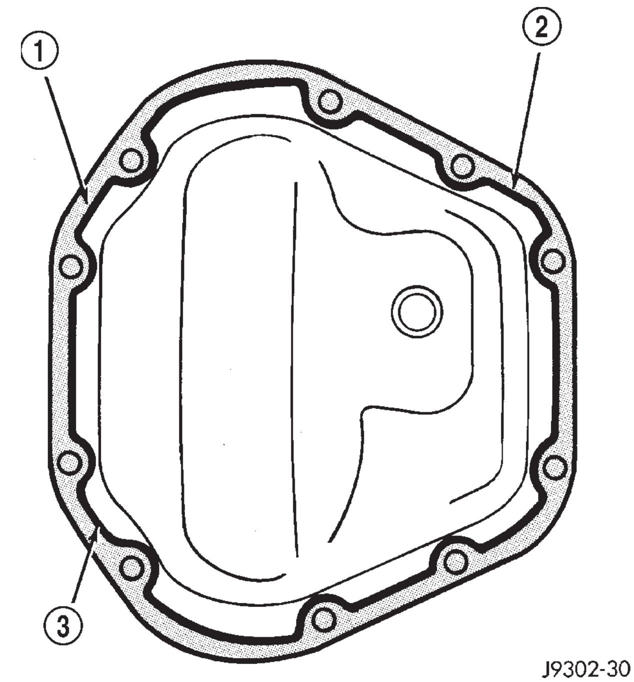


Fig. 3 Typical Housing Cover With Sealant

1 – SEALING SURFACE
2 – CONTOUR OF BEAD
3 – BEAD THICKNESS 6.35MM (1/4")

REMOVAL AND INSTALLATION

FRONT AXLE

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the skid plate, if equipped.

(3) Remove skid plate support crossmember, if necessary.

(4) Remove both C/V driveshafts.

(5) Mark the propeller shaft, transfer case, and pinion companion flange for installation alignment reference.

(6) Remove the front propeller shaft.

(7) Remove the axle vent tube.

(8) Use an adjustable and movable jack to support the differential housing.

(9) Remove bolts holding the axle to the engine mounts (Fig. 4).

(10) Remove bolts holding the axle to the pinion nose bracket (Fig. 5).

(11) Lower the jack and housing.

(12) Remove the axle from vehicle.

REMOVAL AND INSTALLATION (Continued)

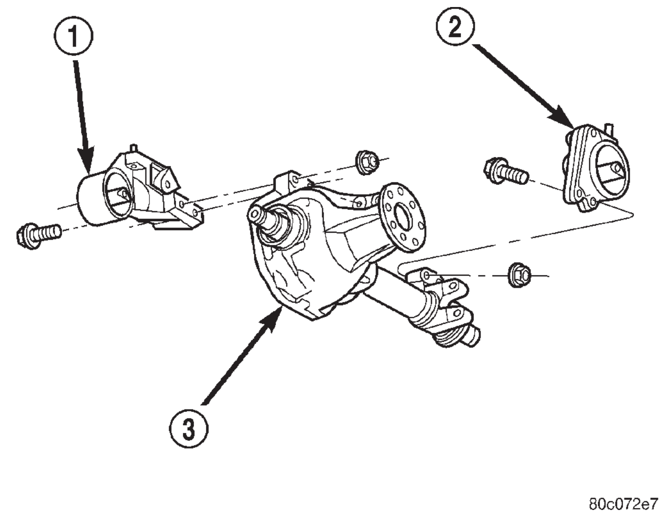


Fig. 4 Axle to Engine Mounts Mounting

1 – LEFT ENGINE MOUNT
2 – RIGHT ENGINE MOUNT
3 – FRONT AXLE

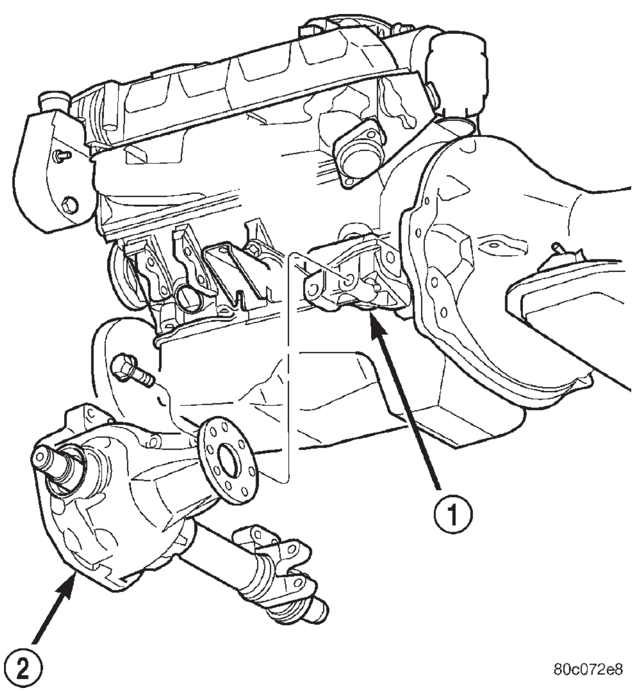


Fig. 5 Pinion Nose Bracket Mounting

1 – PINION NOSE BRACKET
2 – FRONT AXLE

INSTALLATION

(1) Raise the axle into position. Loosely install the bolts and nuts to hold the axle to the engine mounts and pinion nose bracket.

(2) Tighten all the bolts finger-tight, then tighten all bolts to 95 N·m (70 ft. lbs.).

(3) Install the axle vent tube.

(4) Align the reference marks on the propeller shaft, transfer case, and pinion companion flange.

(5) Install propeller shaft.

(6) Install the C/V driveshafts.

(7) Install the skid plate support crossmember, if necessary.

(8) Install the skid plate, if necessary.

(9) Check differential lubricant level and add lubricant, if necessary. Refer to Lubricant Specifications in this group for lubricant requirements.

(10) Remove the supports and lower the vehicle.

PINION SHAFT SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove skid plate, if equipped.

(3) Remove both C/V driveshafts.

(4) Mark the propeller shaft and pinion companion flange for installation alignment reference.

(5) Remove the front propeller shaft.

(6) Rotate the pinion gear three or four times.

(7) Measure the amount of torque necessary to rotate the pinion with a (in. lbs.) dial-type torque wrench (Fig. 6). Record the torque reading for installation reference.

(8) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(9) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(10) Hold the flange with Holder 6719. Remove the pinion nut.

(11) Remove the companion flange with Remover C-452 (Fig. 7).

(12) Using a suitable pry tool, or a slide hammer mounted screw, remove the pinion seal.

INSTALLATION

(1) Clean the seal contact surface in the housing bore.

(2) Examine the splines on the pinion shaft for burrs or wear. Remove any burrs and clean the shaft.

(3) Inspect companion flange for cracks, worn splines and worn seal contact surface. Replace companion flange if necessary.

NOTE: The outer perimeter of the seal is pre-coated with a special sealant. An additional application of sealant is not required.

REMOVAL AND INSTALLATION (Continued)

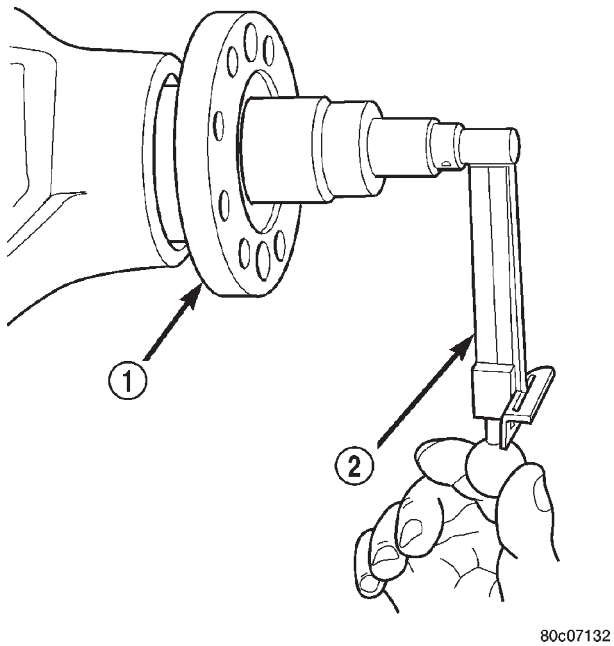


Fig. 6 Measure Total Axle Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

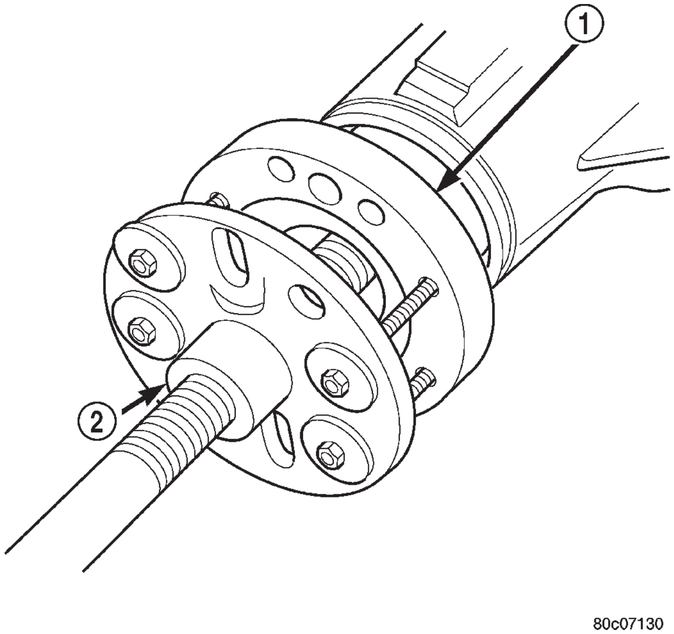


Fig. 7 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

(4) Apply a light coating of gear lubricant on the lip of pinion seal.

(5) Install seal with Installer C-3972-A and Handle C–4171 (Fig. 8).

(6) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

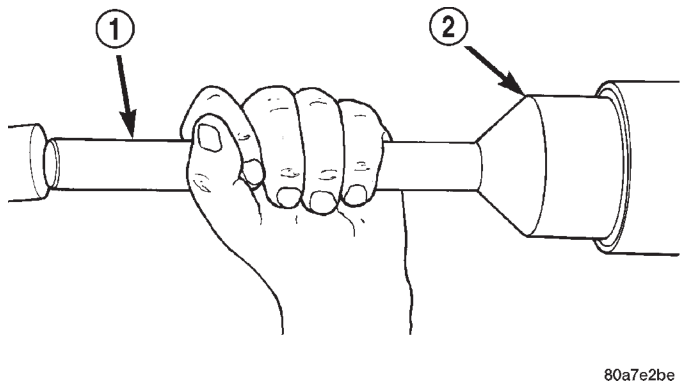


Fig. 8 Pinion Seal Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3972–A

(7) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(8) Install the companion flange onto the pinion with Installer C-3718 and Holder 6719.

CAUTION: Do not exceed the minimum tightening torque when installing the companion flange at this point. Damage to the collapsible spacer or bearings may result.

(9) Install the new pinion nut onto the pinion shaft and tighten the pinion nut until there is zero bearing end-play (Fig. 9).

(10) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(11) Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.) (Fig. 10).

(12) If the rotating torque is low, use Holder 6719 to hold the companion flange, and tighten the pinion nut in 6.8 N·m (5 ft. lbs.) increments until the proper rotating torque is achieved.

CAUTION: If the maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

REMOVAL AND INSTALLATION (Continued)

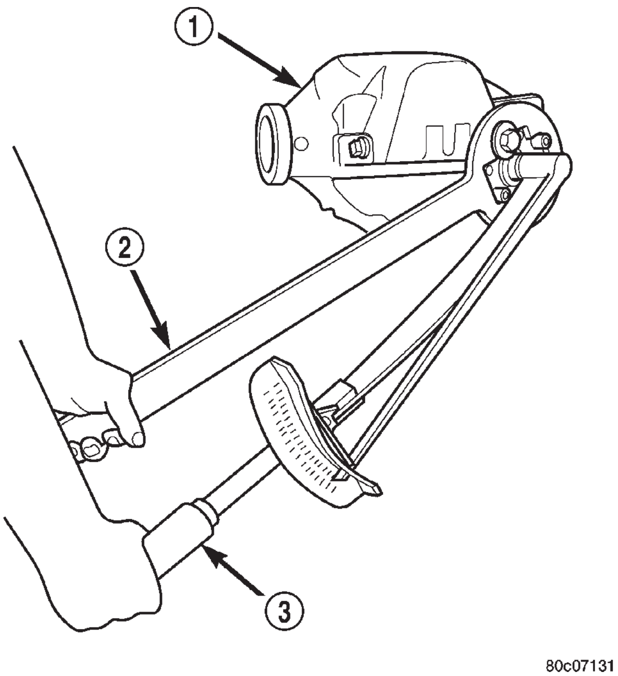


Fig. 9 Tighten Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

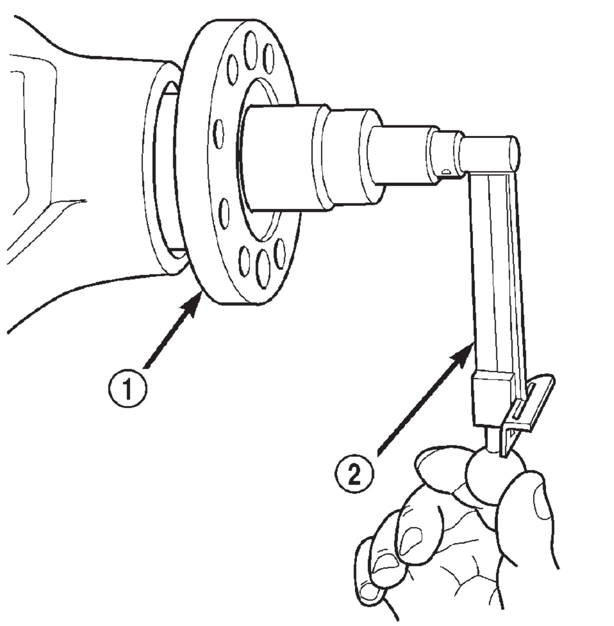


Fig. 10 Check Pinion Rotation Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

(13) Align the installation reference marks on the propeller shaft and companion flange and install the propeller shaft.

(14) Add gear lubricant to the differential housing, if necessary. Refer to the Lubricant Specifications for gear lubricant requirements.
(15) Install both C/V driveshafts.
(16) Install skid plate, if equipped.
(17) Lower the vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support vehicle. Ensure that the transmission is in neutral.
(2) Remove the necessary C/V driveshaft from vehicle.
(3) Remove the skid plate, if equipped.
(4) Clean all foreign material from axle seal area.
(5) Install Puller Adapter 8420 onto the axle shaft.
(6) Install Slide Hammer C-3752 to the puller adapter.
(7) Remove axle shaft. Use care to prevent damage to axle shaft bearing and seal, which will remain in axle shaft tube.
(8) Inspect axle shaft seal for leakage or damage. Replace the seal if there is any question as to its condition.
(9) Inspect roller bearing contact surface on axle shaft for signs of brinelling, galling and pitting. If any of these conditions exist, the axle shaft and/or bearing and seal must be replaced.

INSTALLATION

(1) Lubricate bearing bore and seal lip with gear lubricant. Insert axle shaft through seal, bearing, and engage it into side gear splines.

NOTE: Use care to prevent shaft splines from damaging axle shaft seal lip.

(2) Push firmly on the axle shaft until the axle shaft snap-ring passes completely through the side gear and engages the snap-ring groove.
(3) Check the differential fluid level and add fluid if necessary. Refer to Lubricant in this group for lubricant requirements.
(4) Install skid plate, if necessary.
(5) Install C/V driveshaft.
(6) Lower vehicle.

AXLE SHAFT SEAL AND BEARING

REMOVAL

(1) Remove the axle shaft.
(2) Remove the axle shaft seal from the end of the axle shaft tube with a small pry bar.

NOTE: The seal and bearing can be removed at the same time with the bearing removal tool.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the axle shaft bearing from the axle tube with Bearing Removal Tool C-4660-A.

(4) Inspect the axle shaft tube bore for roughness and burrs. Remove as necessary.

INSTALLATION

Do not install the original axle shaft seal. Always install a new seal.

(1) Wipe the axle shaft tube bore clean.

(2) Install axle shaft bearing with Installer 5063 and Handle C–4171.

(3) Install the new axle shaft seal with Installer 8402 and Handle C–4171.

(4) Install the axle shaft.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.

(2) Remove the differential housing cover and allow fluid to drain.

(3) Remove the axle shafts.

(4) Note the installation reference numbers stamped on one of the bearing caps and a machined flat on the housing next to the sealing surface. If the reference numbers cannot be found or seen easily, make new marks for later reference.

(5) Loosen the differential bearing cap bolts.

(6) Install Adapter Plates 8142-A onto the axle housing.

(7) Position Spreader W–129–B onto the adapter plates and install the safety holddown clamps. Tighten the tool turnbuckle finger-tight.

(8) Install a Pilot Stud L-4438 at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

CAUTION: Do not spread over 0.34 mm (0.013 in). If the housing is over–spread, it could be distorted or damaged.

(9) Spread the housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 11).

(10) Remove the dial indicator.

(11) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(12) Remove the differential from the housing. Ensure that the differential bearing cups and shims remain in position on the differential bearings.

(13) Mark or tag the differential bearing cups and shims to indicate which side of the differential they were removed from.

(14) Remove spreader from housing.

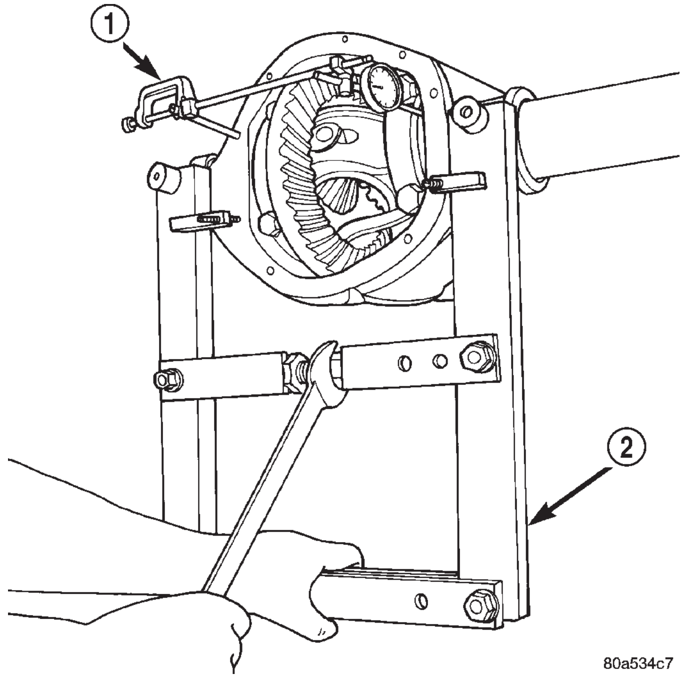


Fig. 11 Spread Axle Housing—Typical

1 – SPECIAL TOOL C-3339
2 – SPECIAL TOOL W-129–B

INSTALLATION

If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Position Spreader W–129–B, with the Adapter Plates 8142-A seated in the locating holes, on the axle and install the safety holddown clamps. Tighten the tool turnbuckle finger–tight.

(2) Install a Pilot Stud C-4438 at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing and zero the indicator.

CAUTION: Do not spread over 0.34 mm (0.013 in). If the housing is over-spread, it could be distorted or damaged.

(3) Spread the housing enough to install the differential case and preload shims in the housing. Measure the distance with the dial indicator.

(4) Remove the dial indicator.

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings and the differential preload shims are seated in the housing. Tap the differential case to ensure the bearings cups are fully seated in the housing.

REMOVAL AND INSTALLATION (Continued)

(6) Install the bearing caps at their original locations.

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten the bearing cap bolts to 61 N·m (45 ft. lbs.) torque.

(10) Install the axle shafts.

(11) Install the differential housing cover and fill with the correct lubricant.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA, C-293-48 Blocks, and Plug C-293-3 (Fig. 12).

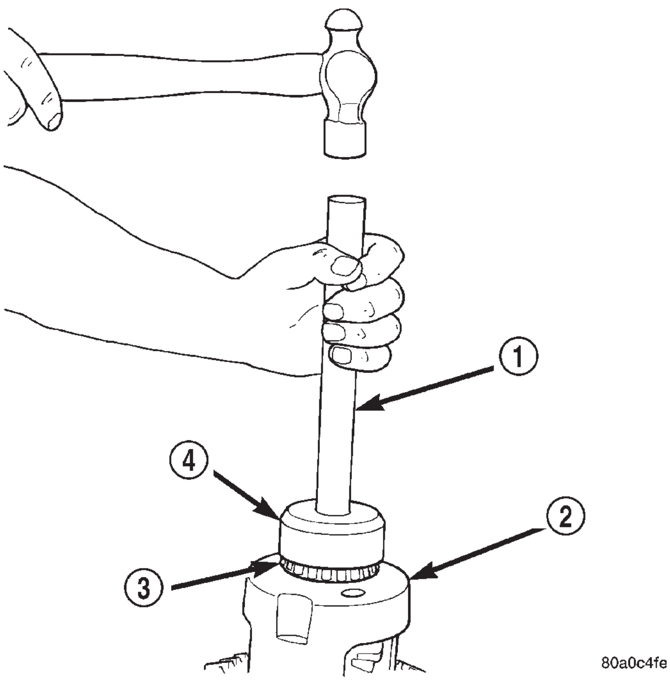


Fig. 12 Differential Bearing Removal

1 – HANDLE C-4171
2 – DIFFERENTIAL
3 – BEARING
4 – TOOL C-4340

INSTALLATION

(1) Using Installer 8236, with handle C-4171, install the differential side bearings (Fig. 13).

(2) Install differential in axle housing.

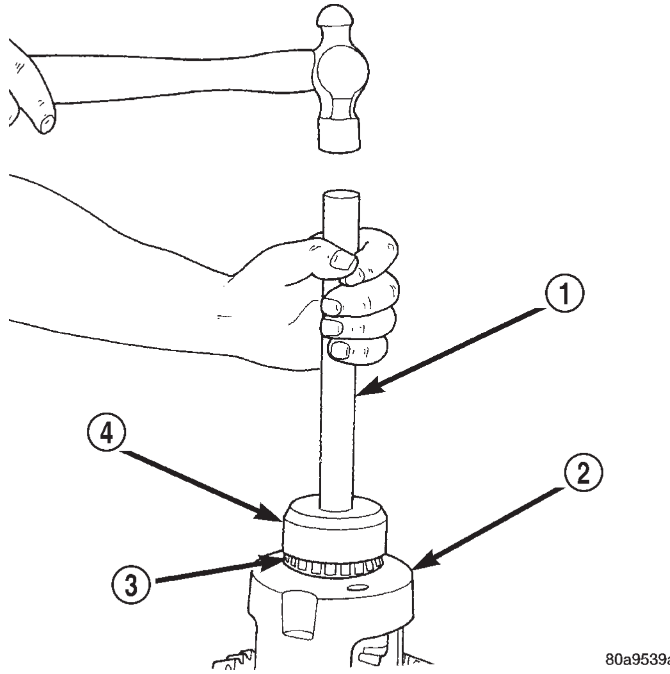


Fig. 13 Install Differential Side Bearings

1 – HANDLE C-4171
2 – DIFFERENTIAL
3 – BEARING
4 – TOOL C-3716–A

RING GEAR

NOTE: The ring gear and pinion are service in a matched set. Do not replace the ring gear without replacing the pinion.

REMOVAL

(1) Remove differential from axle housing.

(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 14)

(3) Remove bolts holding ring gear to differential case.

(4) Using a soft hammer, drive ring gear from differential case (Fig. 14).

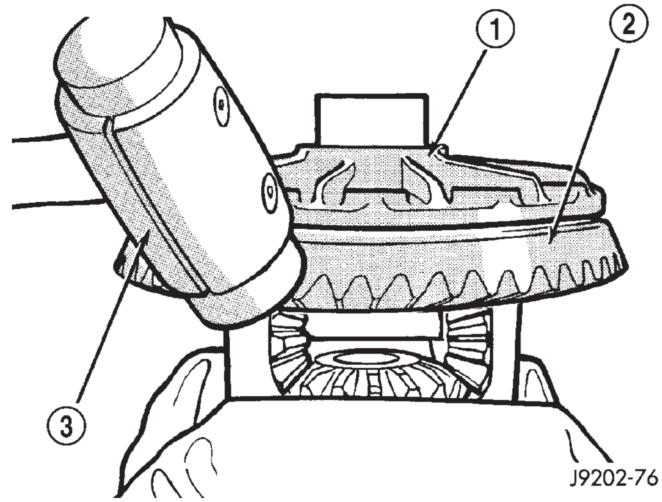


Fig. 14 Ring Gear Removal

1 – CASE
2 – RING GEAR
3 – RAWHIDE HAMMER

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

(1) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(2) Invert the differential case in the vise.

(3) Install new ring gear bolts and alternately tighten to 95–122 N·m (70–90 ft. lbs.) torque (Fig. 15).

(4) Install differential in axle housing and verify gear mesh and contact pattern.

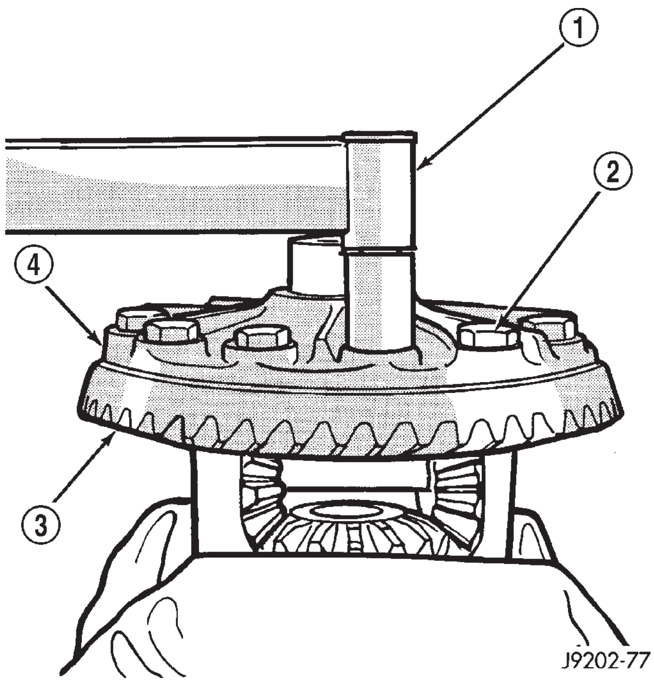


Fig. 15 Ring Gear Bolt Installation

1 – TORQUE WRENCH
2 – RING GEAR BOLT
3 – RING GEAR
4 – CASE

PINION GEAR

NOTE: The ring gear and pinion are serviced in a matched set. Do not replace the pinion without replacing the ring gear.

REMOVAL

(1) Remove differential from the axle housing.

(2) Mark the companion yoke and companion flange for installation alignment.

(3) Remove the bolts holding the companion yoke to the companion flange.

(4) Separate the propeller shaft from the companion flange and using suitable wire, tie the propeller shaft to the vehicle underbody.

(5) Rotate the pinion gear three or four times.

(6) Measure the amount of torque necessary to rotate the pinion with a (in. lbs.) dial-type torque wrench (Fig. 16). Record the torque reading for installation reference.

(7) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(8) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(9) Hold the flange with Holder 6719. Remove the pinion nut.

(10) Remove the companion flange with Remover C-452 (Fig. 17).

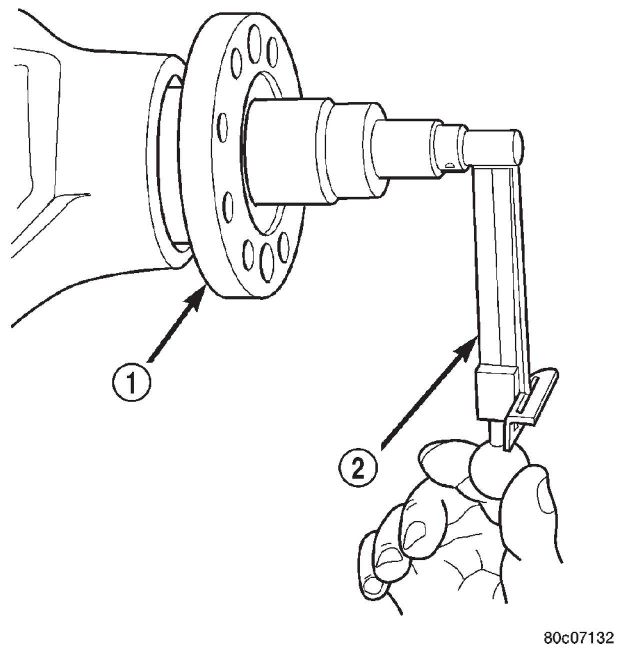


Fig. 16 Measure Pinion Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

REMOVAL AND INSTALLATION (Continued)

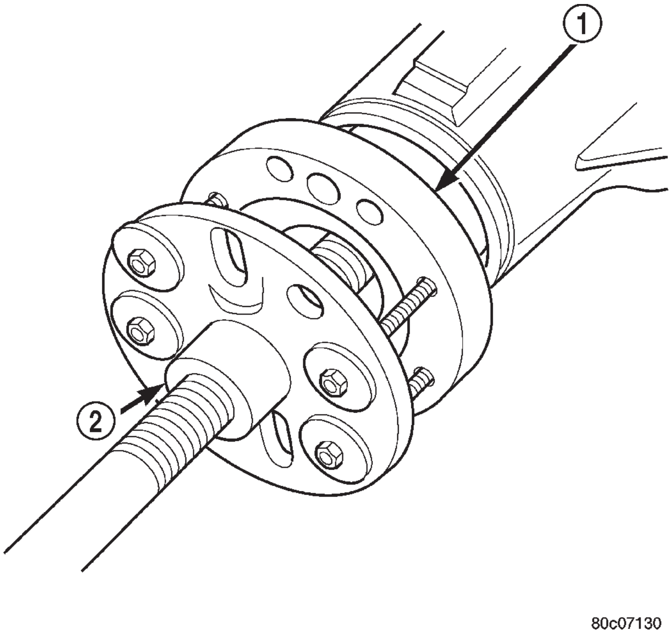


Fig. 17 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

(11) Remove the pinion from housing (Fig. 18). Catch the pinion with your hand to prevent it from falling and being damaged.

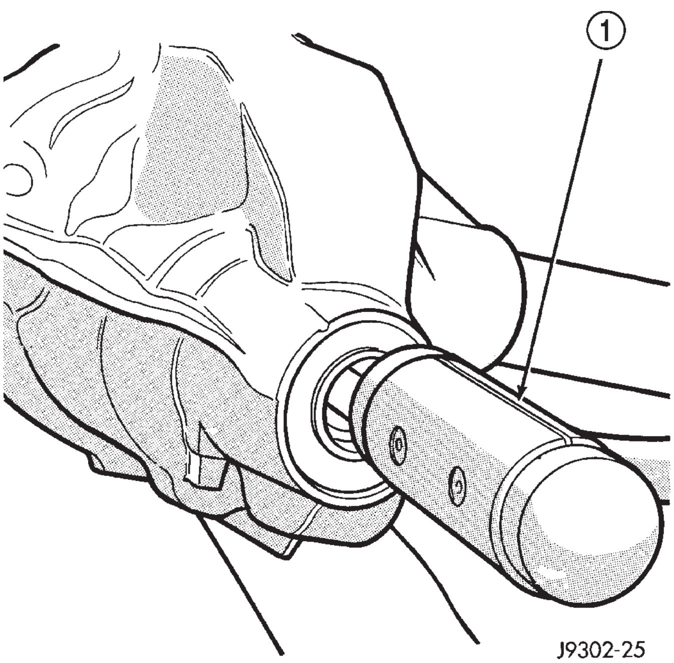


Fig. 18 Remove Pinion

1 – RAWHIDE HAMMER

(12) Using a suitable pry tool, or a slide hammer mounted screw, remove the pinion seal.

(13) Remove oil slinger, if equipped, and front pinion bearing.

(14) Remove the front pinion bearing cup with Remover D–103 and Handle C–4171 (Fig. 19).

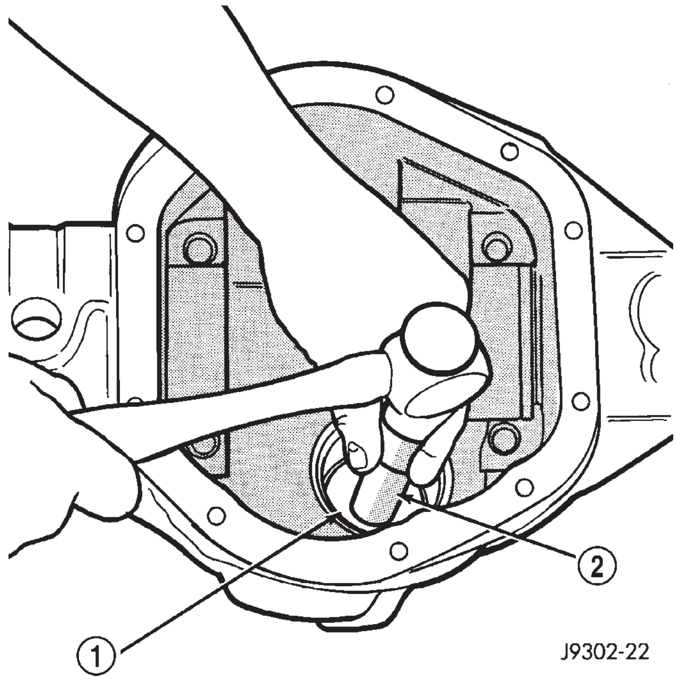


Fig. 19 Front Bearing Cup Removal

1 – REMOVER
2 – HANDLE

(15) Remove the rear bearing cup from housing (Fig. 20). Use Remover 8401 and Handle C–4171.

(16) Remove the collapsible preload spacer (Fig. 21).

(17) Remove the rear bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-42 (Fig. 22).

Place 4 adapter blocks so they do not damage the bearing cage.

(18) Remove the depth shims from the pinion shaft. Record the thickness of the depth shims.

REMOVAL AND INSTALLATION (Continued)

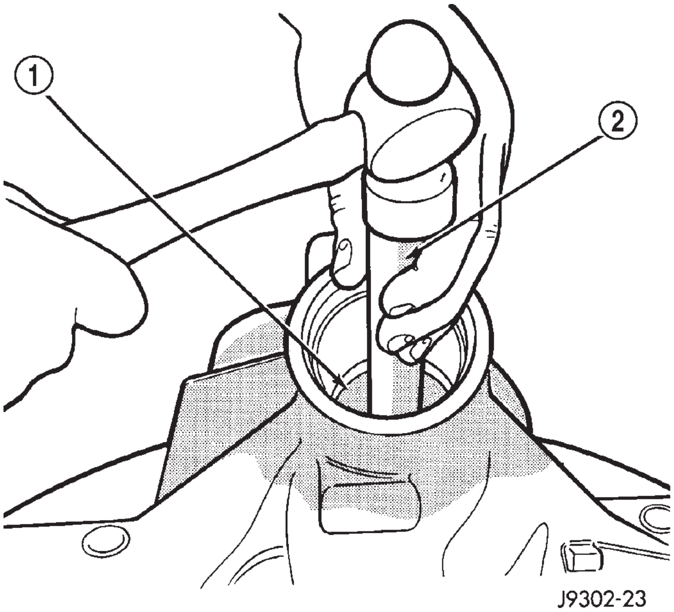


Fig. 20 Rear Bearing Cup Removal

1 – DRIVER
2 – HANDLE

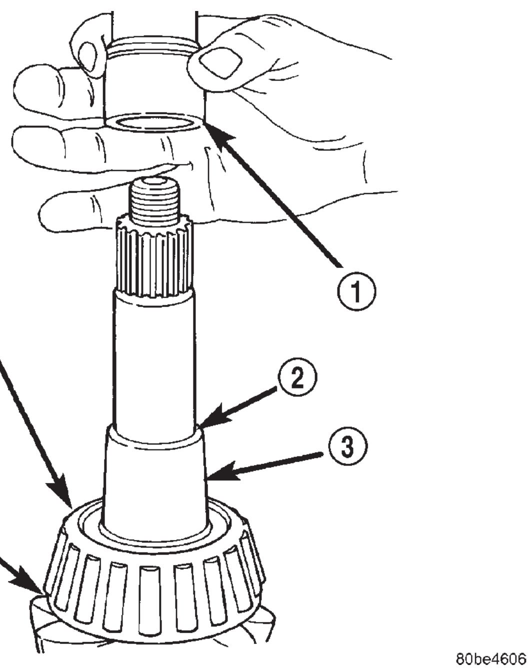


Fig. 21 Collapsible Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION
4 – PINION DEPTH SHIM
5 – REAR BEARING

INSTALLATION

(1) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

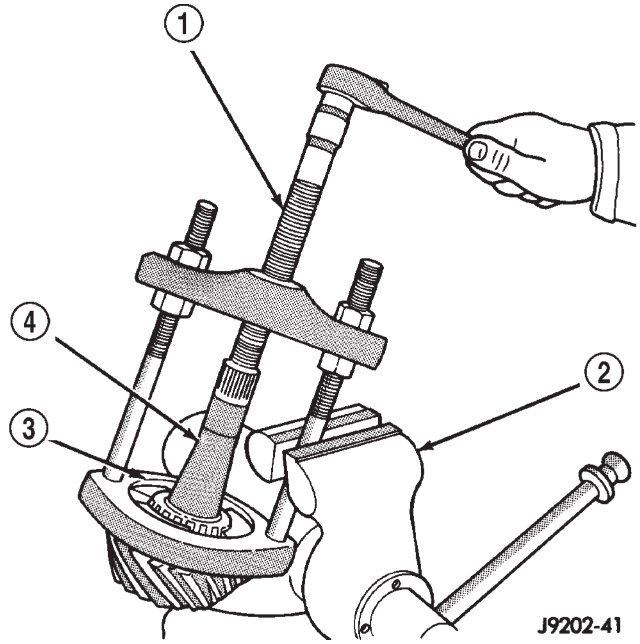


Fig. 22 Rear Bearing Removal

1 – SPECIAL TOOL C-293–PA
2 – VISE
3 – ADAPTERS
4 – DRIVE PINION GEAR SHAFT

(2) Install the pinion rear bearing cup with Installer D-145 and Driver Handle C–4171 (Fig. 23). Ensure cup is correctly seated.

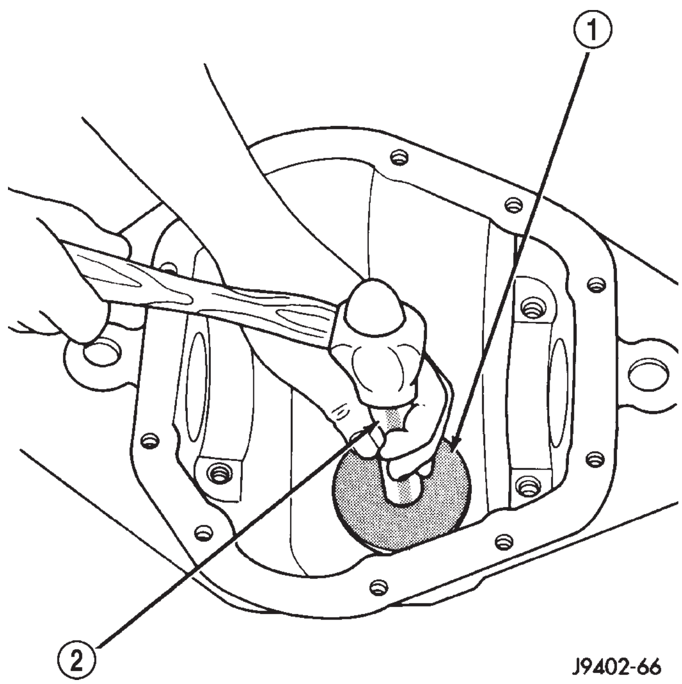


Fig. 23 Pinion Rear Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

REMOVAL AND INSTALLATION (Continued)

(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(4) Install the pinion front bearing cup with Installer D–129 and Handle C–4171 (Fig. 24).

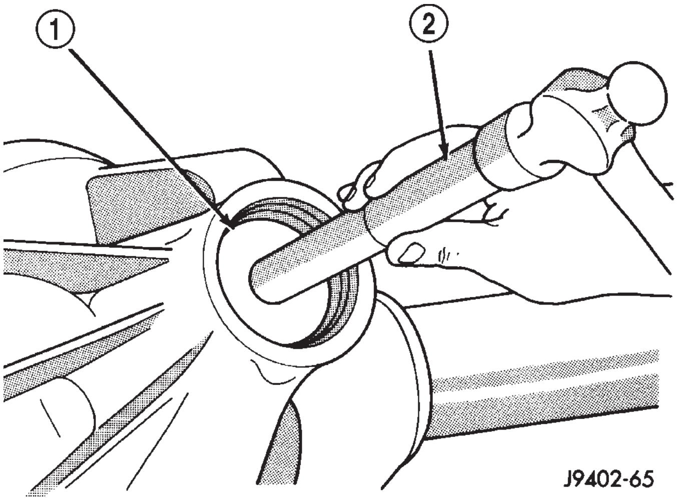


Fig. 24 Pinion Front Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

(5) Install pinion front bearing, and oil slinger, if equipped.

(6) Apply a light coating of gear lubricant on the lip of pinion seal.

(7) Install seal with Installer C-3972-A and Handle C–4171 (Fig. 25).

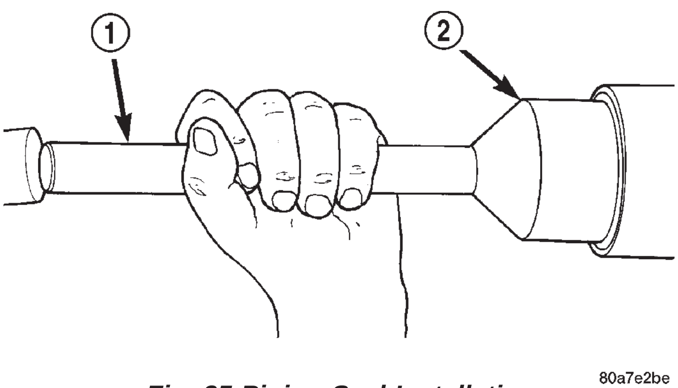


Fig. 25 Pinion Seal Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3972–A

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion gear head to achieve proper ring gear and pinion mesh. If the factory installed ring gear and pinion are reused, the pinion depth shim should not require replacement. If required, refer to Pinion Gear Depth to select the proper thickness shim before installing rear pinion bearing.

(8) Place the proper thickness depth shim on the pinion shaft.

(9) Install the rear bearing and slinger, if equipped, onto the pinion shaft with Installer 6448 (Fig. 26).

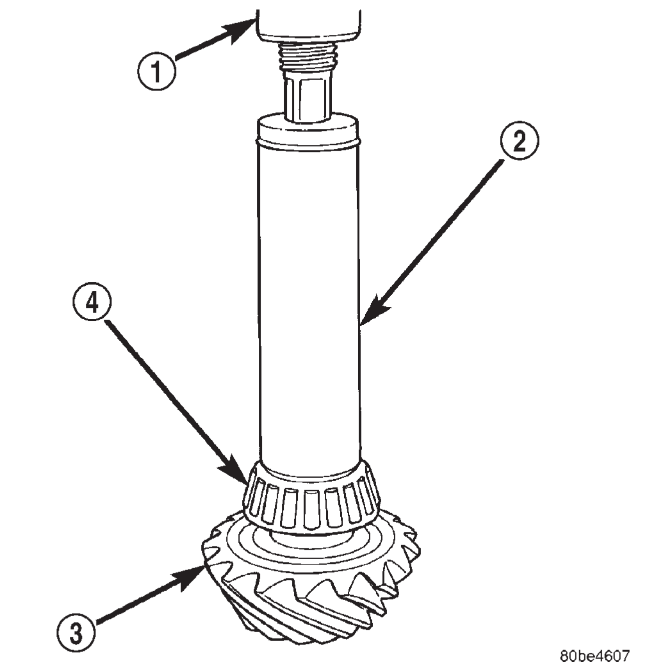


Fig. 26 Shaft Rear Bearing Installation

1 – PRESS
2 – INSTALLATION TOOL
3 – DRIVE PINION
4 – DRIVE PINION SHAFT REAR BEARING

(10) Install a new collapsible preload spacer onto the pinion shaft (Fig. 27).

(11) Install the pinion in the axle housing.

(12) Install the companion flange with Installer C-3718 and Holder 6719.

CAUTION: Do not exceed the minimum tightening torque when installing the companion flange at this point. Damage to the collapsible spacer or bearings may result.

(13) Install the new pinion nut onto the pinion shaft and tighten the pinion nut until there is zero bearing end-play (Fig. 28).

(14) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(15) Using Holder 6719 and a torque wrench set at 474 N·m (350 ft. lbs.), crush collapsible spacer until bearing end play is taken up.

REMOVAL AND INSTALLATION (Continued)

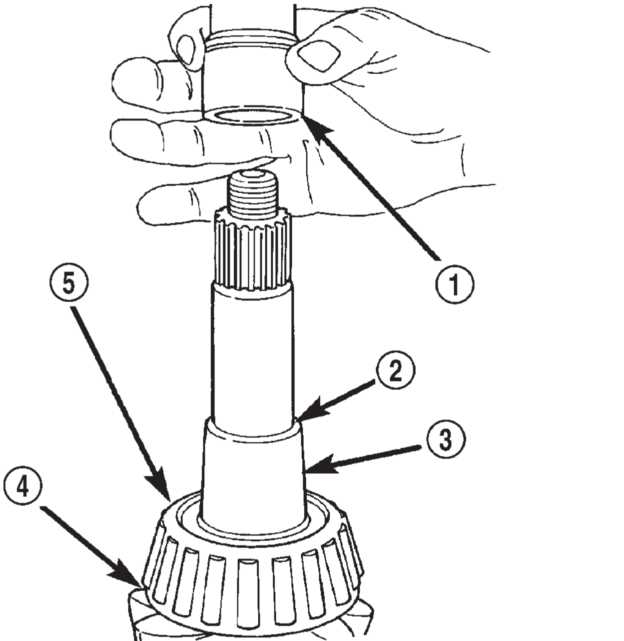


Fig. 27 Collapsible Preload Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION
4 – PINION DEPTH SHIM
5 – REAR BEARING

NOTE: If the spacer requires more than 474 N·m (350 ft. lbs.) torque to crush, the collapsible spacer is defective and must be replaced.

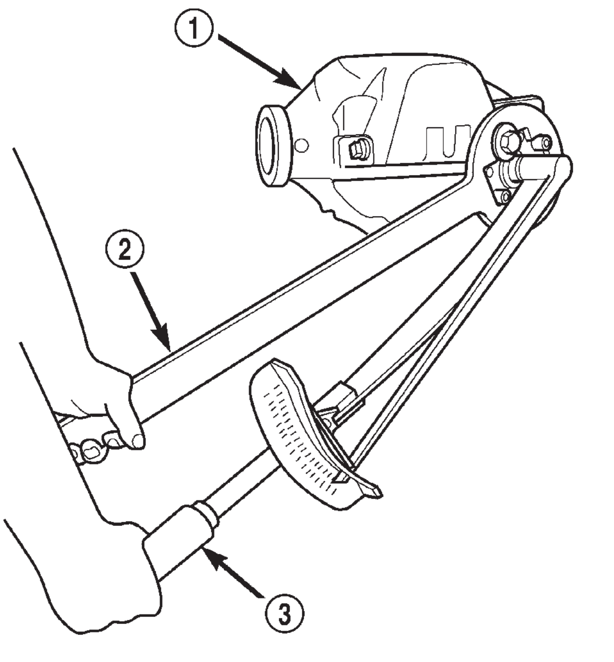


Fig. 28 Tighten Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

(16) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the desired rotating torque is achieved. Measure the rotating torque frequently to avoid overcrushing the collapsible spacer (Fig. 29).

(17) Check bearing rotating torque with an inch pound torque wrench (Fig. 29). The torque necessary to rotate the pinion should be:

• Original Bearings — 1 to 2.5 N·m (10 to 20 in. lbs.).
• New Bearings — 1.0 to 2.5 N·m (15 to 22 in. lbs.).

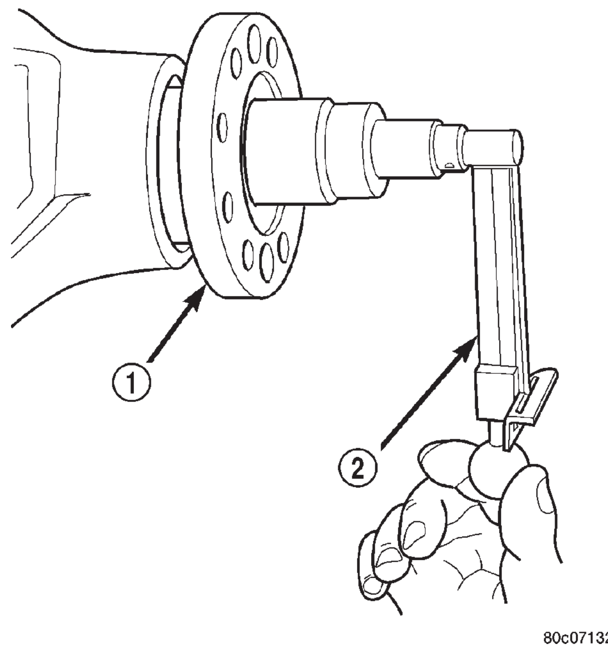


Fig. 29 Check Pinion Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

(18) Install the differential in the axle housing.

FINAL ASSEMBLY

(1) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, on the housing cover (Fig. 30).

Install the housing cover within 5 minutes after applying the sealant.

(2) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts to 23 N·m (17 ft. lbs.) torque.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

REMOVAL AND INSTALLATION (Continued)

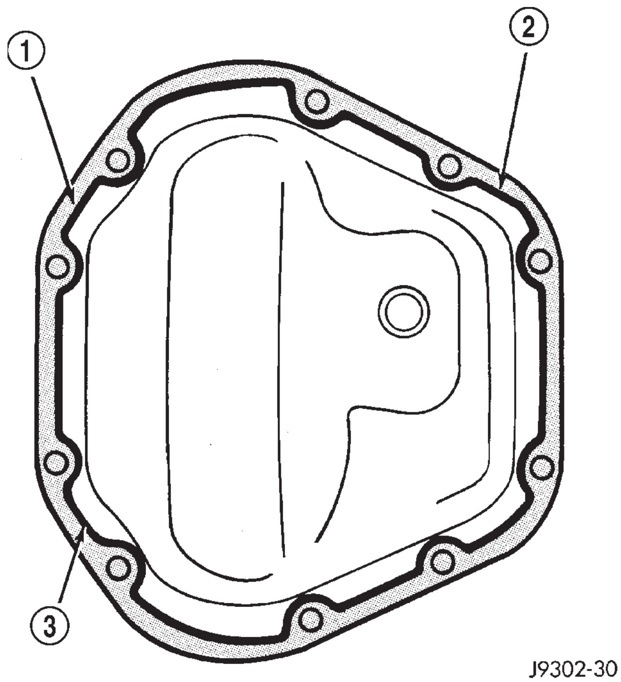


Fig. 30 Typical Housing Cover With Sealant

1 – SEALING SURFACE
2 – CONTOUR OF BEAD
3 – BEAD THICKNESS 6.35MM (1/4")

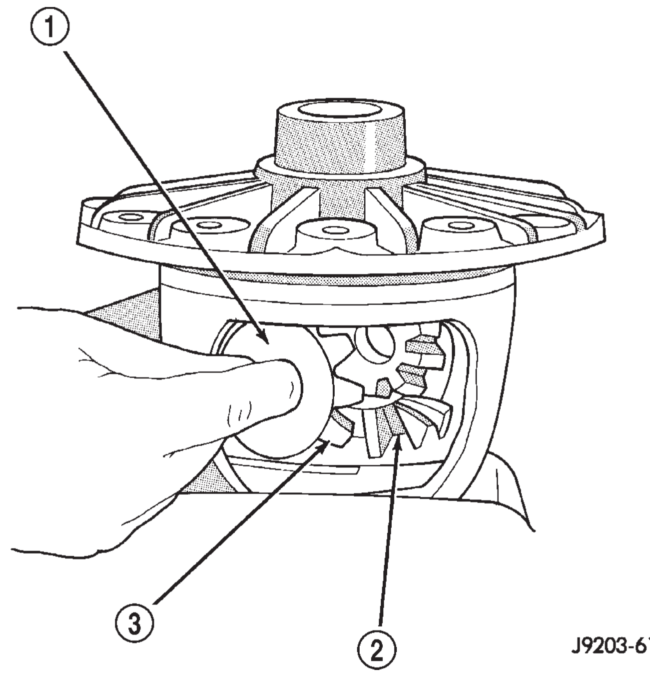


Fig. 31 Pinion Mate Gear Removal

1 – THRUST WASHER
2 – SIDE GEAR
3 – PINION MATE GEAR

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove ring gear.

(2) Remove roll-pin holding mate shaft in housing.

(3) Remove pinion gear mate shaft.

(4) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 31).

(5) Remove the differential side gears and thrust washers.

ASSEMBLY

(1) Install the differential side gears and thrust washers.

(2) Install the pinion mate gears and thrust washers.

(3) Install the pinion gear mate shaft.

(4) Align the hole in the pinion gear mate shaft with the hole in the differential case.

(5) Install and seat the pinion mate shaft roll-pin in the differential case and mate shaft with a punch and hammer (Fig. 32). Peen the edge of the roll-pin hole in the differential case slightly in two places, 180° apart.

(6) Lubricate all differential components with hypoid gear lubricant.

(7) Install ring gear.

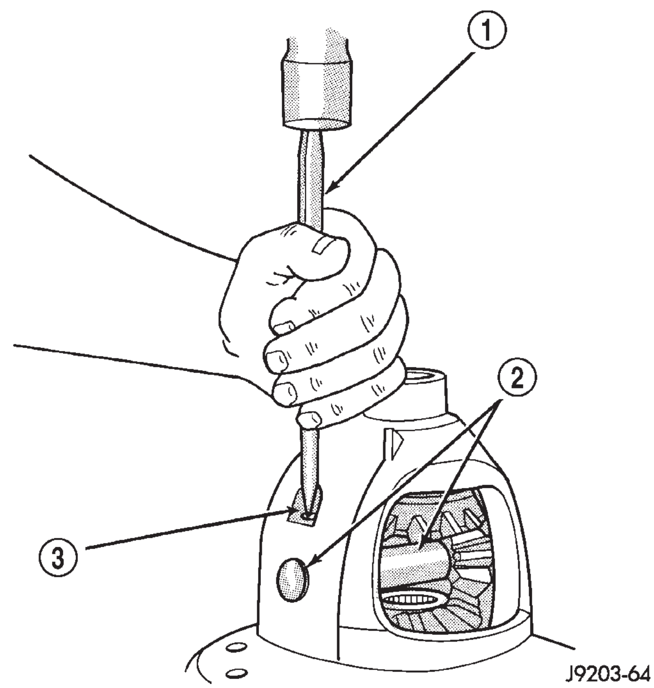


Fig. 32 Pinion Mate Shaft Roll-Pin Installation

1 – PUNCH
2 – PINION MATE SHAFT
3 – MATE SHAFT LOCKPIN

CLEANING AND INSPECTION

AXLE COMPONENTS

Wash differential components with cleaning solvent and dry with compressed air. **Do not steam clean the differential components.**

Wash bearings with solvent and towel dry, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle shaft tubes and oil channels in housing. Inspect for;

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
- Wear and damage to pinion gear mate shaft, pinion gears, side gears and thrust washers. Replace as a matched set only.
- Ring gear and pinion for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Companion flange for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Preload shims for damage and distortion. Install new shims, if necessary.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL INFORMATION

Ring gear and pinion are supplied as matched sets only. The identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (-) number or zero (0) along with the gear set sequence number (01 to 99) is on each gear. This first number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard setting from the center line of the ring gear to the back face of the pinion is 99.690 mm (3.925 in.). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed between the rear pinion bearing cone and the pinion gear head. (Fig. 33).

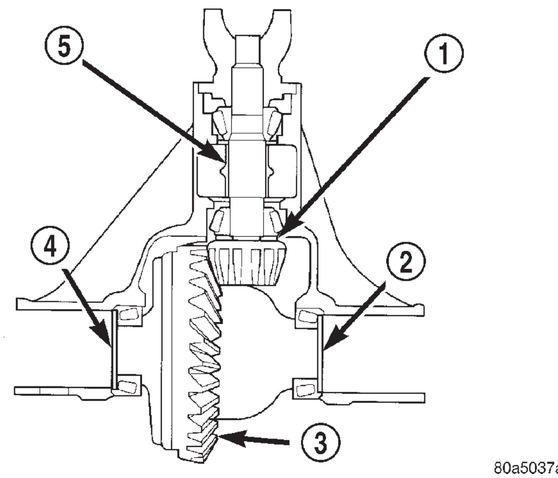


Fig. 33 Shim Locations

1 – PINION GEAR DEPTH SHIM
2 – DIFFERENTIAL BEARING SHIM-PINION GEAR SIDE
3 – RING GEAR
4 – DIFFERENTIAL BEARING SHIM-RING GEAR SIDE
5 – COLLAPSIBLE SPACER

If a new gear set is being installed, note the depth variance marked on both the original and replacement pinion. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance charts.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus amount needed.

Note the painted number on the shaft of the drive pinion (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shim(s). If the number is positive, subtract that value from the thickness of the depth shim(s). If the number is 0 no change is necessary. Refer to the Pinion Gear Depth Variance Chart.

ADJUSTMENTS (Continued)

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with a Pinion Gauge Set, Pinion Block 8177, Arbor Discs 8541, and Dial Indicator C-3339 (Fig. 38).

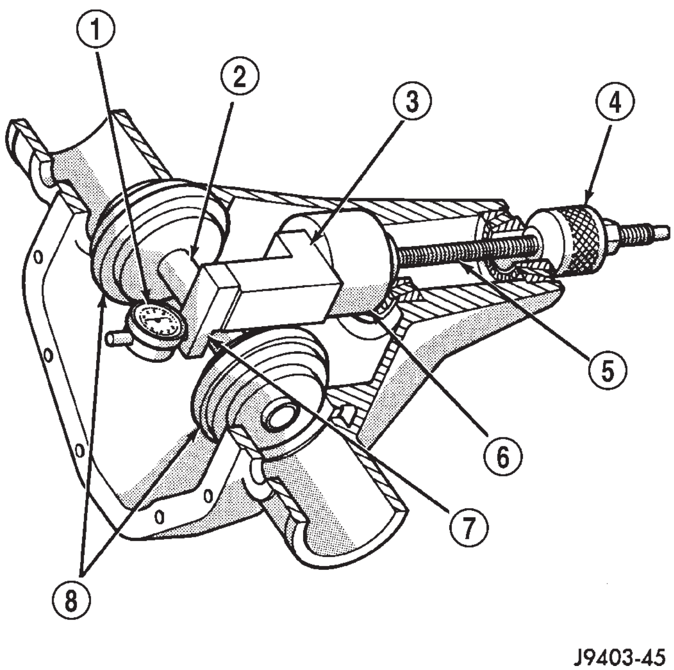


Fig. 34 Pinion Gear Depth Gauge Tools

1 – DIAL INDICATOR
2 – ARBOR
3 – PINION HEIGHT BLOCK
4 – CONE
5 – SCREW
6 – PINION BLOCK
7 – SCOOTER BLOCK
8 – ARBOR DISC

(1) Assemble Pinion Height Block 6739, Pinion Block 8177, and rear pinion bearing onto Screw 6741 (Fig. 34).

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through the pinion bearing cups (Fig. 35).

(3) Install front pinion bearing and Cone 6740 onto the screw hand tight (Fig. 34).

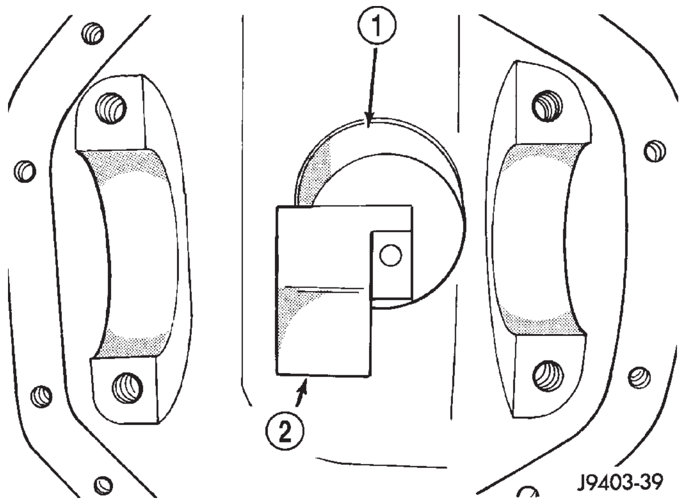


Fig. 35 Pinion Height Block

1 – PINION BLOCK
2 – PINION HEIGHT BLOCK

(4) Place Arbor Discs 8541 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 36). Install differential bearing caps on Arbor Discs and tighten cap bolts. Refer to the Torque Specifications in this section.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the surface of the pinion height block.

ADJUSTMENTS (Continued)

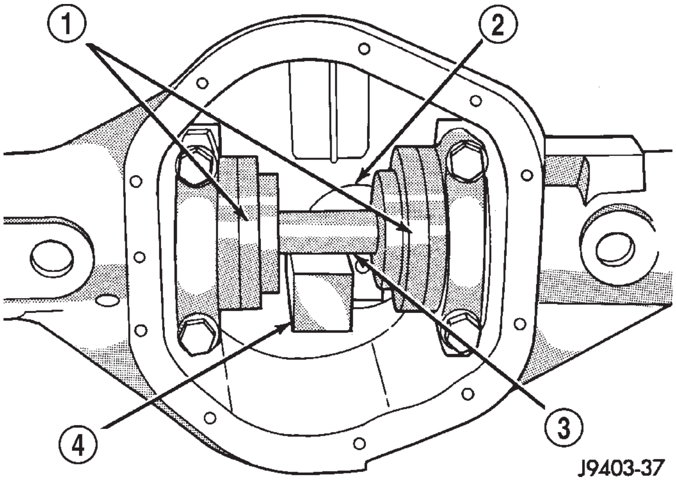


Fig. 36 Gauge Tools In Housing

1 – ARBOR DISC
2 – PINION BLOCK
3 – ARBOR
4 – PINION HEIGHT BLOCK

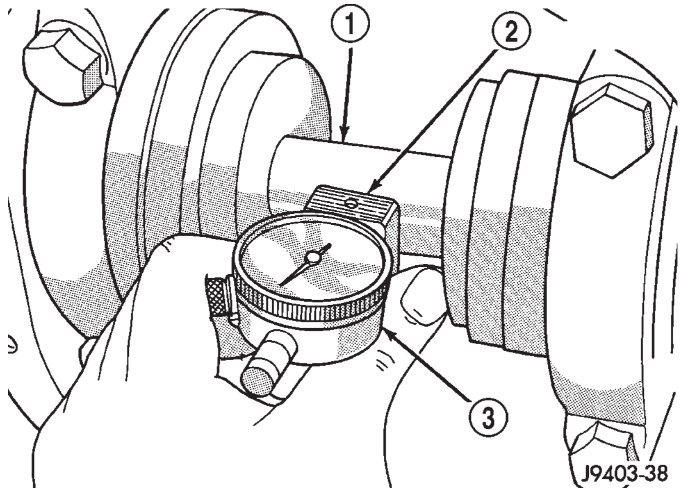


Fig. 37 Pinion Gear Depth Measurement

1 – ARBOR
2 – SCOOTER BLOCK
3 – DIAL INDICATOR

Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block. Observe how many revolutions counterclockwise the dial pointer travels (approximately 0.125 in.) to the out-stop of the dial indicator.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 37). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number marked on the shaft of the pinion gear using the opposite sign on the variance number. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

(10) Remove the pinion depth gauge components from the axle housing

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cup and the axle housing. The proper shim thickness can be determined using slip-fit Dummy Bearings 8398 in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading, starting point shim thicknesses, and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion side of the differential (Fig. 38).

SHIM SELECTION

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.

(1) Remove side bearings from differential case.

(2) Install ring gear, if necessary, on differential case and tighten bolts to specification.

(3) Install Dummy Side Bearings 8398 on differential case.

(4) Install differential case in axle housing.

ADJUSTMENTS (Continued)

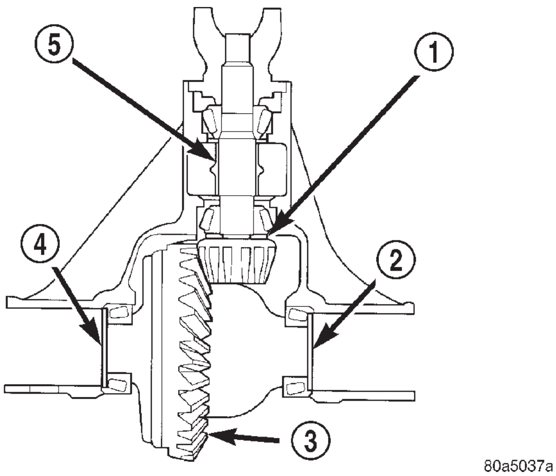


Fig. 38 Axle Adjustment Shim Locations

1 – PINION GEAR DEPTH SHIM
2 – DIFFERENTIAL BEARING SHIM-PINION GEAR SIDE
3 – RING GEAR
4 – DIFFERENTIAL BEARING SHIM-RING GEAR SIDE
5 – COLLAPSIBLE SPACER

(5) Insert Dummy Shims 8107 (0.118 in. (3.0 mm)) starting point shims between both dummy bearings and the axle housing (Fig. 39).

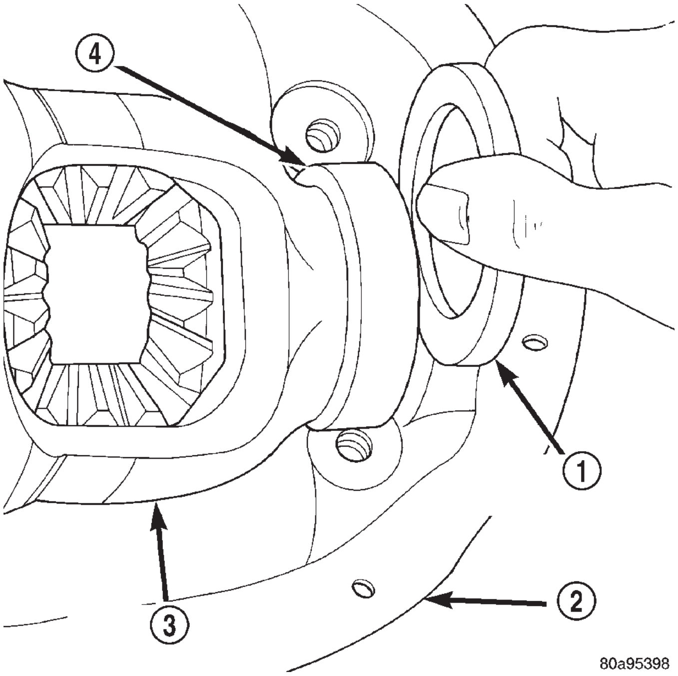


Fig. 39 Insert Starting Point Shims

1 – SPECIAL TOOL 8107
2 – AXLE HOUSING
3 – DIFFERENTIAL CASE
4 – SPECIAL TOOL D-348

(6) Install the marked bearing caps in their correct positions. Install and snug the bolts.

(7) Using a dead-blow type mallet, seat the differential dummy bearings to each side of the axle housing (Fig. 40) and (Fig. 41).

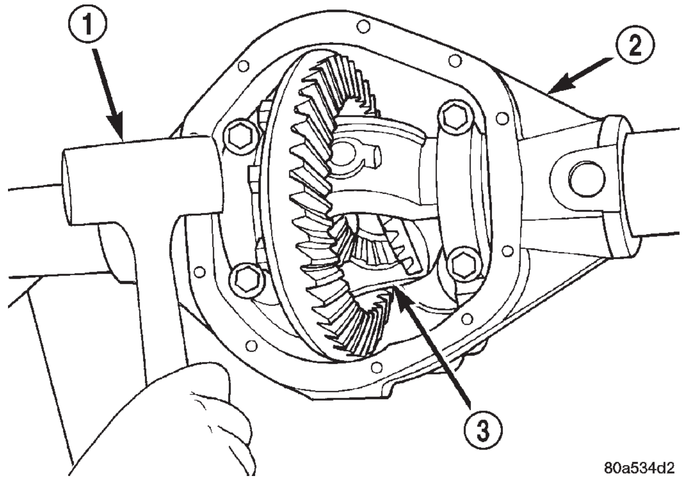


Fig. 40 Seat Pinion Side Dummy Side Bearing

1 – MALLET
2 – AXLE HOUSING
3 – DIFFERENTIAL CASE

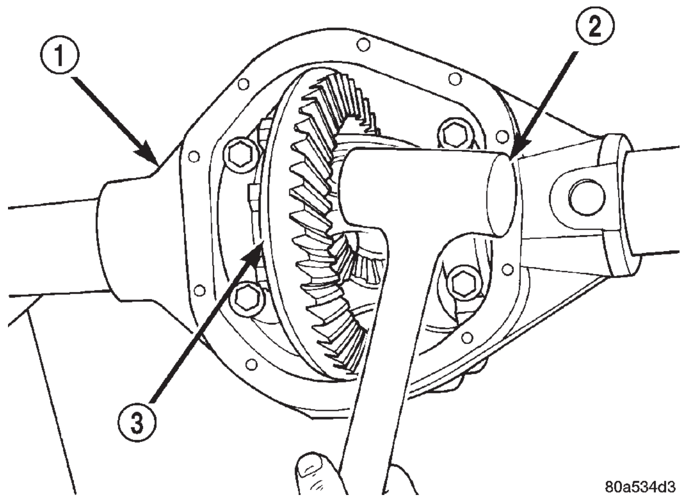


Fig. 41 Seat Ring Gear Side Dummy Bearing

1 – AXLE HOUSING
2 – MALLET
3 – DIFFERENTIAL CASE

(8) Thread guide stud L-4438 into rear cover bolt hole below ring gear (Fig. 42).

(9) Attach dial indicator C-3339 to guide stud. Position the dial indicator plunger on a flat surface on a ring gear bolt head (Fig. 42).

(10) Push firmly and hold differential case to pinion side of axle housing (Fig. 43).

(11) Zero dial indicator face to pointer.

(12) Push firmly and hold differential case to ring gear side of the axle housing (Fig. 44).

ADJUSTMENTS (Continued)

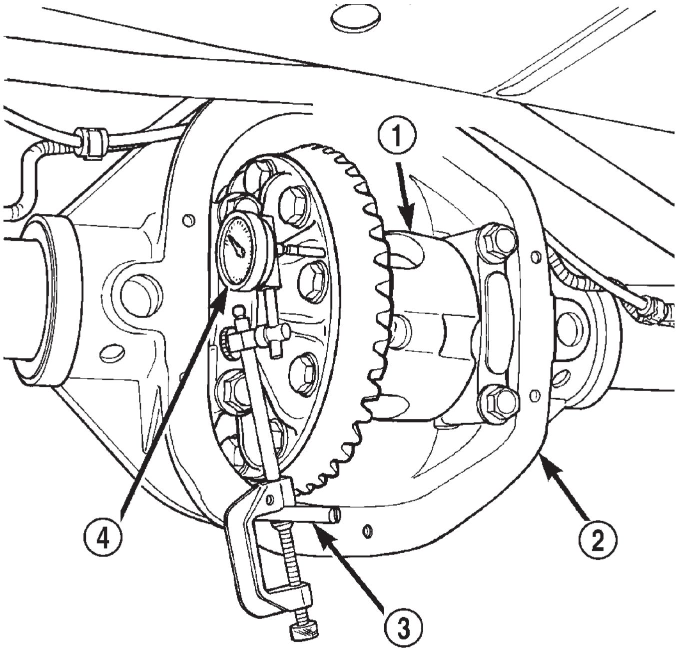


Fig. 42 Differential Side play Measurement

1 – DIFFERENTIAL CASE
2 – AXLE HOUSING
3 – SPECIAL TOOL L-4438
4 – SPECIAL TOOL C-3339

(13) Record dial indicator reading.

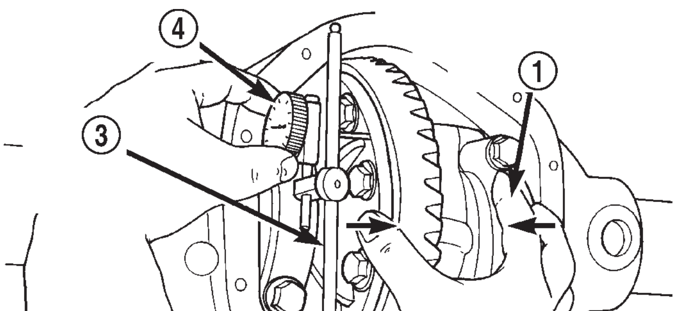


Fig. 43 Hold Differential Case and Zero Dial Indicator

1 – FORCE DIFFERENTIAL CASE TO PINION GEAR SIDE
2 – SPECIAL TOOL L-4438
3 – SPECIAL TOOL C-3339
4 – ZERO DIAL INDICATOR FACE

(14) Add the dial indicator reading to the starting point shim thicknesses to determine the total shim thickness necessary to achieve zero differential end play.

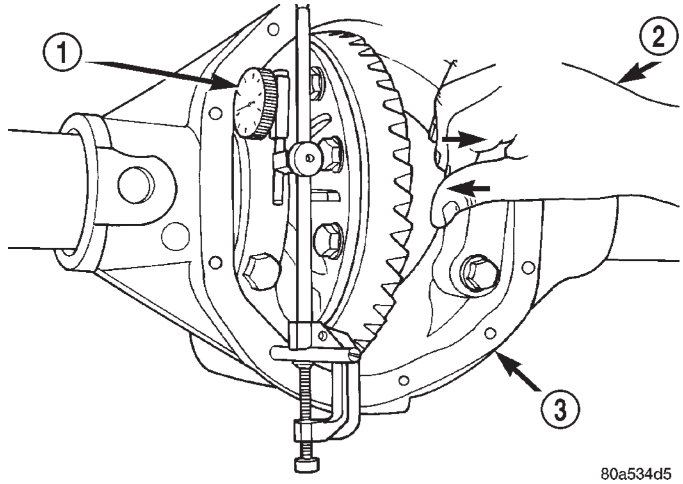


Fig. 44 Hold Differential Case and Read Dial Indicator

1 – READ DIAL INDICATOR
2 – FORCE DIFFERENTIAL CASE TO RING GEAR SIDE
3 – AXLE HOUSING

(15) Add 0.008 in. (0.2 mm) to the zero end play total. This new total represents the thickness of shims necessary to compress, or preload the new bearings when the differential is installed.

(16) Rotate dial indicator out of the way on guide stud.

(17) Remove differential case, dummy bearings, and starting point shims from the axle housing.

(18) Install the pinion in the axle housing. Install the companion flange and establish the correct pinion rotating torque.

(19) Install differential case and dummy bearings in axle housing with a single Dummy Shim 8107 on the ring gear side of the axle and tighten retaining cap bolts.

(20) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 46).

(21) Push and hold differential case toward pinion.

(22) Zero dial indicator face to pointer.

(23) Push and hold differential case to ring gear side of the axle housing.

(24) Record dial indicator reading.

(25) Subtract 0.002 in. (0.05 mm) from the dial indicator reading to compensate for backlash between ring and pinion gears. Add the resulting measurement to the thickness of the single starting point shim. This total is the thickness of shim required to achieve proper backlash.

(26) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the axle housing.

(27) Rotate dial indicator out of the way on guide stud.

(28) Remove differential case, dummy bearings, and dummy shim from axle housing.

ADJUSTMENTS (Continued)

(29) Install new side bearing cones and cups on differential case.

(30) Install spreader W-129-B, utilizing Adapter Plates 8142-A, on axle housing and spread axle opening enough to receive differential case.

(31) Place the side bearing shims in the axle housing against the axle housing shoulder.

(32) Install the differential case in the axle housing.

(33) Rotate the differential case several times to seat the side bearings.

(34) Position the indicator plunger against a ring gear tooth (Fig. 45).

(35) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(36) Zero dial indicator face to pointer.

(37) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the differential housing to the other (Fig. 46).

(38) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at eight locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform the Gear Contact Pattern Analysis procedure.

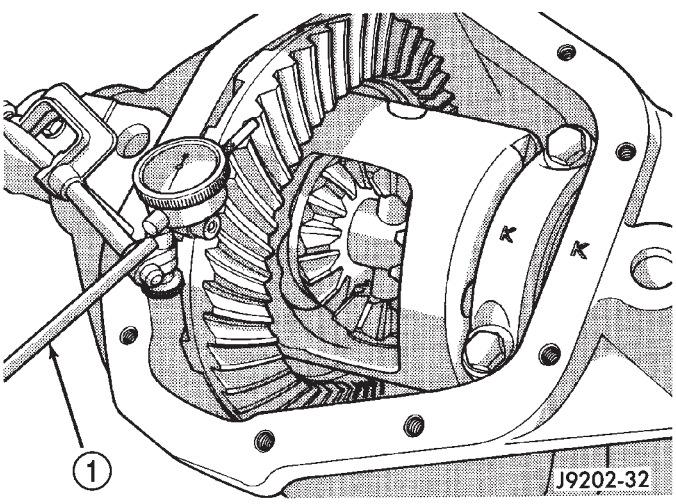


Fig. 45 Ring Gear Backlash Measurement

1 – DIAL INDICATOR

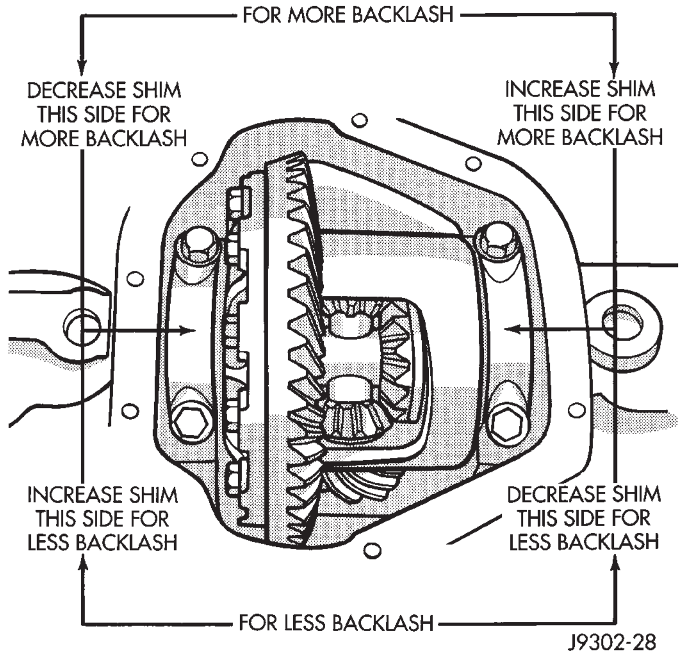


Fig. 46 Backlash Shim Adjustment

GEAR CONTACT PATTERN ANALYSIS

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

(1) Apply a thin coat of hydrated ferric oxide, or equivalent, to the drive and coast side of the ring gear teeth.

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) Using a boxed end wrench on a ring gear bolt, Rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 47) and adjust pinion depth and gear backlash as necessary.

ADJUSTMENTS (Continued)

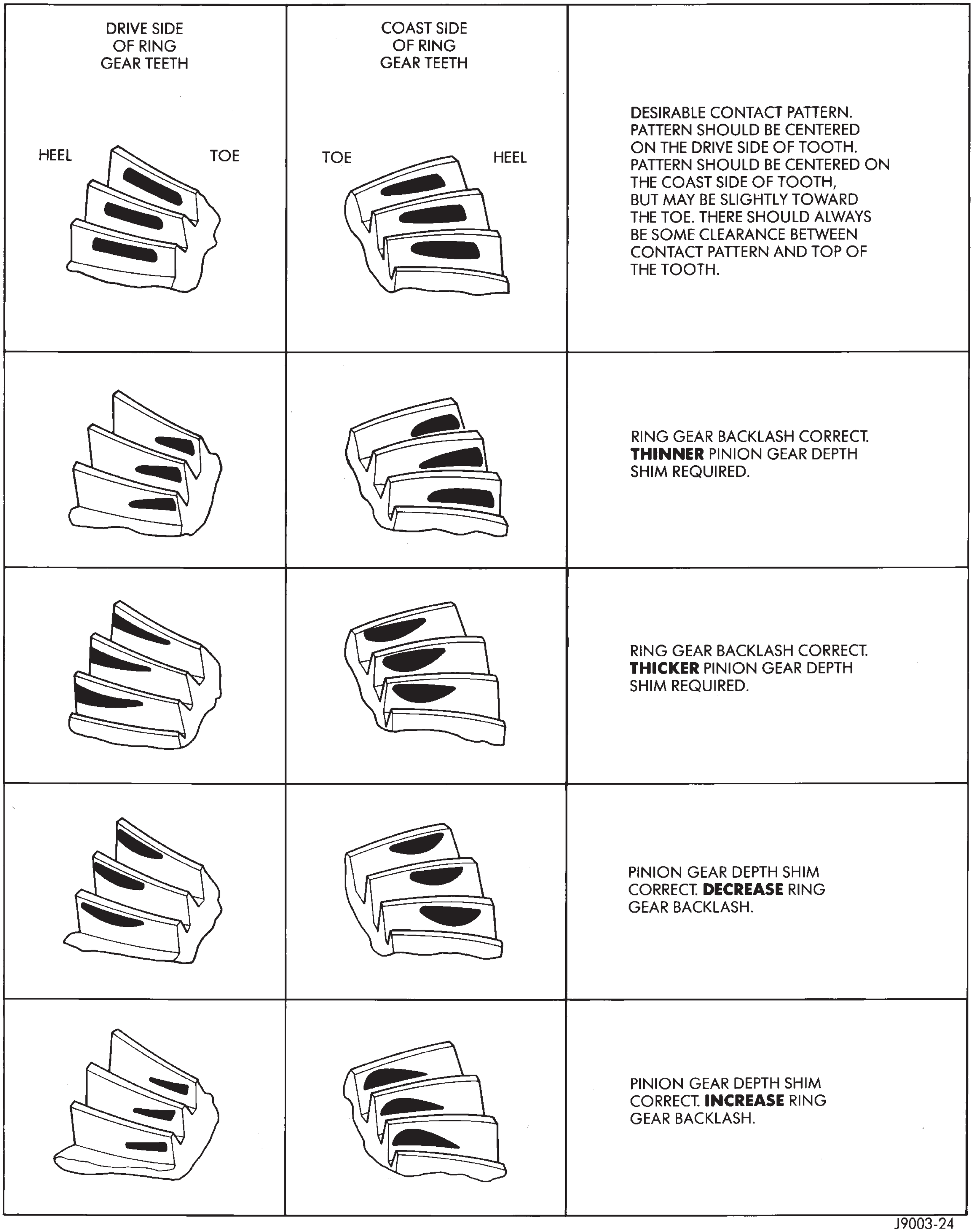


Fig. 47 Gear Tooth Contact Patterns

SPECIFICATIONS

C205F AXLE

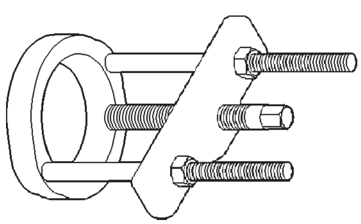
DESCRIPTION	SPECIFICATION
Axle Type	Semi–Floating Hypoid
Lubricant	SAE Thermally Stable 80W–90
Lube Capacity	1.66 L (3.5 pts.)
Axle Ratios	3.55, 3.92
Differential Bearing Preload	0.203 mm (0.008 in.)
Differential Side Gear Clearance	0–0.15 mm (0–0.006 in.)
Ring Gear Diameter	205 mm (7.562 in.)
Ring Gear Backlash	0.12–0.20 mm (0.005–0.008 in.)
Pinion Std. Depth	99.69 mm (3.925 in.)
Pinion Bearing Preload-Original Bearings	1–3 N·m (10–20 in. lbs.)
Pinion Bearing Preload-New Bearings	1.7–2.5 N·m (15–22 in. lbs.)

C205F AXLE

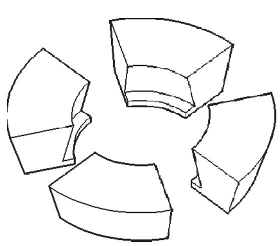
DESCRIPTION	TORQUE
Bolt, Diff. Cover	23 N·m (15 ft. lbs.)
Bolt, Bearing Cap	61 N·m (45 ft. lbs.)
Nut, Pinion	271–474 N·m (200–350 ft. lbs.)
Bolt, Ring Gear	95–122 N·m (70–90 ft. lbs.)

SPECIAL TOOLS

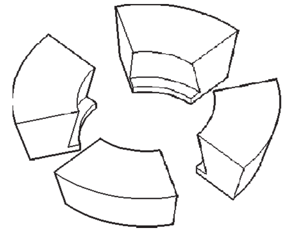
C205F AXLE



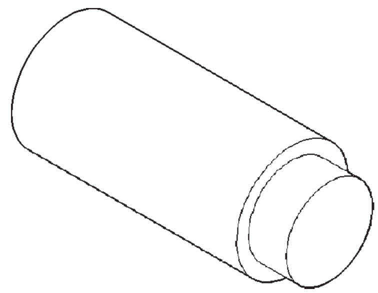
Puller—C-293-PA



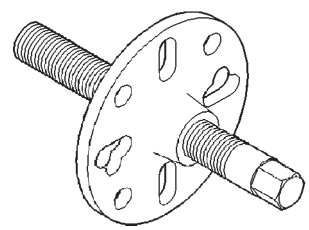
Adapter—C-293-42



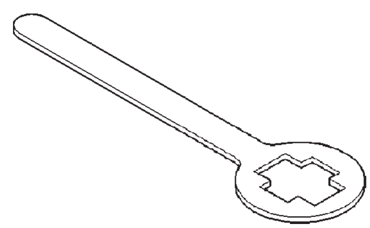
Adapter—C-293-48



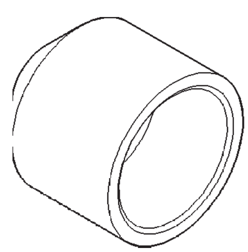
Plug—C-293-3



Puller—C-452

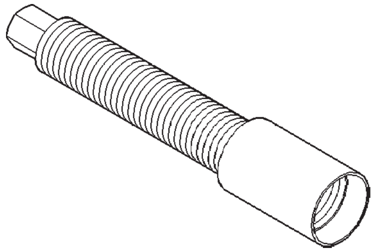


Holder—6719A

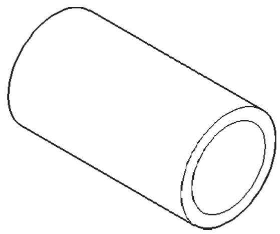


Installer—C-3972-A

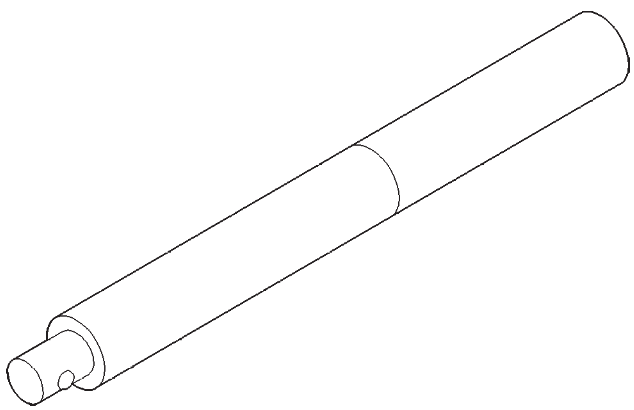
SPECIAL TOOLS (Continued)



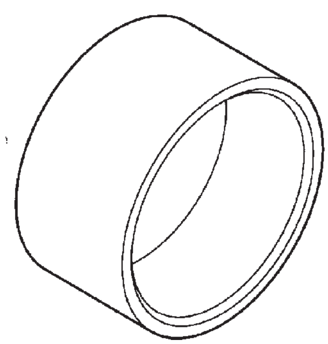
Installer Screw—8112



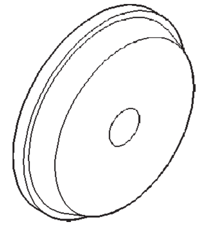
Cup—8109



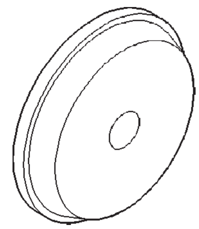
Handle—C-4171



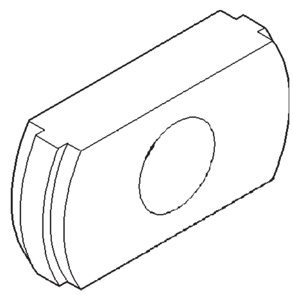
Installer—8236



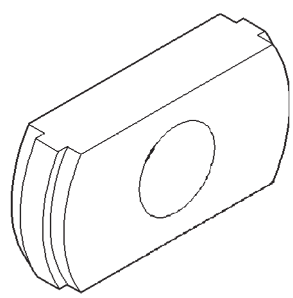
Installer—D-129



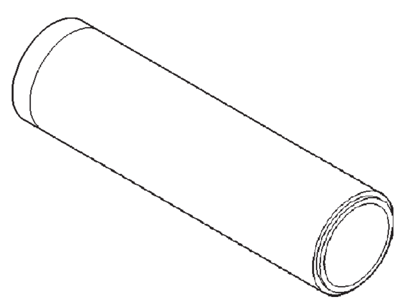
Installer—D-145



Remover—D-103

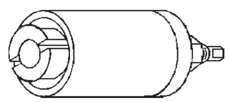


Remover—8401

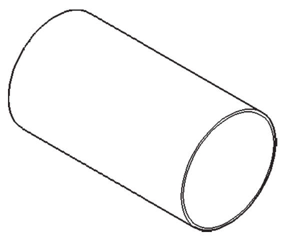


Installer—6448

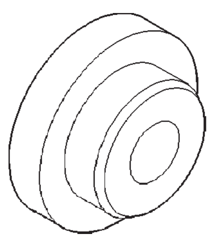
SPECIAL TOOLS (Continued)



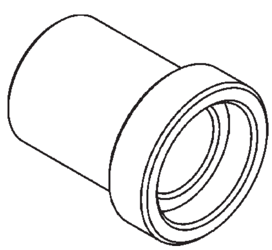
Bearing Remover—C-4660



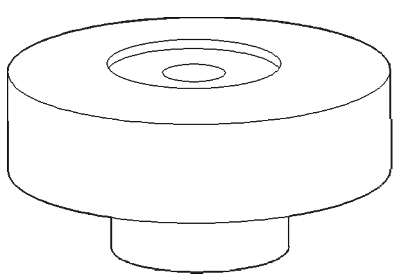
Cup—8150



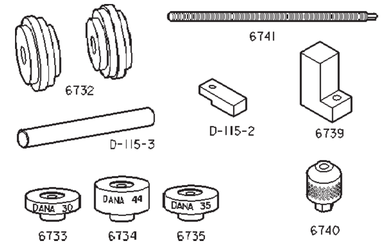
Installer—5063



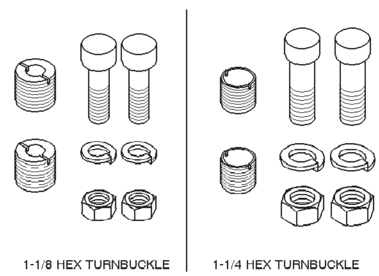
Installer—8402



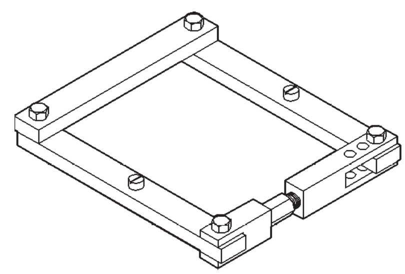
Gauge Block—8177



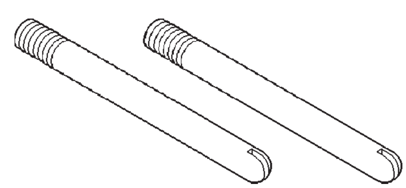
Tool Set, Pinion Depth



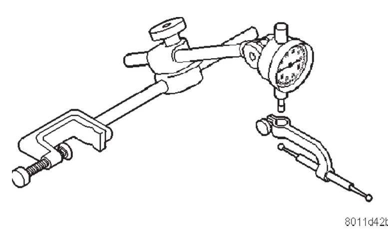
Adapter Kit—6987A



Spreader—W-129-B

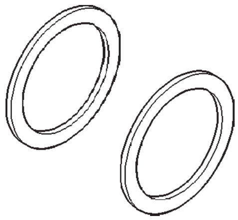


Guide Pin—C-3288-B

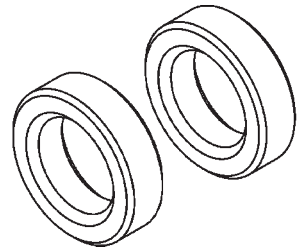


Dial Indicator—C-3339

SPECIAL TOOLS (Continued)



Dummy Shim—8107



Dummy Bearing—8398

8 1/4 AND 9 1/4 AXLE

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
8 1/4 AXLE	59
9 1/4 AXLES	61
LUBRICANT	63
STANDARD DIFFERENTIAL	64
TRAC-LOK™ OPERATION	64
DIAGNOSIS AND TESTING	
GENERAL INFORMATION	65
GEAR NOISE	67
BEARING NOISE	68
LOW SPEED KNOCK	68
VIBRATION	68
DRIVELINE SNAP	68
TRAC–LOK™ DIFFERENTIAL NOISE	68
TRAC–LOK™ TEST	68
SERVICE PROCEDURES	
LUBRICANT CHANGE	69
REMOVAL AND INSTALLATION	
REAR AXLE	69
AXLE SHAFT	70
8 1/4 AND 9 1/4 AXLE SEAL AND BEARING	71
PINION SEAL	72
DIFFERENTIAL	74
DIFFERENTIAL SIDE BEARINGS	75
RING GEAR AND EXCITER RING	75
PINION GEAR	77
FINAL ASSEMBLY	81
DISASSEMBLY AND ASSEMBLY	
STANDARD DIFFERENTIAL	82
8 1/4 TRAC-LOK™ DIFFERENTIAL	82
9 1/4 TRAC-LOK™ DIFFERENTIAL	87
CLEANING AND INSPECTION	
8 1/4 AND 9 1/4 AXLES	91
TRAC-LOK™	92
ADJUSTMENTS	
8 1/4 AXLE PINION GEAR DEPTH	92
9 1/4 AXLE PINION GEAR DEPTH	93
DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH	96
GEAR CONTACT PATTERN ANALYSIS	97
SIDE GEAR CLEARANCE	99
SPECIFICATIONS	
8 1/4 INCH AXLE	99
9 1/4 INCH AXLE	99
8 1/4 and 9 1/4 INCH AXLE	100
SPECIAL TOOLS	
8 1/4 AND 9 1/4 AXLES	100

DESCRIPTION AND OPERATION

8 1/4 AXLE

DESCRIPTION

The 8 1/4 inch axle housings consist of a cast iron center section with axle tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one-piece axle housing (Fig. 1).

The axles have a vent hose to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning vehicle loads are supported by the axle shaft and bearings. The axle shafts are retained by C-locks in the differential side gears.

The removable, stamped steel cover provides a means for inspection and service without removing the complete axle from the vehicle.

The 8 1/4 axle have a date tag and a gear ratio tag. The tags are attached to the differential housing by a cover bolt.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a threaded pin. Differential bearing preload and ring gear backlash are set and maintained by threaded adjusters at the outside of the differential housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

Axles equipped with a Trac-Lok™ differential are optional. A Trac-Lok™ differential has a one-piece differential case, and the same internal components as a standard differential, plus two clutch disc packs.

AXLE IDENTIFICATION

The axle differential cover can be used for identification of the axle (Fig. 2). A tag is also attached to the cover.

DESCRIPTION AND OPERATION (Continued)

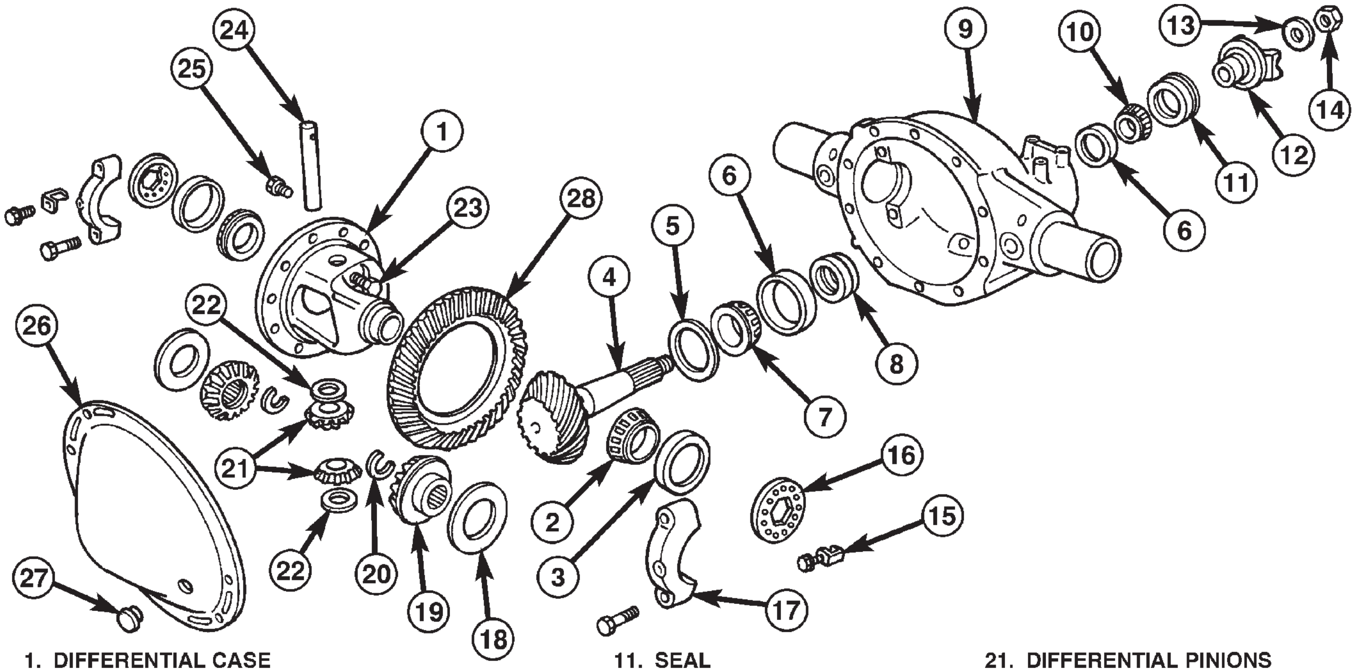


Fig. 1 8 1/4 Axle

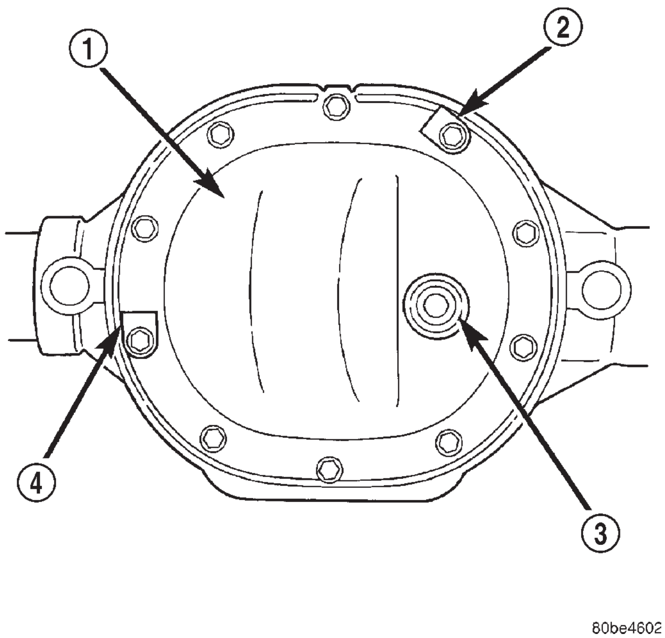


Fig. 2 Differential Cover 8 1/4 Inch Axle

1 – DIFFERENTIAL COVER
2 – IDENTIFICATION TAG
3 – PUSH—IN FILL PLUG
4 – DATE TAG

OPERATION

The axle receives power from the transmission transfer case through the rear propeller shaft. The rear propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

DESCRIPTION AND OPERATION (Continued)

9 1/4 AXLES

DESCRIPTION

The 9 1/4 Inch axle housings consist of a cast iron center section with axle tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one-piece axle housing (Fig. 3).

The axles have a vent hose to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning vehicle loads are supported by the axle shaft and bearings. The axle shafts are retained by C-locks in the differential side gears.

The removable, stamped steel cover provides a means for inspection and service without removing the complete axle from the vehicle.

The axle has a date tag and a gear ratio tag. The tags are attached to the differential housing by a cover bolt.

The rear wheel anti-lock (RWAL) brake speed sensor is attached to the top, forward exterior of the differential housing. A seal is located between the sensor and the wire harness connector. The seal must be in place when the wire connector is connected to the sensor. The RWAL brake exciter ring is press-fitted onto the differential case against the ring gear flange.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a threaded pin. Differential bearing preload and ring gear backlash are set and maintained by threaded adjusters at the outside of the differential housing. Pinion bearing preload is set and maintained by the use of a collapsible spacer.

Axles equipped with a Trac-Lok™ differential are optional. A Trac-Lok™ differential has a one-piece differential case, and the same internal components as a standard differential, plus two clutch disc packs.

DESCRIPTION AND OPERATION (Continued)

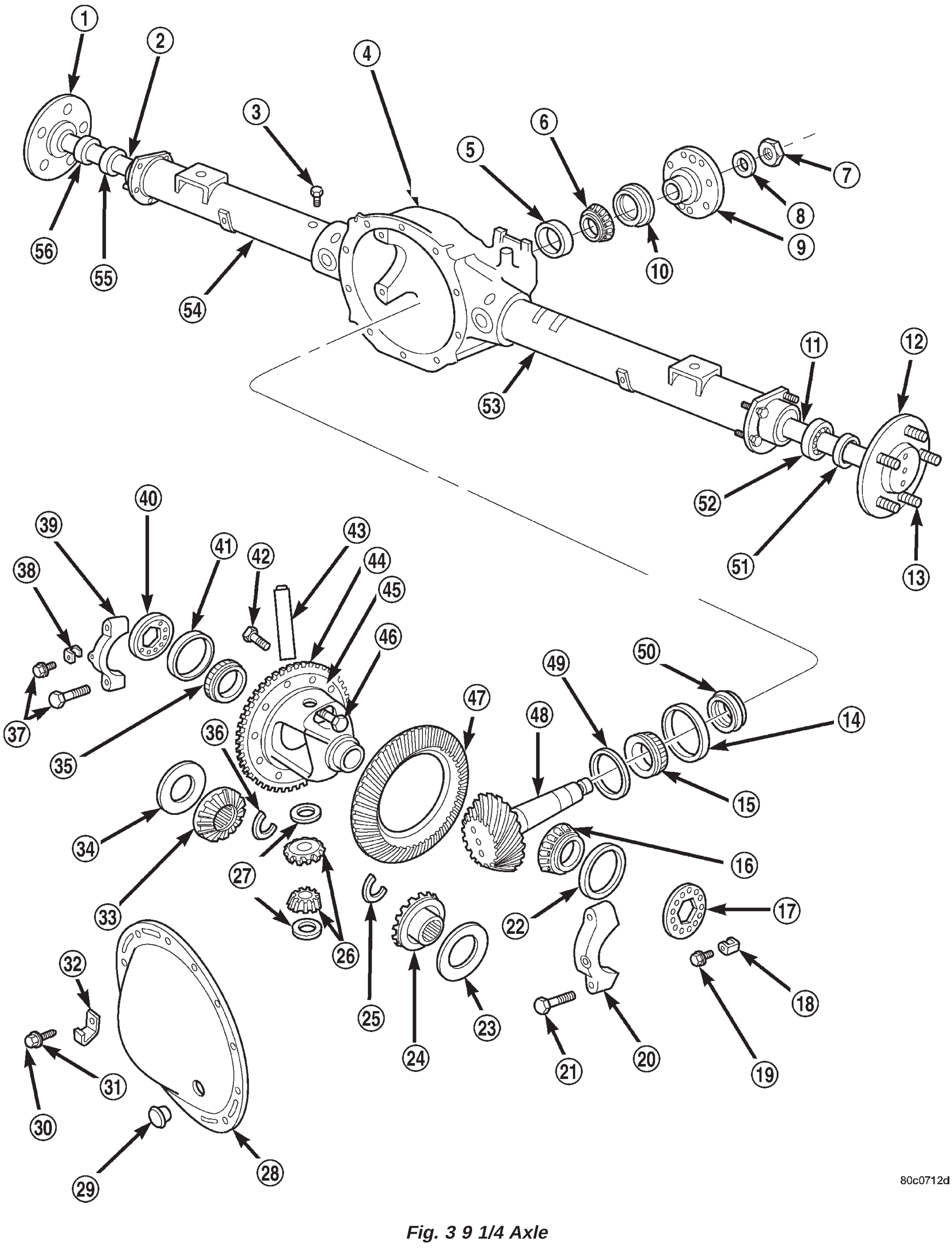


Fig. 3 9 1/4 Axle

DESCRIPTION AND OPERATION (Continued)

1 – HUB
2 – AXLE SHAFT
3 – VENT FITTING
4 – DIFFERENTIAL HOUSING
5 – CUP
6 – PINION FRONT BEARING CONE
7 – NUT
8 – WASHER
9 – COMPANION FLANGE
10 – SEAL
11 – AXLE SHAFT
12 – HUB
13 – STUD
14 – BEARING CUP
15 – PINION REAR BEARING CONE
16 – DIFFERENTIAL BEARING
17 – ADJUSTER
18 – LOCK
19 – BOLT
20 – BEARING CAP
21 – CAP BOLT
22 – BEARING CUP
23 – THRUST WASHER
24 – SIDE GEAR
25 – C—LOCK
26 – DIFFERENTIAL POSITIONS
27 – THRUST WASHER
28 – COVER
29 – PLUG
30 – COVER BOLT
31 – WASHER
32 – CLIP
33 – SIDE GEAR
34 – THRUST WASHER
35 – DIFFERENTIAL BEARING CONE
36 – C—LOCK
37 – BOLT
38 – LOCK
39 – BEARING CUP
40 – ADJUSTER
41 – BEARING CUP
42 – BOLT
43 – PINION MATE SHAFT
44 – EXCITER RING
45 – DIFFERENTIAL CASE
46 – RING GEAR BOLT
47 – RING GEAR
48 – PINION
49 – PINION GEAR DEPTH SHIM
50 – BEARING PRELOAD COLLAPSIBLE SPACER
51 – SEAL
52 – AXLE SHAFT BEARING
53 – AXLE SHAFT TUBE
54 – AXLE TUBE
55 – AXLE SHAFT BEARING
56 – SEAL

AXLE IDENTIFICATION

The axle differential cover can be used for identification of the axle and (Fig. 4). A ratio tag is attached to the differential cover.

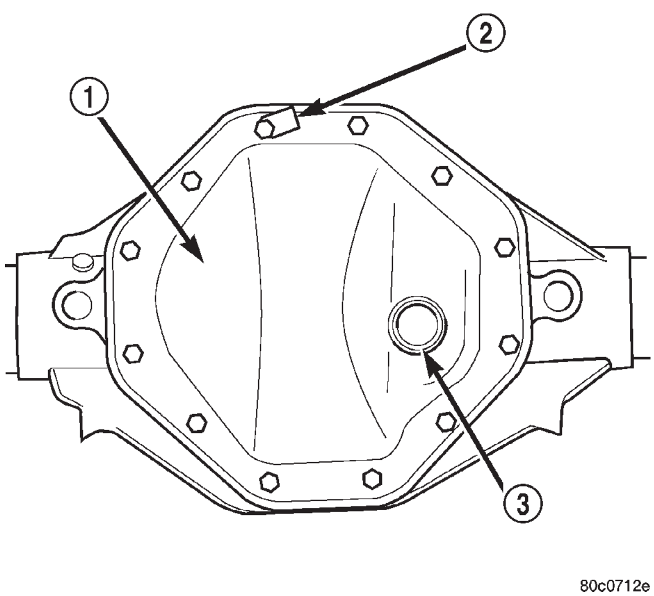


Fig. 4 Differential Cover 9 1/4 Inch Axle

1 – DIFFERENTIAL COVER
2 – RATIO TAG
3 – PUSH—IN FILL PLUG

OPERATION

The axle receives power from the transmission/ transfer case through the rear propeller shaft. The rear propeller shaft is connected to the pinion gear which rotates the differential through the gear mesh with the ring gear bolted to the differential case. The engine power is transmitted to the axle shafts through the pinion mate and side gears. The side gears are splined to the axle shafts.

LUBRICANT

DESCRIPTION

Multi-purpose, hypoid gear lubricant should be used for rear axles with a standard differential. The lubricant should have a MIL-L-2105C and API GL 5 quality specifications.

Trac-Lok differentials require the addition of 5 oz. of friction modifier to the axle lubricant after service. The 8 1/4 axle lubricant capacity is 2.22 L (4.7 pts.) total, including the friction modifier, if necessary. The 9 1/4 axle lubricant capacity is 2.32 L (4.9 pts.) total, including friction modifier, if necessary.

NOTE: If the rear axle is submerged in water, the lubricant must be replaced immediately. Avoid the possibility of premature axle failure resulting from water contamination of the lubricant.

DESCRIPTION AND OPERATION (Continued)

STANDARD DIFFERENTIAL

DESCRIPTION

The differential gear system divides the torque between the axle shafts. It allows the axle shafts to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

OPERATION

In operation, power flow occurs as follows:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The side gears (splined to the axle shafts) rotate the shafts

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (Fig. 5).

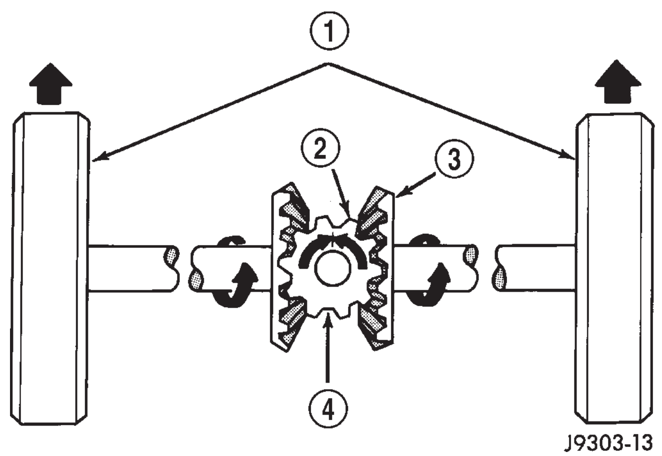


Fig. 5 Differential Operation—Straight Ahead Driving

1 – IN STRAIGHT AHEAD DRIVING EACH WHEEL ROTATES AT 100% OF CASE SPEED
2 – PINION GEAR
3 – SIDE GEAR
4 – PINION GEARS ROTATE WITH CASE

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 6). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

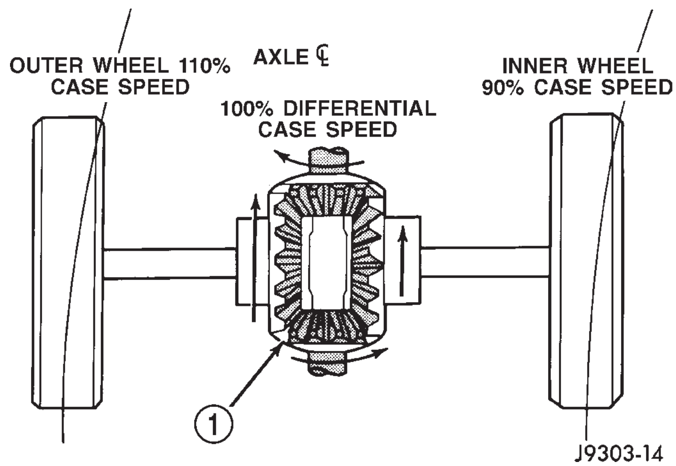


Fig. 6 Differential Operation—On Turns

1 – PINION GEARS ROTATE ON PINION SHAFT

TRAC-LOK™ OPERATION

DESCRIPTION

In a conventional differential, if one wheel spins, the opposite wheel will generate only as much torque as the spinning wheel.

In the Trac-lok™ differential, part of the ring gear torque is transmitted through clutch packs which contain multiple discs. The clutches will have radial grooves on the plates, and concentric grooves on the discs or bonded fiber material that is smooth in appearance.

OPERATION

In operation, the Trac-lok™ clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 7).

The Trac-lok™ design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel looses traction, the clutch packs transfer additional torque to the wheel having the most traction. Trac-lok™ differentials resist wheel spin on bumpy roads and provide more pulling power when one wheel looses traction. Pulling power is provided continuously until both wheels loose traction. If both wheels slip due to unequal traction, Trac-lok™ operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

DESCRIPTION AND OPERATION (Continued)

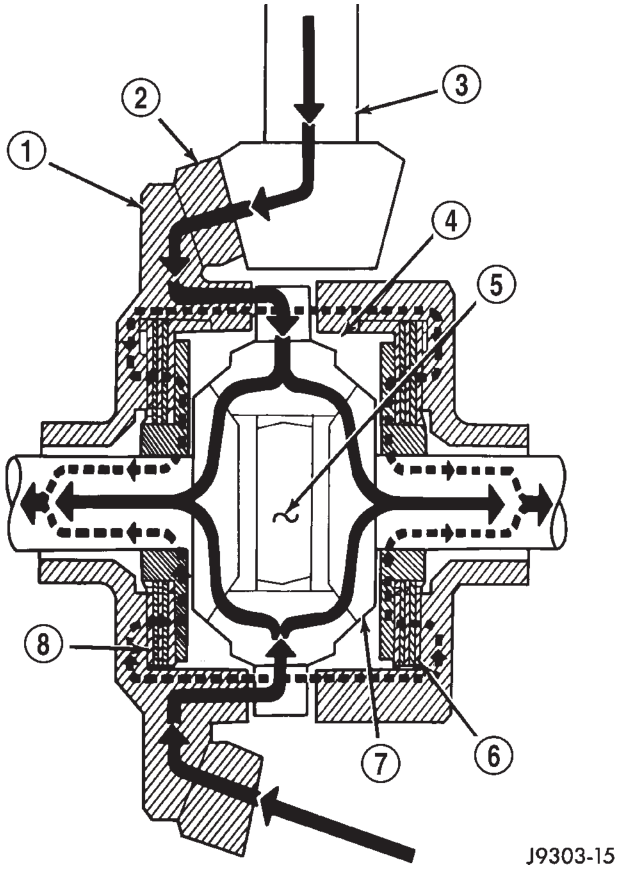


Fig. 7 Trac-lok™ Limited Slip Differential Operation

1 – CASE
2 – RING GEAR
3 – DRIVE PINION
4 – PINION GEAR
5 – MATE SHAFT
6 – CLUTCH PACK
7 – SIDE GEAR
8 – CLUTCH PACK

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Axle bearing problem conditions are usually caused by:

- Insufficient or incorrect lubricant.
- Foreign matter/water contamination.
- Incorrect bearing preload torque adjustment.
- Incorrect backlash.

Axle gear problem conditions are usually the result of:

- Insufficient lubrication.
- Incorrect or contaminated lubricant.
- Overloading (excessive engine torque) or exceeding vehicle weight capacity.
- Incorrect clearance or backlash adjustment.

Axle component breakage is most often the result of:

- Severe overloading.
- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.
- Differential housing bores not square to each other.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSTIC CHART

Condition	Possible Causes	Correction
Wheel Noise	1. Wheel loose.	1. Tighten loose nuts.
	2. Faulty, brinelled wheel bearing.	2. Replace bearing.
Axle Shaft Noise	1. Misaligned axle tube.	1. Inspect axle tube alignment. Correct as necessary.
	2. Bent or sprung axle shaft.	2. Inspect and correct as necessary.
	3. End-play in pinion bearings.	3. Refer to pinion pre-load information and correct as necessary.
	4. Excessive gear backlash between the ring gear and pinion.	4. Check adjustment of the ring gear and pinion backlash. Correct as necessary.
	5. Improper adjustment of pinion gear bearings.	5. Adjust the pinion bearings pre-load.
	6. Loose pinion companion flange nut.	6. Tighten the pinion companion flange nut.
	7. Scuffed gear tooth contact surfaces.	7. Inspect and replace as necessary.
Axle Shaft Broke	1. Misaligned axle tube.	1. Replace the broken shaft after correcting tube mis-alignment.
	2 Vehicle overloaded.	2. Replace broken shaft and avoid excessive weight on vehicle.
	3. Erratic clutch operation.	3. Replace broken shaft and avoid or correct erratic clutch operation.
	4. Grabbing clutch.	4. Replace broken shaft and inspect and repair clutch as necessary.
Differential Cracked	1. Improper adjustment of the differential bearings.	1. Replace case and inspect gears and bearings for further damage. Set differential bearing pre-load properly.
	2. Excessive ring gear backlash.	2. Replace case and inspect gears and bearings for further damage. Set ring gear backlash properly.
	3. Vehicle overloaded.	3. Replace case and inspect gears and bearings for further damage. Avoid excessive vehicle weight.
	4. Erratic clutch operation.	4. Replace case and inspect gears and bearings for further damage. Avoid erratic use of clutch.
Differential Gears Scored	1. Insufficient lubrication.	1. Replace scored gears. Fill differential with the correct fluid type and quantity.
	2. Improper grade of lubricant.	2. Replace scored gears. Fill differential with the correct fluid type and quantity.
	3. Excessive spinning of one wheel/tire.	3. Replace scored gears. Inspect all gears, pinion bores, and shaft for damage. Service as necessary.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Causes	Correction
Loss Of Lubricant	1. Lubricant level too high.	1. Drain lubricant to the correct level.
	2. Worn axle shaft seals.	2. Replace seals.
	3. Cracked differential housing.	3. Repair as necessary.
	4. Worn pinion seal.	4. Replace seal.
	5. Worn/scored companion flange.	5. Replace companion flange and seal.
	6. Axle cover not properly sealed.	6. Remove, clean, and re-seal cover.
Axle Overheating	1. Lubricant level low.	1. Fill differential to correct level.
	2. Improper grade of lubricant.	2. Fill differential with the correct fluid type and quantity.
	3. Bearing pre-loads too high.	3. Re-adjust bearing pre-loads.
	4. Insufficient ring gear backlash.	4. Re-adjust ring gear backlash.
Gear Teeth Broke	1. Overloading.	1. Replace gears. Examine other gears and bearings for possible damage.
	2. Erratic clutch operation.	2. Replace gears and examine the remaining parts for damage. Avoid erratic clutch operation.
	3. Ice-spotted pavement.	3. Replace gears and examine remaining parts for damage.
	4. Improper adjustments.	4. Replace gears and examine remaining parts for damage. Ensure ring gear backlash is correct.
Axle Noise	1. Insufficient lubricant.	1. Fill differential with the correct fluid type and quantity.
	2. Improper ring gear and pinion adjustment.	2. Check ring gear and pinion contact pattern.
	3. Unmatched ring gear and pinion.	3. Replace gears with a matched ring gear and pinion.
	4. Worn teeth on ring gear and/or pinion.	4. Replace ring gear and pinion.
	5. Loose pinion bearings.	5. Adjust pinion bearing pre-load.
	6. Loose differential bearings.	6. Adjust differential bearing pre-load.
	7. Mis-aligned or sprung ring gear.	7. Measure ring gear run-out. Replace components as necessary.
	8. Loose differential bearing cap bolts.	8. Inspect differential components and replace as necessary. Ensure that the bearing caps are torqued tot he proper specification.
	9. Housing not machined properly.	9. Replace housing.

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, worn/damaged gears, or the carrier housing not having the proper offset and squareness.

Gear noise usually happens at a specific speed range. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then acceler-

DIAGNOSIS AND TESTING (Continued)

ate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak–noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side gears and pinions can be checked by turning the vehicle. They usually do not cause noise during straight–ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion mate shaft can also cause a snapping or a knocking noise.

BEARING NOISE

The axle shaft, differential and pinion bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion bearings have a constant–pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U–joint or by worn side–gear thrust washers. A worn pinion shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out–of–balance wheels.
- Loose wheel lug nuts.
- Worn U–joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion nut.
- Excessive companion flange run out.
- Bent axle shaft(s).

Check for loose or damaged front–end components or engine/transmission mounts. These components can contribute to what appears to be a rear–end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels and Tires, for additional vibration information.

DRIVELINE SNAP

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed.
- Transmission shift operation.
- Loose engine/transmission/transfer case mounts.
- Worn U–joints.
- Loose spring mounts.
- Loose pinion nut and companion flange.
- Excessive ring gear backlash.
- Excessive side gear to case clearance.

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

TRAC–LOK™ DIFFERENTIAL NOISE

The most common problem is a chatter noise when turning corners. Before removing a Trac-lok™ unit for repair, drain, flush and refill the axle with the specified lubricant. Refer to Lubricant change in this Group.

A container of Mopar® Trac-lok™ Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

TRAC–LOK™ TEST

WARNING: WHEN SERVICING VEHICLES WITH A TRAC–LOK™ DIFFERENTIAL DO NOT USE THE ENGINE TO TURN THE AXLE AND WHEELS. BOTH REAR WHEELS MUST BE RAISED AND THE VEHICLE SUPPORTED. A TRAC–LOK™ AXLE CAN EXERT ENOUGH FORCE IF ONE WHEEL IS IN CONTACT WITH A SURFACE TO CAUSE THE VEHICLE TO MOVE.

DIAGNOSIS AND TESTING (Continued)

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(4) Remove wheel and bolt Special Tool 6790 to studs.

(5) Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 8).

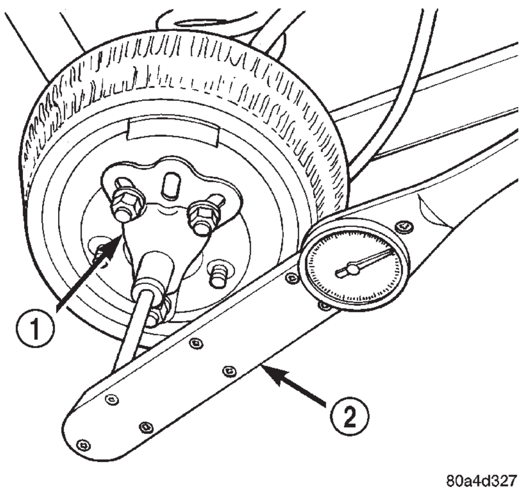


Fig. 8 Trac-lok™ Test —Typical

1 – SPECIAL TOOL 6790 WITH BOLT IN CENTER HOLE
2 – TORQUE WRENCH

(6) If rotating torque is less than 22 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.

SERVICE PROCEDURES

LUBRICANT CHANGE

(1) Raise and support the vehicle.

(2) Remove the lubricant fill hole plug from the differential housing cover.

(3) Remove the differential housing cover and drain the lubricant from the housing.

(4) Clean the housing cavity with a flushing oil, light engine oil, or lint free cloth. **Do not use water, steam, kerosene, or gasoline for cleaning.**

(5) Remove the original sealant from the housing and cover surfaces.

(6) Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 9).

Install the housing cover within 5 minutes after applying the sealant.

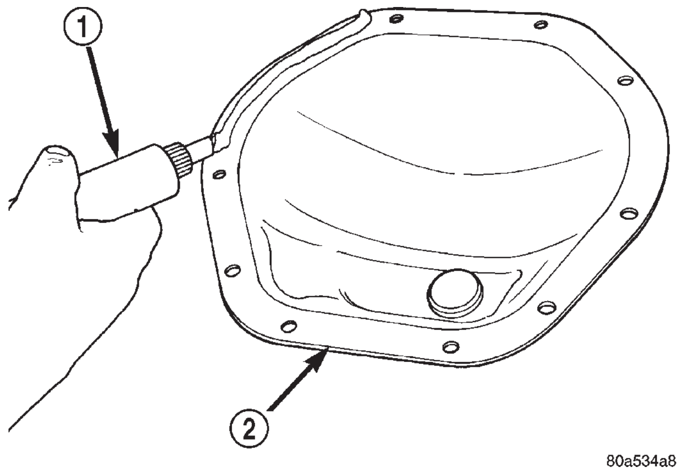


Fig. 9 Apply Sealant

1 – SEALANT
2 – AXLE HOUSING COVER

(7) Install the cover and any identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

(8) For Trac–lok™ differentials, a quantity of Mopar® Trac–lok™ lubricant (friction modifier), or equivalent, must be added after repair service or a lubricant change. Refer to the Lubricant Specifications section of this group for the quantity necessary.

(9) Fill differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications section of this group for the quantity necessary.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(10) Install the fill hole plug and lower the vehicle.

(11) Trac–lok™ differential equipped vehicles should be road tested by making 10 to 12 slow figure-eight turns. This maneuver will pump the lubricant through the clutch discs to eliminate a possible chatter noise complaint.

REMOVAL AND INSTALLATION

REAR AXLE

REMOVAL

(1) Raise and support the vehicle.

(2) Position a suitable lifting device under the axle.

(3) Secure axle to device.

(4) Remove the wheels and tires.

(5) Secure brake drums to the axle shaft.

(6) Remove the RWAL sensor from the differential housing, if necessary. Refer to Group 5, Brakes, for proper procedures.

REMOVAL AND INSTALLATION (Continued)

(7) Disconnect the brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the wheel cylinders. Refer to Group 5, Brakes, for proper procedures.

(8) Disconnect the parking brake cables and cable brackets.

(9) Disconnect the vent hose from the axle shaft tube.

(10) Mark the propeller shaft and companion flange for installation alignment reference.

(11) Remove propeller shaft.

(12) Disconnect shock absorbers from axle.

(13) Remove the spring clamps and spring brackets. Refer to Group 2, Suspension, for proper procedures.

(14) Separate the axle from the vehicle.

INSTALLATION

(1) Raise the axle with lifting device and align to the leaf spring centering bolts.

(2) Install the spring clamps and spring brackets. Refer to Group 2, Suspension, for proper procedures.

(3) Install shock absorbers and tighten nuts to 82 N·m (60 ft. lbs.) torque.

(4) Install the RWAL sensor to the differential housing, if necessary. Refer to Group 5, Brakes, for proper procedures.

(5) Connect the parking brake cables and cable brackets.

(6) Install the brake drums. Refer to Group 5, Brakes, for proper procedures.

(7) Connect the brake hose to the axle junction block. Refer to Group 5, Brakes, for proper procedures.

(8) Install axle vent hose.

(9) Align propeller shaft and pinion companion flange reference marks. Install the companion flange bolts. Tighten to 108 N·m (80 ft. lbs.) torque.

(10) Install the wheels and tires.

(11) Add gear lubricant, if necessary. Refer to Lubricant Specifications in this section for lubricant requirements.

(12) Remove lifting device from axle and lower the vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support vehicle. Ensure that the transmission is in neutral.

(2) Remove wheel and tire assembly.

(3) Remove brake drum. Refer to Group 5, Brakes, for proper procedure.

(4) Clean all foreign material from housing cover area.

(5) Loosen housing cover bolts. Drain lubricant from the housing and axle tubes. Remove housing cover.

(6) Rotate differential case so that pinion mate shaft lock screw is accessible. Remove lock screw and pinion mate shaft from differential case (Fig. 10).

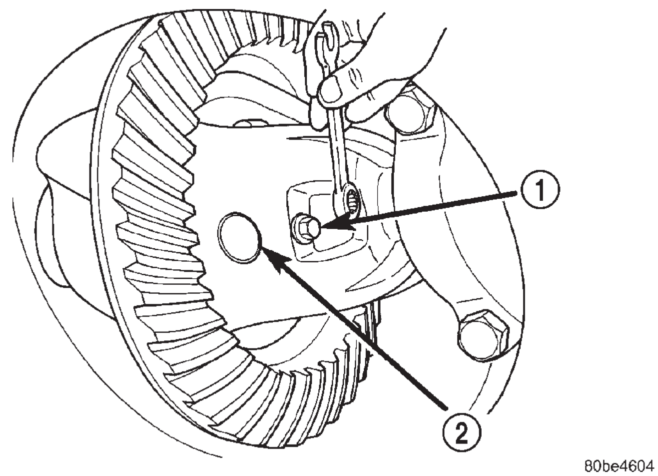


Fig. 10 Pinion Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION MATE SHAFT

(7) Push axle shaft inward and remove axle shaft C–lock from the axle shaft (Fig. 11).

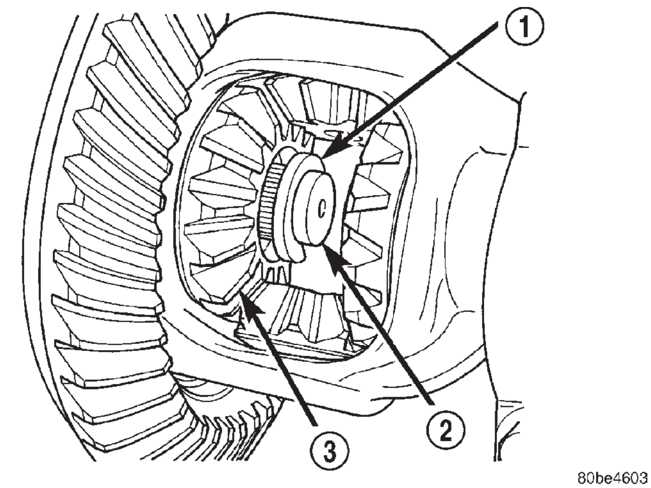


Fig. 11 Axle Shaft C–Lock

1 – C—LOCK
2 – AXLE SHAFT
3 – SIDE GEAR

(8) Remove axle shaft. Use care to prevent damage to axle shaft bearing and seal, which will remain in axle tube.

(9) Inspect axle shaft seal for leakage or damage.

(10) Inspect roller bearing contact surface on axle shaft for signs of brinelling, galling and pitting. If

REMOVAL AND INSTALLATION (Continued)

any of these conditions exist, the axle shaft and/or bearing and seal must be replaced.

INSTALLATION

(1) Lubricate bearing bore and seal lip with gear lubricant. Insert axle shaft through seal, bearing, and engage it into side gear splines.

NOTE: Use care to prevent shaft splines from damaging axle shaft seal lip.

(2) Insert C–lock in end of axle shaft. Push axle shaft outward to seat C–lock in side gear.
(3) Insert pinion shaft into differential case and through thrust washers and differential pinions.
(4) Align hole in shaft with hole in the differential case and install lock screw with Loctite® on the threads. Tighten lock screw to 11 N·m (8 ft. lbs.) torque.
(5) Install cover and add fluid. Refer to Lubricant Change procedure in this section for procedure and lubricant requirements.
(6) Install brake drum. Refer to Group 5, Brakes, for proper procedures.
(7) Install wheel and tire.
(8) Lower vehicle.

8 1/4 AND 9 1/4 AXLE SEAL AND BEARING

REMOVAL

(1) Remove axle shaft.
(2) Remove axle shaft seal from the end of the axle tube with a small pry bar (Fig. 12).

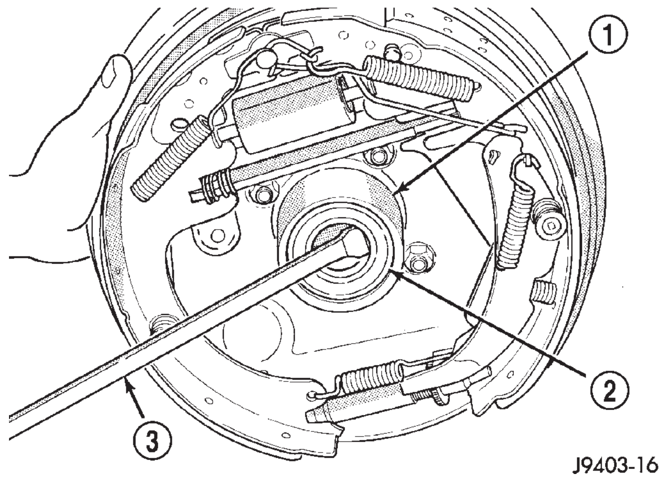


Fig. 12 Axle Seal Removal

1 – AXLE TUBE
2 – AXLE SEAL
3 – PRY BAR

NOTE: The seal and bearing can be removed at the same time with the bearing removal tool.

(3) Remove the axle shaft bearing from the axle tube with Bearing Removal Tool Set 6310, using Adapter Foot 6310-9 (Fig. 13).

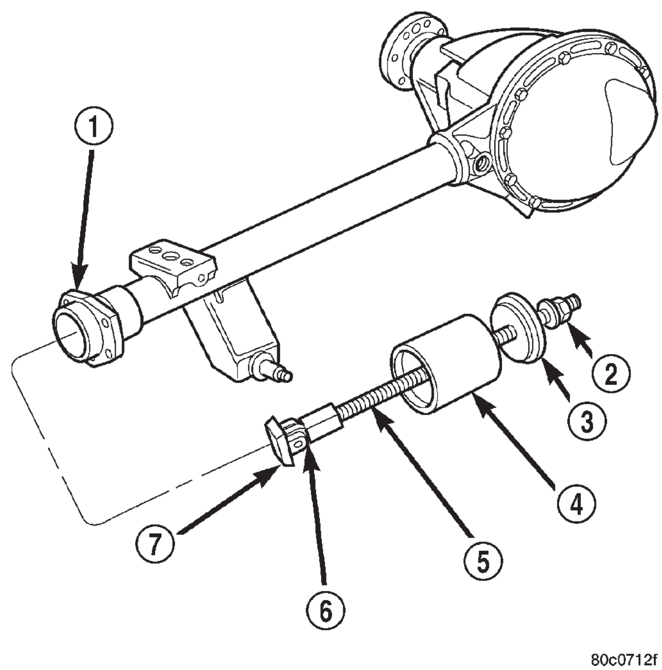


Fig. 13 Axle Shaft Bearing Removal Tool

1 – AXLE SHAFT TUBE
2 – NUT
3 – GUIDE PLATE
4 – GUIDE
5 – THREADED ROD
6 – ADAPTER
7 – FOOT

INSTALLATION

NOTE: Do not install the original axle shaft seal. Always install a new seal.

(1) Wipe the axle tube bore clean. Remove any old sealer or burrs from the tube.
(2) Install the axle shaft bearing with Installer C-4198 and Handle C-4171 (Fig. 14). Ensure that the bearing part number is against the installer. Verify that the bearing in installed straight and the tool fully contacts the axle tube when seating the bearing.
(3) Install a new axle seal with Installer C-4076-B and Handle C-4735-1. When the tool contacts the axle tube, the seal is installed to the correct depth.
(4) Coat the lip of the seal with axle lubricant for protection prior to installing the axle shaft.
(5) Install the axle shaft.

REMOVAL AND INSTALLATION (Continued)

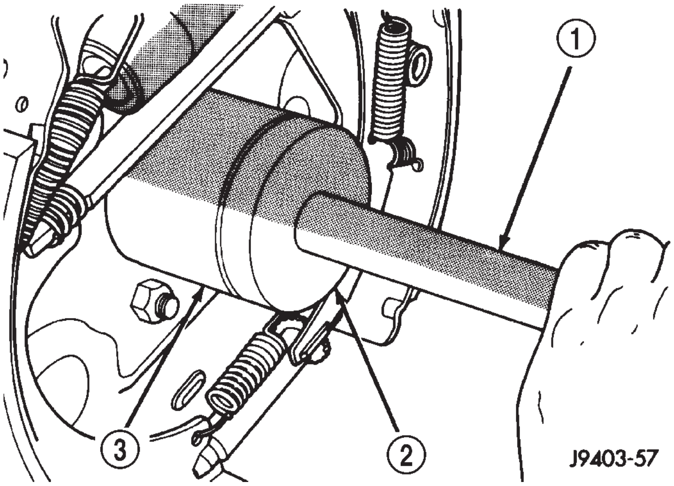


Fig. 14 Axle Shaft Seal and Bearing Installation

1 – HANDLE
2 – INSTALLER
3 – AXLE TUBE

PINION SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Scribe a mark on the universal joint, companion flange, and pinion shaft for installation reference.

(3) Disconnect the propeller shaft from the companion flange. Secure the propeller shaft in an upright position to prevent damage to the rear universal joint.

(4) Remove the wheel and tire assemblies.

(5) Remove the brake drums to prevent any drag. The drag may cause a false bearing preload torque measurement.

(6) Rotate the companion flange three or four times.

(7) Measure the amount of torque necessary to rotate the pinion with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(9) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(10) Hold the flange with Holder 6719. Remove the pinion nut and washer.

(11) Remove the companion flange with Remover C-452 (Fig. 15).

(12) Remove the pinion seal with suitable pry tool or slide-hammer mounted screw.

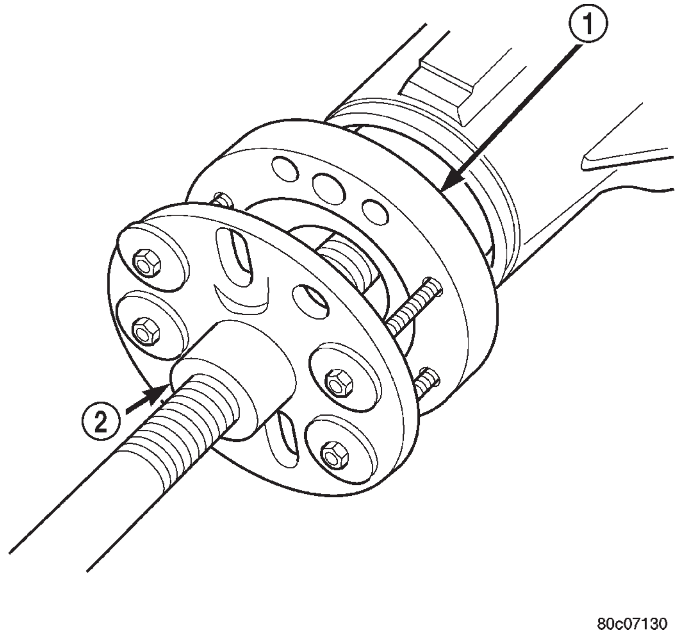


Fig. 15 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

INSTALLATION

(1) Clean the seal contact surface in the housing bore.

(2) Examine the splines on the pinion shaft for burrs or wear. Remove any burrs and clean the shaft.

(3) Inspect companion flange for cracks, worn splines and worn seal contact surface. Replace companion flange if necessary.

NOTE: The outer perimeter of the seal is pre-coated with a special sealant. An additional application of sealant is not required.

(4) Apply a light coating of gear lubricant on the lip of pinion seal.

(5) Install the new pinion seal with Installer C-4076-B and Handle C-4735-1 for 8 1/4 axles (Fig. 16) and Installer C-3860-A and Handle C-4171 for 9 1/4 axles.

NOTE: The seal is correctly installed when the seal flange contacts the face of the differential housing.

(6) Position the companion flange on the end of the shaft with the reference marks aligned.

(7) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(8) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(9) Seat companion flange on pinion shaft with Installer C-3718 and Holder 6719.

REMOVAL AND INSTALLATION (Continued)

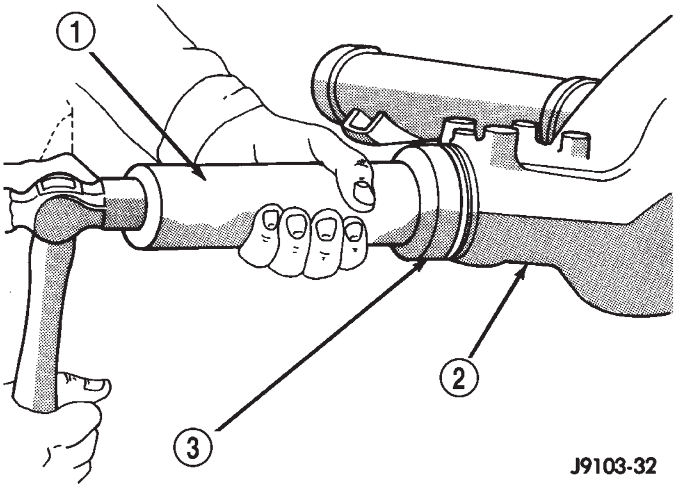


Fig. 16 8 1/4 Axle Pinion Seal Installation

1 – SPECIAL TOOL C-4735
2 – DIFFERENTIAL HOUSING
3 – SPECIAL TOOL C-4076-A

(10) Remove the Installer C-3718 and install the pinion washer and a new pinion nut. The convex side of the washer must face outward.

CAUTION: Do not exceed the minimum tightening torque when installing the companion flange retaining nut at this point. Damage to collapsible spacer or bearings may result.

(11) Hold companion flange with Holder 6719 and tighten the pinion nut to 285 N·m (210 ft. lbs.) (Fig. 17). Rotate pinion several revolutions to ensure the bearing rollers are seated.

(12) Rotate the pinion using an (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.) (Fig. 18).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If rotating torque is exceeded, a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(13) If the rotating torque is low, use Holder 6719 to hold the companion flange (Fig. 17) and tighten the pinion nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

NOTE: The bearing rotating torque should be constant during a complete revolution of the pinion. If the rotating torque varies, this indicates a binding condition.

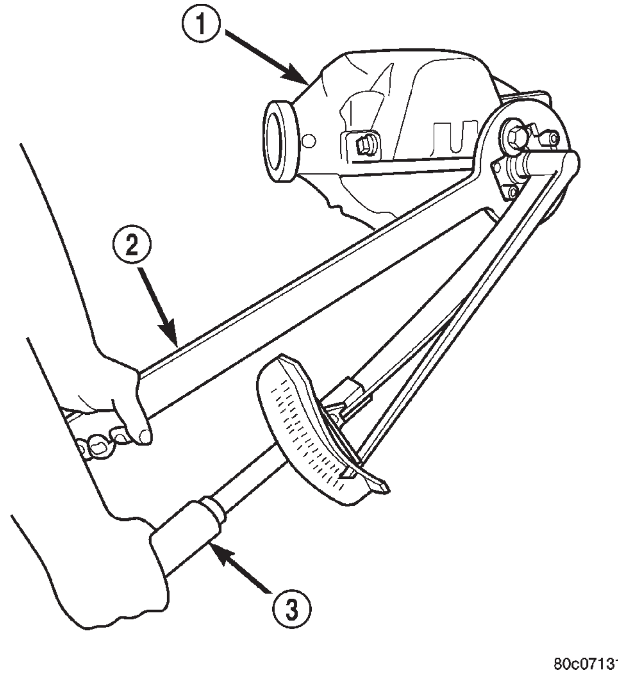


Fig. 17 Tightening Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

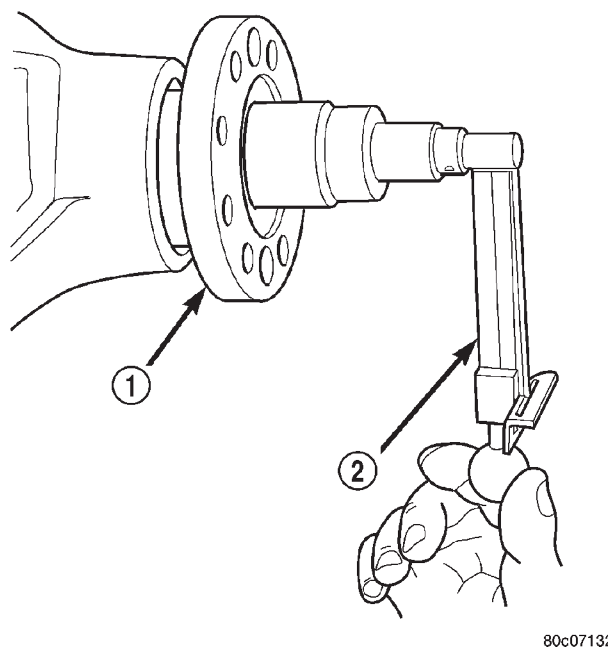


Fig. 18 Check Pinion Rotation Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

REMOVAL AND INSTALLATION (Continued)

(14) The seal replacement is unacceptable if the final pinion nut torque is less than 285 N·m (210 ft. lbs.).

(15) Install the propeller shaft with the installation reference marks aligned.

(16) Tighten the companion flange bolts to 108 N·m (80 ft. lbs.).

(17) Install the brake drums.

(18) Install wheel and tire assemblies and lower the vehicle.

(19) Check the differential housing lubricant level.

DIFFERENTIAL

REMOVAL

(1) Remove the axle shafts.

(2) Remove RWAL/ABS sensor from housing.

NOTE: Side play resulting from bearing races being loose on case hubs requires replacement of the differential case.

(3) Mark the differential housing and the differential bearing caps for installation reference (Fig. 19).

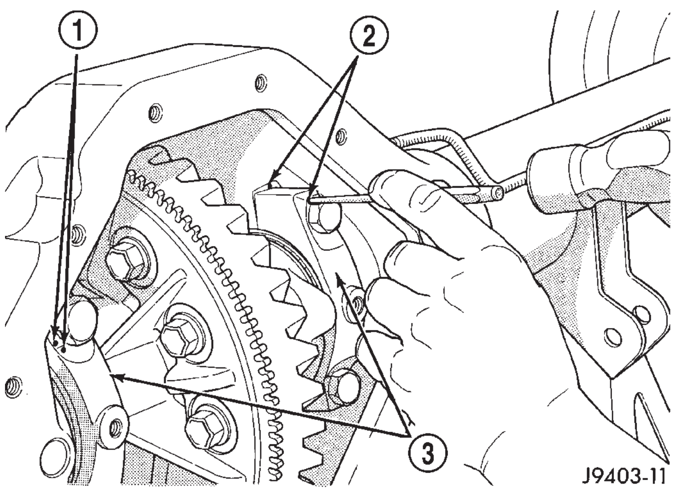


Fig. 19 Mark For Installation Reference

1 – REFERENCE MARKS
2 – REFERENCE MARK
3 – BEARING CAPS

(4) Remove bearing threaded adjuster lock from each bearing cap. Loosen the bolts, but do not remove the bearing caps.

(5) Loosen the threaded adjusters with Wrench C-4164 (Fig. 20).

(6) Hold the differential case while removing bearing caps and adjusters.

(7) Remove the differential case.

NOTE: Each differential bearing cup and threaded adjuster must be kept with their respective bearing.

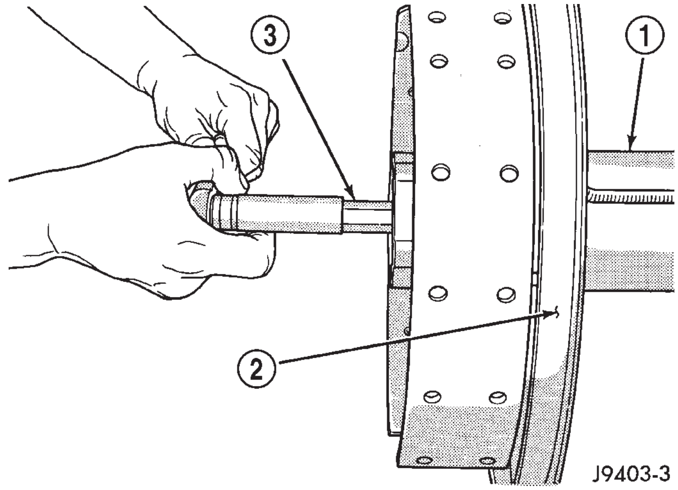


Fig. 20 Threaded Adjuster Tool

1 – AXLE TUBE
2 – BACKING PLATE
3 – TOOL C-4164

INSTALLATION

(1) Apply a coating of hypoid gear lubricant to the differential bearings, bearing cups, and threaded adjusters. A dab of grease can be used to keep the adjusters in position. Carefully position the assembled differential case in the housing.

(2) Observe the reference marks and install the differential bearing caps at their original locations (Fig. 21).

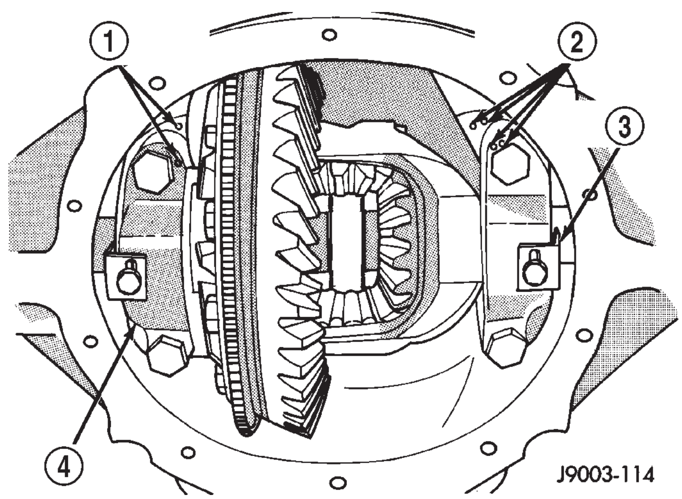


Fig. 21 Bearing Caps & Bolts

1 – INSTALLATION REFERENCE MARKS
2 – INSTALLATION REFERENCE MARKS
3 – ADJUSTER LOCK
4 – BEARING CAP

(3) Install bearing cap bolts and tighten the upper bolts to 14 N·m (10 ft. lbs.). Tighten the lower bolts finger-tight until the bolt head is seated.

REMOVAL AND INSTALLATION (Continued)

(4) Perform the differential bearing preload and adjustment procedure.

NOTE: Be sure that all bearing cap bolts are tightened to their final torque of 136 N·m (100 ft.lbs.) before proceeding.

(5) Install axle shafts and differential housing cover.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA and:

• Adapters C-293-48 and Plug SP-3289 for the 8 1/4 axle (Fig. 22).

• Adapters C-293-47 and Plug C-293-3 for the 9 1/4 axle (Fig. 23).

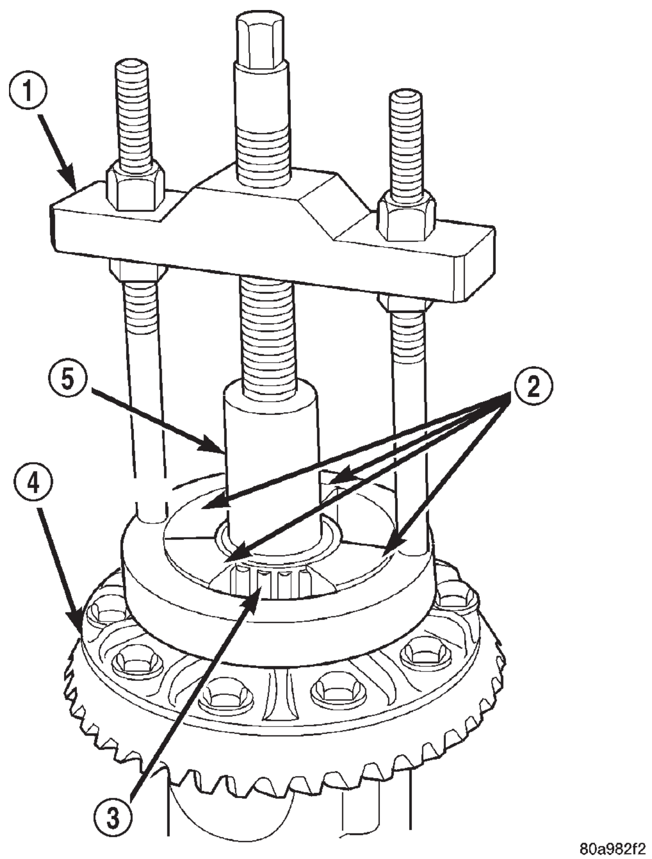


Fig. 22 Differential Bearing Removal—8 1/4 Axle

1 – SPECIAL TOOL C-293–PA
2 – SPECIAL TOOL C-293–48
3 – BEARING
4 – DIFFERENTIAL
5 – SPECIAL TOOL SP-3289

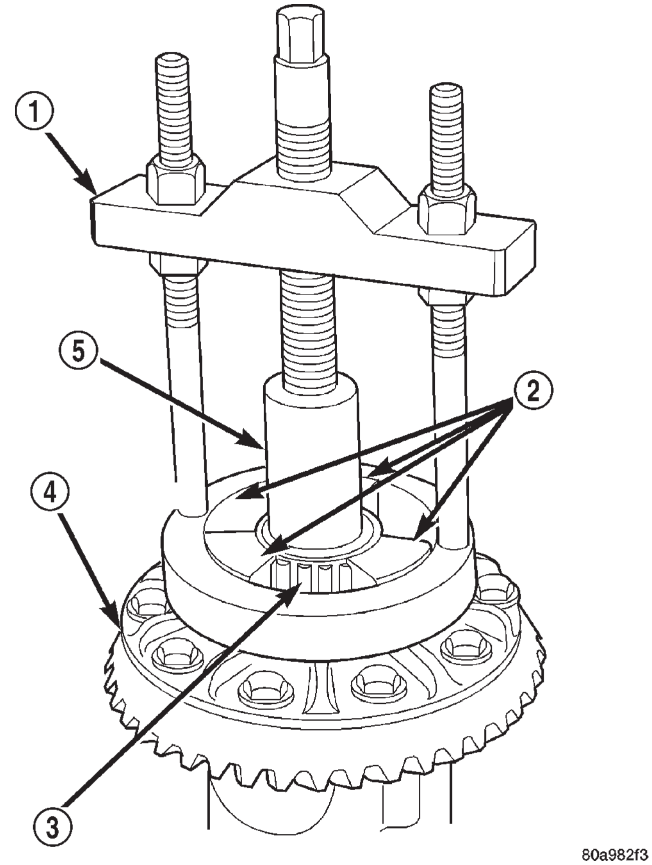


Fig. 23 Differential Bearing Removal—9 1/4 Axle

1 – SPECIAL TOOL C-293–PA
2 – SPECIAL TOOL C-293–47
3 – BEARING
4 – DIFFERENTIAL
5 – SPECIAL TOOL C-293–3

INSTALLATION

(1) Install differential side bearings. Use:

• Installer C-4340 with handle C-4171 for the 8 1/4 axle (Fig. 24).

• Installer C-4213 and Handle C-4171 for the 9 1/4 axle.

(2) Install differential case in axle housing.

RING GEAR AND EXCITER RING

NOTE: The ring gear and pinion are serviced in a matched set. Do not replace the ring gear without replacing the pinion.

REMOVAL AND INSTALLATION (Continued)

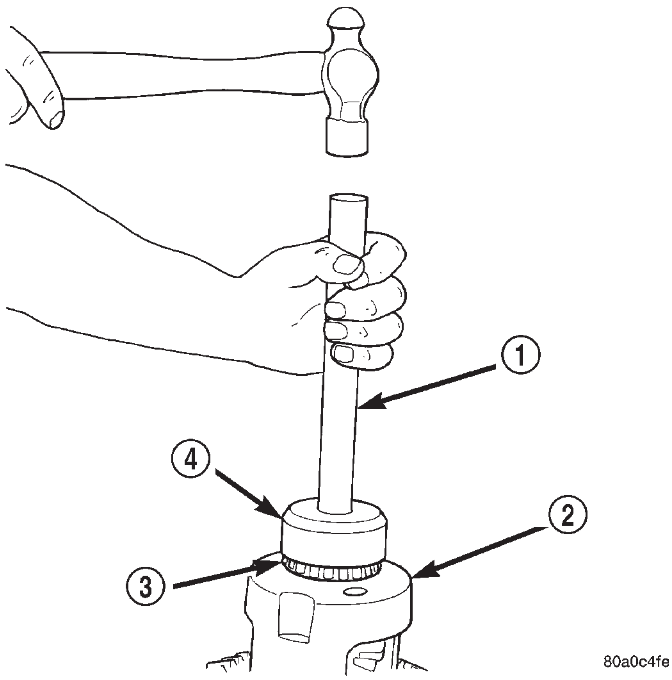


Fig. 24 Install Differential Side Bearings—8 1/4 Axle

1 – HANDLE C-4171
2 – DIFFERENTIAL
3 – BEARING
4 – TOOL C-4340

REMOVAL

(1) Remove differential from axle housing.

(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 25).

(3) Remove bolts holding ring gear to differential case.

(4) Using a soft hammer, drive ring gear from differential case (Fig. 25).

(5) Use a brass drift and slowly tap the exciter ring from the differential case.

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

(1) Invert the differential case.

(2) Position exciter ring on differential case.

(3) Using a brass drift, slowly and evenly tap the exciter ring into position.

(4) Position ring gear on the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.

(5) Invert the differential case in the vise.

(6) Install new ring gear bolts and alternately tighten to:

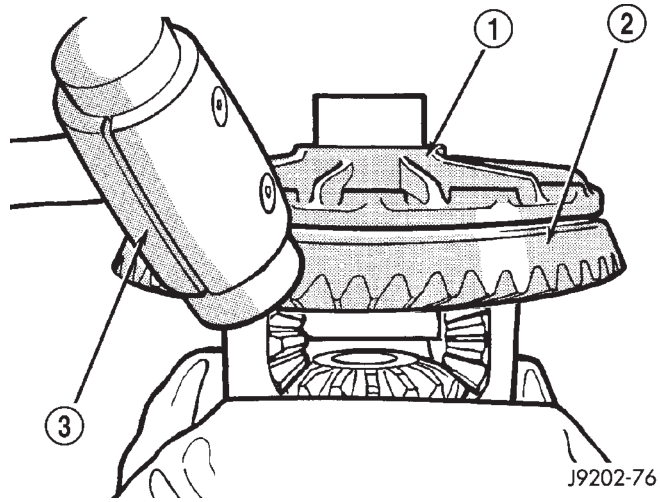


Fig. 25 Ring Gear Removal

1 – CASE
2 – RING GEAR
3 – RAWHIDE HAMMER

- 102 N·m (75 ft. lbs.) torque (Fig. 26) for 8 1/4 axles.
- 157 N·m (115 ft. lbs.) torque (Fig. 26) for 9 1/4 axles.

(7) Install differential in axle housing and verify gear mesh and contact pattern.

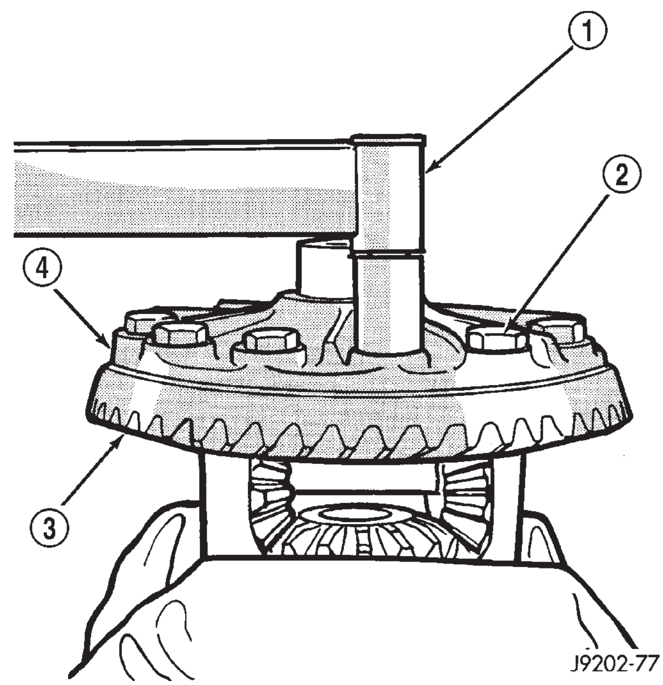


Fig. 26 Ring Gear Bolt Installation

1 – TORQUE WRENCH
2 – RING GEAR BOLT
3 – RING GEAR
4 – CASE

REMOVAL AND INSTALLATION (Continued)

PINION GEAR

NOTE: The ring gear and pinion are serviced in a matched set. Do not replace the pinion without replacing the ring gear.

REMOVAL

(1) Remove differential from the axle housing.

(2) Mark the companion flange and propeller shaft for installation alignment.

(3) Disconnect the propeller shaft from the companion flange. Using suitable wire, tie propeller shaft to underbody.

(4) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(5) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(6) Use Holder 6719 to hold companion flange and remove the companion flange nut and washer.

(7) Using Remover C–452, remove the companion flange from the pinion (Fig. 27).

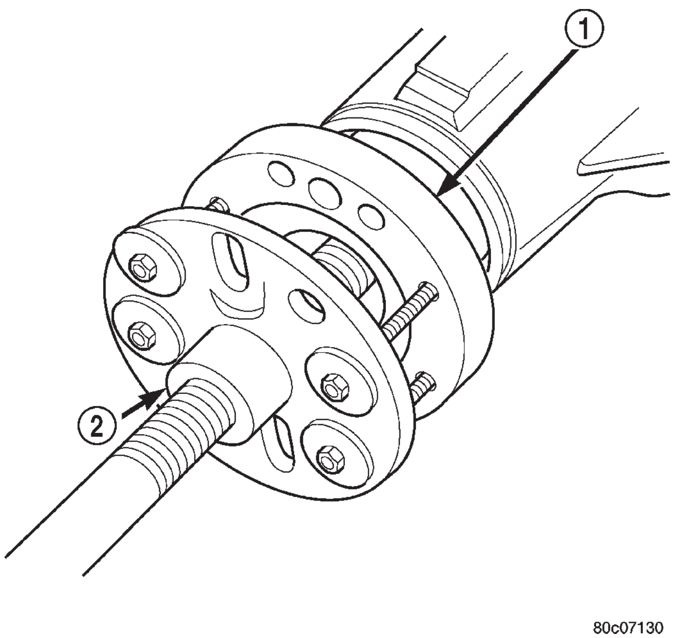


Fig. 27 Companion Flange Removal

1 – COMPANION FLANGE
2 – PULLER TOOL

(8) Partially install pinion nut onto pinion to protect the threads.

(9) Remove the pinion from housing (Fig. 28). Catch the pinion with your hand to prevent it from falling and being damaged.

(10) Remove the pinion shaft seal with suitable pry tool or slide-hammer mounted screw.

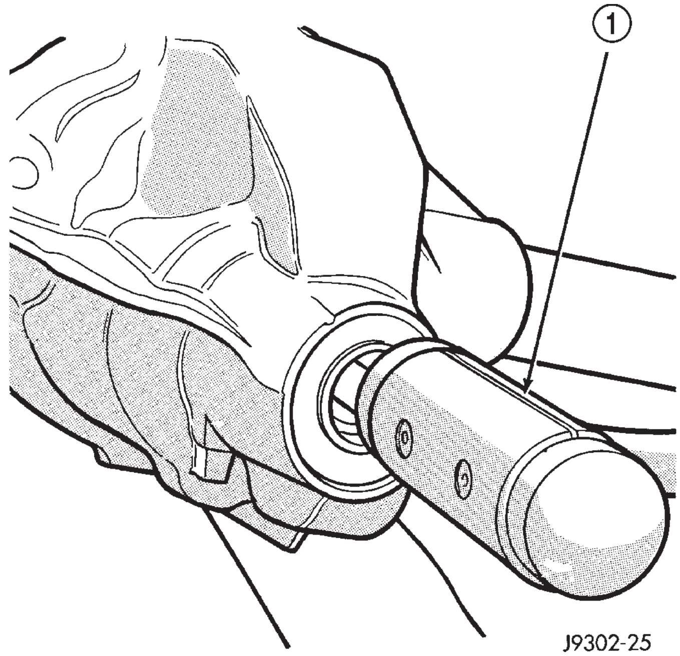


Fig. 28 Remove Pinion

1 – RAWHIDE HAMMER

(11) Remove oil slinger, if equipped, and front pinion bearing.

(12) Remove the front pinion bearing cup with:

• Remover C-4345 and Handle C–4171 for the 8 1/4 axles (Fig. 29).

• Bearing Removal Tool Set 6310 and Adapter Foot 6310-9 for the 9 1/4 axles.

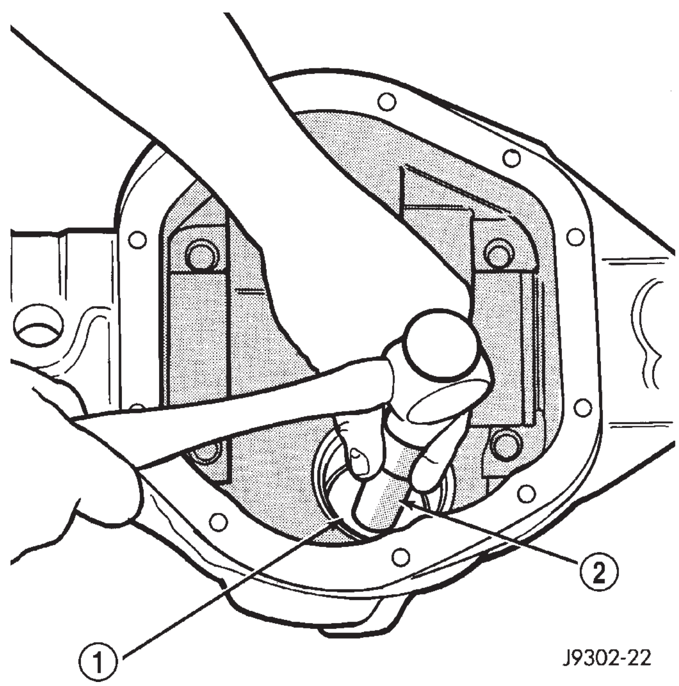


Fig. 29 Front Bearing Cup Removal

1 – REMOVER
2 – HANDLE

REMOVAL AND INSTALLATION (Continued)

(13) Remove the rear bearing cup from housing (Fig. 30). Use:

- Remover C-4307 and Handle C–4171 for the 8 1/4 axle.
- Remover C-4309 and Handle C-4171 for the 9 1/4 axle.

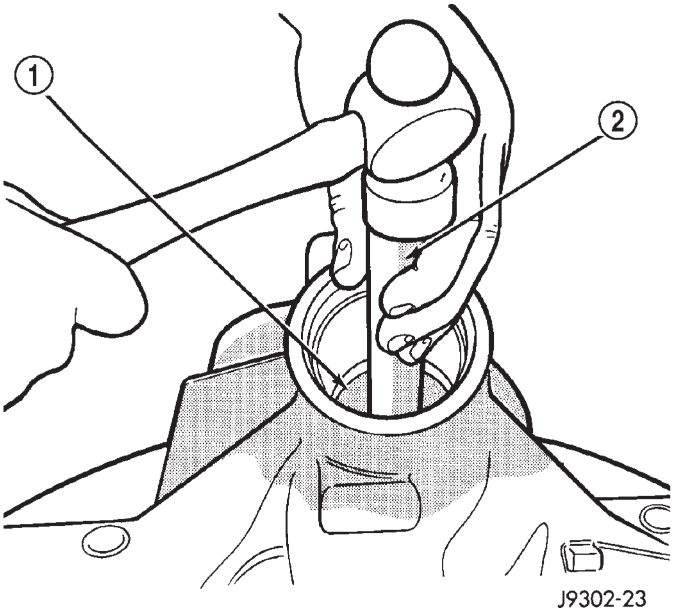


Fig. 30 Rear Bearing Cup Removal

1 – DRIVER
2 – HANDLE

(14) Remove the collapsible preload spacer (Fig. 31).

(15) Remove the rear bearing from the pinion (Fig. 32) with:

- Puller/Press C-293-PA and Adapters C-293-47 for the 8 1/4 axle.
- Puller/Press C-293-PA and Adapters C-293-37 for the 9 1/4 axle.

Place 4 adapter blocks so they do not damage the bearing cage.

(16) Remove the depth shims from the pinion shaft. Record the thickness of the depth shims.

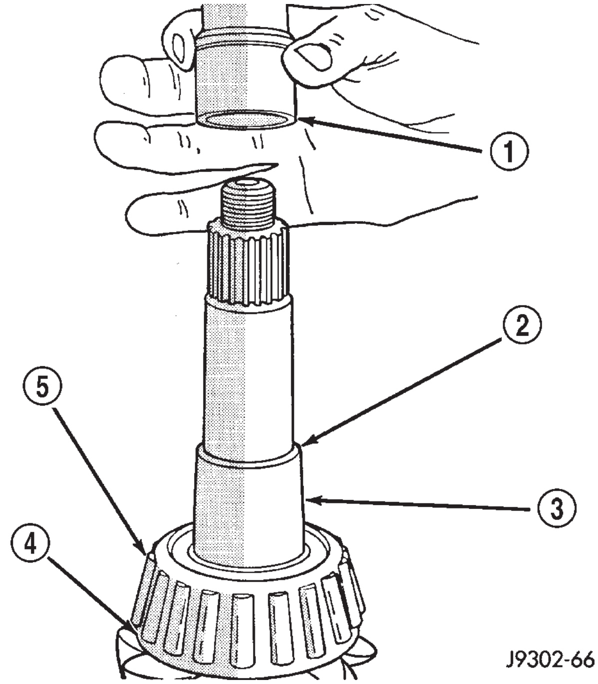


Fig. 31 Collapsible Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION GEAR
4 – OIL SLINGER
5 – REAR BEARING

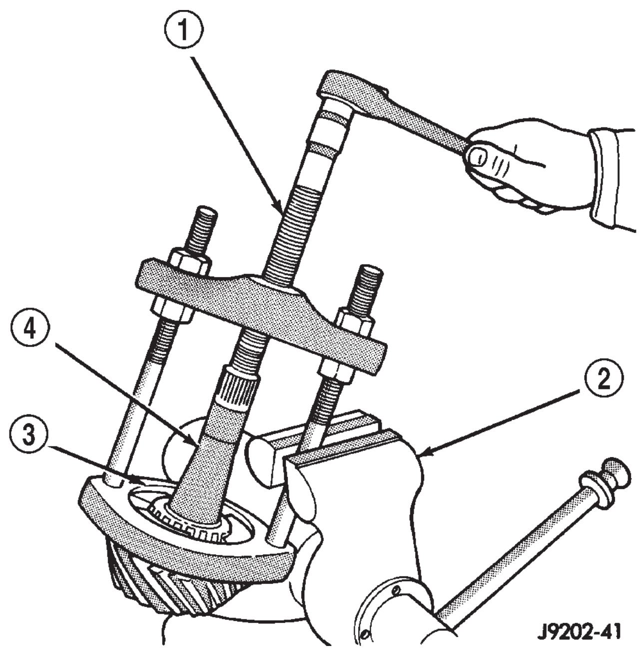


Fig. 32 Rear Bearing Removal

1 – SPECIAL TOOL C-293–PA
2 – VISE
3 – ADAPTERS
4 – DRIVE PINION GEAR SHAFT

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(2) Install the pinion rear bearing cup (Fig. 33) with:

• Installer C-4308 and Driver Handle C–4171 for the 8 1/4 axle.

• Installer C-4310 and Driver Handle C–4171 for the 9 1/4 axle.

(2) Ensure cup is correctly seated.

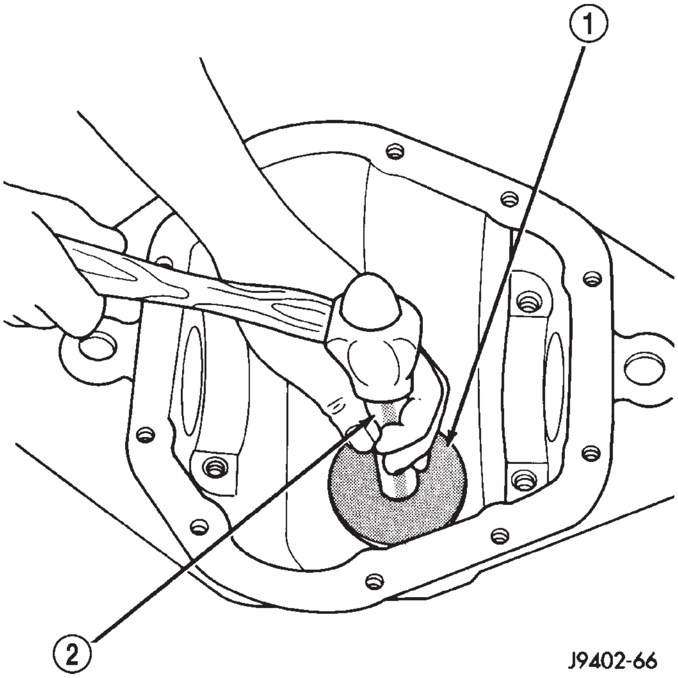


Fig. 33 Pinion Rear Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(4) Install the pinion front bearing cup (Fig. 34) with:

• Installer D–130 and Handle C–4171 for the 8 1/4 axle.

• Installer D–129 and Handle C–4171 for the 9 1/4 axle.

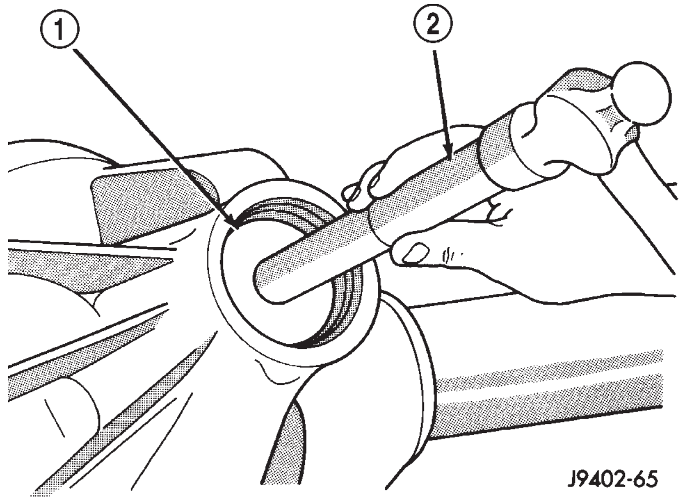


Fig. 34 Pinion Front Bearing Cup Installation

1 – INSTALLER
2 – HANDLE

(5) Install pinion front bearing, and oil slinger, if equipped.

(6) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with:

• Installer C-4076–B and Handle C-4735-1 for the 8 1/4 axle (Fig. 35).

• Installer C-3860-A and Handle C-4171 for the 9 1/4 axle.

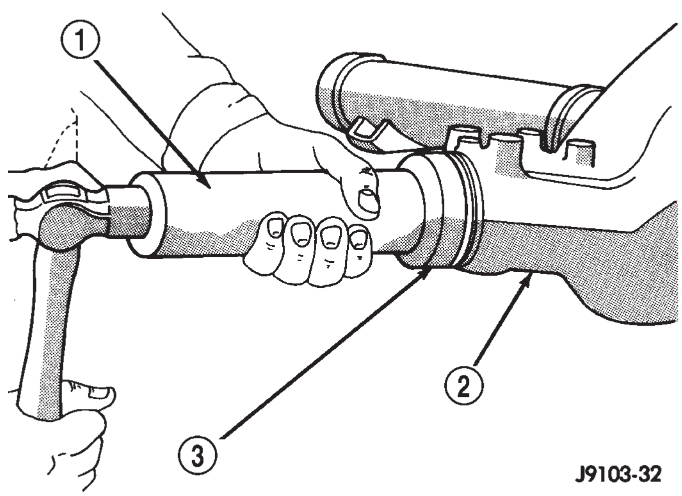


Fig. 35 Pinion Seal Installation—8 1/4 Axle

1 – SPECIAL TOOL C-4735
2 – DIFFERENTIAL HOUSING
3 – SPECIAL TOOL C-4076-A

REMOVAL AND INSTALLATION (Continued)

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion head to achieve proper ring gear and pinion mesh. If the factory installed ring gear and pinion are reused, the pinion depth shim should not require replacement. If required, refer to Pinion Gear Depth to select the proper thickness shim before installing rear pinion bearing.

(7) Place the proper thickness depth shim on the pinion shaft.

(8) Install the rear bearing and slinger, if equipped, on the pinion (Fig. 36) with:

- Installer 6448 for the 8 1/4 axle.
- Installer C-3095 for the 9 1/4 axle.

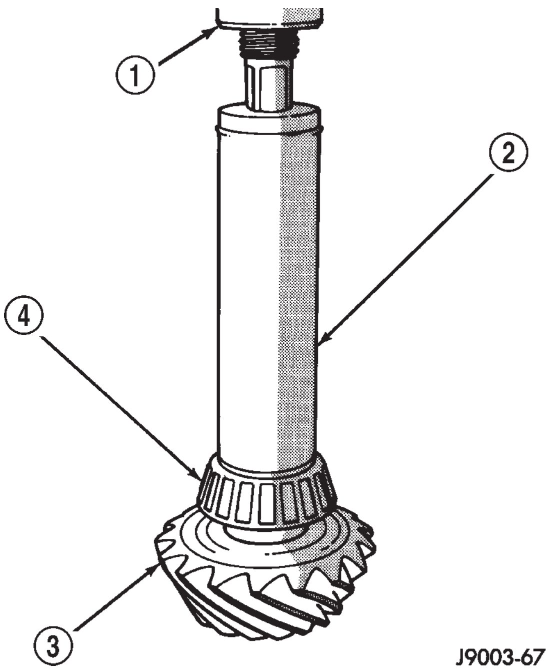


Fig. 36 Shaft Rear Bearing Installation

1 – PRESS
2 – INSTALLATION TOOL
3 – DRIVE PINION GEAR
4 – DRIVE PINION GEAR SHAFT REAR BEARING

(9) Install a new collapsible preload spacer on pinion shaft and install the pinion in the housing (Fig. 37).

(10) Install the pinion in housing.

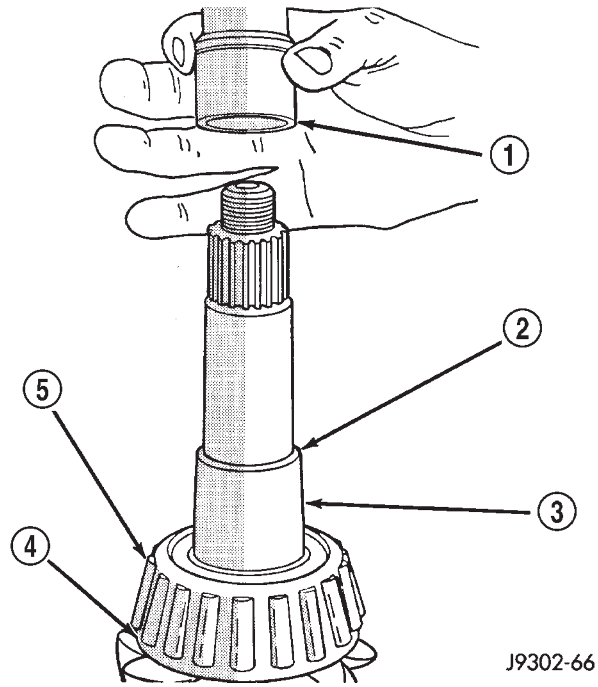


Fig. 37 Collapsible Preload Spacer

1 – COLLAPSIBLE SPACER
2 – SHOULDER
3 – PINION GEAR
4 – OIL SLINGER
5 – REAR BEARING

(11) Install the companion flange with Installer C-3718 and Holder 6719.

(12) Install socket head bolts into two of the threaded holes in the companion flange, 180° apart.

(13) Position Holder 6719 against the companion flange and install a hex head bolt and washer into one of the remaining threaded holes. Tighten the bolt and washer so that the Holder 6719 is held to the flange.

(14) Install the companion flange washer and a new nut on the pinion and tighten the pinion nut until there is zero bearing end-play. It will not be possible at this point to achieve zero bearing end-play if a new collapsible spacer was installed.

REMOVAL AND INSTALLATION (Continued)

(15) Tighten the nut to 285 N·m (210 ft. lbs.) (Fig. 38).

CAUTION: Never loosen pinion nut to decrease pinion bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

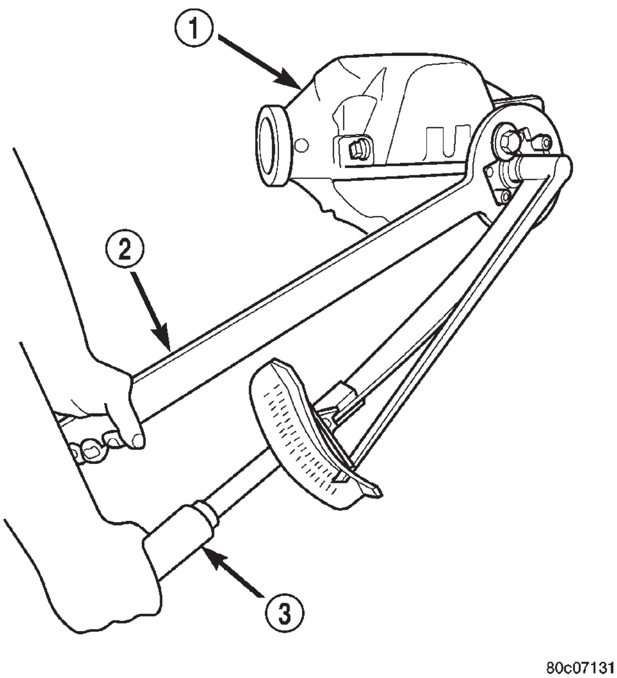


Fig. 38 Tighten the Pinion Nut

1 – DIFFERENTIAL HOUSING
2 – COMPANION FLANGE HOLDER
3 – TORQUE WRENCH

(16) Using Holder 6719, crush collapsible spacer until bearing end play is taken up.

(17) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the desired rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 39).

(18) Check bearing rotating torque with an inch pound torque wrench (Fig. 39). The torque necessary to rotate the pinion should be:

- Original Bearings — 1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

(19) Install propeller shaft.

(20) Install differential in housing.

FINAL ASSEMBLY

(1) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of Mopar® Silicone

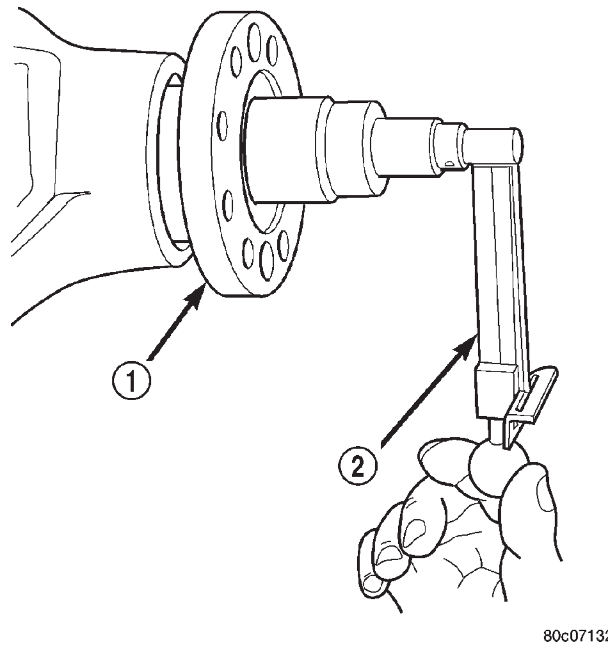


Fig. 39 Check pinion Rotating Torque

1 – COMPANION FLANGE
2 – INCH POUND TORQUE WRENCH

Rubber Sealant, or equivalent, on the housing cover (Fig. 40).

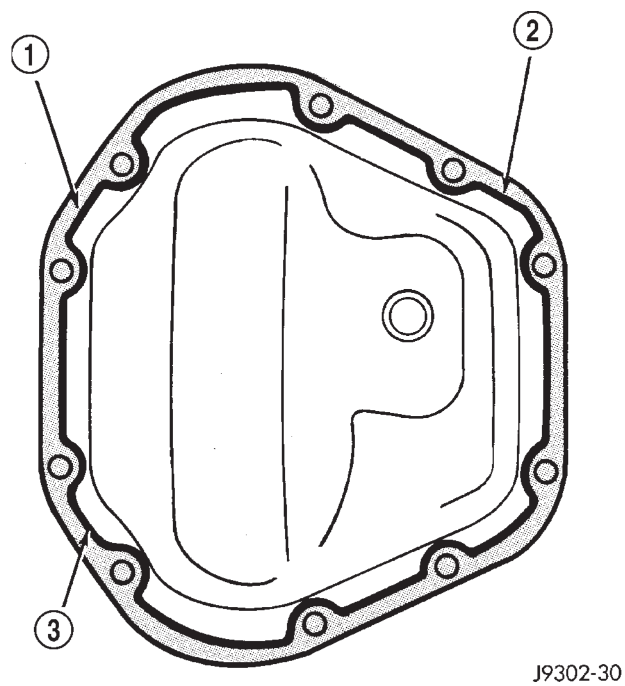


Fig. 40 Typical Housing Cover With Sealant

1 – SEALING SURFACE
2 – CONTOUR OF BEAD
3 – BEAD THICKNESS 6.35MM (1/4”)

Install the housing cover within 5 minutes after applying the sealant.

REMOVAL AND INSTALLATION (Continued)

(2) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove pinion mate shaft lock screw (Fig. 41).

(2) Remove pinion mate shaft.

(3) Rotate the differential side gears and remove the differential pinion gears and thrust washers (Fig. 42).

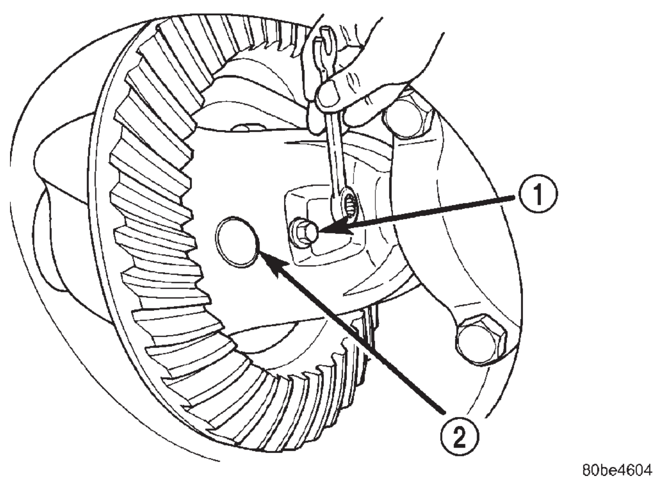


Fig. 41 Pinion Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION MATE SHAFT

(4) Remove the differential side gears and thrust washers.

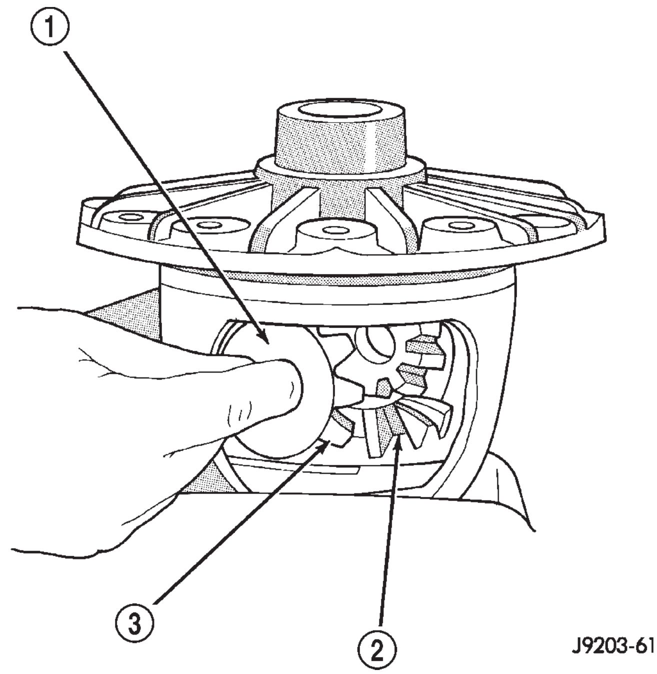


Fig. 42 Pinion Mate Gear Removal

1 – THRUST WASHER
2 – SIDE GEAR
3 – PINION MATE GEAR

ASSEMBLY

(1) Install the differential side gears and thrust washers.

(2) Install the differential pinion gears and thrust washers.

(3) Install the pinion mate shaft.

(4) Align the hole in the pinion mate shaft with the hole in the differential case and install the pinion mate shaft lock screw.

(5) Lubricate all differential components with hypoid gear lubricant.

8 1/4 TRAC-LOK™ DIFFERENTIAL

The Trac–lok™ differential components are illustrated in (Fig. 43). Refer to this illustration during repair service.

DISASSEMBLY AND ASSEMBLY (Continued)

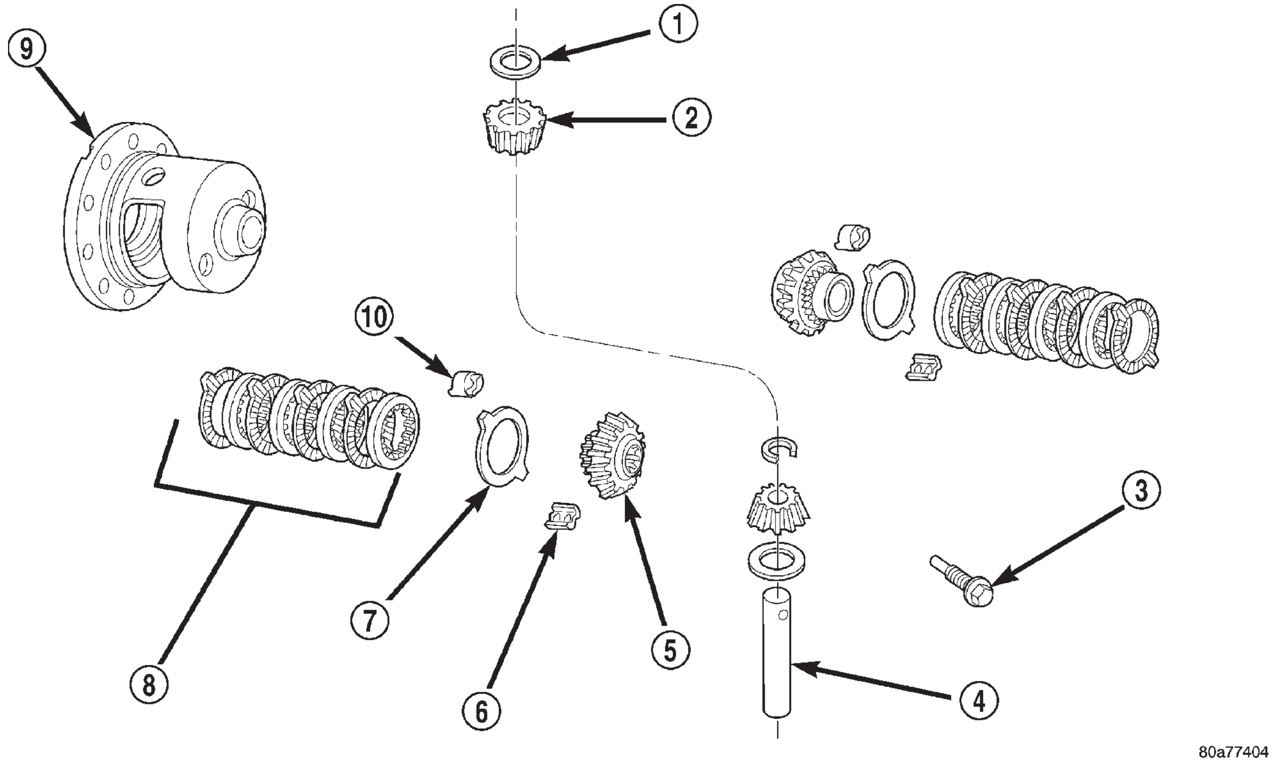


Fig. 43 Trac–lok™ Differential Components

1 – THRUST WASHER
2 – PINION
3 – SHAFT LOCK SCREW
4 – PINION MATE SHAFT
5 – SIDE GEAR
6 – RETAINER
7 – DISC
8 – CLUTCH PACK
9 – DIFFERENTIAL CASE
10 – RETAINER

DISASSEMBLY

(1) Clamp Side Gear Holding Tool 8138 in a vise.

(2) Position the differential case on Side Gear Holding Tool 8138 (Fig. 44).

(3) Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-lok™ differential can be serviced with the ring gear installed.

(4) Remove the pinion gear mate shaft lock screw (Fig. 45).

(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 46).

(6) Install and lubricate Step Plate 8140–2 (Fig. 47).

(7) Assemble Threaded Adapter 8140-1 into top side gear. Thread Forcing Screw 6960-4 into adapter until it becomes centered in adapter plate.

DISASSEMBLY AND ASSEMBLY (Continued)

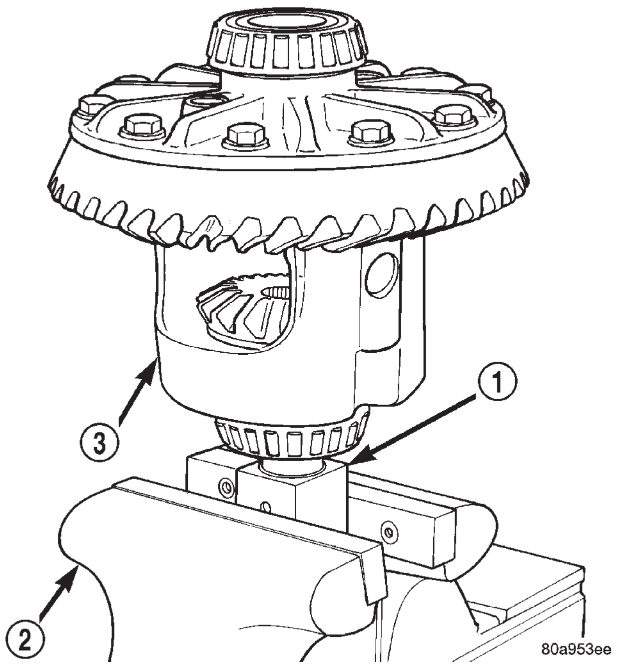


Fig. 44 Differential Case Holding Tool

1 – SIDE GEAR HOLDING TOOL
2 – VISE
3 – DIFFERENTIAL

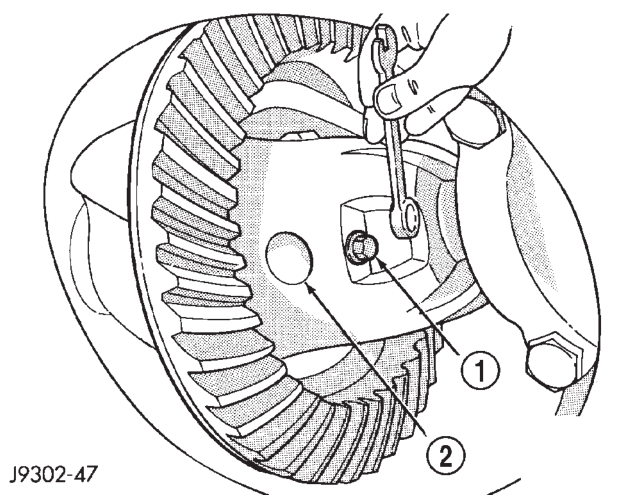


Fig. 45 Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION GEAR MATE SHAFT

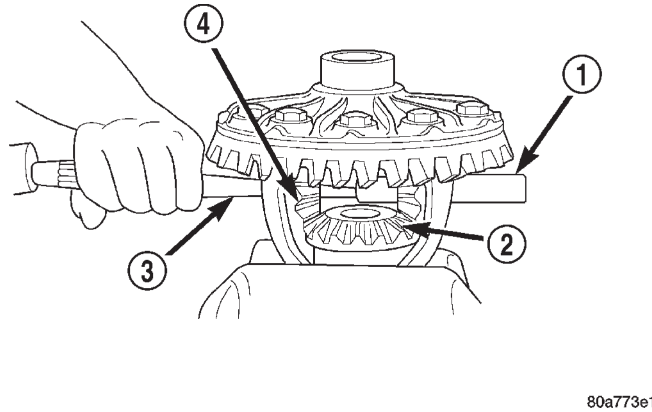


Fig. 46 Mate Shaft Removal

1 – PINION MATE SHAFT
2 – SIDE GEAR
3 – DRIFT
4 – PINION MATE GEAR

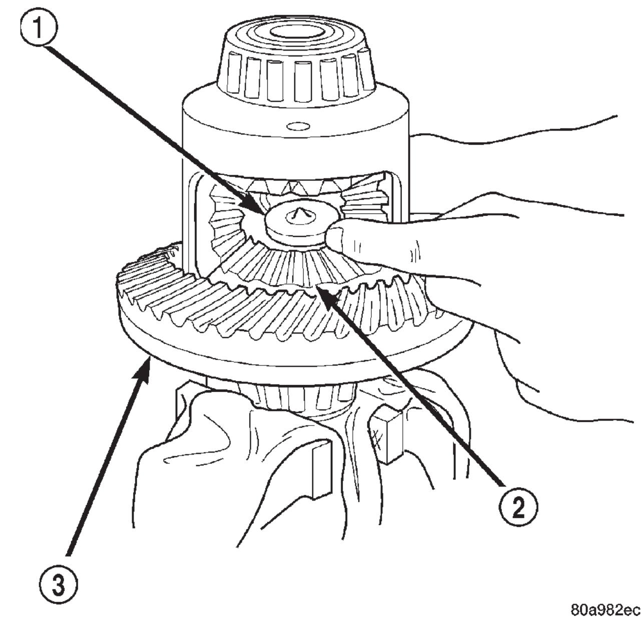


Fig. 47 Step Plate Tool Installation

1 – SPECIAL TOOL 8140–2
2 – LOWER SIDE GEAR
3 – DIFFERENTIAL CASE

(8) Position a small screw driver in slot of Threaded Adapter 8140-1 (Fig. 48) to prevent adapter from turning.

DISASSEMBLY AND ASSEMBLY (Continued)

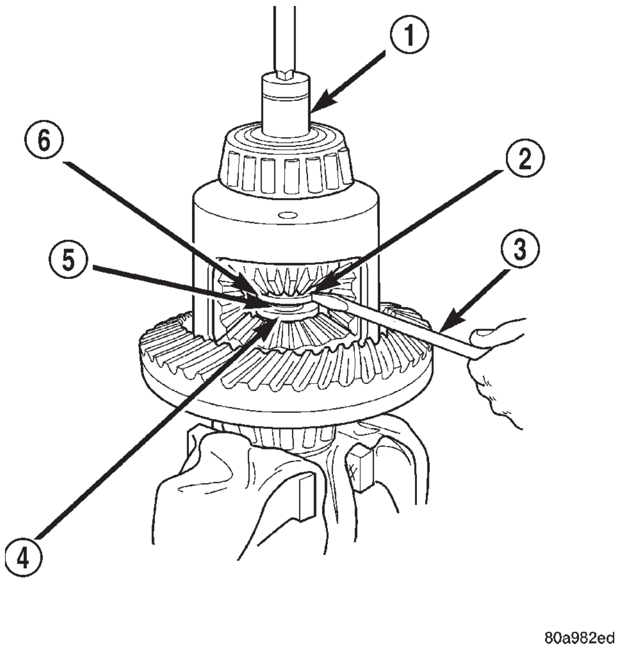


Fig. 48 Threaded Adapter Installation

1 – SOCKET
2 – SLOT IN ADAPTER
3 – SCREWDRIVER
4 – DISC 8140–2
5 – THREADED ROD C-6960–4
6 – THREADED ADAPTER DISC 8140–1

(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 49).

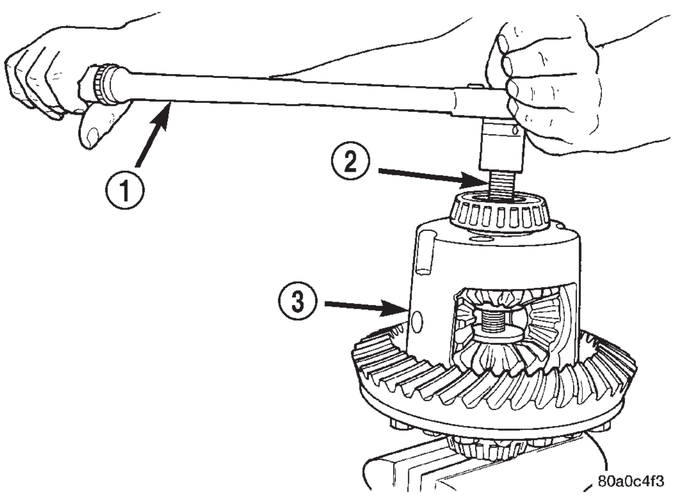


Fig. 49 Tighten Belleville Spring Compressor Tool

1 – TORQUE WRENCH
2 – TOOL ASSEMBLED
3 – DIFFERENTIAL CASE

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 50).

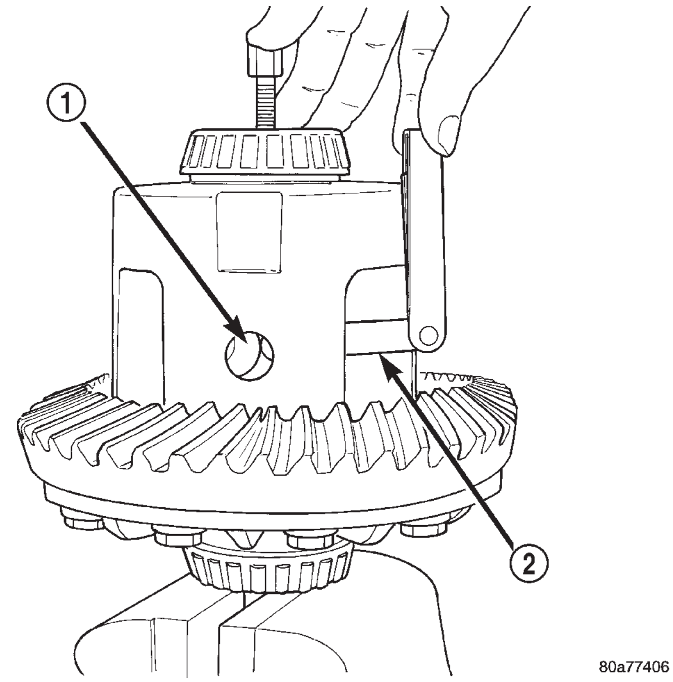


Fig. 50 Remove Pinion Gear Thrust Washer

1 – THRUST WASHER
2 – FEELER GAUGE

(11) Insert Turning Bar 6960-2 in case (Fig. 51).

(12) Loosen the Forcing Screw 6960-4 in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar 6960-2.

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

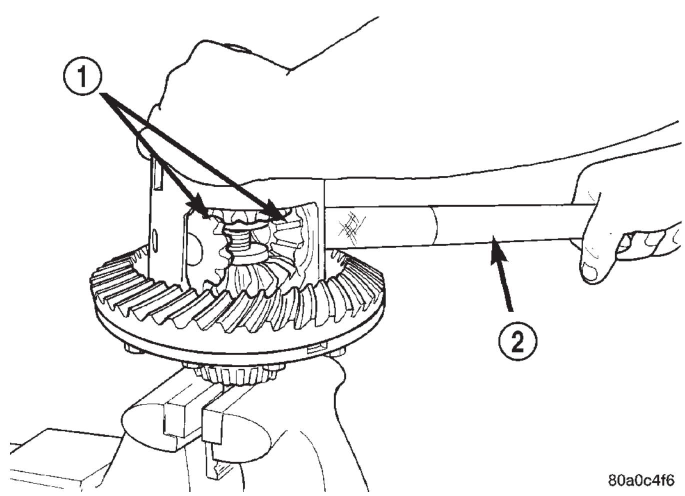


Fig. 51 Pinion Gear Removal

1 – PINION GEARS
2 – TOOL

(15) Remove Forcing Screw 6960-4, Step Plate 8140–2, and Threaded Adapter 8140–1.

DISASSEMBLY AND ASSEMBLY (Continued)

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 52).

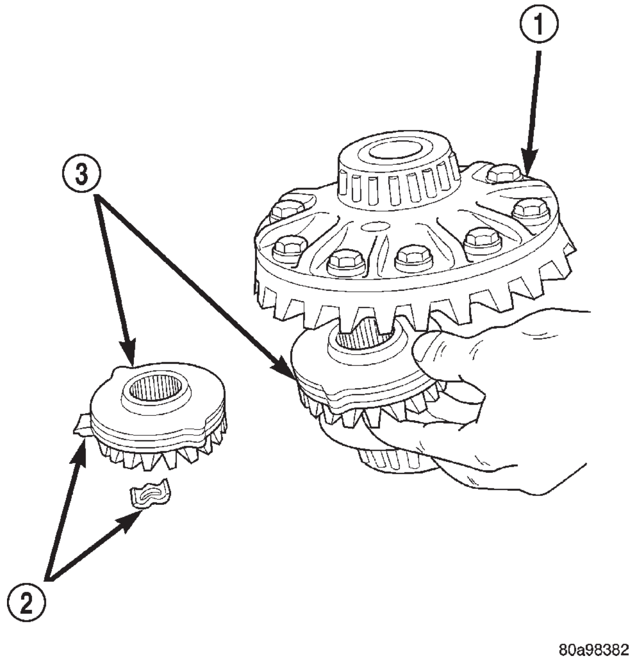


Fig. 52 Side Gear & Clutch Disc Removal

1 – DIFFERENTIAL CASE
2 – RETAINER
3 – SIDE GEAR AND CLUTCH DISC PACK

(17) Remove differential case from Side Gear Holding Tool 8138. Remove side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal.

ASSEMBLY

NOTE: The clutch discs are replaceable as complete sets only. If one clutch disc pack is damaged, both packs must be replaced.

Lubricate each component with gear lubricant before assembly.

(1) Assemble the clutch discs into packs and secure disc packs with retaining clips (Fig. 53).

(2) Position assembled clutch disc packs on the side gear hubs.

(3) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 54). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

(4) Position the differential case on Side Gear Holding Tool 8138.

(5) Install lubricated Step Plate 8140–2 in lower side gear (Fig. 55).

(6) Install the upper side gear and clutch disc pack (Fig. 55).

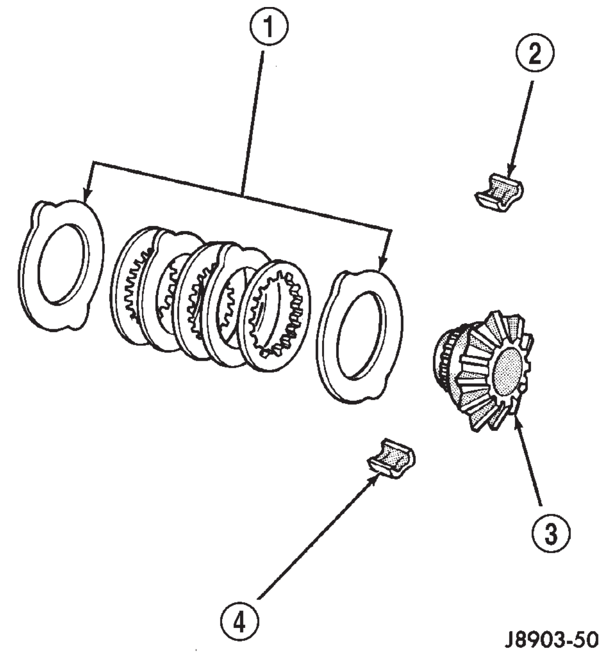


Fig. 53 Clutch Disc Pack

1 – CLUTCH PACK
2 – RETAINER
3 – SIDE GEAR
4 – RETAINER

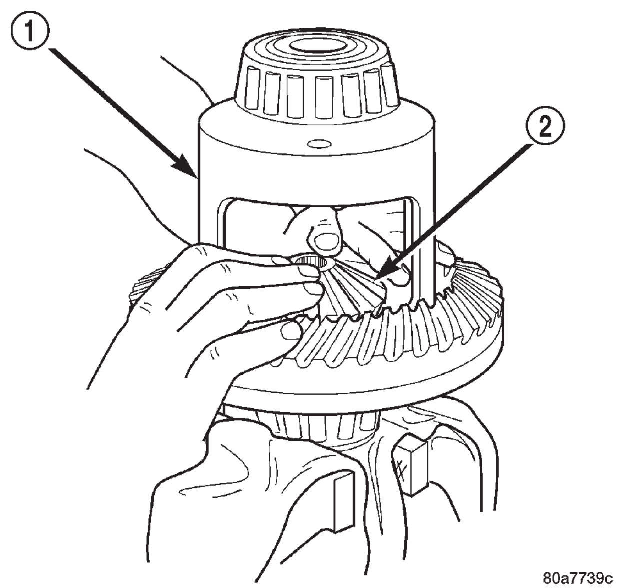


Fig. 54 Clutch Discs & Lower Side Gear Installation

1 – DIFFERENTIAL CASE
2 – LOWER SIDE GEAR AND CLUTCH DISC PACK

(7) Hold assembly in position. Insert Threaded Adapter 8140-1 into top side gear.

(8) Insert Forcing Screw 6960-4.

(9) Tighten forcing screw tool to slightly compress clutch discs.

DISASSEMBLY AND ASSEMBLY (Continued)

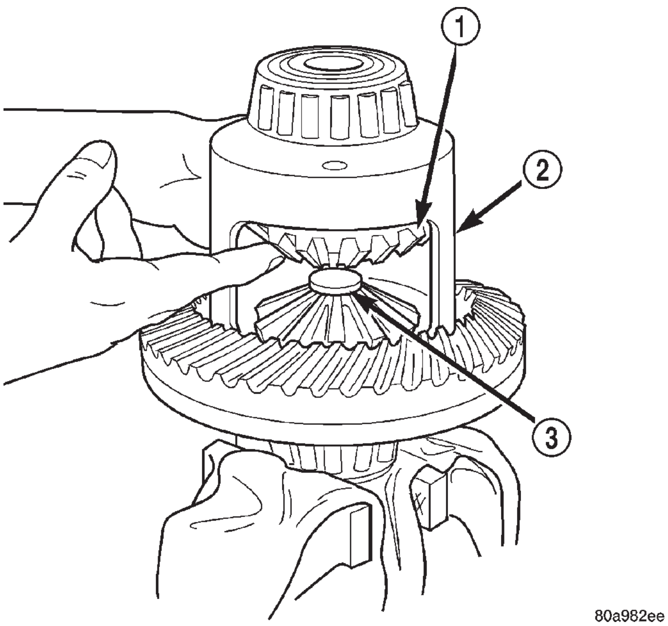


Fig. 55 Upper Side Gear & Clutch Disc Pack Installation

1 – UPPER SIDE GEAR AND CLUTCH DISC PACK
2 – DIFFERENTIAL CASE
3 – SPECIAL TOOL 8140–2

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft holes are aligned.

(11) Rotate case with Turning Bar 6960-2 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw 6960-4, Step Plate 8140–2, and Threaded Adapter 8140-1.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential installation.

(17) Lubricate all differential components with hypoid gear lubricant.

9 1/4 TRAC-LOK™ DIFFERENTIAL

The Trac–lok™ differential components are illustrated in (Fig. 56). Refer to this illustration during repair service.

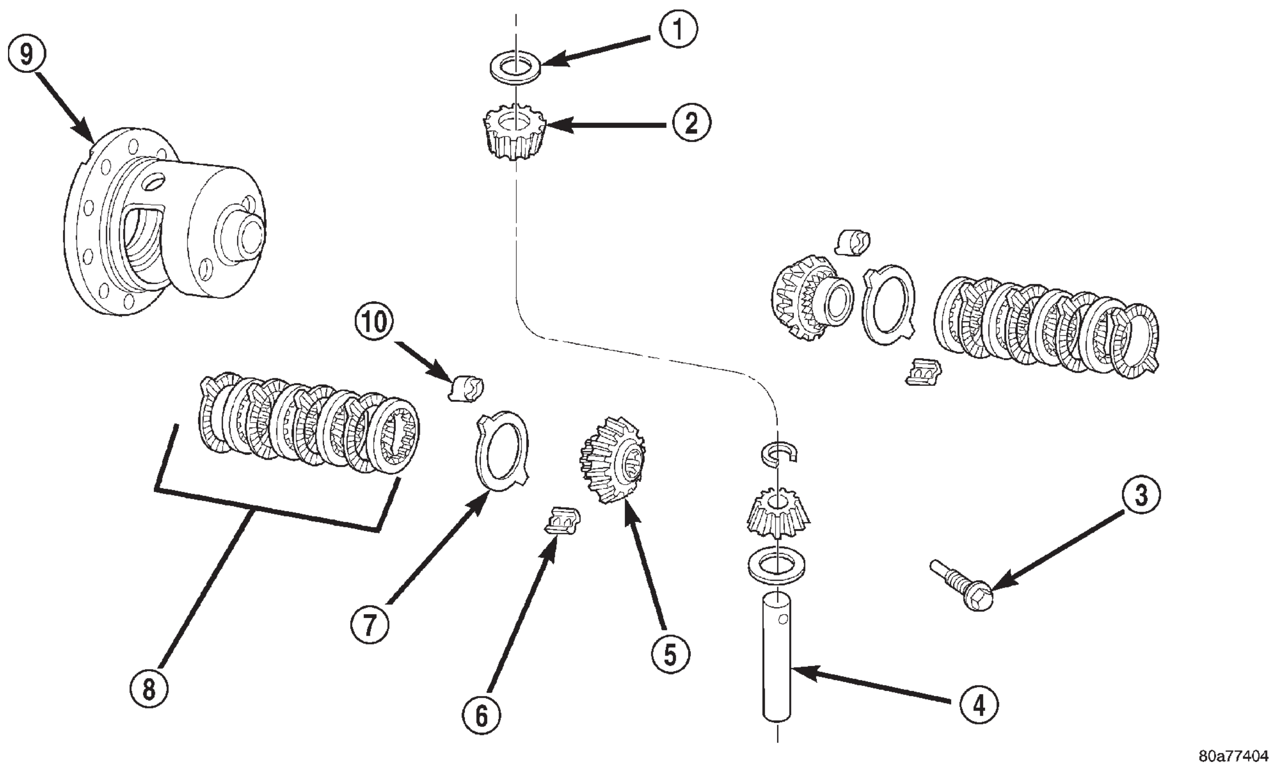


Fig. 56 Trac–lok™ Differential Components

1 – THRUST WASHER
2 – PINION
3 – SHAFT LOCK SCREW
4 – PINION MATE SHAFT
5 – SIDE GEAR
6 – RETAINER
7 – DISC
8 – CLUTCH PACK
9 – DIFFERENTIAL CASE
10 – RETAINER

DISASSEMBLY AND ASSEMBLY (Continued)

DISASSEMBLY

(1) Clamp Side Gear Holding Tool 8136 in a vise.

(2) Position the differential case on Side Gear Holding Tool 8136 (Fig. 57).

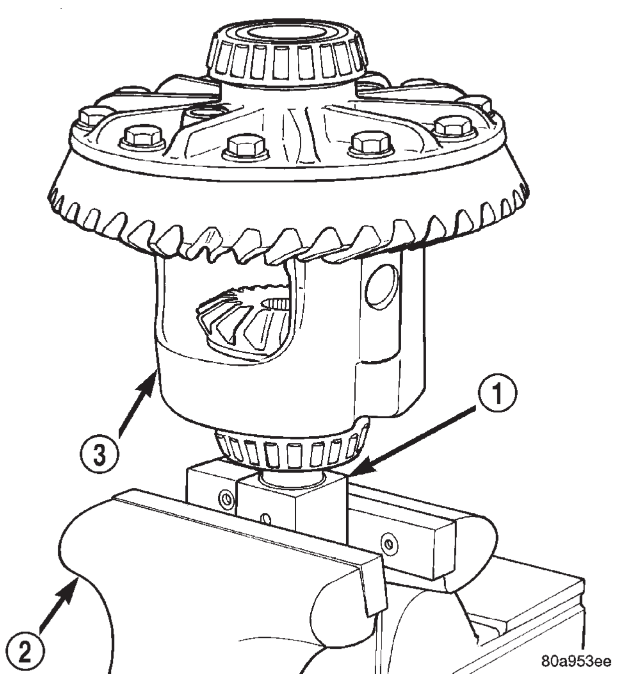


Fig. 57 Differential Case Holding Tool

1 – SIDE GEAR HOLDING TOOL
2 – VISE
3 – DIFFERENTIAL

(3) Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-lok™ differential can be serviced with the ring gear installed.

(4) Remove the pinion gear mate shaft lock screw (Fig. 58).

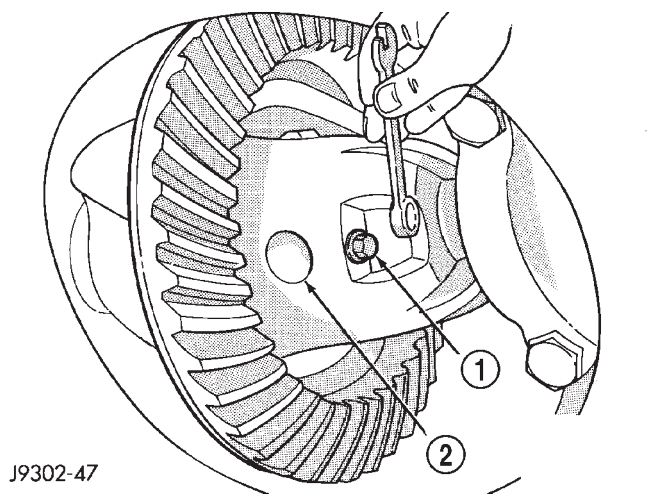


Fig. 58 Mate Shaft Lock Screw

1 – LOCK SCREW
2 – PINION GEAR MATE SHAFT

(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 59).

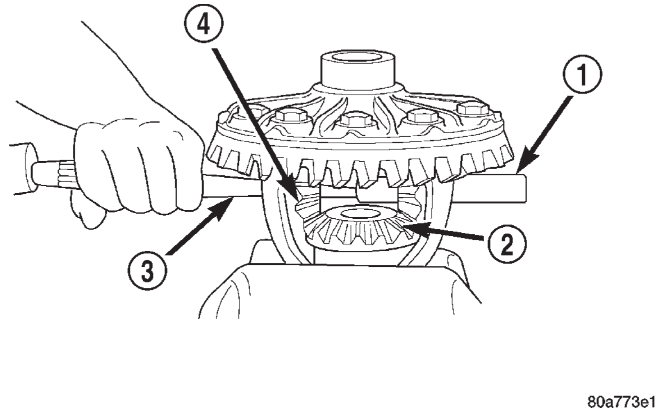


Fig. 59 Mate Shaft Removal

1 – PINION MATE SHAFT
2 – SIDE GEAR
3 – DRIFT
4 – PINION MATE GEAR

(6) Install and lubricate Step Plate 8139-2 (Fig. 60).

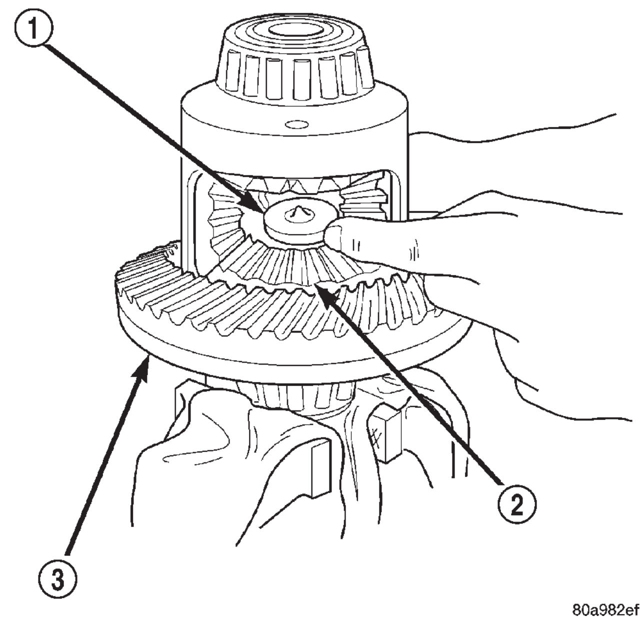


Fig. 60 Step Plate Tool Installation

1 – SPECIAL TOOL 8139–2
2 – LOWER SIDE GEAR
3 – DIFFERENTIAL CASE

(7) Assemble Threaded Adapter 8139-1 into top side gear. Thread Forcing Screw C-4487-2 into adapter until it becomes centered in adapter plate.

(8) Position a small screw driver in slot of Threaded Adapter 8139-1 (Fig. 61) to prevent adapter from turning.

DISASSEMBLY AND ASSEMBLY (Continued)

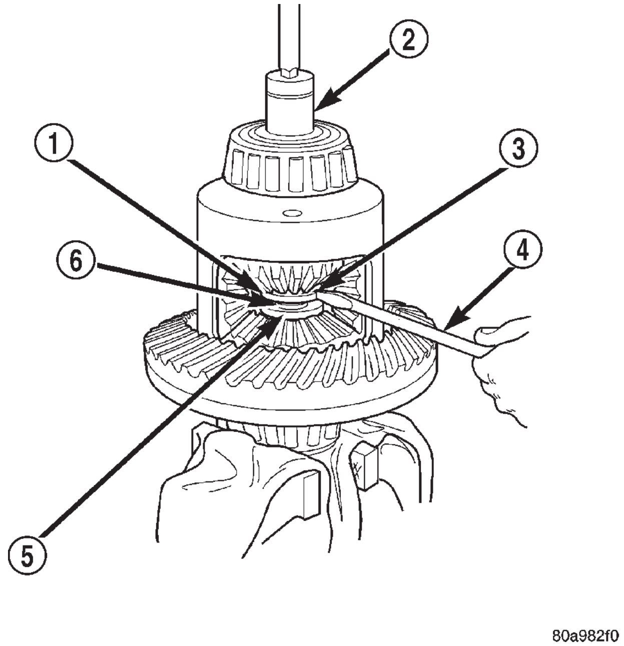


Fig. 61 Threaded Adapter Installation

1 – THREADED ADAPTER DISC 8139–1
2 – SOCKET
3 – SLOT IN ADAPTER
4 – SCREWDRIVER
5 – DISC 8139–2
6 – THREADED ROD C-4487–2

(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 62).

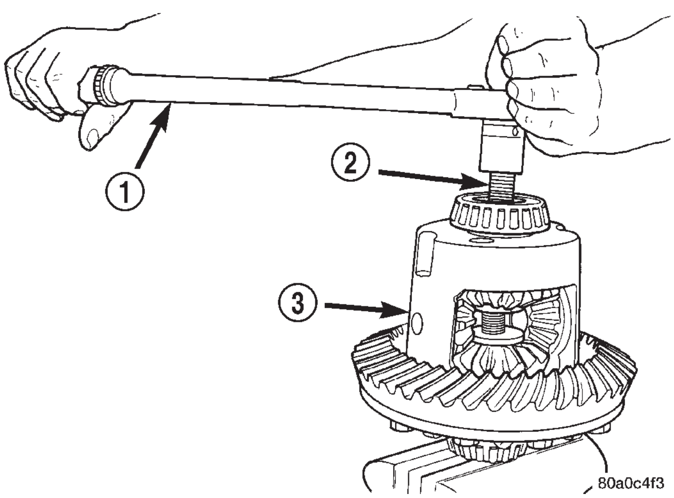


Fig. 62 Tighten Belleville Spring Compressor Tool

1 – TORQUE WRENCH
2 – TOOL ASSEMBLED
3 – DIFFERENTIAL CASE

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 63).

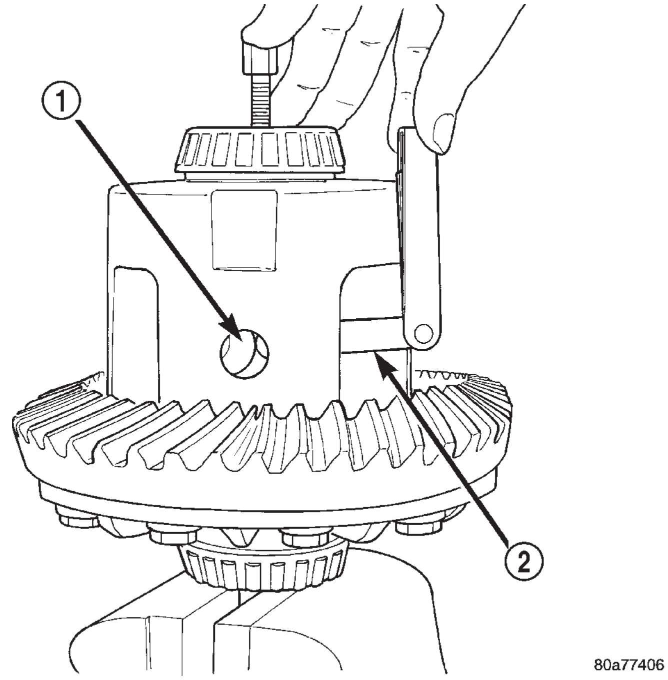


Fig. 63 Remove Pinion Gear Thrust Washer

1 – THRUST WASHER
2 – FEELER GAUGE

(11) Insert Turning Bar C-4487-4 in case (Fig. 64).

(12) Loosen the Forcing Screw C-4487-2 in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar C-4487-4.

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

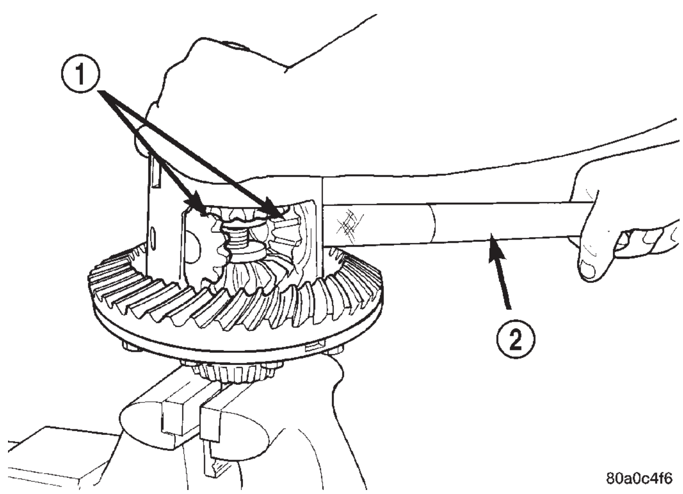


Fig. 64 Pinion Gear Removal

1 – PINION GEARS
2 – TOOL

DISASSEMBLY AND ASSEMBLY (Continued)

(15) Remove Forcing Screw C-4487-2, Step Plate 8139–2, and Threaded Adapter 8139-1.

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 65).

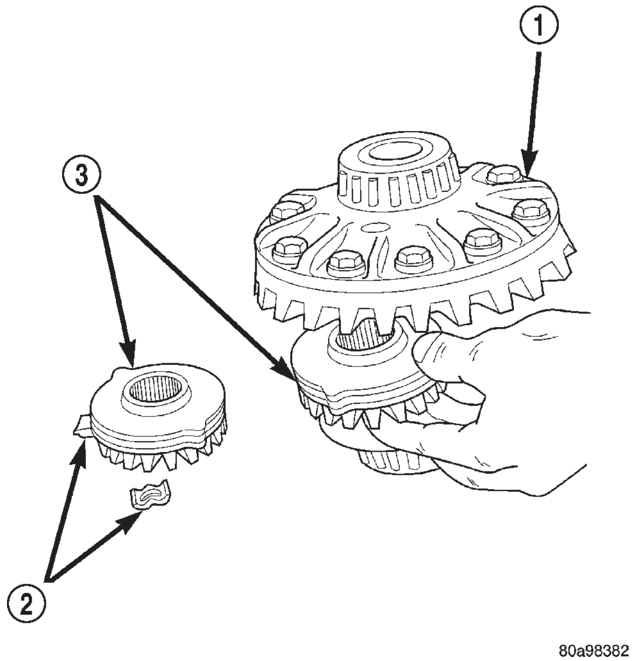


Fig. 65 Side Gear & Clutch Disc Removal

1 – DIFFERENTIAL CASE
2 – RETAINER
3 – SIDE GEAR AND CLUTCH DISC PACK

(17) Remove differential case from Side Gear Holding Tool 8136. Remove side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal.

ASSEMBLY

NOTE: The clutch discs are replaceable as complete sets only. If one clutch disc pack is damaged, both packs must be replaced.

Lubricate each component with gear lubricant before assembly.

(1) Assemble the clutch discs into packs and secure disc packs with retaining clips (Fig. 66).

(2) Position assembled clutch disc packs on the side gear hubs.

(3) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 67). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

(4) Position the differential case on Side Gear Holding Tool 8136.

(5) Install lubricated Step Plate 8139-2 in lower side gear (Fig. 68).

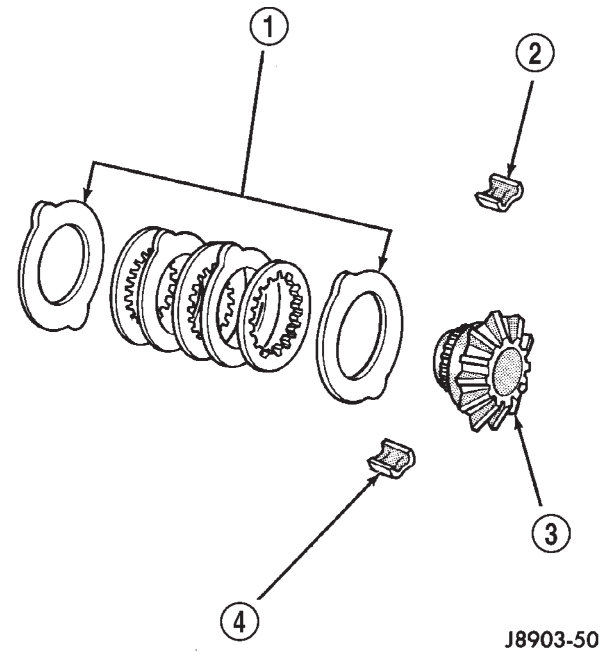


Fig. 66 Clutch Disc Pack

1 – CLUTCH PACK
2 – RETAINER
3 – SIDE GEAR
4 – RETAINER

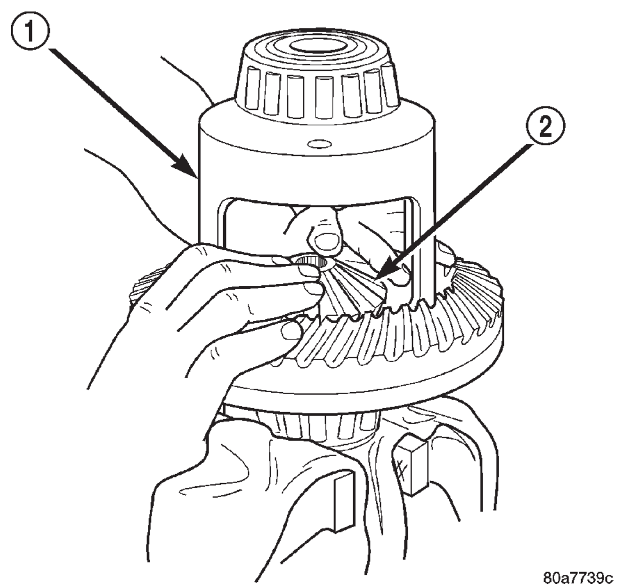


Fig. 67 Clutch Discs & Lower Side Gear Installation

1 – DIFFERENTIAL CASE
2 – LOWER SIDE GEAR AND CLUTCH DISC PACK

(6) Install the upper side gear and clutch disc pack (Fig. 68).

(7) Hold assembly in position. Insert Threaded Adapter 8139-1 into top side gear.

(8) Insert Forcing Screw C-4487-2.

DISASSEMBLY AND ASSEMBLY (Continued)

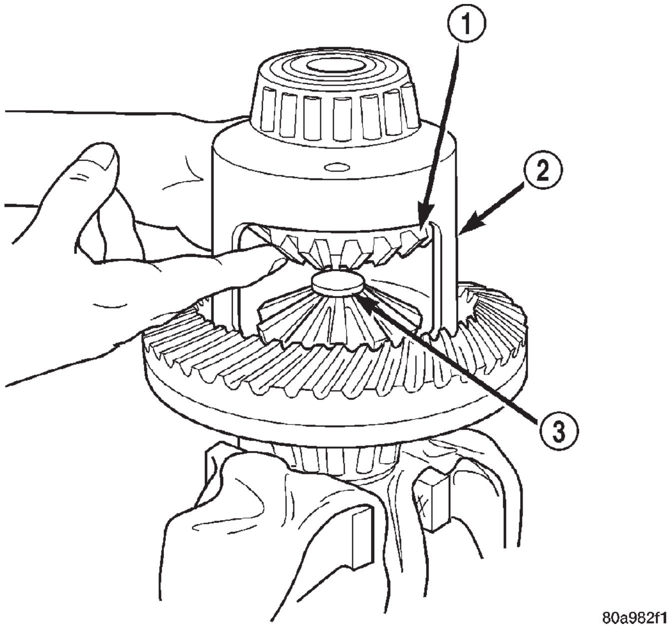


Fig. 68 Upper Side Gear & Clutch Disc Pack Installation

1 – UPPER SIDE GEAR AND CLUTCH DISC PACK
2 – DIFFERENTIAL CASE
3 – SPECIAL TOOL 8139–2

(9) Tighten forcing screw tool to slightly compress clutch discs.

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft holes are aligned.

(11) Rotate case with Turning Bar C-4487-4 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw C-4487-2, Step Plate 8139-2, and Threaded Adapter 8139-1.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential installation.

(17) Lubricate all differential components with hypoid gear lubricant.

CLEANING AND INSPECTION

8 1/4 AND 9 1/4 AXLES

Wash differential components with cleaning solvent and dry with compressed air. **Do not steam clean the differential components.**

Wash bearings with solvent and towel dry, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle tubes and oil channels in housing.

Inspect for:

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
- Wear and damage to pinion mate shaft, differential pinions, side gears and thrust washers. Replace as a matched set only.
- Ring gear and pinion for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Pinion companion flange for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Pinion depth shims for damage and distortion. Install new shims if necessary.
- The differential case. Replace the case if cracked or damaged.
- The axle shaft C-locks for cracks and excessive wear. Replace them if necessary.
- Each threaded adjuster to determine if it rotates freely. If an adjuster binds, repair the damaged threads or replace the adjuster.
- The RWAL exciter ring for damage and missing teeth. Verify that the ring is fully seated to the differential case flange.

Polish each axle shaft sealing surface with No. 600 crocus cloth. This can remove slight surface damage. Do not reduce the diameter of the axle shaft seal contact surface. When polishing, the crocus cloth should be moved around the circumference of the shaft (not in-line with the shaft).

CLEANING AND INSPECTION (Continued)

TRAC-LOK™

Clean all components in cleaning solvent. Dry components with compressed air. Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side gears and pinions. Replace any gear that is worn, cracked, chipped or damaged. Inspect differential case and pinion shaft. Replace if worn or damaged.

PRESOAK PLATES AND DISC

Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

ADJUSTMENTS

8 1/4 AXLE PINION GEAR DEPTH

GENERAL INFORMATION

Ring gear and pinion are supplied as matched sets only. The identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (–) number or zero (0) along with the gear set sequence number (01 to 99) is on each gear. This first number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed behind the rear pinion bearing (Fig. 69).

If a new gear set is being installed, note the depth variance marked on both the original and replacement pinion. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the painted number on the shaft of the pinion gear (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

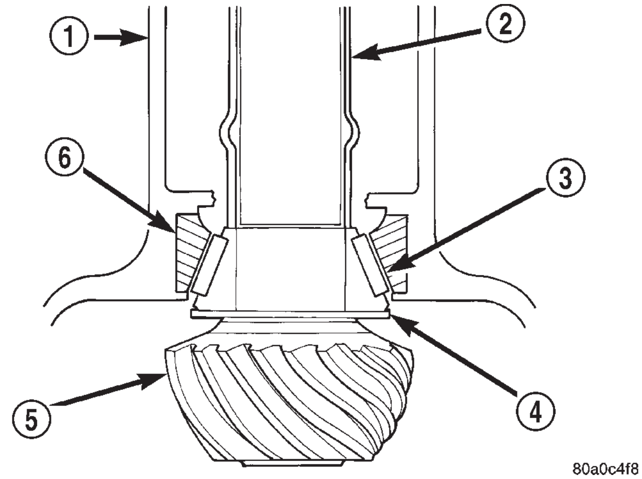


Fig. 69 Shim Locations

1 – AXLE HOUSING
2 – COLLAPSIBLE SPACER
3 – PINION BEARING
4 – PINION DEPTH SHIM
5 – PINION GEAR
6 – BEARING CUP

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the axle housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 70).

(1) Assemble Pinion Height Block 6739, Pinion Block 8540, and rear pinion bearing onto Screw 6741 (Fig. 70).

(2) Insert assembled height gauge components, rear bearing, and screw into axle housing through pinion bearing cups (Fig. 71).

(3) Install front pinion bearing and Cone-Nut 6740 hand tight (Fig. 70).

(4) Place Arbor Disc 8541 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 72). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

NOTE: Arbor Discs 8541 has different step diameters to fit other axles. Choose proper step for axle being serviced.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 70). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.

ADJUSTMENTS (Continued)

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

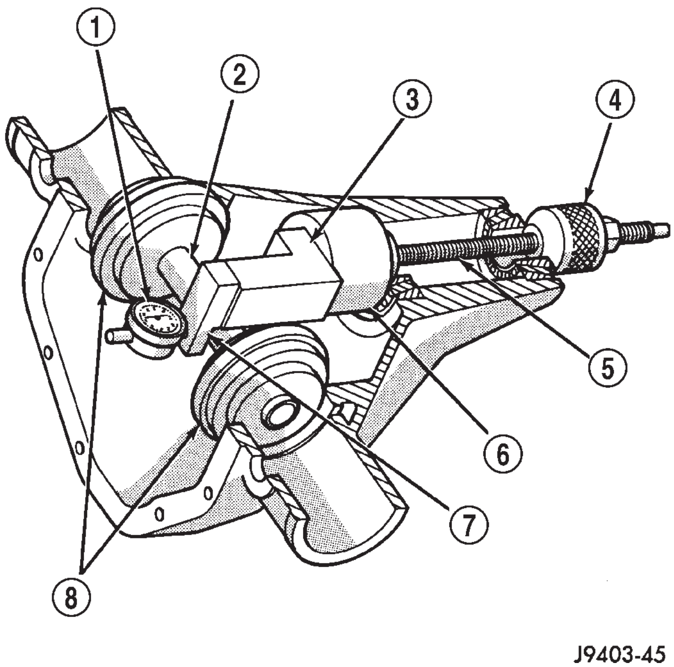


Fig. 70 Pinion Gear Depth Gauge Tools

1 – DIAL INDICATOR
2 – ARBOR
3 – PINION HEIGHT BLOCK
4 – CONE
5 – SCREW
6 – PINION BLOCK
7 – SCOOTER BLOCK
8 – ARBOR DISC

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 73). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading.

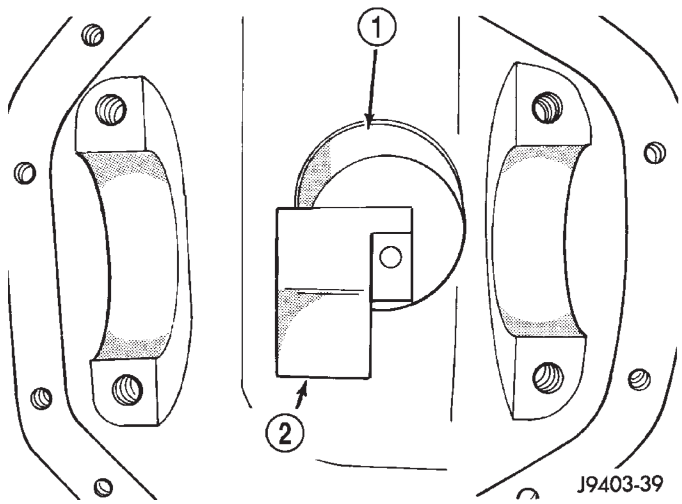


Fig. 71 Pinion Height Block

1 – PINION BLOCK
2 – PINION HEIGHT BLOCK

If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number painted in the shaft of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

9 1/4 AXLE PINION GEAR DEPTH

GENERAL INFORMATION

Ring gear and pinion are supplied as matched sets only. The identifying numbers for the ring gear and pinion are painted onto the pinion gear shaft and the side of the ring gear. A plus (+) number, minus (–) number or zero (0) along with the gear set sequence number (01 to 99) is on each gear. This first number

ADJUSTMENTS (Continued)

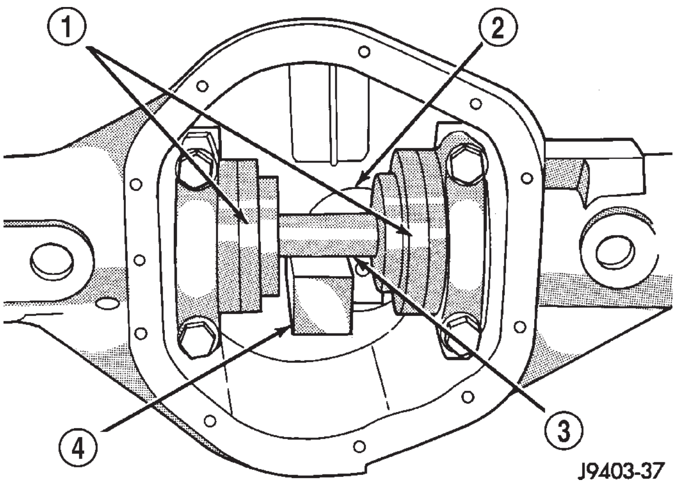


Fig. 72 Gauge Tools In Housing

1 – ARBOR DISC
2 – PINION BLOCK
3 – ARBOR
4 – PINION HEIGHT BLOCK

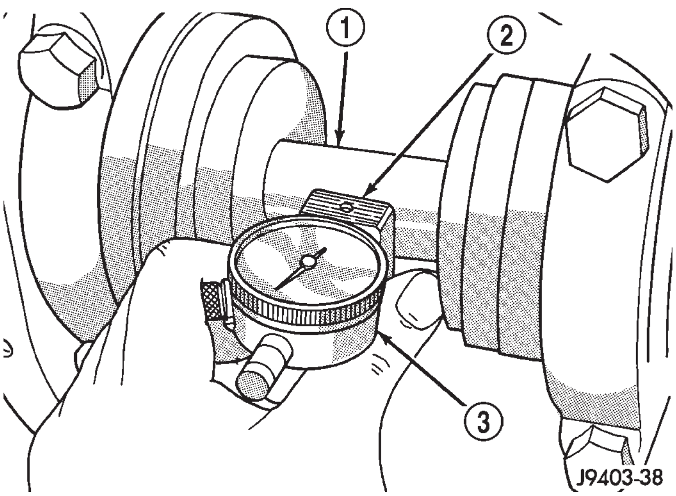


Fig. 73 Pinion Gear Depth Measurement

1 – ARBOR
2 – SCOOTER BLOCK
3 – DIAL INDICATOR

is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion marked with a (0). The next two numbers are the sequence number of the gear set. The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed behind the rear pinion bearing (Fig. 74).

If a new gear set is being installed, note the depth variance painted onto both the original and replacement pinion. Add or subtract the thickness of the

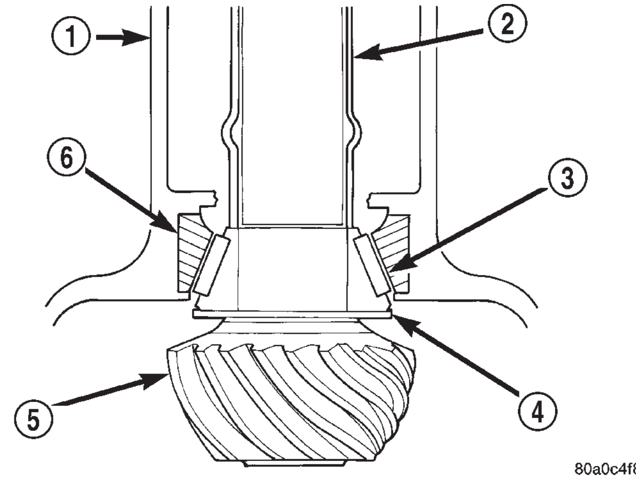


Fig. 74 Shim Locations

1 – AXLE HOUSING
2 – COLLAPSIBLE SPACER
3 – PINION BEARING
4 – PINION DEPTH SHIM
5 – PINION GEAR
6 – BEARING CUP

original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the painted number on the shaft of the drive pinion (–1, –2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the axle housing. Take measurements with Pinion Gauge Set and Dial Indicator C-3339 (Fig. 75).

(1) Assemble Pinion Height Block 6739, Pinion Block 8542, and rear pinion bearing onto Screw 6741 (Fig. 75).

(2) Insert assembled height gauge components, rear bearing, and screw into axle housing through pinion bearing cups (Fig. 76).

(3) Install front pinion bearing and Cone-Nut 6740 hand tight (Fig. 75).

(4) Place Arbor Disc 8541 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 77). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

ADJUSTMENTS (Continued)

PINION GEAR DEPTH VARIANCE

Original Pinion Gear Depth Variance	Replacement Pinion Gear Depth Variance								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

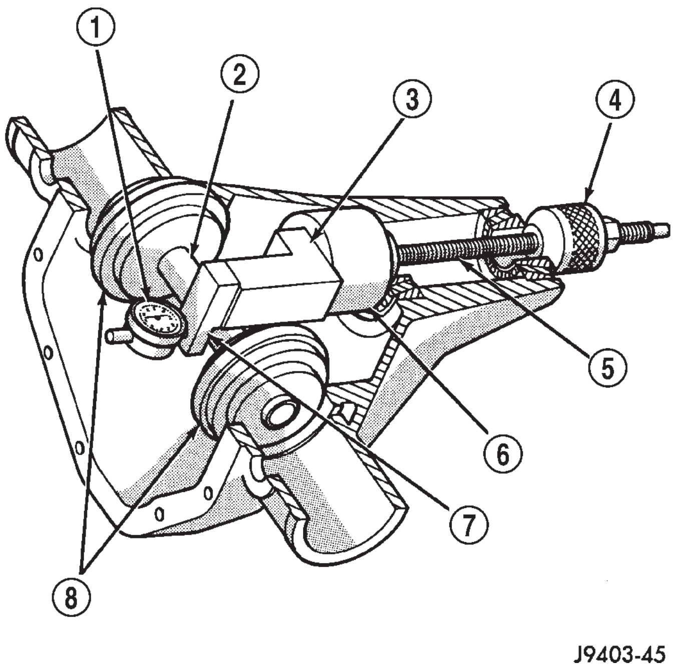


Fig. 75 Pinion Gear Depth Gauge Tools

1 – DIAL INDICATOR
2 – ARBOR
3 – PINION HEIGHT BLOCK
4 – CONE
5 – SCREW
6 – PINION BLOCK
7 – SCOOTER BLOCK
8 – ARBOR DISC

NOTE: Arbor Discs 8541 has different step diameters to fit other axles. Choose proper step for axle being serviced.

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 75). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

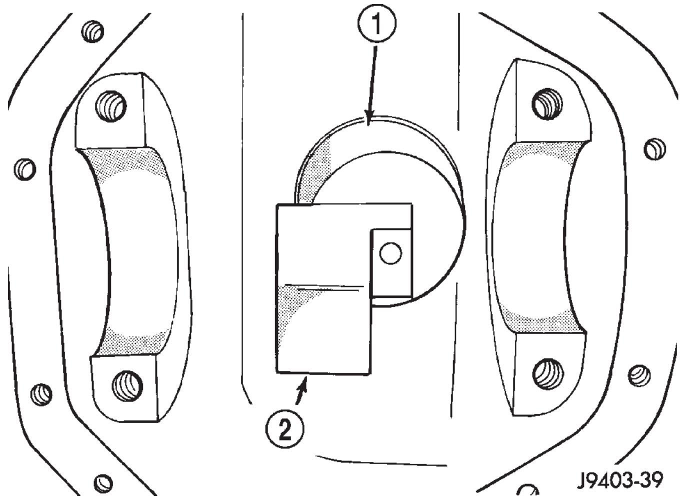


Fig. 76 Pinion Height Block

1 – PINION BLOCK
2 – PINION HEIGHT BLOCK

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 78). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

ADJUSTMENTS (Continued)

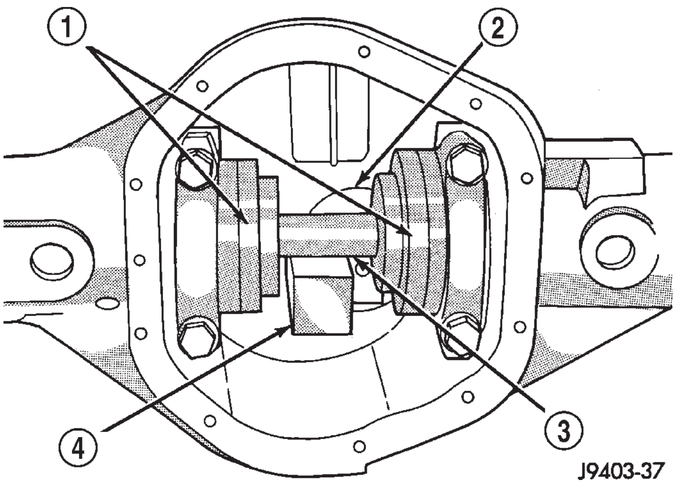


Fig. 77 Gauge Tools In Housing

1 – ARBOR DISC
2 – PINION BLOCK
3 – ARBOR
4 – PINION HEIGHT BLOCK

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number marked on the shaft of the pinion. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

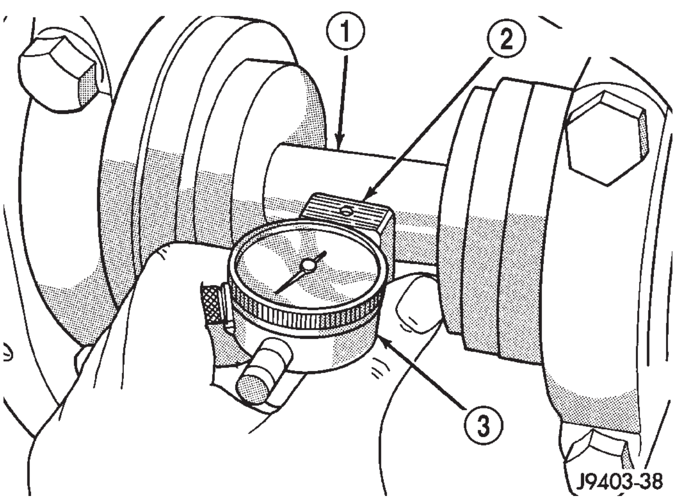


Fig. 78 Pinion Gear Depth Measurement

1 – ARBOR
2 – SCOOTER BLOCK
3 – DIAL INDICATOR

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

The following must be considered when adjusting bearing preload and gear backlash:

• The maximum ring gear backlash variation is 0.003 inch (0.076 mm).

• Mark the gears so the same teeth are meshed during all backlash measurements.

• Maintain the torque while adjusting the bearing preload and ring gear backlash.

• Excessive adjuster torque will introduce a high bearing load and cause premature bearing failure. Insufficient adjuster torque can result in excessive differential case free-play and ring gear noise.

• Insufficient adjuster torque will not support the ring gear correctly and can cause excessive differential case free-play and ring gear noise.

NOTE: The differential bearing cups will not always immediately follow the threaded adjusters as they are moved during adjustment. To ensure accurate bearing cup responses to the adjustments:

• Maintain the gear teeth engaged (meshed) as marked.

• The bearings must be seated by rapidly rotating the pinion gear a half turn back and forth.

• Do this five to ten times each time the threaded adjusters are adjusted.

(1) Use Wrench C-4164 to adjust each threaded adjuster inward until the differential bearing free-play is eliminated (Fig. 79). Allow some ring gear backlash (approximately 0.01 inch/0.25 mm) between the ring and pinion gear. Seat the bearing cups with the procedure described above.

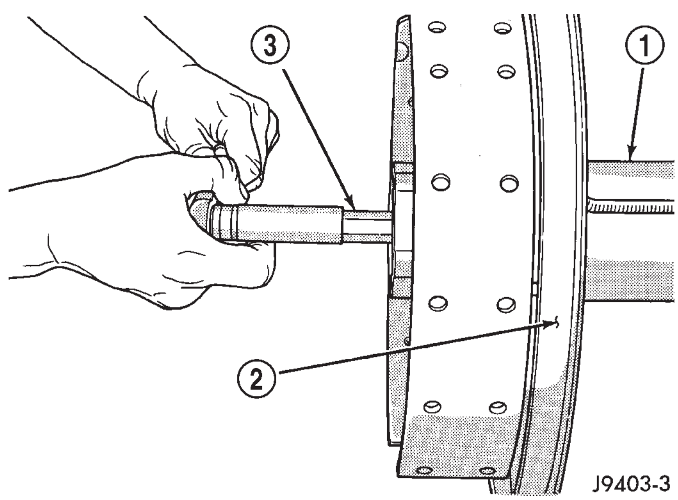


Fig. 79 Threaded Adjuster Tool

1 – AXLE TUBE
2 – BACKING PLATE
3 – TOOL C-4164

(2) Install dial indicator and position the plunger against the drive side of a ring gear tooth (Fig. 80). Measure the backlash at 4 positions (90 degrees apart) around the ring gear. Locate and mark the area of minimum backlash.

ADJUSTMENTS (Continued)

(3) Rotate the ring gear to the position of the least backlash. Mark the gear so that all future backlash measurements will be taken with the same gear teeth meshed.

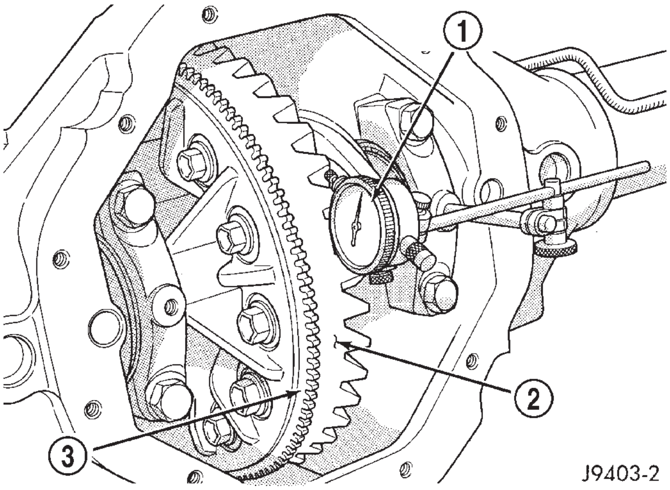


Fig. 80 Ring Gear Backlash Measurement

1 – DIAL INDICATOR
2 – RING GEAR
3 – EXCITER RING

(4) Loosen the right-side, tighten the left-side threaded adjuster. Obtain backlash of 0.003 to 0.004 inch (0.076 to 0.102 mm) with each adjuster tightened to 14 N·m (10 ft. lbs.). Seat the bearing cups with the procedure described above.

(5) Tighten the differential bearing cap bolts;

- 8 1/4 axles: 95 N·m (70 ft. lbs.)
- 9 1/4 axles: 136 N·m (100 ft. lbs.)

(6) Tighten the right-side threaded adjuster to 102 N·m (75 ft. lbs.). Seat the bearing cups with the procedure described above. Continue to tighten the right-side adjuster and seat bearing cups until the torque remains constant at 102 N·m (75 ft. lbs.)

(7) Measure the ring gear backlash. The range of backlash is 0.006 to 0.008 inch (0.15 to 0.203 mm).

(8) Continue increasing the torque at the right-side threaded adjuster until the specified backlash is obtained.

NOTE: The left-side threaded adjuster torque should have approximately 102 N·m (75 ft. lbs.). If the torque is considerably less, the complete adjustment procedure must be repeated.

(9) Tighten the left-side threaded adjuster until 102 N·m (75 ft. lbs.) torque is indicated. Seat the bearing rollers with the procedure described above. Do this until the torque remains constant.

(10) Install the threaded adjuster locks and tighten the lock screws to 10 N·m (90 in. lbs.).

After the proper backlash is achieved, perform the Gear Contact Analysis procedure.

GEAR CONTACT PATTERN ANALYSIS

The ring gear and pinion teeth contact patterns will show if the pinion depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

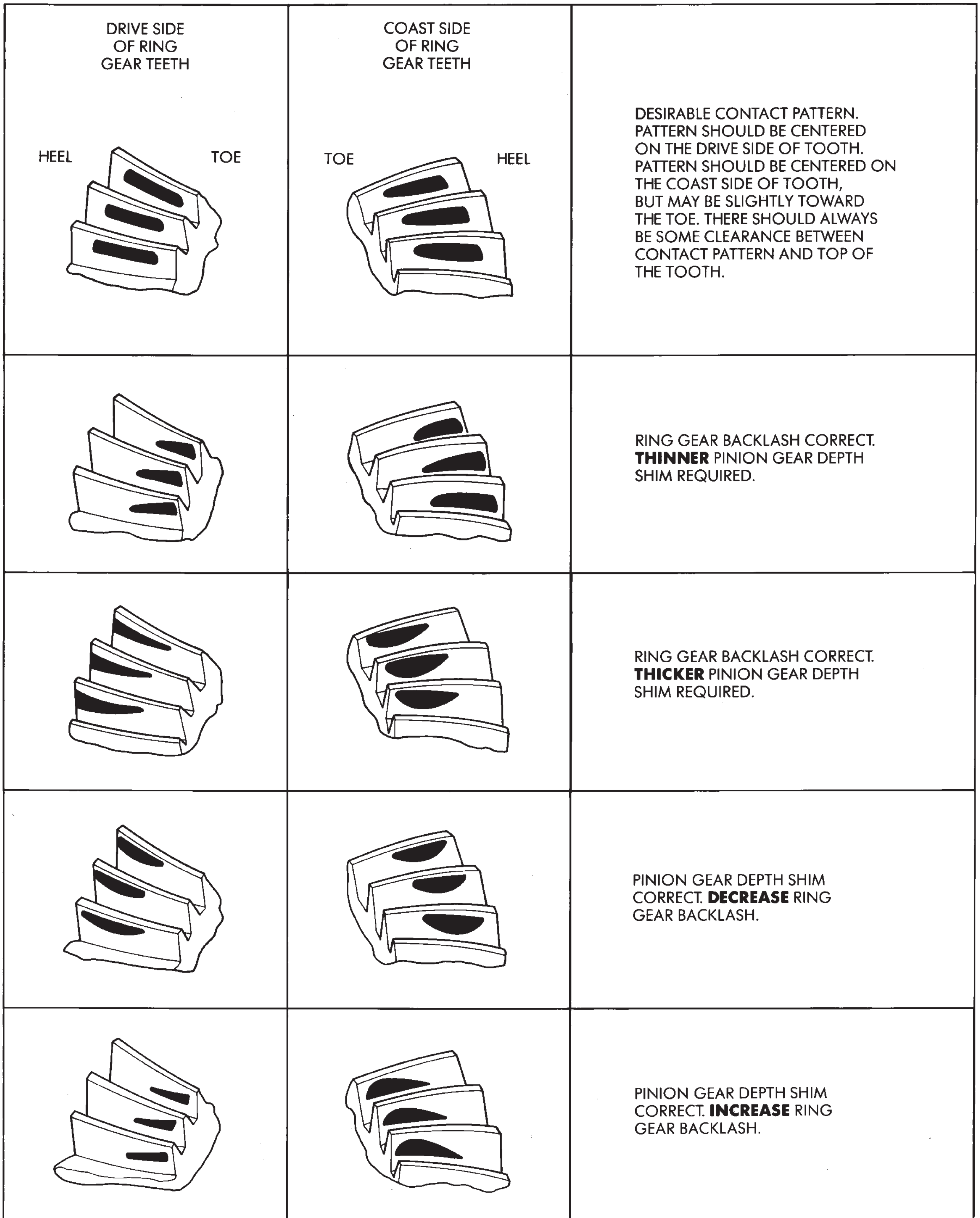
(1) Apply a thin coat of hydrated ferric oxide, or equivalent, to the drive and coast side of the ring gear teeth.

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion. This will provide a more distinct contact pattern.

(3) Using a boxed end wrench on a ring gear bolt, Rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 81) and adjust pinion depth and gear backlash as necessary.

ADJUSTMENTS (Continued)



J9003-24

Fig. 81 Gear Tooth Contact Patterns

ADJUSTMENTS (Continued)

SIDE GEAR CLEARANCE

When measuring side gear clearance, check each gear independently. If it necessary to replace a side gear, replace both gears as a matched set.

(1) Install the axle shafts and C-locks and pinion mate shaft.

(2) Measure each side gear clearance. Insert a matched pair of feeler gauge blades between the gear and differential housing on opposite sides of the hub (Fig. 82).

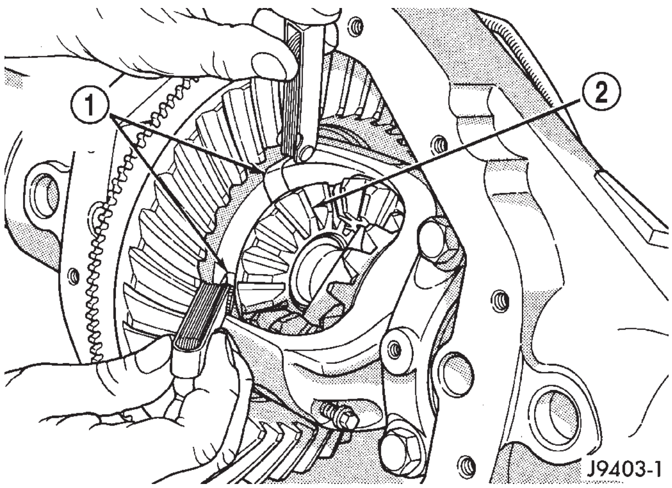


Fig. 82 Side Gear Clearance Measurement

1 – FEELER GAUGE BLADES
2 – SIDE GEAR

(3) If side gear clearances is no more than 0.005 inch. Determine if the axle shaft is contacting the pinion mate shaft. **Do not remove the feeler gauges, inspect the axle shaft with the feeler gauge inserted behind the side gear.** If the end of the axle shaft is not contacting the pinion mate shaft, the side gear clearance is acceptable.

(4) If clearance is more than 0.005 inch (axle shaft not contacting mate shaft), record the side gear clearance. Remove the thrust washer and measure its thickness with a micrometer. Add the washer thickness to the recorded side gear clearance. The sum of gear clearance and washer thickness will determine required thickness of replacement thrust washer (Fig. 83).

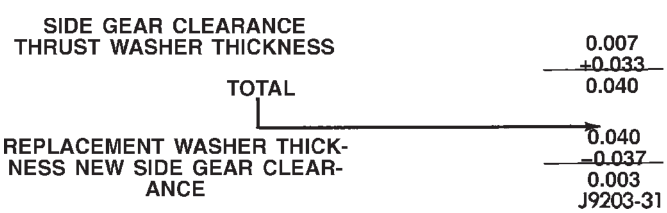


Fig. 83 Side Gear Calculations

In some cases, the end of the axle shaft will move and contact the mate shaft when the feeler gauge is inserted. The C-lock is preventing the side gear from sliding on the axle shaft.

(5) If there is no side gear clearance, remove the C-lock from the axle shaft. Use a micrometer to measure the thrust washer thickness. Record the thickness and re-install the thrust washer. Assemble the differential case without the C-lock installed and re-measure the side gear clearance.

(6) Compare both clearance measurements. If the difference is less than 0.012 inch (0.305 mm), add clearance recorded when the C-lock was installed to thrust washer thickness measured. The sum will determine the required thickness of the replacement thrust washer.

(7) If clearance is 0.012 inch (0.305 mm) or greater, both side gears must be replaced (matched set) and the clearance measurements repeated.

(8) If clearance (above) continues to be 0.012 inch (0.305 mm) or greater, the case must be replaced.

SPECIFICATIONS

8 1/4 INCH AXLE

Axle Type	Semi-floating, hypoid
Lubricant	SAE 80W-90
Lube Capacity	2.22 L (4.7 pts.)
Trac-Lok Additive	148 ml (5 oz.)
Axle Ratio	3.21, 3.55, 3.92
Differential	
Case Clearance	0.12 mm (0.005 in.)
Case Flange Runout	0.076 mm (0.003 in.)
Ring Gear	
Diameter	20.95 cm (8.25 in.)
Backlash	0.12-0.20 mm (0.005-0.008 in.)
Runout	0.127 mm (0.005 in.)
Pinion Bearing Preload	
Original	1-2 N·m (10-20 in.lbs.)
New	2-5 N·m (15-35 in.lbs.)

9 1/4 INCH AXLE

Axle Type	Semi-floating, hypoid
Lubricant	SAE 75W-90
Lube Capacity	2.32 L (4.9 pts.)
Trac-lok Additive	148 ml (5 oz.)
Axle Ratio	3.21, 3.55, 3.92
Differential	
Case Flange Runout	0.076 mm (0.003 in.)
Ring gear	
Diameter	23.50 cm (9.25 in.)
Backlash	0.12-0.20 mm (0.005-0.008 in.)
Runout	0.127 mm (0.005 in.)
Pinion Bearing Preload	
Original	1-2 N·m (10-20 in.lbs.)
New	2–5 N·m (15–35 in. lbs.)

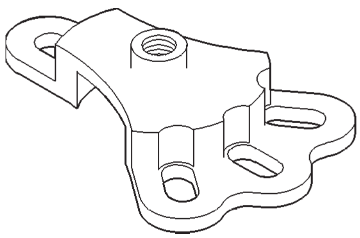
SPECIFICATIONS (Continued)

8 1/4 and 9 1/4 INCH AXLE

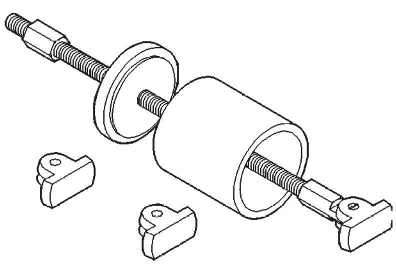
DESCRIPTION	TORQUE
Diff. Cover Bolt	41 N·m (30 ft. lbs.)
Bearing Cap Bolt—8 1/4 Axle	95 N·m (70 ft. lbs.)
Bearing Cap Bolt—9 1/4 Axle	136 N·m (100 ft. lbs.)
Pinion Nut	285 N·m (210 ft. lbs.)
Ring Gear Bolt—8 1/4 Axle	102 N·m (75 ft. lbs.)
Ring Gear Bolt—9 1/4 Axle	157 N·m (115 ft. lbs.)
Backing Plate Bolt	64 N·m (48 ft. lbs.)
RWAL/ABS Sensor Bolt	24 N·m (18. ft. lbs.)
Threaded Adjuster Lock Screw	10 N·m (90 in. lbs.)

SPECIAL TOOLS

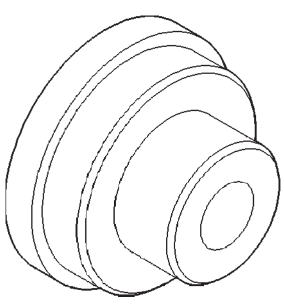
8 1/4 AND 9 1/4 AXLES



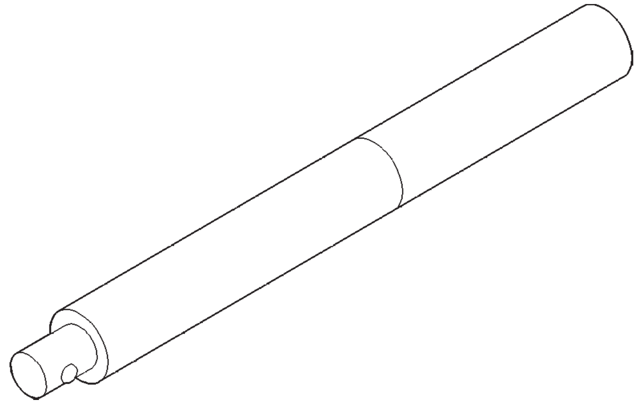
Puller, Hub—6790



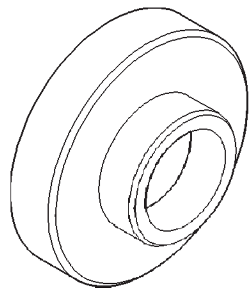
Remover, Bearing—6310



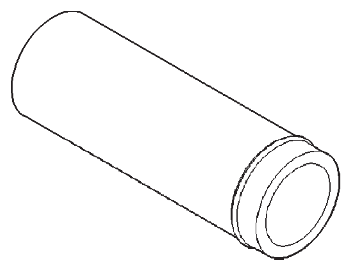
Installer—C-4198



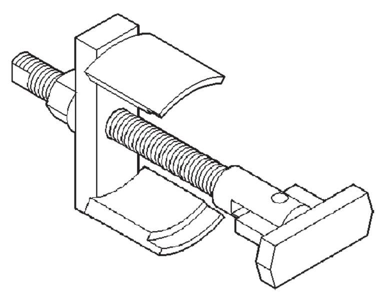
Handle—C-4171



Installer—C-4076-B

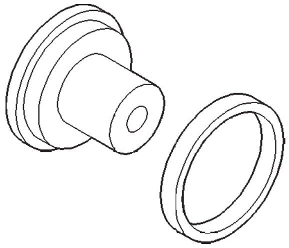


Handle—C-4735-1

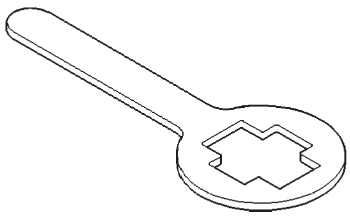


Remover—C-4828

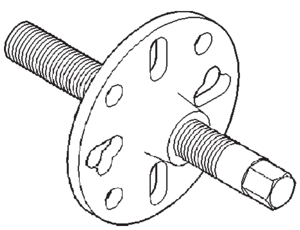
SPECIAL TOOLS (Continued)



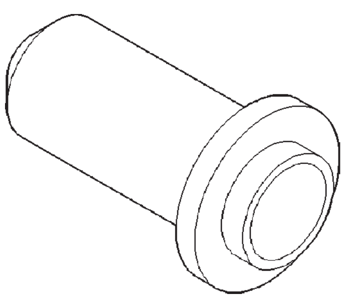
Installer—C-4826



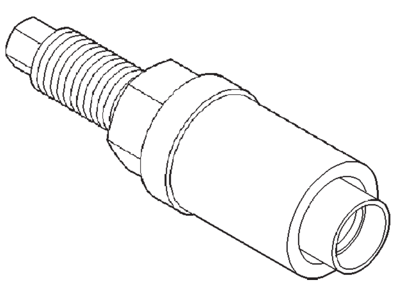
Holder—6719



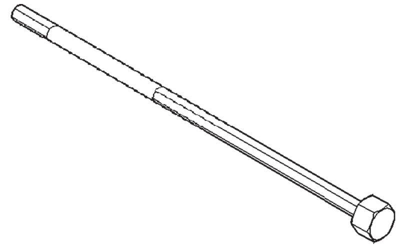
Puller—C-452



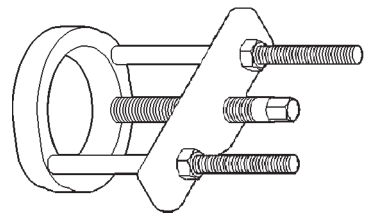
Installer—C-3860-A



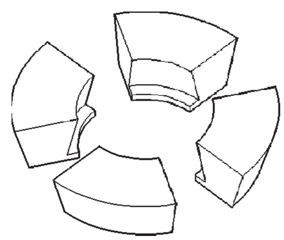
Installer—C-3718



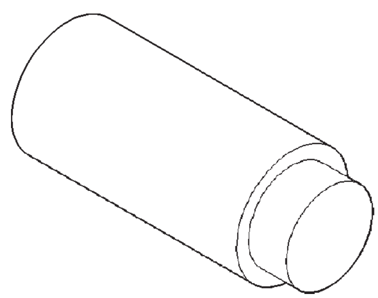
Adjustment Rod—C-4164



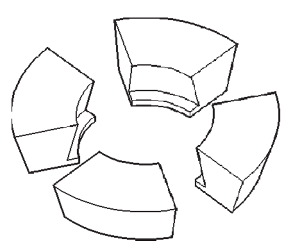
Puller/Press—C-293–PA



Adapters—C-293-48

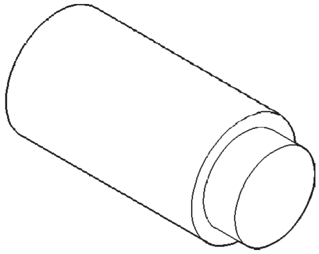


Plug—SP-3289

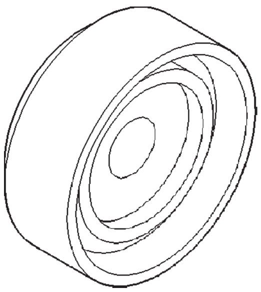


Adapters—C-293-47

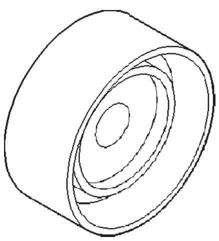
SPECIAL TOOLS (Continued)



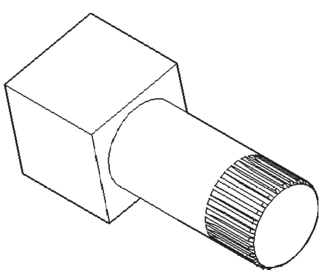
Plug—C-293-3



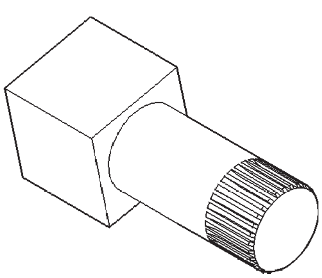
Installer—C-4340



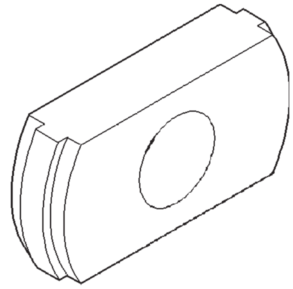
Installer—C-4213



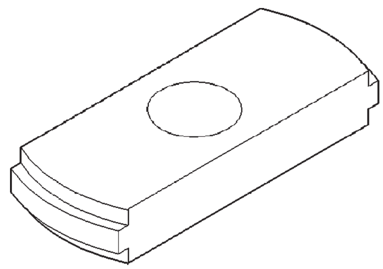
Holder—8136



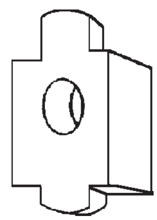
Holder—8138



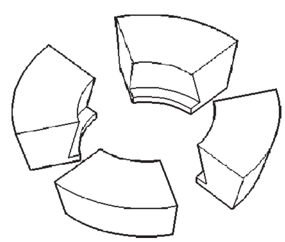
Installer—C-4345



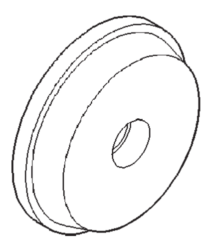
Remover—C-4307



Remover—C-4309

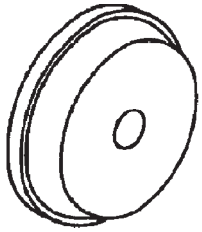


Adapters—C-293-37

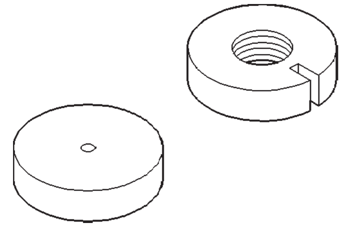


Installer—C-4308

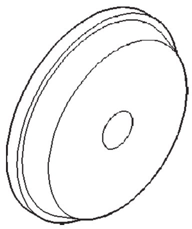
SPECIAL TOOLS (Continued)



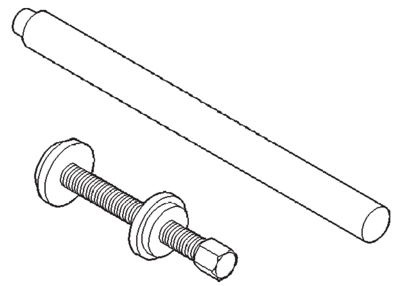
Installer—C-4310



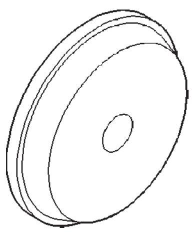
Trac-lok Tools—8140



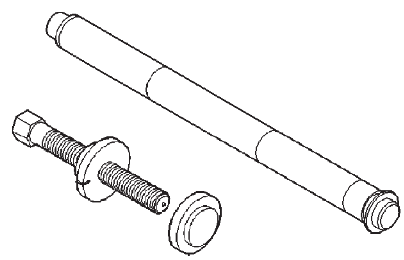
Installer—D-130



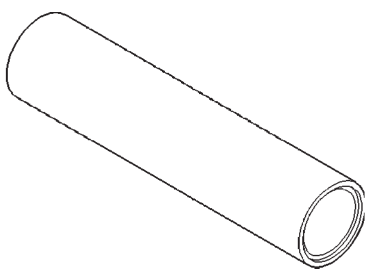
Trac-lok Tools—6960



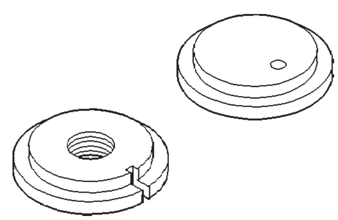
Installer—D-129



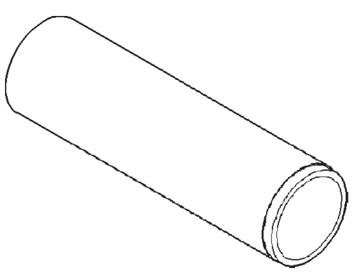
Trac-lok Tools—C-4487



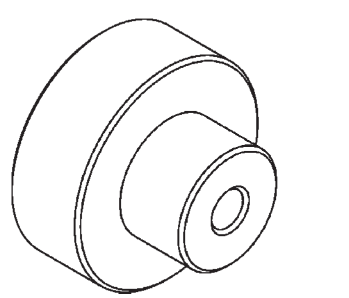
Installer—6448



Trac-lok Tools—8139

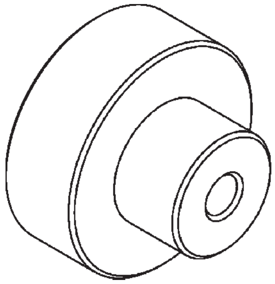


Installer—C-3095

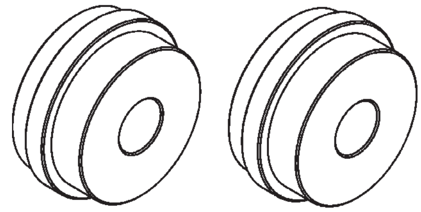


Pinion Gauge Block—8540

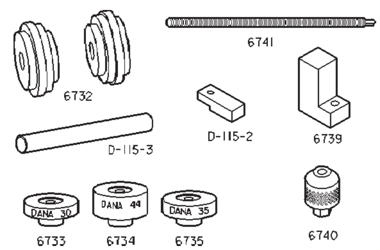
SPECIAL TOOLS (Continued)



Pinion Gauge Block—8542



Arbor Discs—8541



Pinion Gauge Set

BRAKES

TABLE OF CONTENTS

	page
BASE BRAKE SYSTEM	**1**
REAR WHEEL ANTILOCK BRAKES	**32**
FOUR WHEEL ANTILOCK BRAKES	**40**

BASE BRAKE SYSTEM

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
SERVICE WARNINGS & CAUTIONS	2
STOP LAMP SWITCH	2
BRAKE PEDAL	2
BRAKE SYSTEM	2
MASTER CYLINDER	3
COMBINATION VALVE	3
POWER BRAKE BOOSTER	3
RED BRAKE WARNING LAMP	3
DRUM BRAKES	4
FRONT DISC BRAKES	4
PARKING BRAKES	5
BRAKE HOSES AND LINES	5
DIAGNOSIS AND TESTING	
BASE BRAKE SYSTEM	5
BRAKE LAMP SWITCH	8
MASTER CYLINDER/POWER BOOSTER	8
RED BRAKE WARNING LAMP	8
COMBINATION VALVE	9
DISC BRAKE ROTOR	9
BRAKE DRUM	10
BRAKE FLUID CONTAMINATION	10
BRAKE LINE AND HOSES	10
SERVICE PROCEDURES	
BASE BRAKE BLEEDING	11
BRAKE FLUID LEVEL	11
MASTER CYLINDER BLEEDING	11
BRAKE TUBE FLARING	12
DISC ROTOR MACHINING	12
BRAKE DRUM MACHINING	12
REMOVAL AND INSTALLATION	
BRAKE LAMP SWITCH	13
BRAKE PEDAL	14
COMBINATION VALVE	14
MASTER CYLINDER	15
POWER BRAKE BOOSTER	15
DISC BRAKE CALIPER	16
DISC BRAKE SHOES	17
DISC BRAKE ROTOR	19
REAR BRAKE SHOES	19
BRAKE SUPPORT PLATE	21
FRONT PARK BRAKE CABLE	21
WHEEL CYLINDER	21
PARK BRAKE PEDAL ASSEMBLY	22
REAR PARK BRAKE CABLES	22
DISASSEMBLY AND ASSEMBLY	
MASTER CYLINDER RESERVOIR	23
DISC BRAKE CALIPER	24
WHEEL CYLINDER	25
CLEANING AND INSPECTION	
CALIPER	27
REAR DRUM BRAKE	27
WHEEL CYLINDER	28
ADJUSTMENTS	
REAR DRUM BRAKE	28
PARK BRAKE CABLE TENSIONER	29
SPECIFICATIONS	
BRAKE FLUID	30
BASE BRAKES	31
TORQUE CHART	31
SPECIAL TOOLS	
BASE BRAKES	31

DESCRIPTION AND OPERATION

BRAKE SYSTEM

DESCRIPTION

This vehicle is equipped with front disc brakes and rear drum brakes. The front disc brakes consist of single piston calipers and ventilated rotors. The rear brakes are dual brake shoe, internal expanding units with cast brake drums. The parking brake mechanism is cable operated and connected to the rear brake secondary shoes. Power brake assist is standard equipment. A vacuum operated power brake booster is used for all applications.

Two antilock brake systems are used on this vehicle. A rear wheel antilock (RWAL) brake system is standard. An all-wheel antilock brake system (ABS) is available as an option.

SERVICE WARNINGS & CAUTIONS

DESCRIPTION

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM PRODUCTION OR AFTERMARKET LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF ASBESTOS FIBERS FROM BRAKE COMPONENTS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WITH A WATER DAMPENED CLOTH. DO NOT SAND, OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DISPOSE OF ALL RESIDUE CONTAINING ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE EXPOSURE TO YOURSELF AND OTHERS. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.

CAUTION: Use Mopar brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper antilock component operation.

CAUTION: Use Mopar multi-mileage or high temperature grease to lubricate caliper slide surfaces, drum brake pivot pins, and shoe contact points on the backing plates. Use multi-mileage grease or GE 661 or Dow 111 silicone grease on caliper slide pins to ensure proper operation.

BRAKE PEDAL

DESCRIPTION

A suspended-type brake pedal is used. The pedal is attached to the pedal support bracket with a pivot bolt and bushings. The booster push rod is attached to the pedal with a clip. The pedal, bushings, pivot pin and support bracket are all serviceable components.

OPERATION

The brake pedal is attached to the booster push rod. When the pedal is depressed, the primary booster push rod is depressed which move the booster secondary rod. The booster secondary rod depress the master cylinder piston.

STOP LAMP SWITCH

DESCRIPTION

The plunger type stop lamp switch is mounted on a bracket attached to the brake pedal support.

CAUTION: The switch can only be adjusted during initial installation. If the switch is not adjusted properly a new switch must be installed.

OPERATION

The brake lamp switch is used to for the brake lamp, speed control and brake sensor circuits. The brake lamp circuit is open until the plunger is

DESCRIPTION AND OPERATION (Continued)

depressed. The speed control and brake sensor circuits is closed until the plunger is depressed.

RED BRAKE WARNING LAMP

DESCRIPTION

A red warning lamp is used for the service brake portion of the hydraulic system. The lamp is located in the instrument cluster.

OPERATION

The red warning light alerts the driver if a pressure differential exists between the front and rear hydraulic systems or the parking brakes are applied. The lamp is turned on momentarily when the ignition switch is turn to the on position. This is a self test to verify the lamp is operational.

POWER BRAKE BOOSTER

DESCRIPTION

All models use a tandem diaphragm, power brake booster.

NOTE: The power brake booster is not a repairable component. The booster must be replaced as an assembly if diagnosis indicates a malfunction has occurred.

OPERATION

The booster unit consists of a single housing divided into two by a tandem diaphragm. The outer edge of the diaphragm is secured to the housing. The booster push rod, which connects the booster to the brake pedal and master cylinder, is attached to the center of the diaphragm. A check valve is used in the booster outlet connected to the engine intake manifold. Power assist is generated by utilizing a combination of vacuum and atmospheric pressure to boost brake assist.

MASTER CYLINDER

DESCRIPTION

A two-piece master cylinder is used on all models. The cylinder body containing the primary and secondary pistons is made of aluminum. The removable fluid reservoir is made of nylon reinforced with glass fiber. The reservoir stores reserve brake fluid for the hydraulic brake circuits. The reservoir is the only serviceable component.

The fluid compartments of the nylon reservoir are interconnected to permit fluid level equalization. However, the equalization feature does not affect circuit separation in the event of a front or rear brake malfunction. The reservoir compartments will retain enough fluid to operate the functioning hydraulic circuit.

Care must be exercised when removing/installing the master cylinder connecting lines. The threads in the cylinder fluid ports can be damaged if care is not exercised. Start all brake line fittings by hand to avoid cross threading.

The cylinder reservoir can be replaced when necessary. However, the aluminum body section of the master cylinder is not a repairable component.

NOTE: If diagnosis indicates that an internal malfunction has occurred, the aluminum body section must be replaced as an assembly.

OPERATION

The master cylinder bore contains a primary and secondary piston. The primary piston supplies hydraulic pressure to the front brakes. The secondary piston supplies hydraulic pressure to the rear brakes.

COMBINATION VALVE

DESCRIPTION

The combination valve contains a pressure differential valve and switch and a rear brake proportioning valve. The valve is not repairable and must be replaced as an assembly if diagnosis indicates this is necessary.

OPERATION

PRESSURE DIFFERENTIAL VALVE

The pressure differential switch is connected to the brake warning light. The switch is actuated by movement of the switch valve. The switch monitors fluid pressure in the separate front/rear brake hydraulic circuits.

A decrease or loss of fluid pressure in either hydraulic circuit will cause the switch valve to shuttle to the low pressure side. Movement of the valve pushes the switch plunger upward. This action closes the switch internal contacts completing the electrical circuit to the red warning light. The switch valve will remain in an actuated position until repairs to the brake system are made.

PROPORTIONING VALVE

The proportioning valve is used to balance front-rear brake action at high decelerations. The valve allows normal fluid flow during moderate braking. The valve only controls fluid flow during high decelerations brake stops.

DESCRIPTION AND OPERATION (Continued)

FRONT DISC BRAKES

DESCRIPTION

The calipers are a single piston type. The calipers are free to slide laterally, this allows continuous compensation for lining wear.

OPERATION

When the brakes are applied fluid pressure is exerted against the caliper piston. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bore will be equal (Fig. 1).

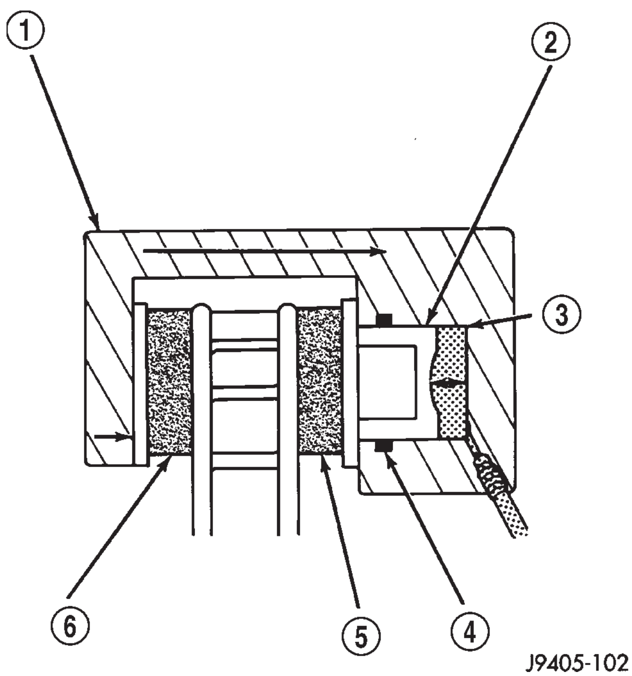


Fig. 1 Brake Caliper Operation

1 – CALIPER
2 – PISTON
3 – PISTON BORE
4 – SEAL
5 – INBOARD SHOE
6 – OUTBOARD SHOE

Fluid pressure applied to the piston is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the mounting bolts. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.

In summary, fluid pressure acting simultaneously on both piston and caliper, produces a strong clamping action. When sufficient force is applied, friction will attempt to stop the rotors from turning and bring the vehicle to a stop.

Application and release of the brake pedal generates only a very slight movement of the caliper and piston. Upon release of the pedal, the caliper and piston return to a rest position. The brake shoes do not retract an appreciable distance from the rotor. In fact, clearance is usually at, or close to zero. The reasons for this are to keep road debris from getting between the rotor and lining and in wiping the rotor surface clear each revolution.

The caliper piston seal controls the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seal is deflected outward by fluid pressure and piston movement (Fig. 2). When the brakes (and fluid pressure) are released, the seal relaxes and retracts the piston.

The amount of piston retraction is determined by the amount of seal deflection. Generally the amount is just enough to maintain contact between the piston and inboard brake shoe.

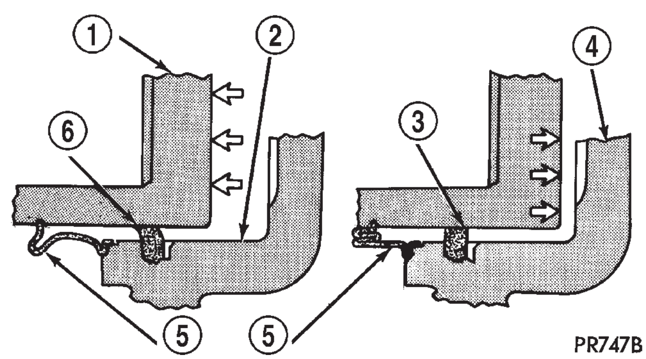


Fig. 2 Lining Wear Compensation By Piston Seal

1 – PISTON
2 – CYLINDER BORE
3 – PISTON SEAL BRAKE PRESSURE OFF
4 – CALIPER HOUSING
5 – DUST BOOT
6 – PISTON SEAL BRAKE PRESSURE ON

DRUM BRAKES

DESCRIPTION

Drum brakes on all models are dual shoe, internal expanding units with an automatic self adjusting mechanism (Fig. 3). Nine inch and eleven inch brakes are used.

OPERATION

When the brake pedal is depressed hydraulic pressure pushes the rear wheel cylinder pistons outward. The wheel cylinder push rods then push the brake shoes outward against the brake drum. When the brake pedal is released return springs attached to the brake shoes pull the shoes back to there original position.

DESCRIPTION AND OPERATION (Continued)

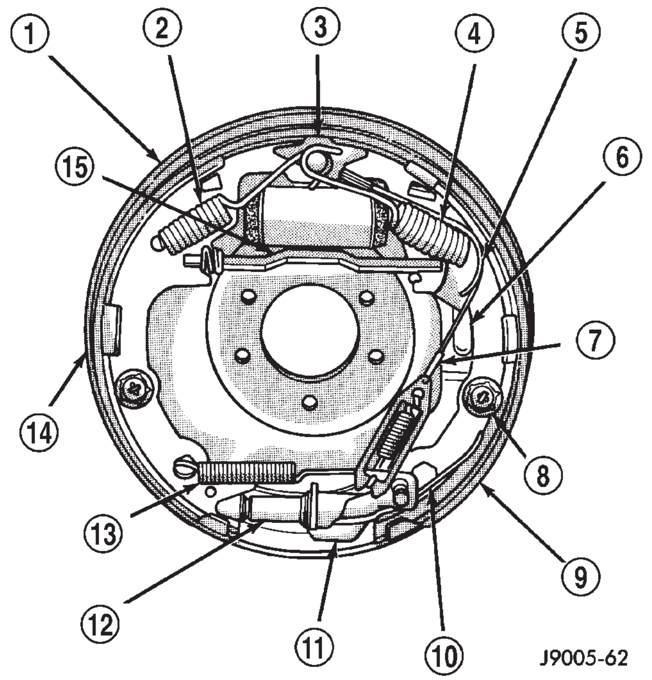


Fig. 3 Brake Assembly

1 – SUPPORT PLATE
2 – RETURN SPRING
3 – ANCHOR PLATE
4 – RETURN SPRING
5 – CABLE GUIDE
6 – PARKING BRAKE LEVER
7 – ADJUSTER CABLE AND SPRING
8 – SHOE RETAINER, SPRING AND PIN
9 – SECONDARY SHOE AND LINING
10 – LEVER SPRING
11 – ADJUSTER LEVER
12 – ADJUSTER SCREW ASSEMBLY
13 – SHOE SPRING
14 – PRIMARY SHOE AND LINING
15 – PARKING BRAKE STRUT AND SPRING

PARKING BRAKES

DESCRIPTION

The rear drum brake shoes serve as the parking brakes. The parking brakes are operated by a system of cables and levers attached to the rear brake secondary shoes.

OPERATION

The shoes make contact with the brake drum surface by a cable and lever mechanism attached to the secondary brake shoe. The front parking brake cable is connected to the parking brake pedal and to the rear cables. An intermediate cable is used on some vehicles to connect the front and rear cables.

The parking brake pedal assembly is mounted on the driver side cowl panel. The front cable is directly attached to the assembly. The pedal assembly contains a spring loaded mechanism to hold the pedal in the applied position. A rod and spring are used to release the ratchet mechanism and return the pedal to normal position.

BRAKE HOSES AND LINES

DESCRIPTION

Flexible rubber hose is used at both front brakes and at the rear axle junction block. Double walled steel tubing is used to connect the master cylinder to the major hydraulic braking components and then to the flexible rubber hoses. Double inverted style and ISO style flares are used on the brake lines.

OPERATION

The hoses and lines transmit the brake fluid hydraulic pressure to the calipers and or wheel cylinders.

DIAGNOSIS AND TESTING

BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, wheel cylinders, brake drums, rotors, brake lines, master cylinder, booster, and parking brake components.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, or vacuum operated component.

The first diagnosis step is the preliminary check.

PRELIMINARY BRAKE CHECK

(1) Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.

(2) If complaint was based on noise when braking, check suspension components. Jounce front and rear of vehicle and listen for noise that might be caused by loose, worn or damaged suspension or steering components.

(3) Inspect brake fluid level and condition. Note that the brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**

(a) If fluid level is abnormally low, look for evidence of leaks at calipers, wheel cylinders, brake lines, and master cylinder.

(b) If fluid appears contaminated, drain out a sample to examine. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals

and cups will also have to be replaced after flushing. Use clean brake fluid to flush the system.

(4) Check parking brake operation. Verify free movement and full release of cables and pedal. Also note if vehicle was being operated with parking brake partially applied.

(5) Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

(6) Check booster vacuum check valve and hose.

(7) If components checked appear OK, road test the vehicle.

ROAD TESTING

(1) If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.

(2) Check brake pedal response with transmission in Neutral and engine running. Pedal should remain firm under constant foot pressure.

(3) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.

(4) Attempt to stop the vehicle with the parking brake only and note grab, drag, noise, etc.

PEDAL FALLS AWAY

A brake pedal that falls away under steady foot pressure is generally the result of a system leak. The leak point could be at a brake line, fitting, hose, or caliper/wheel cylinder. If leakage is severe, fluid will be evident at or around the leaking component.

Internal leakage (seal by-pass) in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

An internal leak in the ABS or RWAL system may also be the problem with no physical evidence.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up worn linings, rotors, drums, or rear brakes out of adjustment are the most likely causes. The proper course of action is to inspect and replace all worn component and make the proper adjustments.

SPONGY PEDAL

A spongy pedal is most often caused by air in the system. However, thin brake drums or substandard brake lines and hoses can also cause a spongy pedal. The proper course of action is to bleed the system, and replace thin drums and substandard quality brake hoses if suspected.

HARD PEDAL OR HIGH PEDAL EFFORT

A hard pedal or high pedal effort may be due to lining that is water soaked, contaminated, glazed, or badly worn. The power booster or check valve could also be faulty.

PEDAL PULSATION

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation, or out of round brake drums. Other causes are loose wheel bearings or calipers and worn, damaged tires.

NOTE: Some pedal pulsation may be felt during ABS activation.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake shoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, wheels and tires are quite warm to the touch after the vehicle is stopped.

Severe drag can char the brake lining all the way through. It can also distort and score rotors and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Common causes of brake drag are:

- Seized or improperly adjusted parking brake cables.
- Loose/worn wheel bearing.
- Seized caliper or wheel cylinder piston.
- Caliper binding on corroded bushings or rusted slide surfaces.
- Loose caliper mounting.
- Drum brake shoes binding on worn/damaged support plates.
- Mis-assembled components.
- Long booster output rod.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port, or faulty power booster (binds-does not release).

BRAKE FADE

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating

DIAGNOSIS AND TESTING (Continued)

and resulting fade can also be caused by riding the brake pedal, making repeated high deceleration stops in a short time span, or constant braking on steep mountain roads. Refer to the Brake Drag information in this section for causes.

BRAKE PULL

Front brake pull condition could result from:
- Contaminated lining in one caliper
- Seized caliper piston
- Binding caliper
- Loose caliper
- Rusty caliper slide surfaces
- Improper brake shoes
- Damaged rotor

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. Remember that pull will return to the original direction, if the dragging brake unit is allowed to cool down (and is not seriously damaged).

REAR BRAKE GRAB OR PULL

Rear grab or pull is usually caused by improperly adjusted or seized parking brake cables, contaminated lining, bent or binding shoes and support plates, or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or proportioning valve could be at fault.

BRAKES DO NOT HOLD AFTER DRIVING THROUGH DEEP WATER PUDDLES

This condition is generally caused by water soaked lining. If the lining is only wet, it can be dried by driving with the brakes very lightly applied for a mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and/or replacement will be necessary.

BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers or wheel cylinders, worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

WHEEL AND TIRE PROBLEMS

Some conditions attributed to brake components may actually be caused by a wheel or tire problem.

A damaged wheel can cause shudder, vibration and pull. A worn or damaged tire can also cause pull.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. A tire with internal damage such as a severe bruise, cut, or ply separation can cause pull and vibration.

BRAKE NOISES

Some brake noise is common with rear drum brakes and on some disc brakes during the first few stops after a vehicle has been parked overnight or stored. This is primarily due to the formation of trace corrosion (light rust) on metal surfaces. This light corrosion is typically cleared from the metal surfaces after a few brake applications causing the noise to subside.

BRAKE SQUEAK/SQUEAL

Brake squeak or squeal may be due to linings that are wet or contaminated with brake fluid, grease, or oil. Glazed linings and rotors with hard spots can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake shoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors and drums can become so scored that replacement is necessary.

BRAKE CHATTER

Brake chatter is usually caused by loose or worn components, or glazed/burnt lining. Rotors with hard spots can also contribute to chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.

THUMP/CLUNK NOISE

Thumping or clunk noises during braking are frequently **not** caused by brake components. In many cases, such noises are caused by loose or damaged steering, suspension, or engine components. However, calipers that bind on the slide surfaces can generate a thump or clunk noise. In addition, worn out, improperly adjusted, or improperly assembled rear brake shoes can also produce a thump noise.

DIAGNOSIS AND TESTING (Continued)

BRAKE LAMP SWITCH

The brake lamp switch can be tested with an ohmmeter. The ohmmeter is used to check continuity between the pin terminals (Fig. 4).

SWITCH CIRCUIT IDENTIFICATION

- Terminals 1 and 2: brake lamp circuit
- Terminals 3 and 4: RWAL/ABS module and Powertrain Control Module (PCM) circuit
- Terminals 5 and 6: speed control circuit

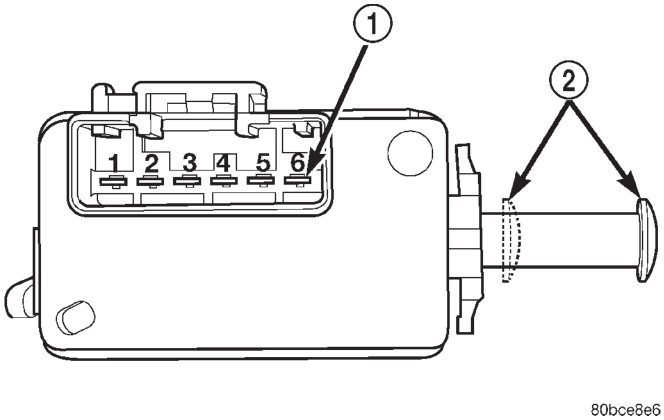


Fig. 4 Brake Lamp Switch Terminal Identification

1 – TERMINAL PINS
2 – PLUNGER TEST POSITIONS

SWITCH CONTINUITY TEST

NOTE: Disconnect switch harness before testing switch continuity.

With switch plunger extended, attach test leads to pins 1 and 2. Replace switch if meter indicates no continuity.

With switch plunger retracted, attach test leads to pins 3 and 4. Replace switch if meter indicates no continuity.

With switch plunger retracted, attach test leads to pins 5 and 6. Replace switch if meter indicates no continuity.

RED BRAKE WARNING LAMP

The red warning lamp is in circuit with the parking brake switch and pressure differential switch in the combination valve.

The red lamp illuminates when the parking brakes are applied, or when a pressure drop occurs in the front or rear brake hydraulic circuit.

The lamp illuminates for approximately 2-4 seconds at every engine start up. This is a self test feature designed to check bulb and circuit operation.

A pressure drop in the front or rear brake hydraulic circuit activates the pressure differential valve inside the combination valve. A pressure decrease moves the valve toward the low pressure side. As the valve moves, it pushes the pressure differential switch contact plunger upward. This closes the switch internal contacts and completes the circuit to the red warning lamp. The lamp will remain on until repairs are made and normal fluid pressure restored.

MASTER CYLINDER/POWER BOOSTER

(1) Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.

(2) Stop engine and shift transmission into Neutral.

(3) Pump brake pedal until all vacuum reserve in booster is depleted.

(4) Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away master cylinder is faulty (internal leakage).

(5) Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.

(6) If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and immediately turn off ignition to stop engine.

(7) Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, booster is faulty.

POWER BOOSTER VACUUM TEST

(1) Connect vacuum gauge to booster check valve with short length of hose and T-fitting (Fig. 5).

(2) Start and run engine at curb idle speed for one minute.

(3) Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.

(4) Clamp hose shut between vacuum source and check valve.

(5) Stop engine and observe vacuum gauge.

(6) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm or check valve is faulty.

POWER BOOSTER CHECK VALVE TEST

(1) Disconnect vacuum hose from check valve.

(2) Remove check valve and valve seal from booster.

(3) Use a hand operated vacuum pump for test.

(4) Apply 15-20 inches vacuum at large end of check valve (Fig. 6).

DIAGNOSIS AND TESTING (Continued)

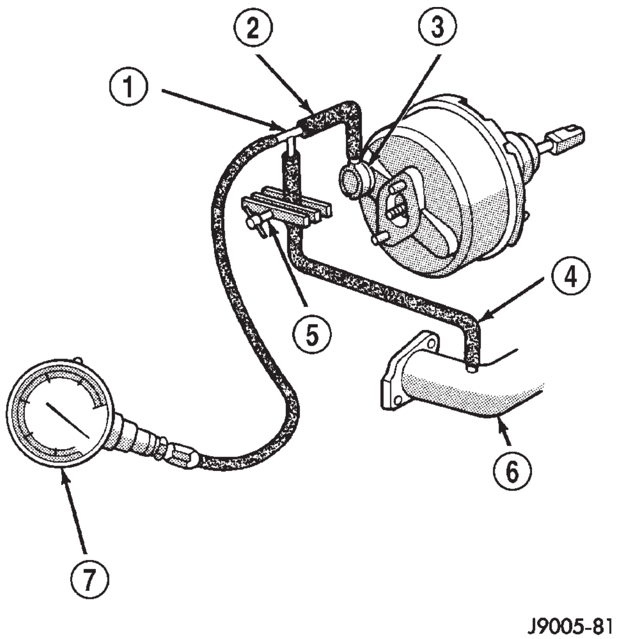


Fig. 5 Typical Booster Vacuum Test Connections

1 – TEE FITTING
2 – SHORT CONNECTING HOSE
3 – CHECK VALVE
4 – CHECK VALVE HOSE
5 – CLAMP TOOL
6 – INTAKE MANIFOLD
7 – VACUUM GAUGE

(5) Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.

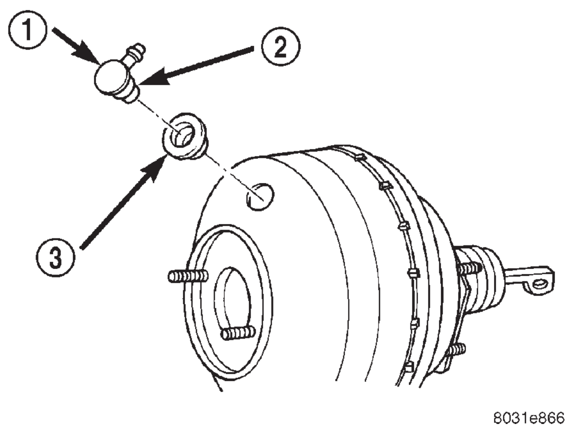


Fig. 6 Vacuum Check Valve And Seal

1 – BOOSTER CHECK VALVE
2 – APPLY TEST VACUUM HERE
3 – VALVE SEAL

COMBINATION VALVE

Pressure Differential Switch

(1) Have helper sit in drivers seat to apply brake pedal and observe red brake warning light.

(2) Raise vehicle on hoist.

(3) Connect bleed hose to a rear wheel cylinder and immerse hose end in container partially filled with brake fluid.

(4) Have helper press and hold brake pedal to floor and observe warning light.

(a) If warning light illuminates, switch is operating correctly.

(b) If light fails to illuminate, check circuit fuse, bulb, and wiring. The parking brake switch can be used to aid in identifying whether or not the brake light bulb and fuse is functional. Repair or replace parts as necessary and test differential pressure switch operation again.

(5) If warning light still does not illuminate, switch is faulty. Replace combination valve assembly, bleed brake system and verify proper switch and valve operation.

DISC BRAKE ROTOR

The rotor braking surfaces should not be refinished unless necessary.

Light surface rust and scale can be removed with a lathe equipped with dual sanding discs. The rotor surfaces can be restored by machining in a disc brake lathe if surface scoring and wear are light.

Replace the rotor under the following conditions:

- severely scored
- tapered
- hard spots
- cracked
- below minimum thickness

ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if worn below minimum thickness, or if machining would reduce thickness below the allowable minimum.

Rotor minimum thickness is usually specified on the rotor hub. The specification is either stamped or cast into the hub surface.

ROTOR RUNOUT

Check rotor lateral runout with dial indicator C-3339 (Fig. 7). Excessive lateral runout will cause brake pedal pulsation and rapid, uneven wear of the brake shoes. Position the dial indicator plunger approximately 25.4 mm (1 in.) inward from the rotor edge. Maximum allowable rotor runout is 0.102 mm (0.004 in.).

DIAGNOSIS AND TESTING (Continued)

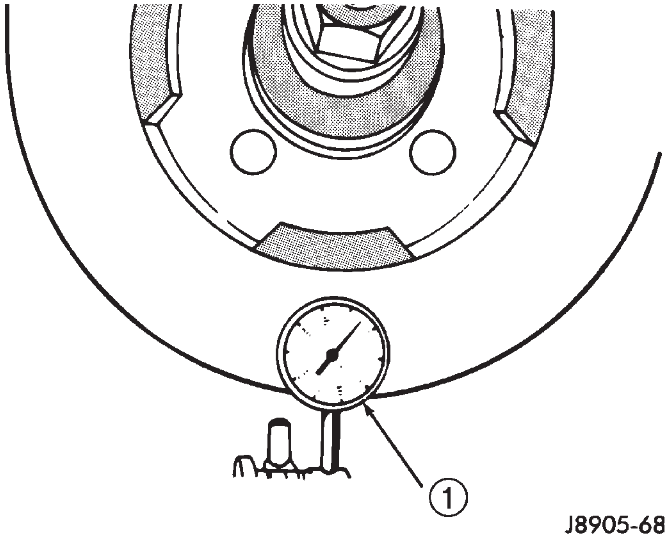


Fig. 7 Checking Rotor Runout And Thickness Variation

1 – DIAL INDICATOR

ROTOR THICKNESS VARIATION

Variations in rotor thickness will cause pedal pulsation, noise and shudder.

Measure rotor thickness at 6 to 12 points around the rotor face (Fig. 8).

Position the micrometer approximately 25.4 mm (1 in.) from the rotor outer circumference for each measurement.

Thickness should not **vary** by more than 0.013 mm (0.0005 in.) from point-to-point on the rotor. Machine or replace the rotor if necessary.

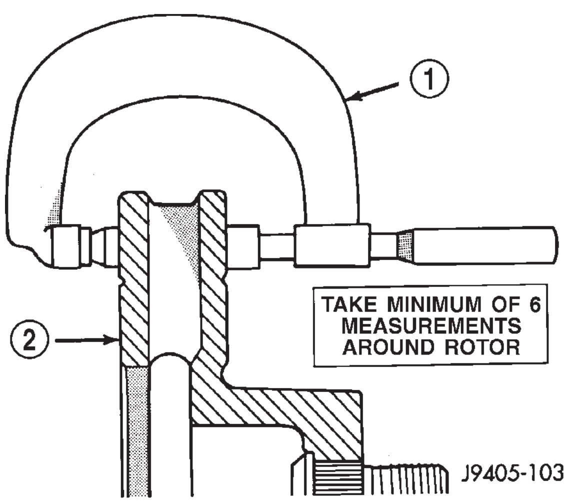


Fig. 8 Measuring Rotor Thickness

1 – MICROMETER
2 – ROTOR

BRAKE DRUM

The maximum allowable diameter of the drum braking surface is indicated on the drum outer edge. Generally, a drum can be machined to a maximum of 1.52 mm (0.060 in.) oversize. Always replace the drum if machining would cause drum diameter to exceed the size limit indicated on the drum.

BRAKE DRUM RUNOUT

Measure drum diameter and runout with an accurate gauge. The most accurate method of measurement involves mounting the drum in a brake lathe and checking variation and runout with a dial indicator.

Variations in drum diameter should not exceed 0.069 mm (0.0028 in.). Drum runout should not exceed 0.18 mm (0.007 in.) out of round. Machine the drum if runout or variation exceed these values. Replace the drum if machining causes the drum to exceed the maximum allowable diameter.

BRAKE LINE AND HOSES

Flexible rubber hose is used at both front brakes and at the rear axle junction block. Inspect the hoses whenever the brake system is serviced, at every engine oil change, or whenever the vehicle is in for service.

Inspect the hoses for surface cracking, scuffing, or worn spots. Replace any brake hose immediately if the fabric casing of the hose is exposed due to cracks or abrasions.

Also check brake hose installation. Faulty installation can result in kinked, twisted hoses, or contact with the wheels and tires or other chassis components. All of these conditions can lead to scuffing, cracking and eventual failure.

The steel brake lines should be inspected periodically for evidence of corrosion, twists, kinks, leaks, or other damage. Heavily corroded lines will eventually rust through causing leaks. In any case, corroded or damaged brake lines should be replaced.

Factory replacement brake lines and hoses are recommended to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that brake line and hose mating surfaces are clean and free from nicks and burrs. Also remember that right and left brake hoses are not interchangeable.

Use new copper seal washers at all caliper connections. Be sure brake line connections are properly made (not cross threaded) and tightened to recommended torque.

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

DIAGNOSIS AND TESTING (Continued)

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

SERVICE PROCEDURES

BRAKE FLUID LEVEL

Always clean the master cylinder reservoir and caps before checking fluid level. If not cleaned, dirt could enter the fluid.

The fluid fill level is indicated on the side of the master cylinder reservoir (Fig. 9).

The correct fluid level is to the FULL indicator on the side of the reservoir. If necessary, add fluid to the proper level.

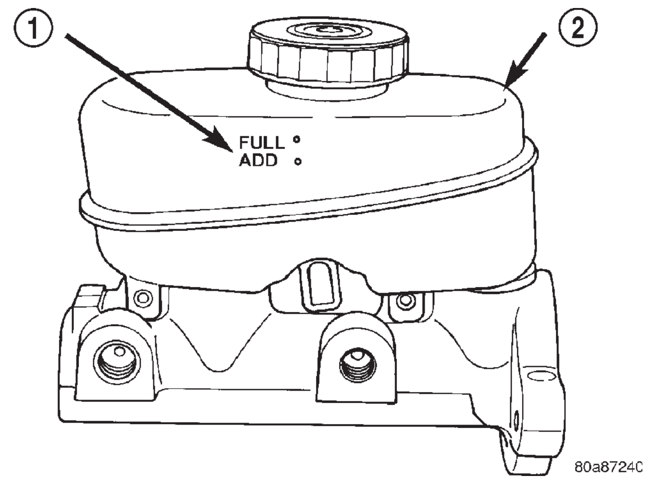


Fig. 9 Master Cylinder Fluid Level - Typical

1 – INDICATOR
2 – RESERVOIR

MASTER CYLINDER BLEEDING

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

BLEEDING PROCEDURE

(1) Mount master cylinder in vise.

(2) Attach bleed tubes to cylinder outlet ports. Then position each tube end into reservoir (Fig. 10).

(3) Fill reservoir with fresh brake fluid.

(4) Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.

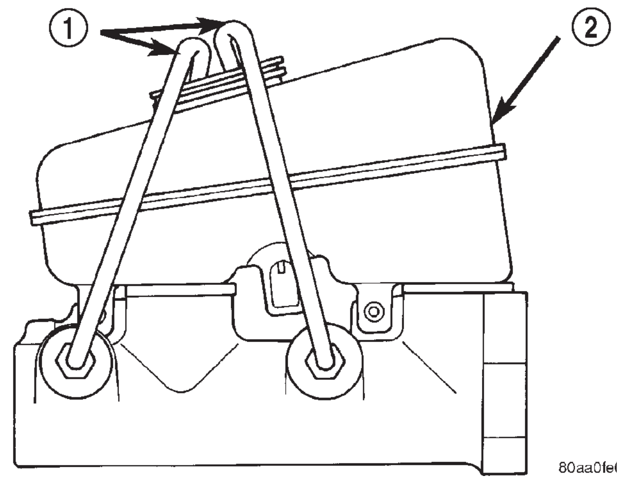


Fig. 10 Master Cylinder Bleeding–Typical

1 – BLEEDING TUBES
2 – RESERVOIR

BASE BRAKE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Do not pump the brake pedal at any time while bleeding. Air in the system will be compressed into small bubbles that are distributed throughout the hydraulic system. This will make additional bleeding operations necessary.

Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

Bleed only one brake component at a time in the following sequence:

- Master Cylinder
- Combination Valve
- Rear Antilock Valve
- Right Rear Wheel
- Left Rear Wheel
- Right Front Wheel
- Left Front Wheel

MANUAL BLEEDING

(1) Remove reservoir filler caps and fill reservoir.

(2) If calipers, or wheel cylinders were overhauled, open all caliper and wheel cylinder bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.

SERVICE PROCEDURES (Continued)

(3) Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid (Fig. 11). Be sure end of bleed hose is immersed in fluid.

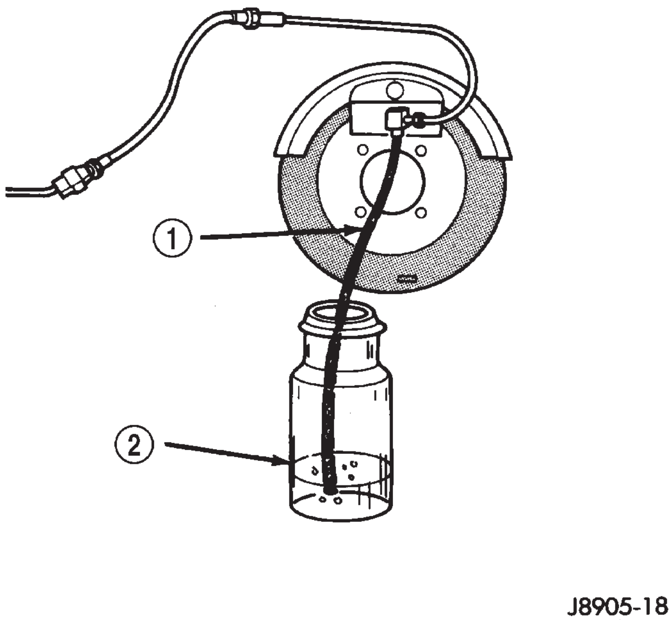


Fig. 11 Bleed Hose Setup

1 – BLEED HOSE
2 – FLUID CONTAINER PARTIALLY FILLED WITH FLUID

(4) Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.

PRESSURE BLEEDING

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter 6921.

DISC ROTOR MACHINING

The disc brake rotor can be machined if scored or worn. The lathe must machine both sides of the rotor simultaneously with dual cutter heads. The rotor mounting surface must be clean before placing on the lathe. Equipment capable of machining only one side at a time may produce a tapered rotor.

NOTE: A hub mounted on-vehicle lathe is recommended. This type of lathe trues the rotor to the vehicles hub/bearing.

CAUTION: Brake rotors that do not meet minimum thickness specifications before or after machining must be replaced.

BRAKE DRUM MACHINING

The brake drums can be machined on a drum lathe when necessary. Initial machining cuts should be limited to 0.12 - 0.20 mm (0.005 - 0.008 in.) at a time as heavier feed rates can produce taper and surface variation. Final finish cuts of 0.025 to 0.038 mm (0.001 to 0.0015 in.) are recommended and will generally provide the best surface finish.

Be sure the drum is securely mounted in the lathe before machining operations. A damper strap should always be used around the drum to reduce vibration and avoid chatter marks.

The maximum allowable diameter of the drum braking surface is stamped or cast into the drum outer edge.

CAUTION: Replace the drum if machining will cause the drum to exceed the maximum allowable diameter.

BRAKE TUBE FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

Special bending tools are needed to avoid kinking or twisting of metal brake tubes. Special flaring tools are needed to make a double inverted flare or ISO flare (Fig. 12).

DOUBLE INVERTED FLARING

(1) Cut off damaged tube with Tubing Cutter.

(2) Ream cut edges of tubing to ensure proper flare.

(3) Install replacement tube nut on the tube.

(4) Insert tube in flaring tool.

(5) Place gauge form over the end of the tube.

(6) Push tubing through flaring tool jaws until tube contacts recessed notch in gauge that matches tube diameter.

(7) Tighten the tool bar on the tube

(8) Insert plug on gauge in the tube. Then swing compression disc over gauge and center tapered flaring screw in recess of compression disc (Fig. 13).

SERVICE PROCEDURES (Continued)

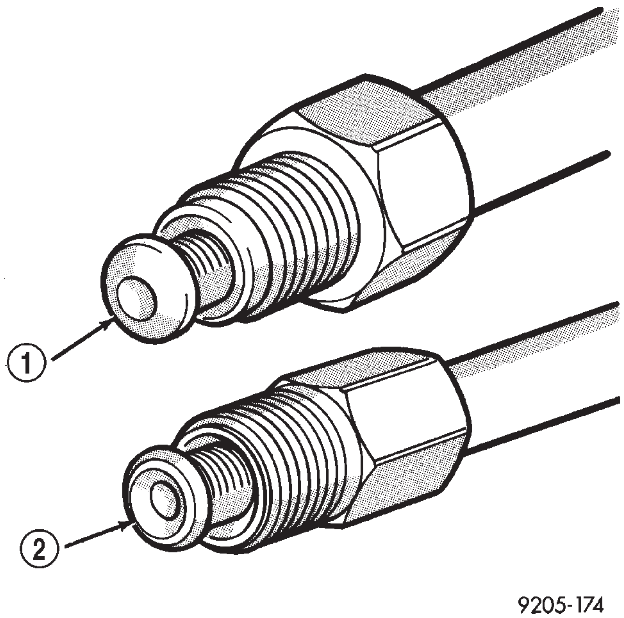


Fig. 12 Inverted Flare And ISO Flare

1 – ISO-STYLE FLARE
2 – DOUBLE INVERTED-STYLE FLARE

(9) Tighten tool handle until plug gauge is squarely seated on jaws of flaring tool. This will start the inverted flare.

(10) Remove the plug gauge and complete the inverted flare.

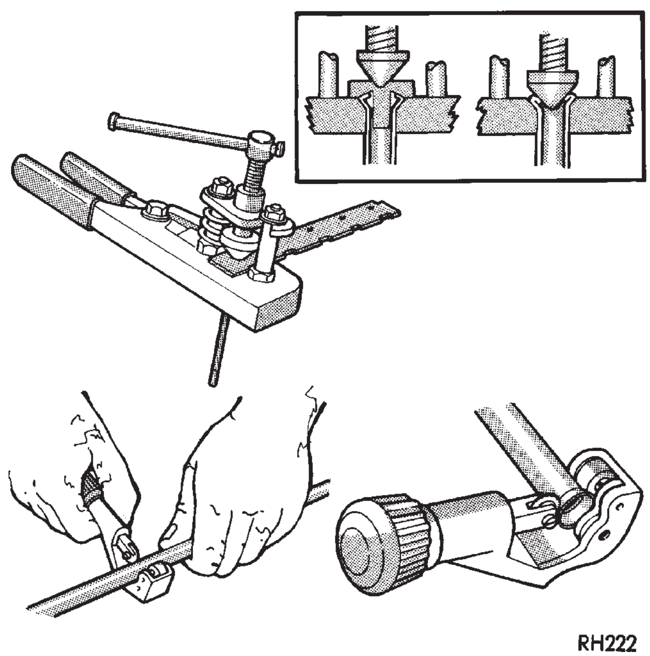


Fig. 13 Inverted Flare Tools

ISO FLARING

To make a ISO flare use Snap-On® Flaring Tool TFM-428 or equivalent.

(1) Cut off damaged tube with Tubing Cutter.

(2) Remove any burrs from the inside of the tube.

(3) Install tube nut on the tube.

(4) Position the tube in the flaring tool flush with the top of the tool bar (Fig. 14). Then tighten the tool bar on the tube.

(5) Install the correct size adaptor on the flaring tool yoke screw.

(6) Lubricate the adaptor.

(7) Align the adaptor and yoke screw over the tube (Fig. 14).

(8) Turn the yoke screw in until the adaptor is squarely seated on the tool bar.

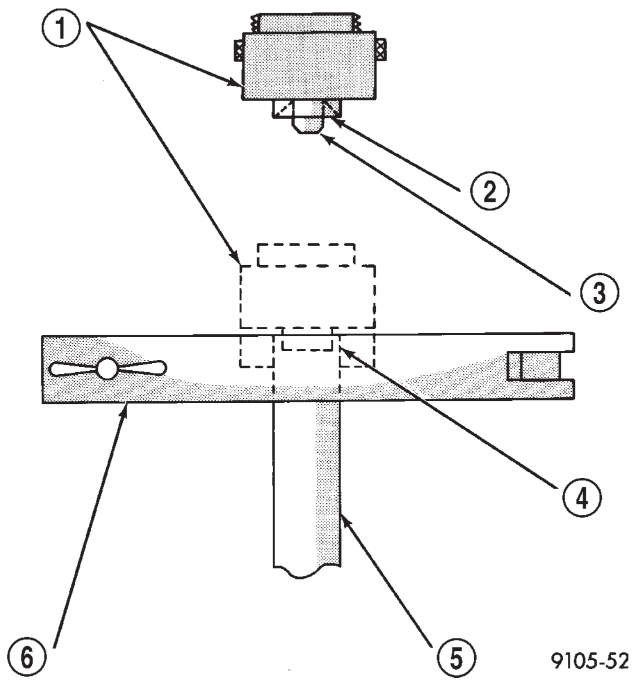


Fig. 14 ISO Flaring

1 – ADAPTER
2 – LUBRICATE HERE
3 – PILOT
4 – FLUSH WITH BAR
5 – TUBING
6 – BAR ASSEMBLY

REMOVAL AND INSTALLATION

BRAKE LAMP SWITCH

REMOVAL

(1) Disconnect switch harness (Fig. 15).

(2) Press and hold brake pedal in applied position.

(3) Rotate switch counterclockwise about 30° to align switch lock tab with notch in bracket.

(4) Pull switch rearward out of mounting bracket and release brake pedal.

REMOVAL AND INSTALLATION (Continued)

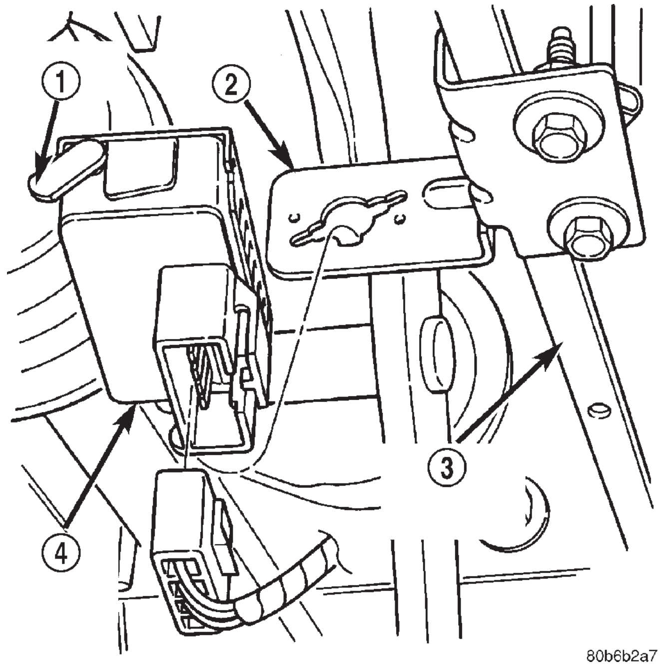


Fig. 15 Brake Lamp Switch & Bracket

1 – RELEASE LEVER
2 – BRACKET
3 – BRAKE PEDAL SUPPORT
4 – BRAKE LAMP SWITCH

INSTALLATION

(1) Press and hold brake pedal down.

(2) Align tab on **new** switch with notch in switch bracket. Then insert switch in bracket and turn it clockwise about 30° to lock it in place.

(3) Connect harness wires to switch.

(4) Release brake pedal.

(5) Move the release lever (Fig. 15) on the switch to engage the switch plunger. The switch is now adjusted and **can not** be adjusted again.

BRAKE PEDAL

REMOVAL

(1) Remove stop lamp switch.

(2) Remove clip securing booster push rod to brake pedal (Fig. 16).

(3) Remove pedal pivot pin C-clip and slide pin out of support bracket and pedal.

(4) Remove pedal and bushings.

INSTALLATION

(1) Replace bushings if worn or damaged.

(2) Lubricate pedal bushings and pivot pin with Mopar multi mileage grease, Lubriplate, or a silicone grease.

(3) Install bushings in pedal and position pedal in support.

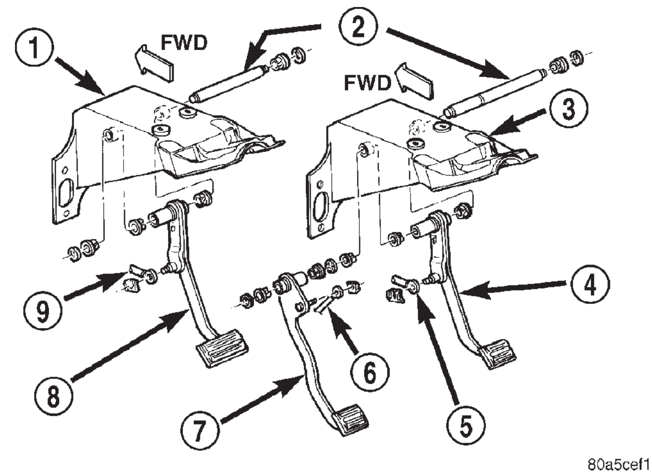


Fig. 16 Brake Pedal Mounting

1 – PEDAL SUPPORT
2 – PIVOT ROD
3 – PEDAL SUPPORT
4 – BRAKE PEDAL
5 – BOOSTER ROD
6 – CLUTCH ROD
7 – CLUTCH PEDAL
8 – BRAKE PEDAL
9 – BOOSTER ROD

(4) Insert pivot pin through support and pedal bushings and install C-clip.

(5) Install booster push rod on brake pedal and install push rod retainer clip.

(6) Install stop lamp switch.

COMBINATION VALVE

REMOVAL

(1) Disconnect wire from the pressure differential switch.

(2) Disconnect rear brake lines from combination valve.

(3) Remove the bolt from the combination valve and remove the valve.

INSTALLATION

(1) Install the combination valve to the bracket and tighten the mounting bolt to 20-27 N·m (15-20 ft. lbs.). If vehicle is equipped with ABS brakes tighten the bolt to 10-13 N·m (7-10 ft. lbs.).

(2) Install the brake lines to the combination valve.

(3) Tighten the brake line to 19 N·m (170 in. lbs.).

(4) Connect the wire to the pressure differential switch.

(5) Bleed brakes system.

REMOVAL AND INSTALLATION (Continued)

MASTER CYLINDER

REMOVAL

(1) Remove brake lines from the master cylinder (Fig. 17).

(2) Remove mounting nuts from the master cylinder (Fig. 17).

(3) Remove master cylinder.

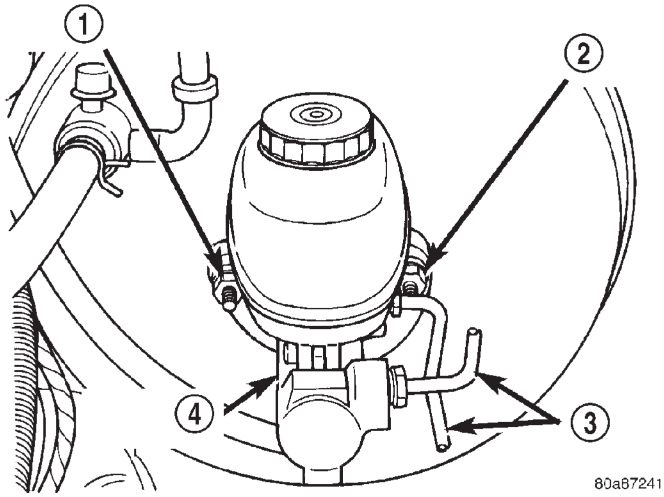


Fig. 17 Master Cylinder

1 – MOUNTING NUT
2 – MOUNTING NUT
3 – BRAKE LINES
4 – MASTER CYLINDER

INSTALLATION

NOTE: If master cylinder is replaced bleed cylinder before installation.

(1) Install master cylinder on booster mounting studs.

(2) Install mounting nuts and tighten to 18 N·m (160 in. lbs.)

(3) Install brake lines and tighten to 19 N·m (170 in. lbs.)

(4) Fill and bleed base brake system.

POWER BRAKE BOOSTER

REMOVAL

(1) Remove master cylinder.

(2) Disconnect vacuum lines at booster.

(3) Remove clip securing booster push rod to brake pedal (Fig. 18).

(4) Remove nuts from booster mounting studs (Fig. 19).

(5) Remove booster, spacer and gaskets from front cowl panel.

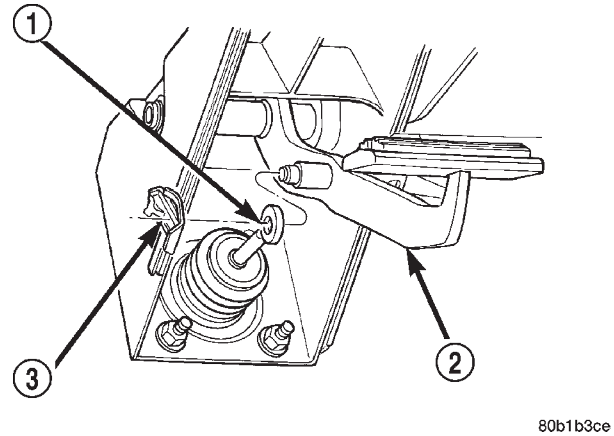


Fig. 18 Booster Rod Clip

1 – BOOSTER ROD
2 – BRAKE PEDAL
3 – CLIP

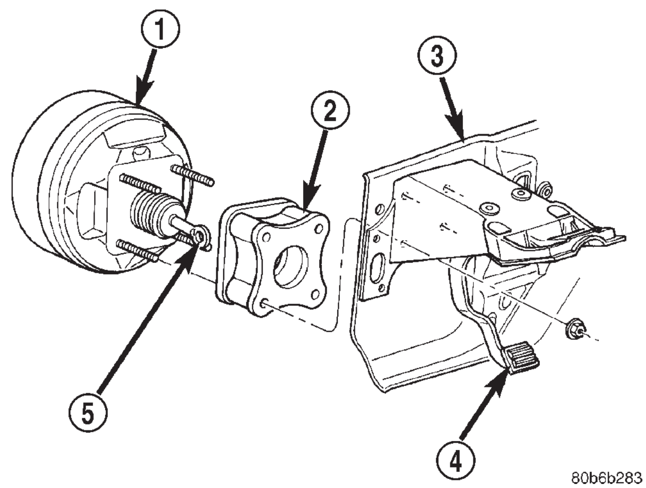


Fig. 19 Power Brake Booster Mounting

1 – BRAKE BOOSTER
2 – SPACER
3 – FRONT COWL PANEL
4 – BRAKE PEDAL
5 – BRAKE BOOSTER ROD

INSTALLATION

(1) Position spacer and gaskets on booster studs.

(2) Guide booster studs into cowl panel holes and seat booster on panel.

(3) Install and tighten booster attaching nuts to 28 N·m (250 in. lbs.).

(4) Install booster push rod on brake pedal and install clip.

(5) Install booster check valve if removed and connect vacuum hose to check valve.

(6) Install master cylinder.

(7) Fill and bleed brake system.

REMOVAL AND INSTALLATION (Continued)

DISC BRAKE CALIPER

REMOVAL

(1) Clean master cylinder reservoir and filler caps.

(2) Remove reservoir filler cap and drain approximately 1/4 of fluid from reservoir. Use clean suction gun or similar device to drain fluid.

(3) Raise and support vehicle.

(4) Remove front wheel and tire assemblies.

(5) Bottom caliper pistons in bores with large C-clamp. Position clamp frame on rear of caliper and clamp screw on outboard brake shoe.

(6) Disconnect brake hose at caliper. Discard hose fitting washers if worn, or damaged (Fig. 20).

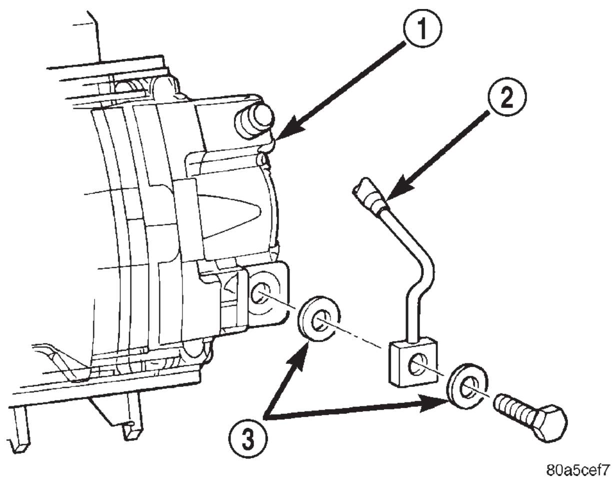


Fig. 20 Caliper Brake Hose Connection

1 – CALIPER
2 – FRONT BRAKE HOSE
3 – FITTING WASHERS

(7) With a screw driver pry up on the caliper spring and pull the spring out of the caliper holes.

(8) Remove caliper and brake shoes from caliper.

INSTALLATION

(1) Install brake shoes in caliper.

(2) Install caliper and shoes over rotor and into ledges in steering knuckle. Be sure ends of brake shoes are properly seated on slide surfaces of ledges.

(3) Install and tighten caliper slide pins to 30 N·m (22 ft. lbs.). **Start the slide pins by hand before tightening. Do not cross thread the pins.**

(4) Install caliper spring into one caliper hole and under the adapter. Pull down on the opposite end of the spring (Fig. 21) and hold the end under the adapter. With a scew driver pry up on the spring (Fig. 22) to seat the spring into the other caliper hole.

NOTE: Verify the spring is seated properly into the caliper holes.

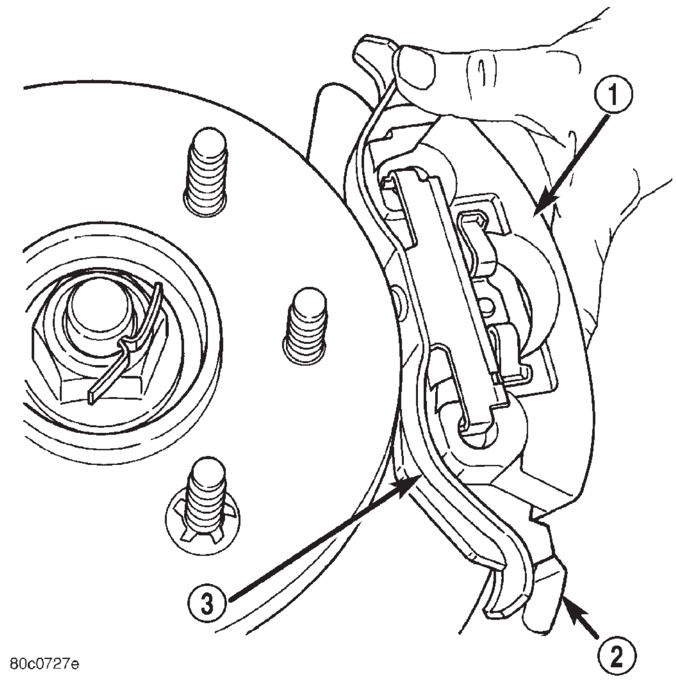


Fig. 21 Caliper Spring

1 – CALIPER
2 – ADAPTER
3 – CALIPER SPRING

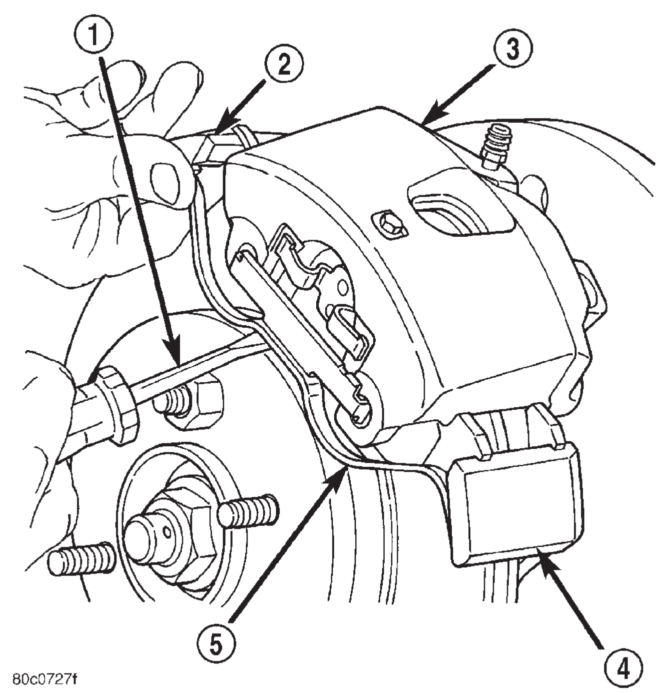


Fig. 22 Seat Caliper Spring

1 – SCREWDRIVER
2 – ADAPTER
3 – CALIPER
4 – ADAPTER
5 – CALIPER SPRING

REMOVAL AND INSTALLATION (Continued)

(5) Install brake hose to caliper with **new seal washers** and tighten fitting bolt to 24 N·m (18 ft. lbs.).

CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.

(6) Bleed base brake system.
(7) Install wheel and tire assemblies.
(8) Remove supports and lower vehicle.
(9) Pump brake pedal to seat brake shoes.
(10) Fill brake fluid reservoir.
(11) Verify firm pedal before moving vehicle.

DISC BRAKE SHOES

REMOVAL

(1) Clean master cylinder reservoir and filler caps.
(2) Remove reservoir filler cap and drain approximately 1/4 of fluid from reservoir. Use clean suction gun or similar device to drain fluid.
(3) Raise and support vehicle.
(4) Remove front wheel and tire assemblies.
(5) Bottom caliper pistons in bores with large C-clamp. Position clamp frame on rear of caliper and clamp screw on outboard brake shoe.
(6) With a screw driver pry up on the caliper spring and pull the spring out of the caliper holes.
(7) Remove caliper slide pins.
(8) Remove caliper and brake shoes (Fig. 23).

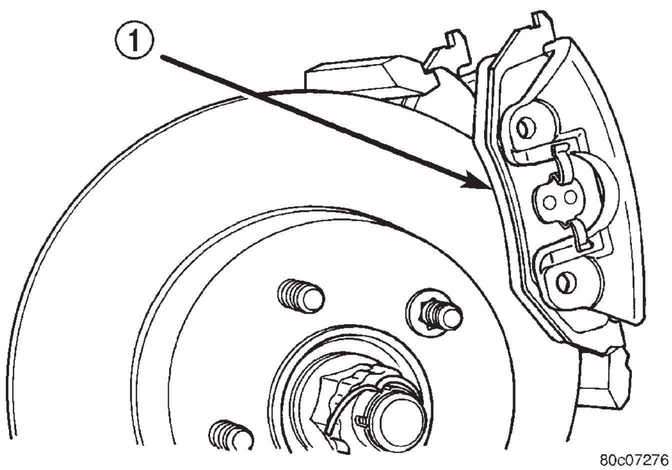


Fig. 23 Removing Caliper Assembly
1 – CALIPER AND BRAKE SHOES

(9) Remove outboard brake shoe (Fig. 24). Pry one end of shoe retainer spring away from caliper. Then tilt shoe upward and rotate it out of caliper.
(10) Remove inboard shoe by tilting shoe outward until retainer spring is clear of caliper piston (Fig. 25).

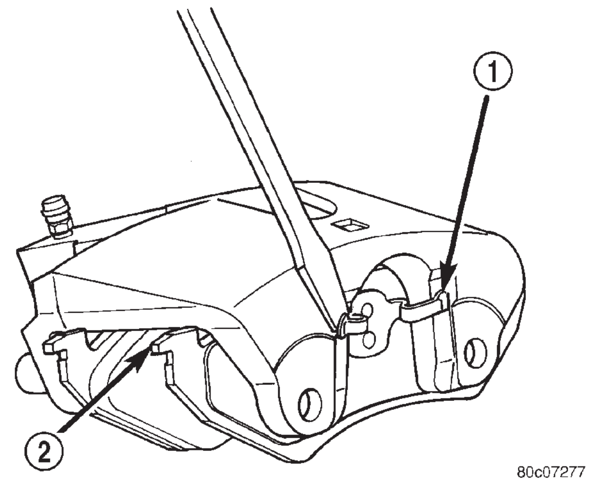


Fig. 24 Outboard Brake Shoe
1 – SHOE SPRING
2 – OUTBOARD SHOE

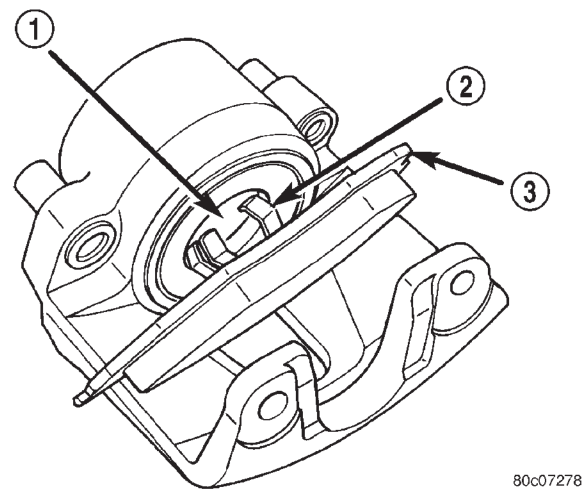


Fig. 25 Inboard Brake Shoe
1 – CALIPER PISTON
2 – RETAINER SPRING
3 – INBOARD SHOE

(11) Support caliper with wire from suspension component. Do not allow brake hose to support caliper weight.

INSTALLATION

(1) Clean slide surfaces of adapter ledges with a wire brush. Then lubricate surfaces with a thin coat of high temperature grease.
(2) Install new slide pin bushings if necessary.
(3) Install inboard shoe. Be sure retainer spring is firmly seated in caliper piston.
(4) Insert outboard brake shoe in caliper (Fig. 26).
(5) Insure the outboard shoe retainer spring are seated in the caliper (Fig. 27).

REMOVAL AND INSTALLATION (Continued)

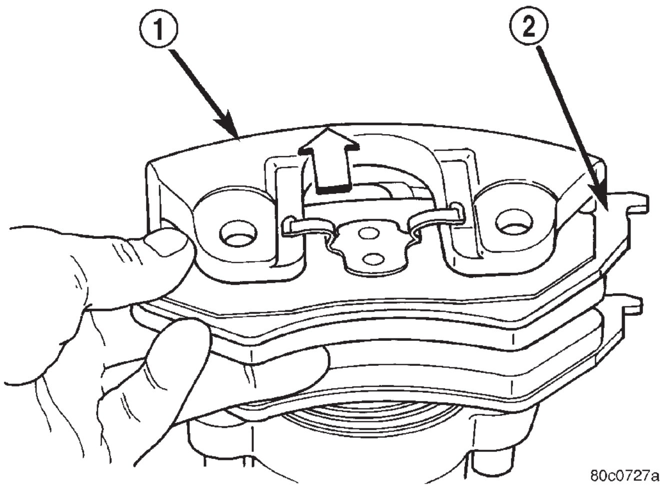


Fig. 26 Installing Outboard Shoe

1 – CALIPER
2 – OUTBOARD SHOE

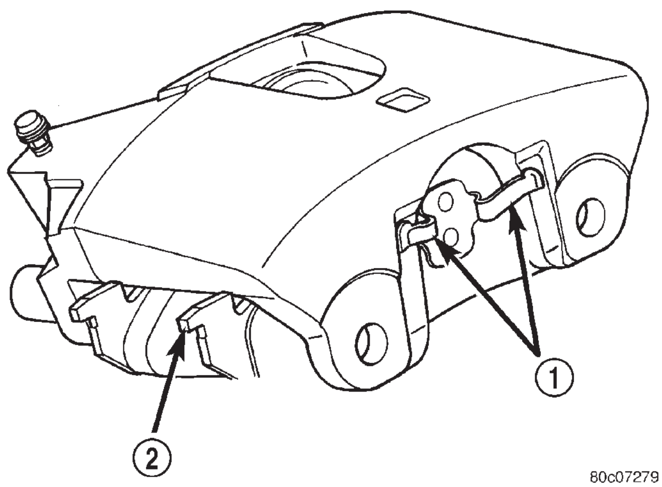


Fig. 27 Outboard Shoe Retainer Spring

1 – SEAT RETAINER SPRING ENDS IN CALIPER
2 – OUTBOARD SHOE

(6) Install caliper and brake shoes over rotor and into adapter.

(7) Install and tighten caliper slide pins to 30 N·m (22 ft. lbs.). **Start the slide pins by hand before tightening. Do not cross thread the pins.**

(8) Install caliper spring into one caliper hole and under the adapter. Pull down on the opposite end of the spring (Fig. 28) and hold the end under the adapter. With a screw driver pry up on the spring (Fig. 29) to seat the spring into the other caliper hole.

NOTE: Verify the spring is seated properly into the caliper holes.

(9) Install wheel and tire assembly.

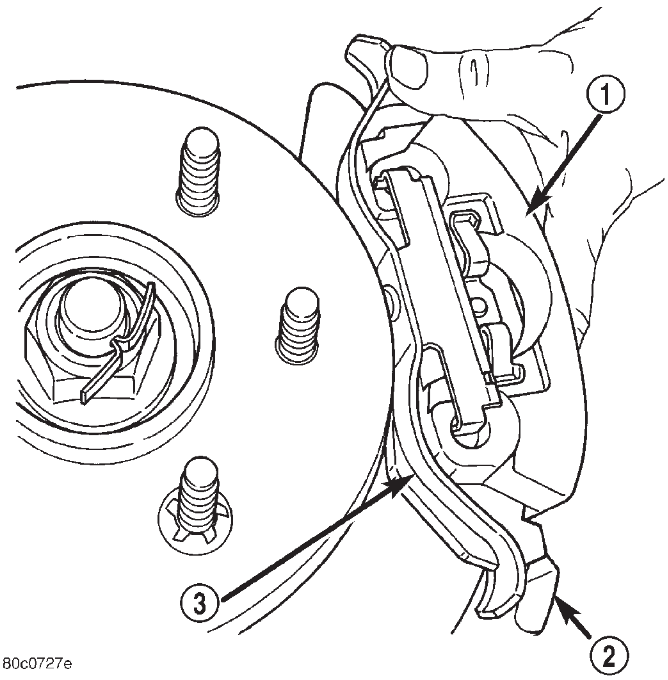


Fig. 28 Caliper Spring

1 – CALIPER
2 – ADAPTER
3 – CALIPER SPRING

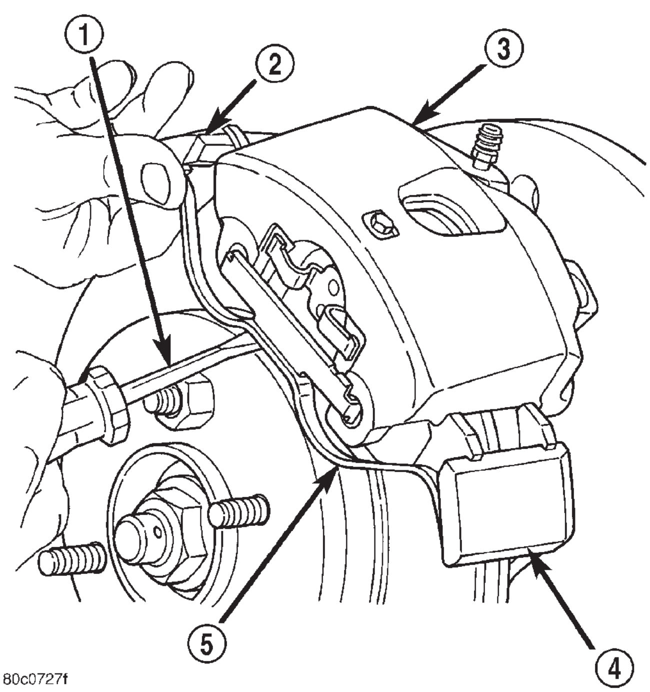


Fig. 29 Seat Caliper Spring

1 – SCREWDRIVER
2 – ADAPTER
3 – CALIPER
4 – ADAPTER
5 – CALIPER SPRING

REMOVAL AND INSTALLATION (Continued)

(10) Remove support and lower vehicle.
(11) Pump brake pedal to seat brake shoes.
(12) Fill brake fluid reservoir.
(13) Verify a firm brake pedal before moving vehicle.

DISC BRAKE ROTOR

REMOVAL

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Remove brake caliper.
(4) Remove retainers on wheel studs and remove rotor.

INSTALLATION

(1) Install rotor hub and install retainers.
(2) Install brake caliper.
(3) Install wheel and tire assembly.
(4) Remove support and lower vehicle.
(5) Depress brake pedal several time to seat brake shoes.

REAR BRAKE SHOES

REMOVAL

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Remove clip nuts securing brake drum to wheel studs.
(4) Remove drum. If drum is difficult to remove, remove rear plug from access hole in support plate. Back-off self adjusting by inserting a thin screwdriver into access hole and push lever away from adjuster screw star wheel. Then insert an adjuster tool into brake adjusting hole rotate adjuster star wheel to retract brake shoes.
(5) Vacuum brake components to remove brake lining dust.
(6) Remove shoe return springs with brake spring plier tool (Fig. 30).
(7) Remove adjuster cable. Slide cable eye off anchor pin. Then unhook and remove cable from adjuster lever.
(8) Remove cable guide from secondary shoe and anchor plate from anchor pin.
(9) Remove adjuster lever. Disengage lever from spring by sliding lever forward to clear pivot and work lever out from under spring.
(10) Remove adjuster lever spring from pivot.
(11) Disengage and remove shoe spring from brake shoes.
(12) Disengage and remove adjuster screw assembly from brake shoes.
(13) Remove brake shoe retainers, springs (Fig. 31).

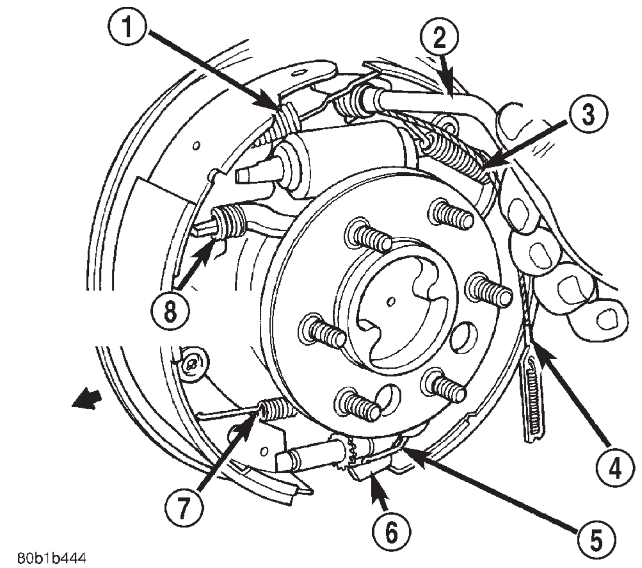


Fig. 30 Shoe Return Springs

1 – SHOE RETURN SPRING
2 – SPECIAL TOOL (REMOVING AND INSTALLING)
3 – SHOE RETURN SPRING
4 – ADJUSTER CABLE
5 – LEVER SPRING
6 – ADJUSTER LEVER
7 – SHOE TO SHOE SPRING
8 – ANTI—RATTLE SPRING

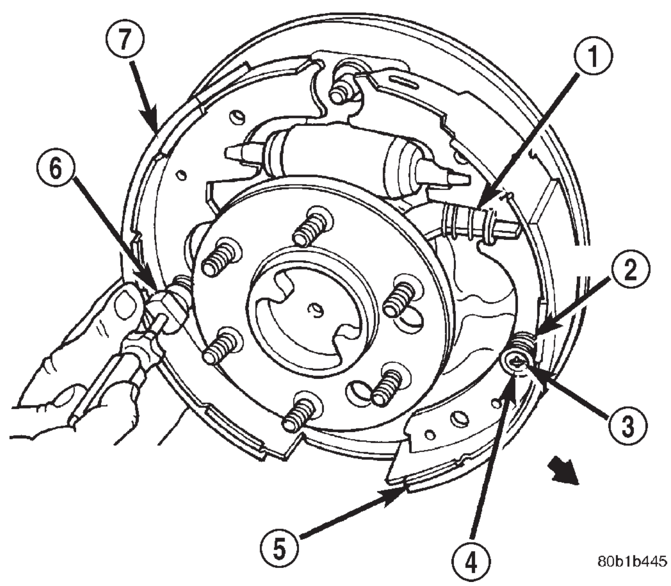


Fig. 31 Shoe Retainers, Springs and Pins

1 – STRUT AND SPRING
2 – SPRING
3 – PIN
4 – RETAINER
5 – PRIMARY SHOE AND LINING
6 – TOOL C—4070
7 – SECONDARY SHOE AND LINING

REMOVAL AND INSTALLATION (Continued)

(14) Remove secondary brake shoe from support plate.

(15) Remove strut and spring (Fig. 31).

(16) Remove parking brake lever retaining clip from the secondary shoe and remove the lever.

(17) Remove primary shoe from support plate.

(18) Disengage parking brake lever from parking brake cable.

INSTALLATION

(1) Clean and inspect individual brake components, refer to Cleaning and Inspection Section.

(2) Lubricate anchor pin and brake shoe contact pads on support plate with high temperature grease or Lubriplate (Fig. 32).

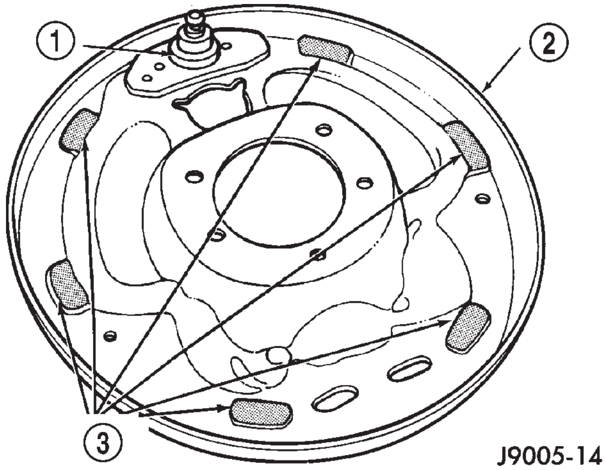


Fig. 32 Shoe Contact Surfaces

1 – ANCHOR PIN
2 – SUPPORT PLATE
3 – SHOE CONTACT SURFACES

(3) Lubricate adjuster screw socket, nut, button and screw thread surfaces with grease or Lubriplate.

(4) Install the parking brake cable to the parking brake lever.

(5) Install parking brake lever to the secondary shoe and install retaining clip.

(6) Install primary shoe on support plate. Secure shoe with new spring retainers and pin.

(7) Install spring on parking brake strut and engage strut in primary.

(8) Install secondary shoe on support plate (Fig. 33). Insert strut in shoe and guide shoe onto anchor pin. Temporarily secure shoe with retaining pin.

(9) Install anchor plate and adjuster cable eyelet on support plate anchor pin.

(10) Install cable guide in secondary shoe and position cable in guide.

(11) Assemble adjuster screw (Fig. 34). Then install and adjuster screw between the brake shoes.

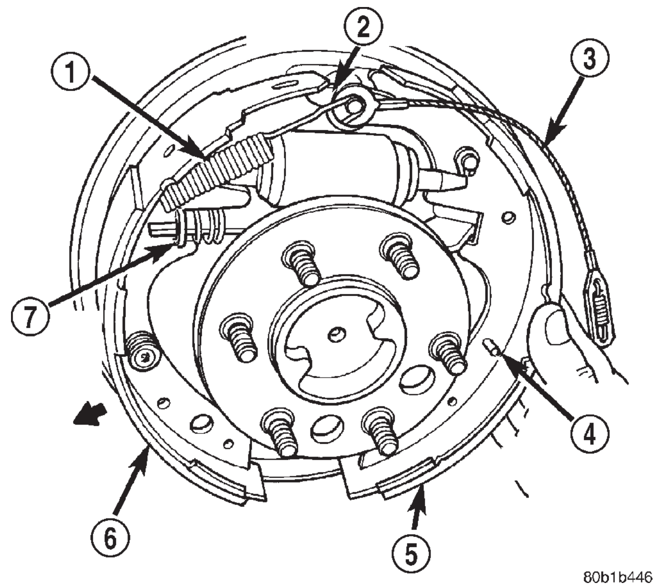


Fig. 33 Brake Shoe Installation

1 – SHOE RETURN SPRING
2 – ANCHOR PLATE
3 – ADJUSTER CABLE
4 – SHOE RETAINING PIN
5 – SECONDARY SHOE AND LINING
6 – PRIMARY SHOE AND LINING
7 – STRUT AND SPRING

CAUTION: Be sure the adjuster screws are installed on the correct brake unit. The adjuster screws are marked L (left) and R (right) for identification.

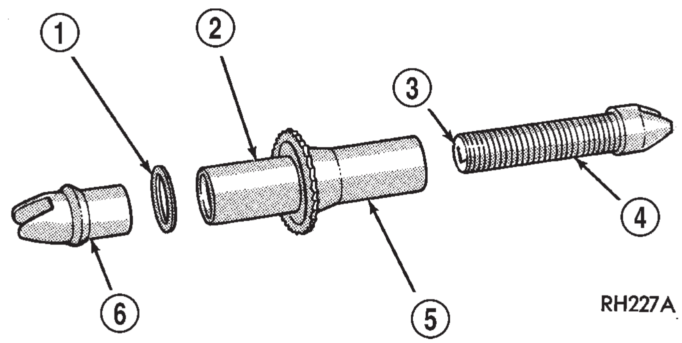


Fig. 34 Adjuster Screw

1 – WASHER
2 – SOCKET
3 – STAMPED LETTER
L-LEFT BRAKE
R-RIGHT BRAKE
4 – SCREW THREADS
5 – NUT
6 – BUTTON

(12) Install adjuster lever and spring and connect adjuster cable to lever.

(13) Install secondary shoe retainers and spring.

REMOVAL AND INSTALLATION (Continued)

(14) Install shoe spring. Connect spring to secondary shoe first. Then to primary shoe.

(15) Verify adjuster operation. Pull adjuster cable upward, cable should lift lever and rotate star wheel. Be sure adjuster lever properly engages star wheel teeth.

(16) Adjust brake shoes to drum with brake gauge.

(17) Install wheel and tire assembly.

WHEEL CYLINDER

REMOVAL

(1) Remove wheel and tire assembly.

(2) Remove brake drum.

(3) Disconnect wheel cylinder brake line.

(4) Remove brake shoe return springs and move shoes out of engagement with cylinder push rods.

(5) Remove cylinder attaching bolts and remove cylinder from support plate.

INSTALLATION

(1) Apply bead of silicone sealer around cylinder mounting surface of support plate.

(2) Install cylinder mounting bolts and tighten to 20 N·m (15 ft. lbs.).

(3) Connect brake line to cylinder.

(4) Install brake shoe return spring.

(5) Install brake drum.

(6) Install wheel and tire assembly.

(7) Bleed base brake system.

BRAKE SUPPORT PLATE

REMOVAL

(1) Remove wheel and tire assembly and brake drum.

(2) Remove brake shoe assembly.

(3) Remove parking brake cable from parking brake lever.

(4) Compress parking brake cable retainer tabs. Then push retainer and cable through and out of support plate.

(5) Disconnect brake line at wheel cylinder.

(6) Remove wheel cylinder from support plate.

(7) Remove axle shaft, refer to Group 3 for procedures.

(8) Remove bolts attaching support plate to axle and remove support plate.

INSTALLATION

(1) Apply bead of silicone sealer around axle mounting surface of support plate.

(2) Install support plate on axle flange. Tighten attaching bolts to 115 N·m (85 ft. lbs.).

(3) Apply bead of silicone sealer around wheel cylinder mounting surface and install wheel cylinder.

(4) Install brake line in wheel cylinder.

(5) Install parking brake cable in support plate.

(6) Install axle shaft, refer to Group 3 for procedure.

(7) Connect parking brake cable to lever on secondary shoe and install brake shoes on support plate.

(8) Adjust brake shoes to drum with brake gauge.

(9) Install brake drum and wheel and tire assembly.

(10) Bleed brake system.

FRONT PARK BRAKE CABLE

REMOVAL

(1) Raise and support the vehicle.

(2) Loosen cable adjusting nut.

(3) Disengage front cable (Fig. 35) from cable tensioner.

(4) Remove support cable from the front cable (Fig. 36).

(5) Remove support and lower vehicle.

(6) Remove left kick panel.

(7) Fold left front edge of floor covering rearward and remove cable grommet from floor pan (Fig. 36).

(8) Remove cable from park brake pedal assembly.

(9) Work cable and housing assembly up through floor pan.

(10) Remove front cable from vehicle.

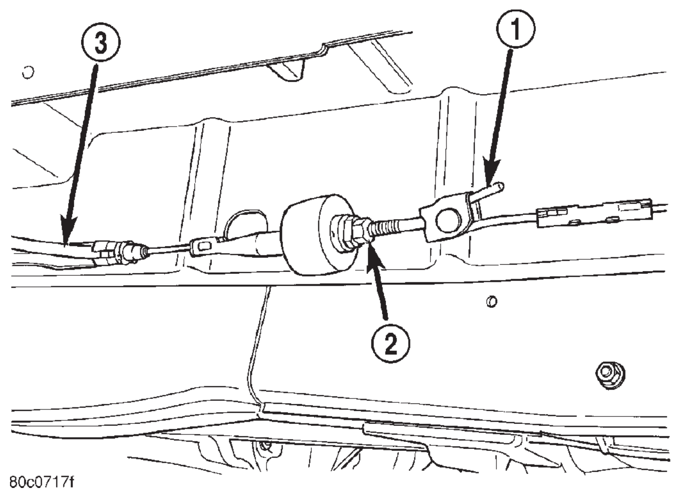


Fig. 35 Front Cable & Tensioner

1 – TENSIONER
2 – ADJUSTER NUT
3 – FRONT CABLE

INSTALLATION

(1) Insert front cable through floor pan and install grommet.

(2) Insert cable retainer into hole at bottom of pedal assembly bracket and connect cable end.

(3) Fold floor covering down and install kick panel.

(4) Raise and support vehicle.

REMOVAL AND INSTALLATION (Continued)

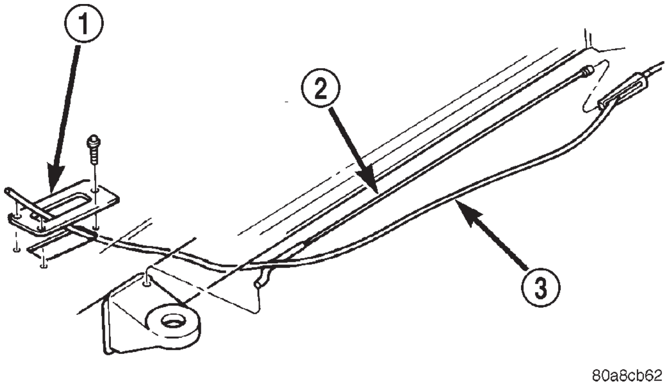


Fig. 36 Support Cable

1 – GROMMET
2 – SUPPORT CABLE
3 – FRONT CABLE

(5) Install support cable to the front cable.
(6) Attach front cable to tensioner.
(7) Adjust parking brakes.
(8) Remove support and lower vehicle.

REAR PARK BRAKE CABLES

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the rear wheel and tire assemblies.
(3) Loosen tensioner adjuster nut.
(4) Remove the right cable (Fig. 37) from the extension cable.
(5) Remove the right cable from the frame clip and pull the cable housing through the left cable connector.
(6) Remove the left cable connector from the left cable.
(7) Pull both cables (Fig. 37) through the cable bracket.
(8) Remove the right cable mounting retainers from the from the differential housing.
(9) Remove the brake drums.
(10) Disconnect each cable from park brake lever.
(11) Compress tabs on each cable housing retainer at the brake support plate.
(12) Remove the cables from the brake support plates.

INSTALLATION

(1) Push each cable housing through the brake support plate hole until cable housing retainer tabs lock into place.

NOTE: Pull on the cable housing to ensure it is lock into place.

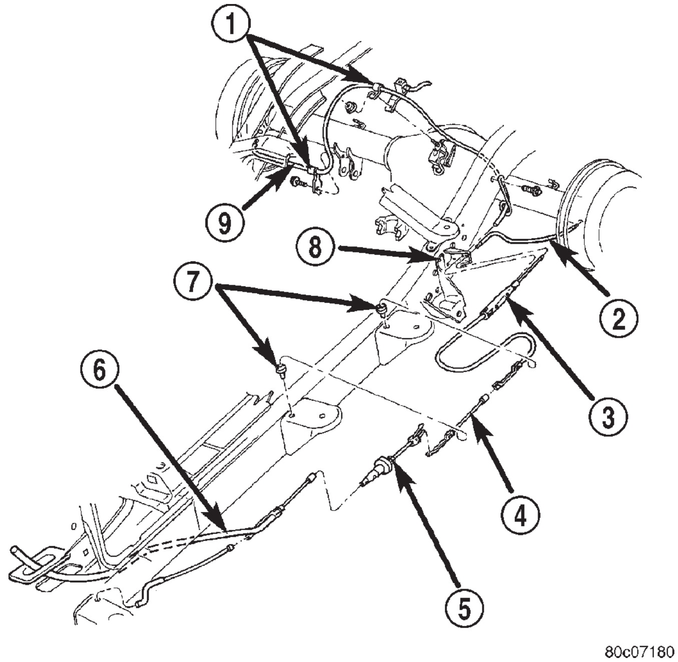


Fig. 37 Park Brake Cables

1 – CABLE RETAINERS
2 – LEFT CABLE
3 – LEFT CABLE CONNECTOR
4 – EXTENSION CABLE
5 – TENSIONER
6 – FRONT CABLE
7 – FRAME CLIPS
8 – CABLE BRACKET
9 – RIGHT CABLE

(2) Pull back on the end of the cable. Then push the cable in to engage the cable in the park brake lever.

NOTE: Pull on the cable end to ensure it is attached it the park brake lever.

(3) Install the brake drums.
(4) Install right cable mounting retainers.
(5) Push the cables housing through the cable bracket
(6) Install the left cable onto the cable connector.
(7) Push the right cable housing through the left cable connector and connect the cable to the extension cable.
(8) Install the wheel and tire assemblies.
(9) Perform park brake adjustment procedure.
(10) Remove support and lower the vehicle.

PARK BRAKE PEDAL ASSEMBLY

Removal

(1) Remove left side kick panel.

REMOVAL AND INSTALLATION (Continued)

(2) Remove brake release rod from pedal assembly (Fig. 38).
(3) Disconnect brake warning lamp switch.
(4) Remove front parking brake cable.
(5) Remove mounting nuts and mounting bolt.
(6) Slide assembly rearward off the mounting studs (Fig. 38).

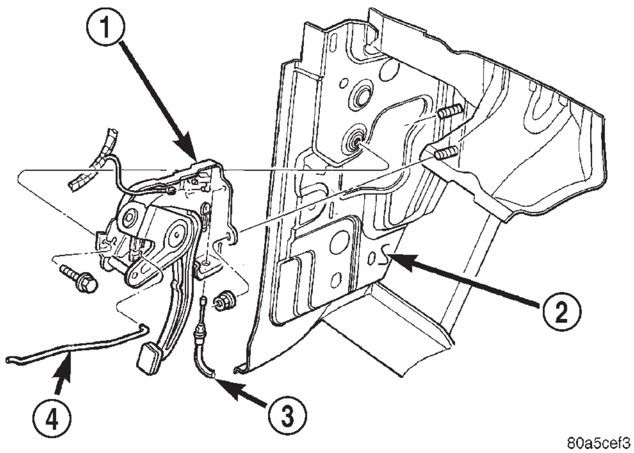


Fig. 38 Parking Brake Pedal Assembly

1 – PARKING BRAKE ASSEMBLY
2 – LEFT COWL PANEL
3 – FRONT CABLE
4 – RELEASE ROD

Installation

(1) Install assembly on the mounting studs.
(2) Install mounting bolt and nuts.
(3) Install front parking brake cable.
(4) Connect brake warning lamp switch.
(5) Install brake release rod to pedal assembly.
(6) Install left side kick panel.

DISASSEMBLY AND ASSEMBLY

MASTER CYLINDER RESERVOIR

REMOVAL

(1) Remove reservoir cap and empty fluid into drain container.
(2) Clamp cylinder body in vise with brass protective jaws.
(3) Remove pins that retain reservoir to master cylinder. Use hammer and pin punch to remove pins (Fig. 39).
(4) Loosen reservoir from grommets with pry tool (Fig. 40).
(5) Remove reservoir by rocking it to one side and pulling free of grommets (Fig. 41).
(6) Remove old grommets from cylinder body (Fig. 42).

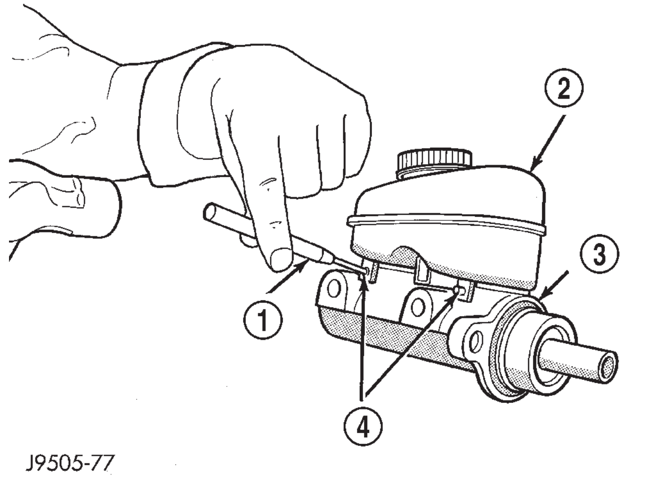


Fig. 39 Reservoir Retaining Pins

1 – PIN PUNCH
2 – RESERVOIR
3 – BODY
4 – ROLL PINS

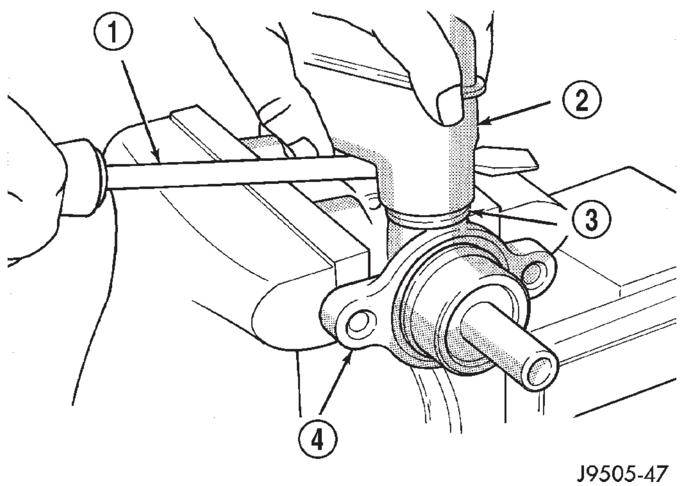


Fig. 40 Loosening Reservoir

1 – PRY TOOL
2 – RESERVOIR
3 – GROMMET
4 – MASTER CYLINDER BODY

INSTALLATION

CAUTION: Do not use any type of tool to install the grommets. Tools may cut, or tear the grommets creating a leak problem after installation. Install the grommets using finger pressure only.

(1) Lubricate new grommets with clean brake fluid and Install new grommets in cylinder body (Fig. 43). Use finger pressure to install and seat grommets.

DISASSEMBLY AND ASSEMBLY (Continued)

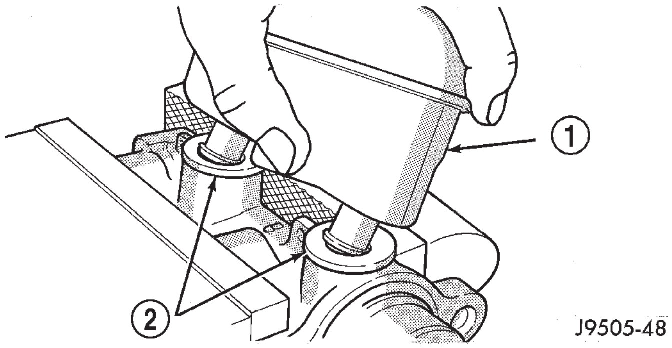


Fig. 41 Reservoir Removal

1 – RESERVOIR
2 – GROMMETS

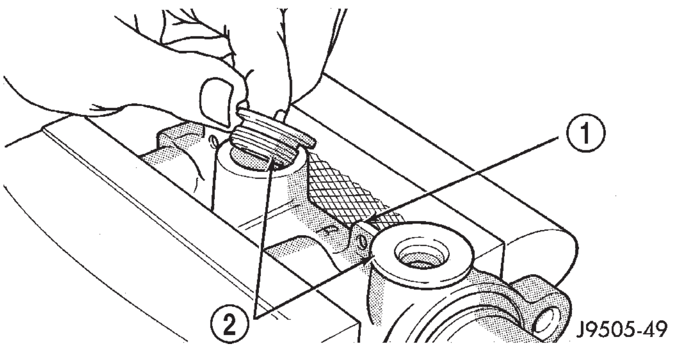


Fig. 42 Grommet Removal

1 – MASTER CYLINDER BODY
2 – GROMMETS

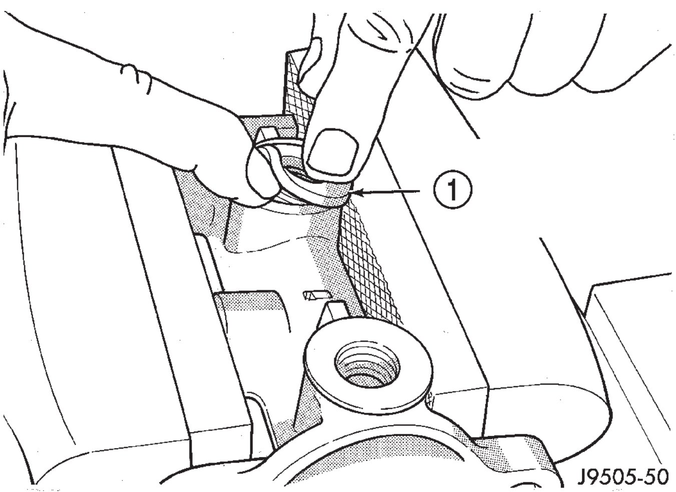


Fig. 43 Grommet Installation

1 – WORK NEW GROMMETS INTO PLACE USING FINGER PRESSURE ONLY

(2) Start reservoir in grommets. Then rock reservoir back and forth while pressing downward to seat it in grommets.

(3) Install pins that retain reservoir to cylinder body.

(4) Fill and bleed master cylinder on bench before installation in vehicle.

DISC BRAKE CALIPER

DISASSEMBLY

(1) Drain old brake fluid out of caliper into drain pan.

(2) Remove piston dust boot (Fig. 44). Use screwdriver to push boot out of groove.

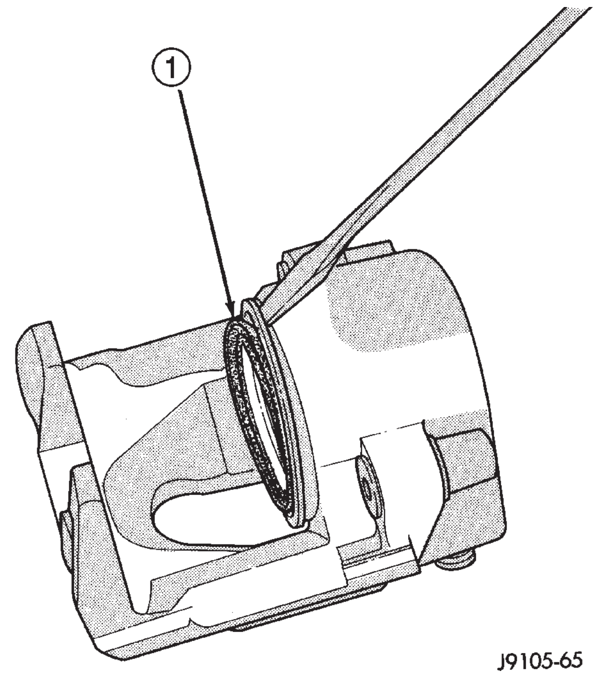


Fig. 44 Piston Dust Boot

1 – PISTON BOOT DUST

(3) Pad outboard shoe side of caliper interior with a minimum 1 inch thickness of shop towels (Fig. 45). Towels will prevent piston damage when piston comes out of the caliper bore.

(4) Remove caliper piston with short bursts of compressed air. Apply air pressure through fluid inlet port of caliper (Fig. 45).

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston. Use only enough air pressure to ease the piston out.

WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS MAY RESULT IN PERSONAL INJURY.

DISASSEMBLY AND ASSEMBLY (Continued)

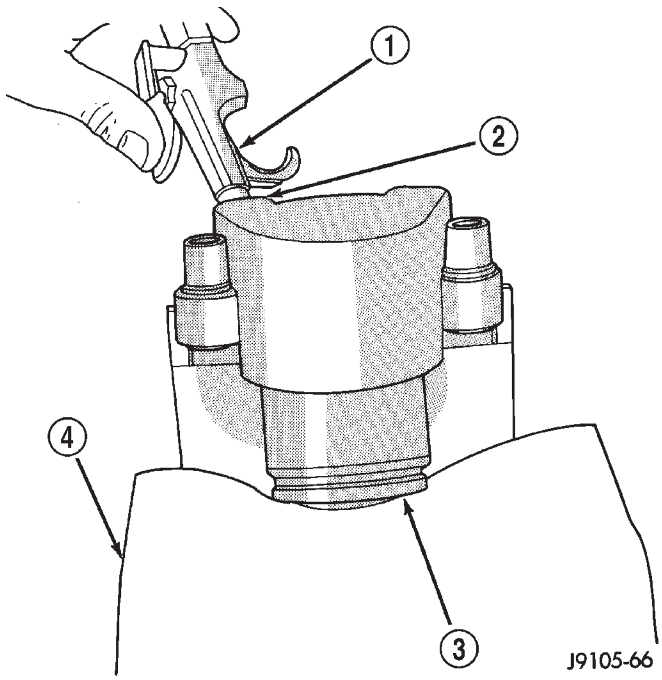


Fig. 45 Caliper Piston

1 – AIR GUN NOZZLE
2 – FLUID INLET PORT
3 – CALIPER PISTON
4 – PADDING MATERIAL (TO PROTECT PISTON)

(5) Remove caliper piston seal with wood pencil or plastic tool (Fig. 46). Do not use metal tools as they will scratch piston bore.

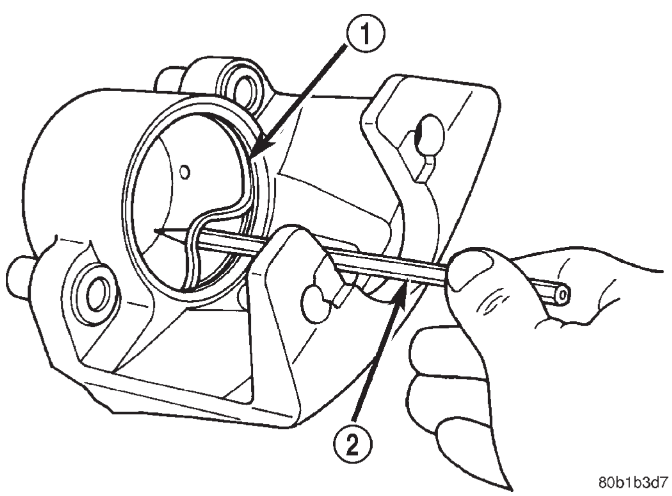


Fig. 46 Caliper Piston Seal

1 – PISTON SEAL
2 – WOOD PENCIL

(6) Remove caliper slide pin bushings and boots.
(7) Remove caliper bleed screw and cap.

ASSEMBLY

(1) Lubricate slide pin boots and bushings with GE, or Dow silicone grease. Then install the boots and bushings in caliper.

(2) Coat caliper piston bore, piston and new piston seal with clean brake fluid.

(3) Install new piston seal in caliper bore. Press seal into groove with finger (Fig. 47). Lubricate seal and caliper bore with additional, fresh brake fluid after seal installation.

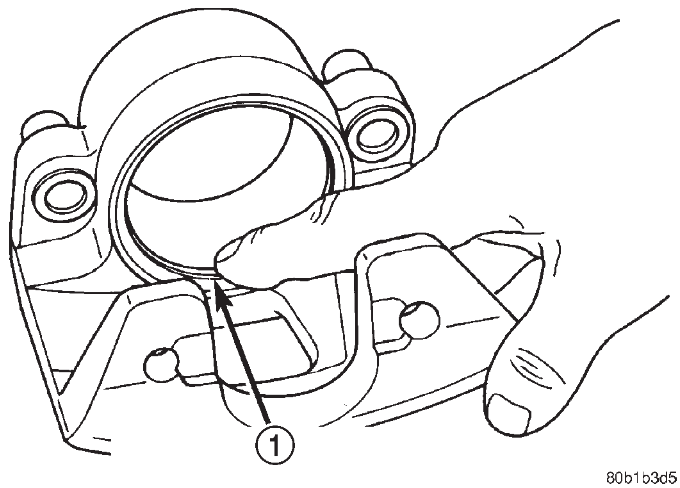


Fig. 47 Caliper Piston Seal

1 – CALIPER PISTON SEAL
(PRESS SEAL INTO PLACE WITH FINGER)

(4) Apply light coat of GE 661, Dow 111 or similar silicone grease to edge and groove of piston and dust seal. Grease acts as corrosion protection for these areas.

(5) Slide new seal boot over piston until boot lip seats in piston groove (Fig. 48).

(6) Push retainer part of boot forward until folds in boot snap into place (Fig. 49).

(7) Start caliper piston in bore with a twisting motion. When piston is started in seal, push piston only **part way** into bore (Fig. 50). Maintain uniform pressure on piston to avoid cocking it in bore.

(8) Press caliper piston to bottom of bore.

(9) Seat piston dust boot with Installer 8248 and Handle C-4171 (Fig. 51).

(10) Install caliper bleed screw and bleed screw cap if removed (Fig. 52).

WHEEL CYLINDER

DISASSEMBLY

(1) Remove push rods and boots (Fig. 53).

(2) Press pistons, cups and spring and expander out of cylinder bore.

(3) Remove bleed screw.

DISASSEMBLY AND ASSEMBLY (Continued)

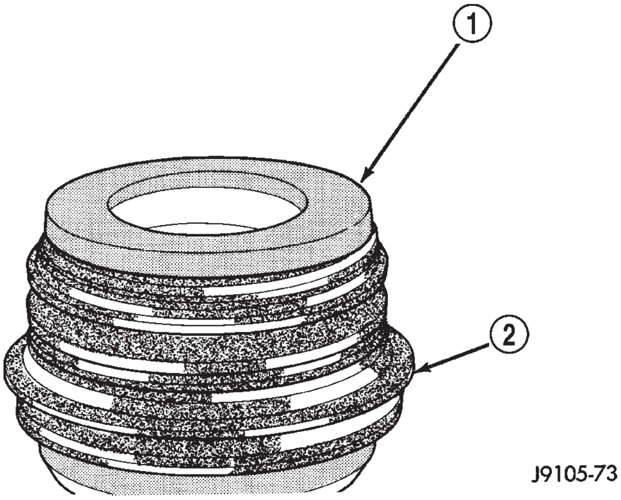


Fig. 48 Sliding Boot Onto Piston

1 – CALIPER PISTON
2 – SLIDE DUST BOOT DOWNWARD OVER PISTON

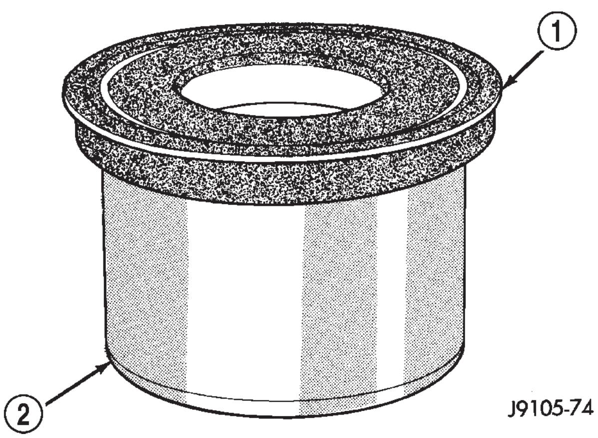


Fig. 49 Snapping Boot Folds Into Place

1 – FOLD DUST BOOT UPWARD UNTIL IT “SNAPS” INTO PLACE
2 – CALIPER PISTON

ASSEMBLY

(1) Lubricate wheel cylinder bore, pistons, piston cups and spring and expander with clean brake fluid.

(2) Install first piston in cylinder bore. Then install first cup in bore and against piston. **Be sure lip of piston cup is facing inward (toward spring and expander) and flat side is against piston.**

(3) Install spring and expander followed by remaining piston cup and piston.

(4) Install boots on each end of cylinder and insert push rods in boots.

(5) Install cylinder bleed screw.

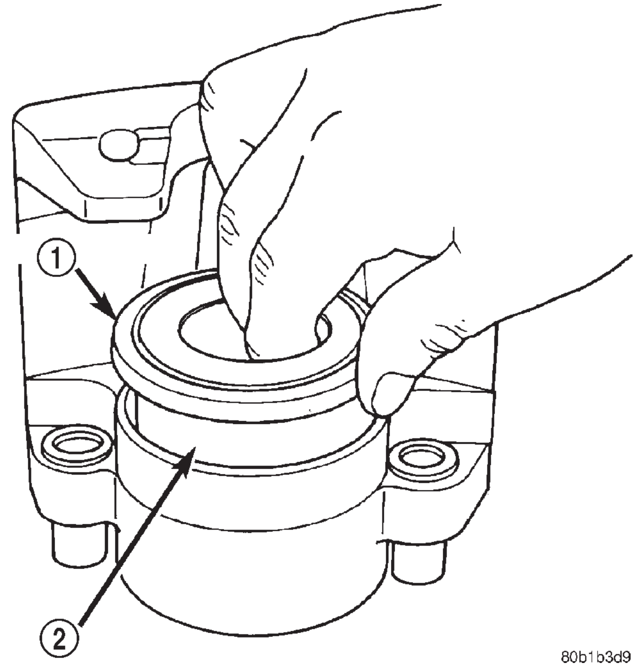


Fig. 50 Installing Caliper Piston And Boot

1 – DUST BOOT
2 – CALIPER PISTON

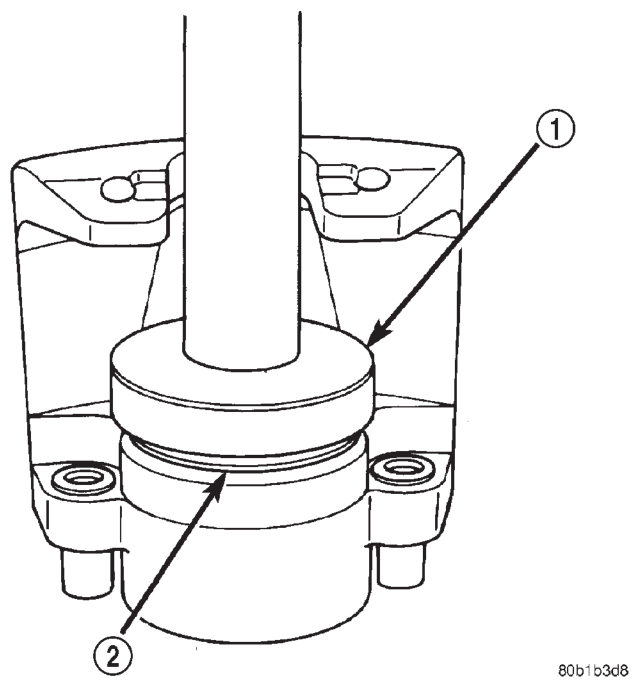


Fig. 51 Seating Piston Dust Boot

1 – SEAL INSTALLER
2 – DUST BOOT

CLEANING AND INSPECTION (Continued)

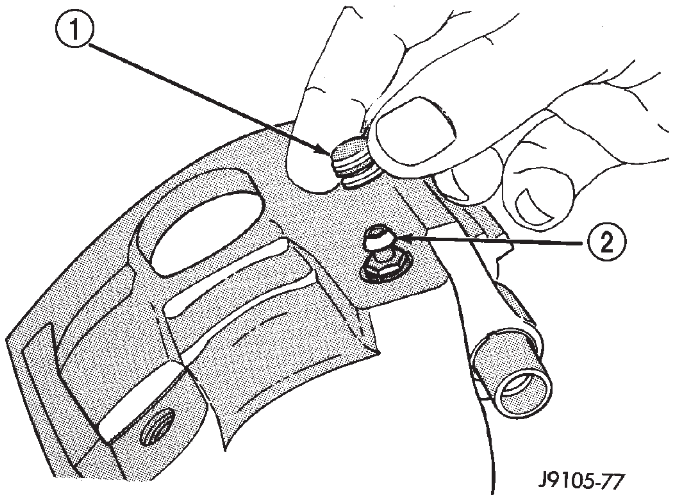


Fig. 52 Installing Caliper Bleed Screw And Cap

1 – BLEED SCREW CAP
2 – BLEED SCREW

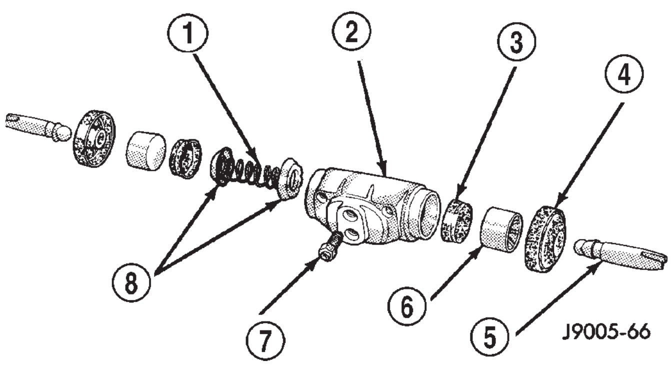


Fig. 53 Wheel Cylinder Components–Typical

1 – SPRING
2 – CYLINDER
3 – PISTON CUP
4 – BOOT
5 – PUSH ROD
6 – PISTON
7 – BLEED SCREW
8 – CUP EXPANDERS

CLEANING AND INSPECTION

REAR DRUM BRAKE

CLEANING

Clean the individual brake components, including the support plate and wheel cylinder exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

INSPECTION

As a general rule, riveted brake shoes should be replaced when worn to within 0.78 mm (1/32 in.) of the rivet heads. Bonded lining should be replaced when worn to a thickness of 1.6 mm (1/16 in.).

Examine the lining contact pattern to determine if the shoes are bent or the drum is tapered. The lining should exhibit contact across its entire width. Shoes exhibiting contact only on one side should be replaced and the drum checked for runout or taper.

Inspect the adjuster screw assembly. Replace the assembly if the star wheel or threads are damaged, or the components are severely rusted or corroded.

Discard the brake springs and retainer components if worn, distorted or collapsed. Also replace the springs if a brake drag condition had occurred. Overheating will distort and weaken the springs.

Inspect the brake shoe contact pads on the support plate, replace the support plate if any of the pads are worn or rusted through. Also replace the plate if it is bent or distorted (Fig. 54).

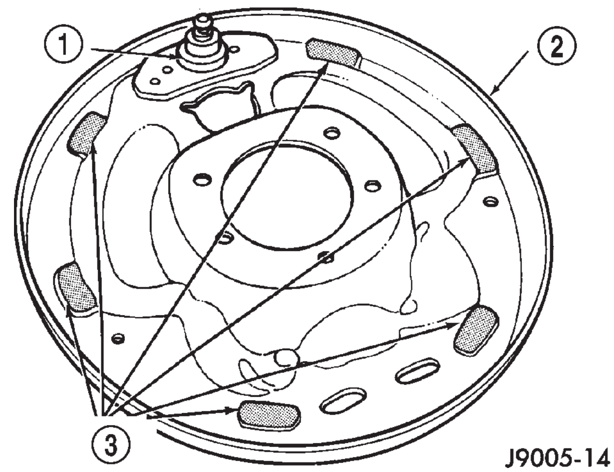


Fig. 54 Shoe Contact Surfaces

1 – ANCHOR PIN
2 – SUPPORT PLATE
3 – SHOE CONTACT SURFACES

CALIPER

CLEANING

Clean the caliper components with clean brake fluid or brake clean only. Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

CAUTION: Do not use gasoline, kerosene, paint thinner, or similar solvents. These products may leave a residue that could damage the piston and seal.

CLEANING AND INSPECTION (Continued)

INSPECTION

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections (Fig. 55). The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).

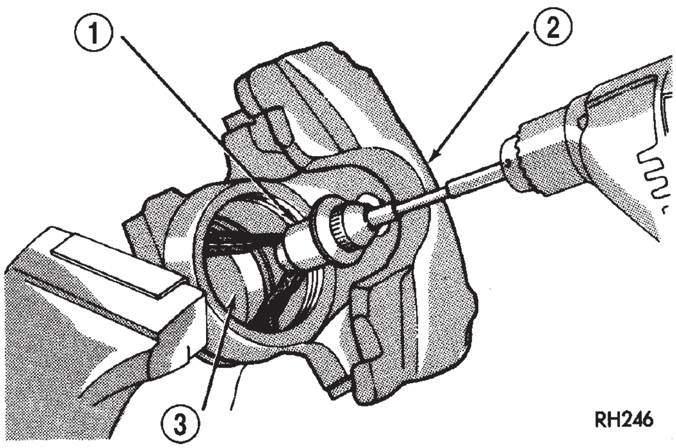


Fig. 55 Polishing Piston Bore

1 – SPECIAL HONE
2 – CALIPER
3 – PISTON BORE

WHEEL CYLINDER

CLEANING

Clean the cylinder and pistons with clean brake fluid or brake cleaner only. Do not use any other cleaning agents.

Dry the cylinder and pistons with compressed air. Do not use rags or shop towels to dry the cylinder components. Lint from cloth material will adhere to the cylinder bores and pistons.

INSPECTION

Inspect the cylinder bore. Light discoloration and dark stains in the bore are normal and will not impair cylinder operation.

The cylinder bore can be lightly polished but only with crocus cloth. Replace the cylinder if the bore is scored, pitted or heavily corroded. Honing the bore to restore the surface is not recommended.

Inspect the cylinder pistons. The piston surfaces should be smooth and free of scratches, scoring and corrosion. Replace the pistons if worn, scored, or corroded. Do attempt to restore the surface by sanding or polishing.

Discard the old piston cups and the spring and expander. These parts are not reusable. The original dust boots may be reused but only if they are in good condition.

ADJUSTMENTS

REAR DRUM BRAKE

The rear drum brakes are equipped with a self-adjusting mechanism. Under normal circumstances, the only time adjustment is required is when the shoes are replaced, removed for access to other parts, or when one or both drums are replaced.

Adjustment can be made with a standard brake gauge or with adjusting tool. Adjustment is performed with the complete brake assembly installed on the backing plate.

ADJUSTMENT WITH BRAKE GAUGE

(1) Be sure parking brakes are fully released.

(2) Raise rear of vehicle and remove wheels and brake drums.

(3) Verify that left and right automatic adjuster levers and cables are properly connected.

(4) Insert brake gauge in drum. Expand gauge until gauge inner legs contact drum braking surface. Then lock gauge in position (Fig. 56).

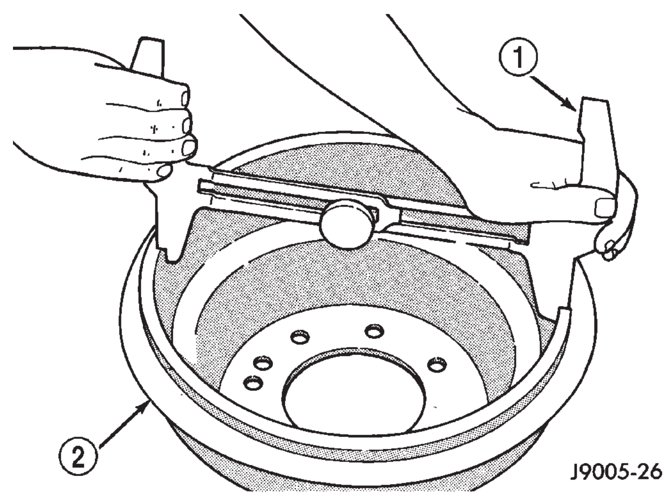


Fig. 56 Adjusting Gauge On Drum

1 – BRAKE GAUGE
2 – BRAKE DRUM

ADJUSTMENTS (Continued)

(5) Reverse gauge and install it on brake shoes. Position gauge legs at shoe centers as shown (Fig. 57). If gauge does not fit (too loose/too tight), adjust shoes.

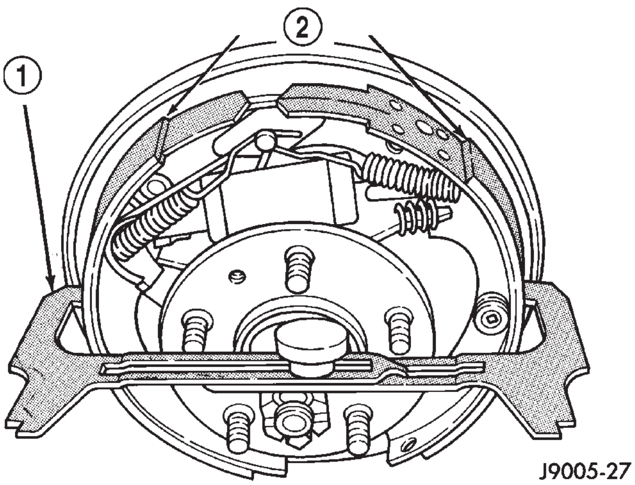


Fig. 57 Adjusting Gauge On Brake Shoes

1 – BRAKE GAUGE
2 – BRAKE SHOES

(6) Pull shoe adjuster lever away from adjuster screw star wheel.

(7) Turn adjuster screw star wheel (by hand) to expand or retract brake shoes. Continue adjustment until gauge outside legs are light drag-fit on shoes.

(8) Install brake drums and wheels and lower vehicle.

(9) Drive vehicle and make one forward stop followed by one reverse stop. Repeat procedure 8-10 times to operate automatic adjusters and equalize adjustment.

NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.

ADJUSTMENT WITH ADJUSTING TOOL

(1) Be sure parking brake lever is fully released.

(2) Raise vehicle so rear wheels can be rotated freely.

(3) Remove plug from each access hole in brake support plates.

(4) Loosen parking brake cable adjustment nut until there is slack in front cable.

(5) Insert adjusting tool through support plate access hole and engage tool in teeth of adjusting screw star wheel (Fig. 58).

(6) Rotate adjuster screw star wheel (move tool handle upward) until slight drag can be felt when wheel is rotated.

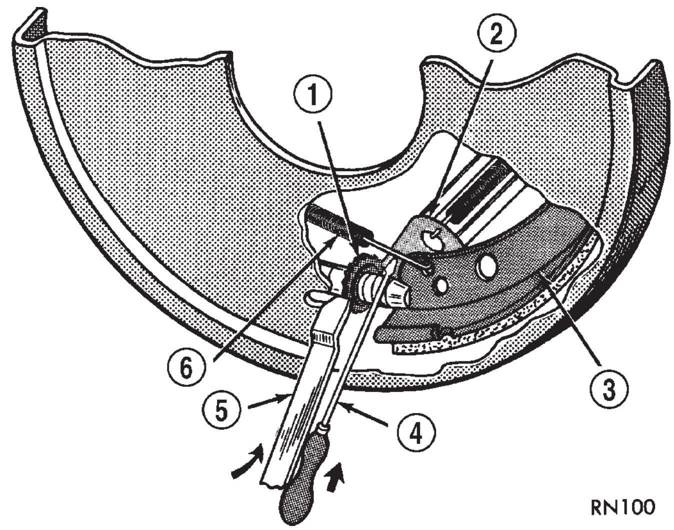


Fig. 58 Brake Adjustment

1 – STAR WHEEL
2 – LEVER
3 – BRAKE SHOE WEB
4 – SCREWDRIVER
5 – ADJUSTING TOOL
6 – ADJUSTER SPRING

(7) Push and hold adjuster lever away from star wheel with thin screwdriver.

(8) Back off adjuster screw star wheel until brake drag is eliminated.

(9) Repeat adjustment at opposite wheel. Be sure adjustment is equal at both wheels.

(10) Install support plate access hole plugs.

(11) Adjust parking brake cable and lower vehicle.

(12) Drive vehicle and make one forward stop followed by one reverse stop. Repeat procedure 8-10 times to operate automatic adjusters and equalize adjustment.

NOTE: Bring vehicle to complete standstill at each stop. Incomplete, rolling stops will not activate automatic adjusters.

PARK BRAKE CABLE TENSIONER

NOTE: Tensioner adjustment is only necessary when the tensioner, or a cable has been replaced or disconnected for service. When adjustment is necessary, perform adjustment only as described in the following procedure. This is necessary to avoid faulty park brake operation.

(1) Raise vehicle.

(2) Back off cable tensioner adjusting nut at equalizer to create slack in cables.

(3) Remove rear wheel/tire assemblies. Then remove brake drums.

ADJUSTMENTS (Continued)

(4) Verify brakes are in good condition and operating properly.

(5) Verify park brake cables operate freely and are not binding, or seized.

(6) Check rear brake shoe adjustment with standard brake gauge.

(7) Install drums and verify that drums rotate freely without drag.

(8) Reinstall wheel/tire assemblies after brake shoe adjustment is complete.

(9) Lower vehicle enough for access to park brake foot pedal. Then fully apply park brakes.

NOTE: Leave park brakes applied until adjustment is complete.

(10) Raise vehicle again.

(11) Mark tensioner rod 6.35 mm (1/4 in.) from edge of tensioner bracket (Fig. 59).

(12) Tighten adjusting nut at equalizer until mark on tensioner rod moves into alignment with tensioner bracket.

CAUTION: Do not loosen, or tighten the tensioner adjusting nut for any reason after completing adjustment.

(13) Lower vehicle until rear wheels are 15-20 cm (6-8 in.) off shop floor.

(14) Release park brake foot pedal and verify that rear wheels rotate freely without drag. Then lower vehicle.

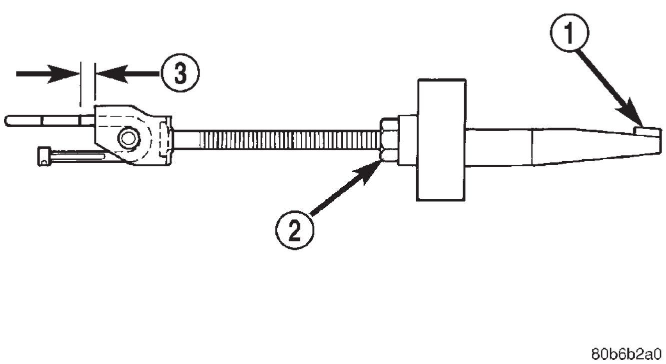


Fig. 59 Adjustment Mark On Cable Tensioner Rod

1 – CABLE CONNECTOR
2 – ADJUSTER NUT
3 – 6.35MM (1/4 IN.)

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

SPECIFICATIONS (Continued)

BASE BRAKES

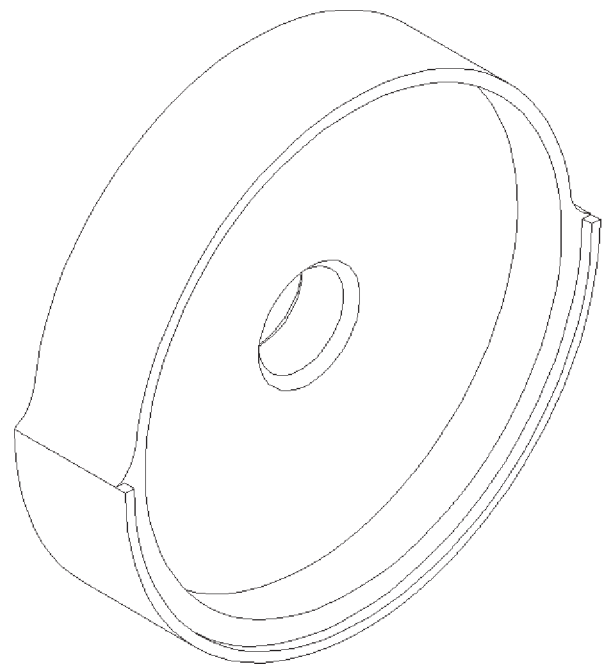
Disc Brake Caliper
Type . . . . Sliding
Bore . . . . 70 mm (2.75 in.)
Disc Brake Rotor
Type . . . . Ventilated
Size . . . . 287 x 24 mm (11.3 x 0.944 in.)
Max. Runout . . . . 0.102 mm (0.004)
Max. Thickness Variation . . . . 0.013 mm (0.0005 in.)
Min. Rotor Thickness . . . . . 22.6 mm (0.8898 in.)
Drum Brake
Size . . . . 279 x 57 mm (11 x 2.25 in.)
Max. Runout . . . . 0.20 mm (0.008 in.)
Max. Diameter Variation . . . 0.076 mm (0.003 in.)
Brake Booster
Type . . . . Tandem Diaphragm

TORQUE CHART

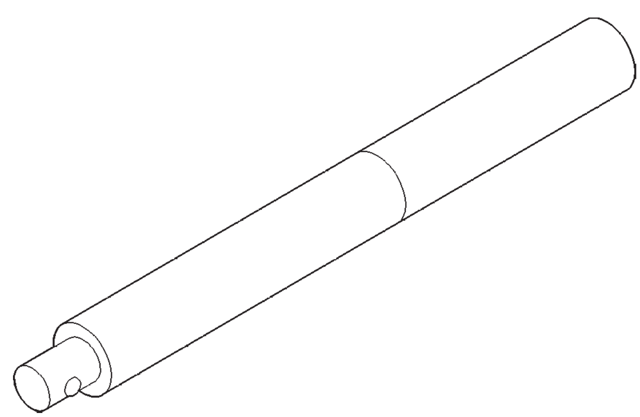
DESCRIPTION	TORQUE
Brake Booster	
Mounting Nuts	28 N·m (250 in. lbs.)
Master Cylinder	
Mounting Nuts	18 N·m (160 in. lbs.)
Caliper	
Mounting Pins	30 N·m (22 ft. lbs.)
Wheel Cylinder Bolts	
1/4-20	15 N·m (11 ft. lbs.)
5/16-18	22 N·m (16 ft. lbs.)
Support Plate	
Mounting Bolts/Nuts	64 N·m (47 ft. lbs)
Brake Line Fittings	
Master Cylinder	19 N·m (170 in. lbs.)
Combination Valve	19 N·m (170 in. lbs.)
Wheel Cylinder	16 N·m (145 in. lbs.)
Brake Hose	
Front Fitting	16 N·m (145 in. lbs.)
Front Bolt	28 N·m (250 in. lbs.)
Rear Fitting	19 N·m (170 in. lbs.)

SPECIAL TOOLS

BASE BRAKES



Install Dust Boot 8248



Universal Handle C-4171

REAR WHEEL ANTILOCK BRAKES

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
REAR WHEEL ANTILOCK 32
CONTROLLER REAR WHEEL ANTILOCK BRAKES 33
RWAL COMPONENT LOCATION 33
REAR WHEEL SPEED SENSOR AND EXCITER RING 34
RWAL VALVE 34
BRAKE WARNING LAMPS 35
BRAKE LAMP SWITCH 36
DIAGNOSIS AND TESTING
REAR WHEEL ANTILOCK 36

page

SERVICE PROCEDURES
RWAL SERVICE PRECAUTIONS 36
REAR WHEEL ANTILOCK BRAKE BLEEDING . . . 37
REMOVAL AND INSTALLATION
CONTROLLER 37
REAR WHEEL SPEED SENSOR 38
RWAL VALVE 38
EXCITER RING 39
SPECIFICATIONS
TORQUE CHART 39

DESCRIPTION AND OPERATION

REAR WHEEL ANTILOCK

DESCRIPTION

Rear Wheel Antilock (RWAL) brake system is standard equipment. The RWAL brake system is designed to prevent rear wheel lock-up under heavy braking conditions on virtually all types of road surfaces. RWAL braking is desirable because a vehicle which is stopped without locking the wheels will retain directional stability. This allows the driver to retain greater control of the vehicle during braking.

The RWAL components include:

- RWAL Valve
- Controller Antilock brake (CAB)
- Rear Wheel Speed Sensor (WSS)

OPERATION

When the brakes are applied, hydraulic fluid is routed from the master cylinder's secondary circuit, through the combination valve, to the RWAL valve. From there hydraulic fluid is routed to the rear brake wheel cylinders. The Controller Antilock Brake monitors rear wheel speed through the rear wheel speed sensor. If a wheel is about to lock-up, the CAB signals the RWAL valve. The RWAL valve modulates the hydraulic brake pressure to the rear wheels to prevent wheel lock-up.

NORMAL BRAKING

During light brake application, rear wheel deceleration is not sufficient to activate the antilock system components. During a normal stop hydraulic brake fluid flows unrestricted to the rear wheel cylinders to stop the vehicle. The antilock solenoid valves are inactive. The isolation valve is open and the dump valve is closed allowing normal fluid flow to the rear wheel cylinders.

REAR WHEEL ANTILOCK BRAKING

If the CAB senses impending rear wheel lock-up, it will energize the isolation solenoid. This prevents a further increase of driver induced brake pressure to the rear wheels. If this initial action is not enough to prevent rear wheel lock-up, the CAB will momentarily energize a dump solenoid. This opens the dump valve to vent a small amount of isolated rear brake pressure to an accumulator. The action of fluid moving to the accumulator reduces the isolated brake pressure at the wheel cylinders. The dump (pressure venting) cycle is limited to very short time periods (milliseconds). The CAB will pulse the dump valve until rear wheel deceleration reaches the desired slip rate programmed into the CAB. The system will switch to normal braking once wheel locking tendencies are no longer present.

DESCRIPTION AND OPERATION (Continued)

RWAL COMPONENT LOCATION

DESCRIPTION

COMPONENT	LOCATION	FUNCTION
RWAL CONTROLLER	Driver side inner fender on a bracket.	Tests, monitors and controls the rear brake system.
HYDRAULIC CONTROL UNIT/ RWAL VALVE	Driver side inner fender on a bracket.	Modulates hydraulic pressure to rear brakes during an RWAL stop.
REAR WHEEL SPEED SENSOR	Top of the rear axle housing.	Sends an AC voltage sinewave to the CAB whose frequency is proportional to vehicle speed.
EXCITER RING	Ring gear inside the differential housing.	Used to pull the magnetic field across the wheel speed sensor's windings.
RED BRAKE WARNING LAMP	Instrument cluster.	Indicator for park brake engagement, hydraulic brake malfunction, or RWAL malfunction.
AMBER ABS WARNING LAMP	Instrument cluster.	Indicator of an RWAL malfunction.
BRAKE WARNING LAMP DIODE	Instrument panel harness near the parking brake switch.	Isolates the park brake switch circuit from the CAB for proper red brake warning lamp operation.
ISOLATION AND DUMP VALVE FUSE	Inside the CAB.	Fail-safe device for unwanted control of the isolation and dump solenoid/valves
ISOLATION AND DUMP SOLENOID/VALVES	Inside the HCU/RWAL valve.	Used to modulation hydraulic pressure to the rear brakes during an RWAL stop.

CONTROLLER REAR WHEEL ANTILOCK BRAKES

DESCRIPTION

The Controller Antilock Brakes (CAB) is a microprocessor which handles testing, monitoring and controlling the ABS brake system operation (Fig. 1). The CAB functions are:

- Perform self-test diagnostics.
- Monitor the RWAL brake system for proper operation.
- Control the RWAL valve solenoids.

NOTE: If the CAB needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new CAB. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile refer to Group 22 Tire and Wheels. To program the CAB refer to the Chassis Diagnostic Manual.

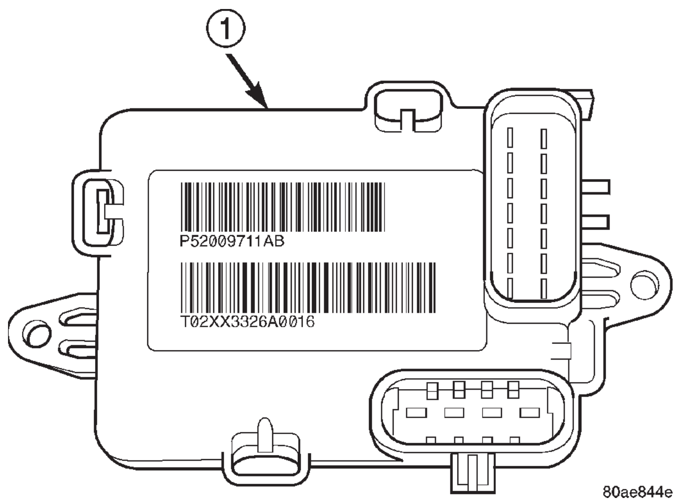


Fig. 1 RWAL CAB

1 – RWAL CAB

DESCRIPTION AND OPERATION (Continued)

OPERATION

SYSTEM SELF-TEST

When the ignition switch is turned-on the microprocessor RAM and ROM are tested. If an error occurs during the test, a DTC will be set into the RAM memory. However it is possible the DTC will not be stored in memory if the error has occurred in the RAM module were the DTC's are stored. Also it is possible a DTC may not be stored if the error has occurred in the ROM which signals the RAM to store the DTC.

CAB INPUTS

The CAB continuously monitors the speed of the differential ring gear by monitoring signals generated by the rear wheel speed sensor. The CAB determines a wheel locking tendency when it recognizes the ring gear is decelerating too rapidly. The CAB monitors the following inputs to determine when a wheel locking tendency may exists:

- Rear Wheel Speed Sensor
- Brake Lamp Switch
- Brake Warning Lamp Switch
- Reset Switch
- 4WD Switch (If equipped)

CAB OUTPUTS

The CAB controls the following outputs for antilock braking and brake warning information:

- RWAL Valve
- ABS Warning Lamp
- Brake Warning Lamp

RWAL VALVE

DESCRIPTION

The valve is located on the drivers side inner fender under the hood. The valve modulates hydraulic pressure to the rear brakes during an RWAL stop.

OPERATION

If the CAB senses that rear wheel speed deceleration is excessive, it will energize an isolation solenoid by providing battery voltage to the solenoid. This prevents a further increase of driver induced brake pressure to the rear wheels. If this initial action is not enough to prevent rear wheel lock-up, the CAB will momentarily energize a dump solenoid (the CAB energizes the dump solenoid by providing battery voltage to the solenoid). This opens the dump valve to vent a small amount of isolated rear brake pressure to an accumulator. The action of fluid moving to the accumulator reduces the isolated brake pressure at the wheel cylinders. The dump (pressure venting) cycle is limited to very short time periods (milliseconds). The CAB will pulse the dump valve until rear wheel deceleration matches the desired slip rate programmed into the CAB. The system will switch to normal braking once wheel locking tendencies are no longer present.

A predetermined maximum number of consecutive dump cycles can be performed during any RWAL stop. If excessive dump cycles occur, a DTC will be set and stored in the CAB memory. If during a RWAL stop, the driver releases the brake pedal, the reset switch contacts will open. This signal to the CAB is an indication that pressure has equalized across the RWAL valve. The CAB will then reset the dump cycle counter in anticipation of the next RWAL stop. Additionally, any fluid stored in the accumulator will force its way past the dump valve, back into the hydraulic circuit and return to the master cylinder.

A fuse internal to the CAB, provides a fail-safe device which prevents unwanted control over the isolation and dump solenoids. The fuse is in series with the isolation and dump solenoids output circuits. If the internal fuse is open, the CAB cannot provide voltage to energize either solenoid and RWAL stops are prevented. If the fuse is open, the braking system will operate normally but without antilock control over rear brake pressure.

REAR WHEEL SPEED SENSOR AND EXCITER RING

DESCRIPTION

The rear Wheel Speed Sensor (WSS) is mounted in the rear differential housing (Fig. 2).

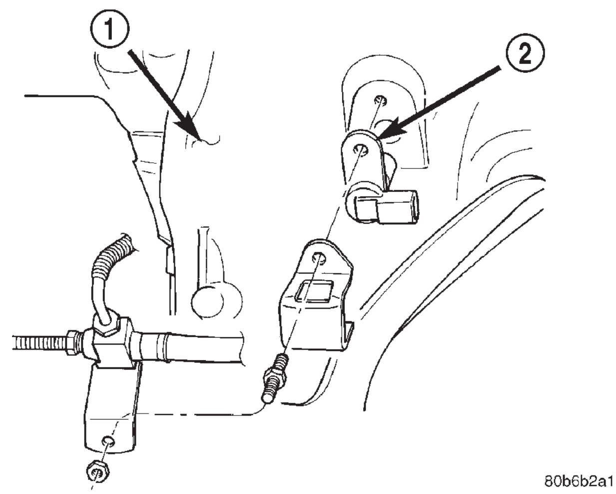


Fig. 2 Rear Wheel Speed Sensor Location

1 – DIFFERENTIAL HOUSING
2 – WHEEL SPEED SENSOR

The exciter ring is press fitted onto the differential carrier next to the final drive ring gear (Fig. 3). For

DESCRIPTION AND OPERATION (Continued)

replacement procedure of the exciter ring, refer to Group 3 Differential and Driveline.

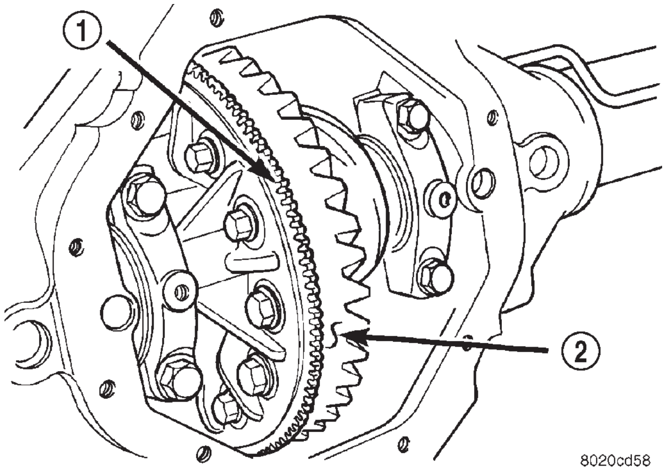


Fig. 3 Exciter Ring Location

1 – EXCITER RING
2 – RING GEAR

OPERATION

The WSS consists of a magnet surrounded by windings from a single strand of wire. The sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction. The magnetic induction is created when a toothed sensor ring (exciter ring or tone wheel) passes the stationary magnetic WSS.

When the ring gear is rotated, the exciter ring passes the tip of the WSS. As the exciter ring tooth approaches the tip of the WSS, the magnetic lines of force expand, causing the magnetic field to cut across the sensor's windings. This, in turn causes current to flow through the WSS circuit (Fig. 4) in one direction. When the exciter ring tooth moves away from the sensor tip, the magnetic lines of force collapse cutting the winding in the opposite direction. This causes the current to flow in the opposite direction. Every time a tooth of the exciter ring passes the tip of the WSS, an AC signal is generated. Each AC signal (positive to negative signal or sinewave) is interpreted by the CAB. It then compares the frequency of the sinewave to a time value to calculate vehicle speed. The CAB continues to monitor the frequency to determine a deceleration rate that would indicate a possible wheel-locking tendency.

The signal strength of any magnetic induction sensor is directly affected by:

- Magnetic field strength; the stronger the magnetic field, the stronger the signal
- Number of windings in the sensor; more windings provide a stronger signal
- Exciter ring speed; the faster the exciter ring rotates, the stronger the signal will be

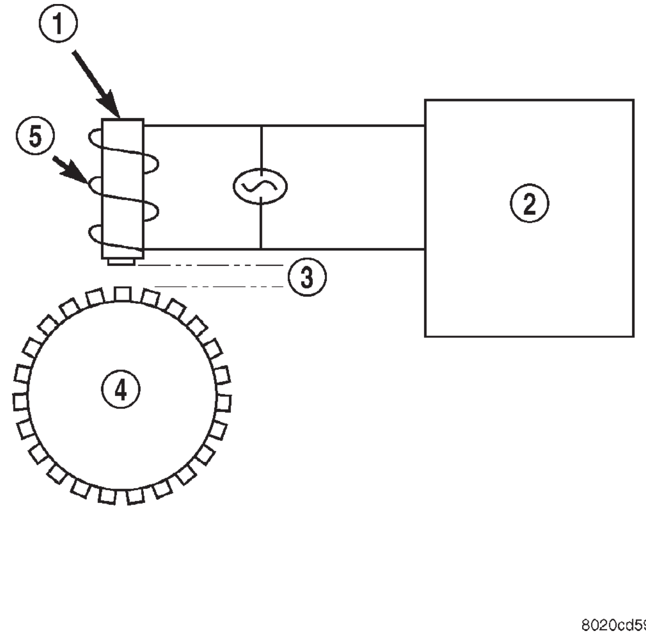


Fig. 4 Operation of the Wheel Speed Sensor

1 – MAGNETIC CORE
2 – CAB
3 – AIR GAP
4 – EXCITER RING
5 – COIL

- Distance between the exciter ring teeth and WSS; the closer the WSS is to the exciter ring, the stronger the signal will be

The rear WSS is not adjustable. A clearance specification has been established for manufacturing tolerances. If the clearance is not within these specifications, then either the WSS or other components may be damaged. The clearance between the WSS and the exciter ring is 0.005 – 0.050 in.

The assembly plant performs a “Rolls Test” on every vehicle that leaves the assembly plant. One of the test performed is a test of the WSS. To properly test the sensor, the assembly plant connects test equipment to the Data Link Connector (DLC). This connector is located to the right of the steering column and attached to the lower portion of the instrument panel (Fig. 5). The rolls test terminal is spliced to the WSS circuit. The vehicle is then driven on a set of rollers and the WSS output is monitored for proper operation.

BRAKE WARNING LAMPS

DESCRIPTION

The red brake warning lamp and amber ABS warning lamp are located in the instrument cluster. The red brake warning lamp is used to alert the driver of a hydraulic fault or that the parking brake is applied. For the RWAL system, the red brake

DESCRIPTION AND OPERATION (Continued)

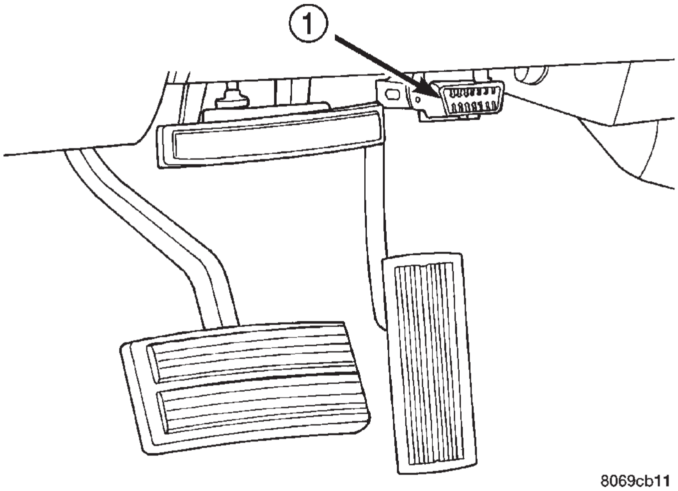


Fig. 5 Data Link Connector - Typical

1 – 16–WAY DATA LINK CONNECTOR

warning lamp also is used to alerts the driver of a problem with the RWAL system.

OPERATION

The red brake warning lamp illuminates when a message is sent over the bus to the cluster to illuminate the bulb. A ground for the bulb is provided when:

- The parking brake is applied and the park brake switch is actuated.
- A hydraulic fault has occurred and the pressure differential switch is actuated.
- A RWAL fault has occurred.

The amber ABS warning lamp is used to alert the driver of an RWAL problem and identify DTCs stored in the CABs memory.

BRAKE LAMP SWITCH

DESCRIPTION

The plunger type brake lamp switch is mounted on a bracket attached to the brake pedal support.

CAUTION: The switch can only be adjusted during initial installation. If the switch is not adjusted properly a new switch must be installed.

OPERATION

The primary function of the switch is to turn on the brake lamps during braking. The switch is also used to send signals to components that must know when the brakes are applied, such as the Powertrain Control Module (PCM), which uses the signal to cancel speed control. The CAB uses the brake switch signal to monitor brake pedal application. When the switch contacts open (brakes applied), the CAB receives the brake applied signal. The CAB then monitors the RWAL system to anticipate the need for an RWAL stop.

DIAGNOSIS AND TESTING

REAR WHEEL ANTILOCK

Diagnosis of base brake conditions which are mechanical in nature should be performed first. This includes brake noise, lack of power assist, parking brake, or vehicle vibration during normal braking.

The RWAL brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the system inputs and outputs circuits to verify the system is operating properly. If the CAB senses a malfunction in the system it will set a DTC into memory and trigger the warning lamp.

NOTE: The MDS or DRB III scan tool is used to diagnose the RWAL system. For test procedures refer to the Chassis Diagnostic Manual. For additional information refer to the Antilock brake section in Group 8W.

SERVICE PROCEDURES

RWAL SERVICE PRECAUTIONS

The RWAL uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits. **In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.** These circuits should only be tested using a high impedance multi-meter or the DRB tester as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, ect.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.

SERVICE PROCEDURES (Continued)

REAR WHEEL ANTILOCK BRAKE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

Do not pump the brake pedal at any time while bleeding. Air in the system will be compressed into small bubbles that are distributed throughout the hydraulic system. This will make additional bleeding operations necessary.

Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

Bleed only one brake component at a time in the following sequence:

- Master Cylinder
- Combination Valve
- Rear Antilock Valve
- Left Rear Wheel
- Right Rear Wheel
- Right Front Wheel
- Left Front Wheel

MANUAL BLEEDING

(1) Remove reservoir filler caps and fill reservoir.

(2) If calipers, or wheel cylinders were overhauled, open all caliper and wheel cylinder bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.

(3) Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid (Fig. 6). Be sure end of bleed hose is immersed in fluid.

(4) Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.

PRESSURE BLEEDING

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 15-20 psi is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use the adapter provided with the equipment or Adapter 6921.

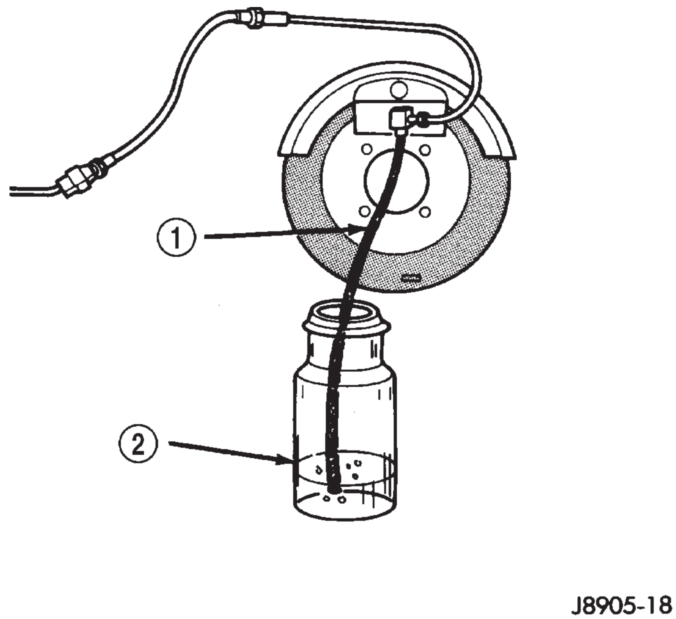


Fig. 6 Bleed Hose Setup

1 – BLEED HOSE
2 – FLUID CONTAINER PARTIALLY FILLED WITH FLUID

REMOVAL AND INSTALLATION

CONTROLLER

NOTE: If the CAB needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new CAB. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile refer to Group 22 Tire and Wheels. To program the CAB refer to the Chassis Diagnostic Manual.

REMOVAL

(1) Push the CAB harness connector lock to release the lock and remove the connector (Fig. 7) from the controller.

(2) Remove the RWAL valve harness connector from the controller.

(3) Remove the controller mounting screws and remove the controller from the mounting bracket (Fig. 7).

INSTALLATION

(1) Position the controller on the bracket.

(2) Install the mounting screws and tighten to 6 N·m (53 in. lbs).

(3) Install the RWAL valve harness connector into the controller.

(4) Install the CAB harness connector into the controller and push down on the connector lock.

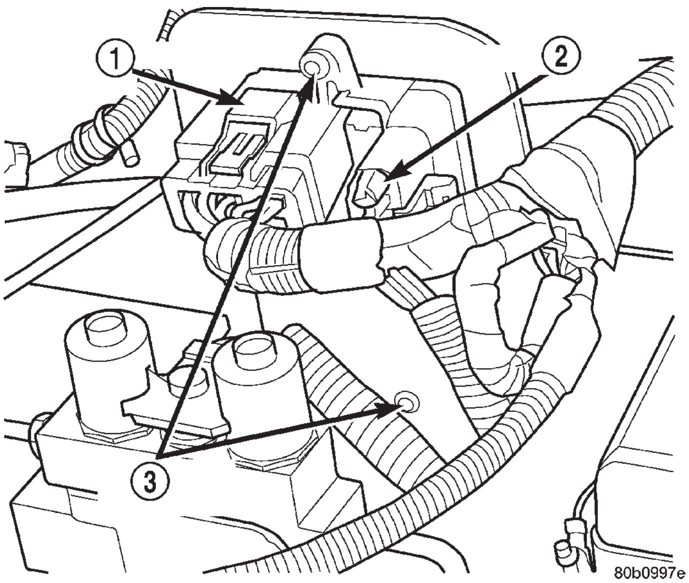


Fig. 7 RWAL Controller

1 – CAB CONNECTOR LOCK
2 – RWAL CONNECTOR
3 – MOUNTING SCREWS

RWAL VALVE

REMOVAL

(1) Remove RWAL valve harness connector from the RWAL controller.

(2) Remove the brake lines from the valve.

(3) Remove the valve mounting bolt (Fig. 8) and remove the valve from the bracket.

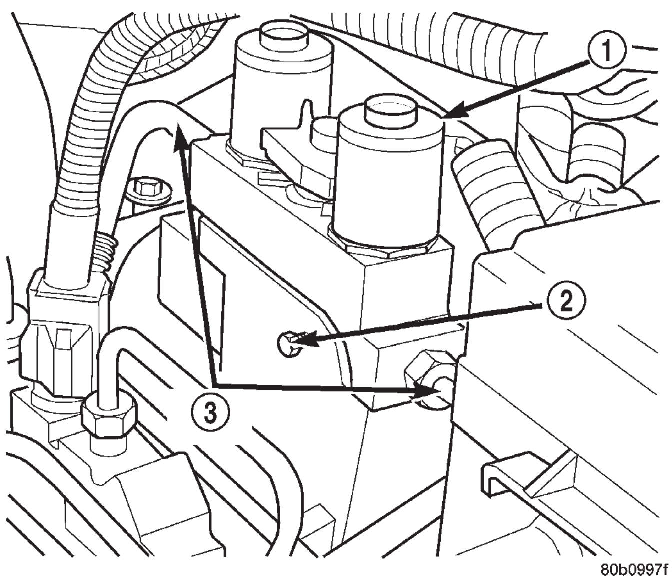


Fig. 8 RWAL Valve

1 – RWAL VALVE
2 – MOUNTING BOLT
3 – BRAKE LINES

INSTALLATION

(1) Position the valve on the bracket and install the mounting bolt. Tighten the mounting bolt to 20-27 N·m (15-20 ft. lbs.).

(2) Install the brake lines and tighten to 19 N·m (170 in. lbs.).

(3) Install the RWAL valve harness connector into the RWAL controller.

(4) Bleed base brake system.

REAR WHEEL SPEED SENSOR

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove brake line mounting nut and remove the brake line from the sensor stud.

(3) Remove mounting stud from the sensor and shield (Fig. 9).

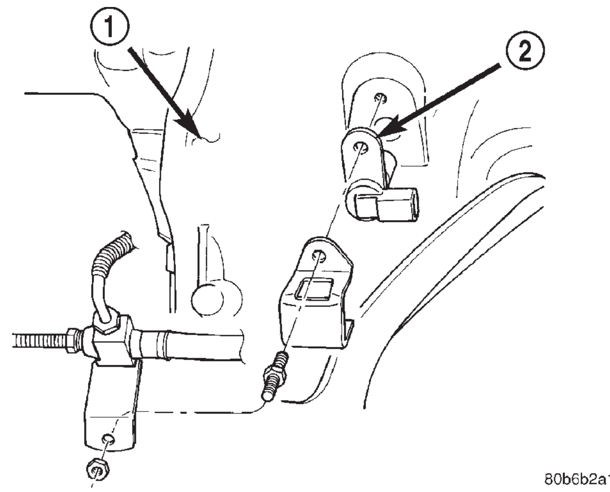


Fig. 9 Rear Speed Sensor Mounting

1 – DIFFERENTIAL HOUSING
2 – WHEEL SPEED SENSOR

(4) Remove sensor and shield from differential housing.

(5) Disconnect sensor wire harness and remove sensor.

INSTALLATION

(1) Connect harness to sensor. **Be sure seal is securely in place between sensor and wiring connector.**

(2) Install O-ring on sensor (if removed).

(3) Insert sensor in differential housing.

(4) Install sensor shield.

(5) Install the sensor mounting stud and tighten to 24 N·m (200 in. lbs.).

(6) Install the brake line on the sensor stud and install the nut.

(7) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

EXCITER RING

The exciter ring is mounted on the differential case. If the ring is damaged refer to Group 3 Differential and Driveline for service procedures.

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Controller	
Mounting Screws	6 N·m (53 in. lbs.)
RWAL Valve	
Mounting Bolt	20-27 N·m (15-20 ft. lbs.)
Brake Line Fittings	19 N·m (170 in. lbs.)
Wheel Speed Sensor	
Mounting Bolt	24 N·m (200 in. lbs.)

FOUR WHEEL ANTILOCK BRAKES

TABLE OF CONTENTS

	page		page
DESCRIPTION AND OPERATION		**REMOVAL AND INSTALLATION**	
ANTILOCK BRAKE SYSTEM	40	ANTILOCK CONTROL ASSEMBLY	44
CONTROLLER ANTILOCK BRAKES	41	CONTROLLER ANTILOCK BRAKES	44
HYDRAULIC CONTROL UNIT	41	FRONT WHEEL SPEED SENSOR - 4x2	45
WHEEL SPEED SENSOR	42	FRONT WHEEL SPEED SENSOR - 4x4	46
ABS WARNING LAMP	43	TONE WHEEL	46
DIAGNOSIS AND TESTING		REAR WHEEL SPEED SENSOR	47
ANTILOCK BRAKES	43	EXCITER RING	47
SERVICE PROCEDURES		**SPECIFICATIONS**	
BLEEDING ABS BRAKE SYSTEM	43	TORQUE CHART	47

DESCRIPTION AND OPERATION

ANTILOCK BRAKE SYSTEM

DESCRIPTION

The antilock brake system (ABS) is an electronically operated, all wheel brake control system.

The system is designed to prevent wheel lockup and maintain steering control during periods of high wheel slip when braking. Preventing lockup is accomplished by modulating fluid pressure to the wheel brake units.

The hydraulic system is a three channel design. The front wheel brakes are controlled individually and the rear wheel brakes in tandem (Fig. 1). The ABS electrical system is separate from other electrical circuits in the vehicle. A specially programmed controller antilock brake unit operates the system components.

ABS system major components include:

- Controller Antilock Brakes (CAB)
- Hydraulic Control Unit (HCU)
- Wheel Speed Sensors (WSS)
- ABS Warning Light

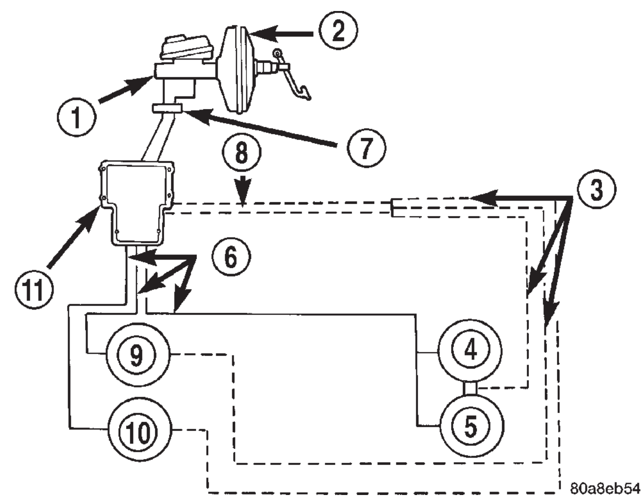


Fig. 1 Antilock Brake System

1 – MASTER CYLINDER AND RESERVOIR
2 – POWER BRAKE BOOSTER
3 – WIRES TO WHEEL SPEED SENSORS
4 – RIGHT REAR WHEEL
5 – LEFT REAR WHEEL
6 – HYDRAULIC BRAKE LINES TO WHEELS
7 – COMBINATION VALVE
8 – HARNESS
9 – RIGHT FRONT WHEEL
10 – LEFT FRONT WHEEL
11 – CAB/HCU

OPERATION

Battery voltage is supplied to the CAB ignition terminal when the ignition switch is turned to Run position. The CAB performs a system initialization procedure at this point. Initialization consists of a static and dynamic self check of system electrical components.

The static and dynamic checks occurs at ignition start up. During the dynamic check, the CAB briefly cycles the pump and solenoids to verify operation. An audible noise may be heard during this self check. This noise should be considered normal.

If an ABS component exhibits a fault during initialization, the CAB illuminates the amber warning light and registers a fault code in the microprocessor memory.

The CAB monitors wheel speed sensor inputs continuously while the vehicle is in motion. However, the CAB will not activate any ABS components as long as sensor inputs indicate normal braking.

DESCRIPTION AND OPERATION (Continued)

During normal braking, the master cylinder, power booster and wheel brake units all function as they would in a vehicle without ABS. The HCU components are not activated.

The purpose of the antilock system is to prevent wheel lockup during periods of high wheel slip. Preventing lockup helps maintain vehicle braking action and steering control.

The antilock CAB activates the system whenever sensor signals indicate periods of high wheel slip. High wheel slip can be described as the point where wheel rotation begins approaching 20 to 30 percent of actual vehicle speed during braking. Periods of high wheel slip occur when brake stops involve high pedal pressure and rate of vehicle deceleration.

The antilock system prevents lockup during high slip conditions by modulating fluid apply pressure to the wheel brake units.

Brake fluid apply pressure is modulated according to wheel speed, degree of slip and rate of deceleration. Sensors at each front wheel convert wheel speed into electrical signals. These signals are transmitted to the CAB for processing and determination of wheel slip and deceleration rate.

The ABS system has three fluid pressure control channels. The front brakes are controlled separately and the rear brakes in tandem. A speed sensor input signal indicating a high slip condition activates the CAB antilock program.

Two solenoid valves are used in each antilock control channel. The valves are all located within the HCU valve body and work in pairs to either increase, hold, or decrease apply pressure as needed in the individual control channels.

The solenoid valves are not static during antilock braking. They are cycled continuously to modulate pressure. Solenoid cycle time in antilock mode can be measured in milliseconds.

CONTROLLER ANTILOCK BRAKES

DESCRIPTION

The CAB is mounted on the top of the hydraulic control unit (Fig. 2). The CAB operates the ABS system and is separate from other vehicle electrical circuits. CAB voltage source is through the ignition switch in the RUN position.

OPERATION

The CAB contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously.

The CAB contains a self check program that illuminates the ABS warning light when a system fault

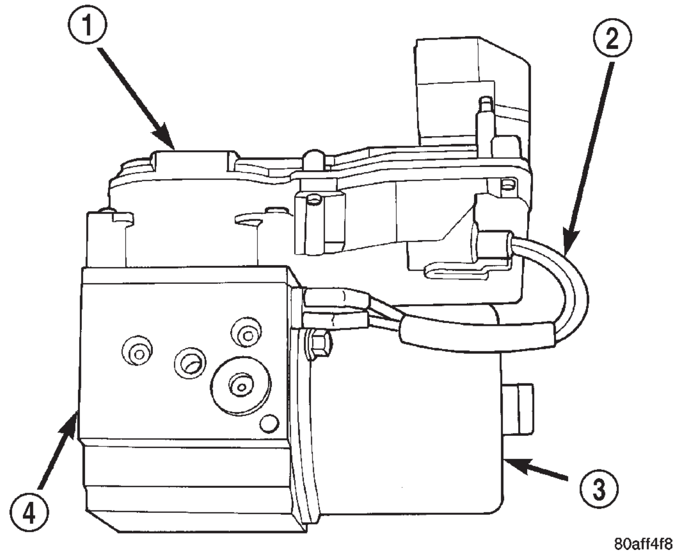


Fig. 2 CAB/HCU

1 – CAB
2 – PUMP WIRING
3 – PUMP MOTOR
4 – HCU

is detected. Faults are stored in a diagnostic program memory and are accessible with the DRB scan tool.

ABS faults remain in memory until cleared, or until after the vehicle is started approximately 50 times. Stored faults are **not** erased if the battery is disconnected.

NOTE: If the CAB needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new CAB. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile refer to Group 22 Tire and Wheels. To program the CAB refer to the Chassis Diagnostic Manual.

HYDRAULIC CONTROL UNIT

DESCRIPTION

The hydraulic control unit (HCU) consists of a valve body, pump, two accumulators and a motor (Fig. 2). The assembly is mounted on the driverside inner fender under the hood.

OPERATION

The pump, motor, and accumulators are combined into an assembly attached to the valve body. The accumulators store the extra fluid which had to be dumped from the brakes. This is done to prevent the wheels from locking up. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the CAB.

DESCRIPTION AND OPERATION (Continued)

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

The valve body contains the solenoid valves. The valves modulate brake pressure during antilock braking and are controlled by the CAB.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two remaining channels control the front wheel brakes individually.

During antilock braking, the solenoid valves are opened and closed as needed. The valves are not static. They are cycled rapidly and continuously to modulate pressure and control wheel slip and deceleration.

During antilock braking, solenoid valve pressure modulation occurs in three stages, pressure decrease, pressure hold, and pressure increase. The valves are all contained in the valve body portion of the HCU.

PRESSURE DECREASE

The inlet valve is closed and the outlet valve is opened during the pressure decrease cycle.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the CAB closes the inlet to prevent the driver from further increasing the brake pressure and locking the brakes. The CAB then opens the outlet valve, which also opens the return circuit to the accumulators. Fluid pressure is allowed to bleed off (decrease) as needed to prevent wheel lock.

Once the period of high wheel slip has ended, the CAB closes the outlet valve and begins a pressure increase or hold cycle as needed.

PRESSURE HOLD

Both solenoid valves are closed in the pressure hold cycle. Fluid apply pressure in the control channel is maintained at a constant rate. The CAB maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

PRESSURE INCREASE

The inlet valve is open and the outlet valve is closed during the pressure increase cycle. The pressure increase cycle is used to counteract unequal wheel speeds. This cycle controls re-application of fluid apply pressure due to changing road surfaces or wheel speed.

WHEEL SPEED SENSOR

DESCRIPTION

The ABS brake system uses 3 wheel speed sensors. A sensor is mounted to each front steering knuckles. The third sensor is mounted on top of the rear axle differential housing.

OPERATION

The WSS consists of a magnet surrounded by windings from a single strand of wire. The sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction. The magnetic induction is created when a toothed sensor ring (exciter ring or tone wheel) passes the stationary magnetic WSS.

When the ring gear is rotated, the exciter ring passes the tip of the WSS. As the exciter ring tooth approaches the tip of the WSS, the magnetic lines of force expand, causing the magnetic field to cut across the sensor's windings. This, in turn causes current to flow through the WSS circuit (Fig. 3) in one direction. When the exciter ring tooth moves away from the sensor tip, the magnetic lines of force collapse cutting the winding in the opposite direction. This causes the current to flow in the opposite direction. Every time a tooth of the exciter ring passes the tip of the WSS, an AC signal is generated. Each AC signal (positive to negative signal or sinewave) is interpreted by the CAB. It then compares the frequency of the sinewave to a time value to calculate vehicle speed. The CAB continues to monitor the frequency to determine a deceleration rate that would indicate a possible wheel-locking tendency.

The signal strength of any magnetic induction sensor is directly affected by:

- Magnetic field strength; the stronger the magnetic field, the stronger the signal
- Number of windings in the sensor; more windings provide a stronger signal
- Exciter ring speed; the faster the exciter ring/tone wheel rotates, the stronger the signal will be
- Distance between the exciter ring teeth and WSS; the closer the WSS is to the exciter ring/tone wheel, the stronger the signal will be

The rear WSS is not adjustable. A clearance specification has been established for manufacturing tolerances. If the clearance is not within these specifications, then either the WSS or other components may be damaged. The clearance between the WSS and the exciter ring is 0.005 – 0.050 in.

The assembly plant performs a "Rolls Test" on every vehicle that leaves the assembly plant. One of the test performed is a test of the WSS. To properly test the sensor, the assembly plant connects test equipment to the Data Link Connector (DLC). This

DESCRIPTION AND OPERATION (Continued)

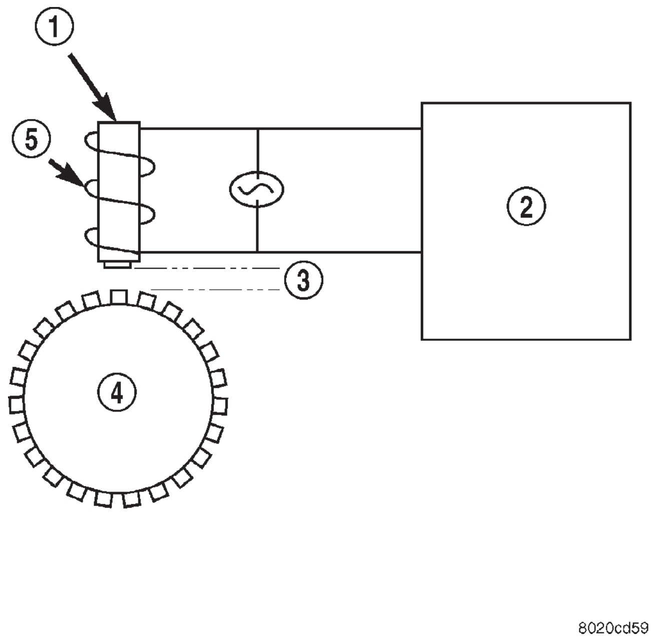


Fig. 3 Operation of the Wheel Speed Sensor

1 – MAGNETIC CORE
2 – CAB
3 – AIR GAP
4 – EXCITER RING
5 – COIL

connector is located to the right of the steering column and attached to the lower portion of the instrument panel (Fig. 4). The rolls test terminal is spliced to the WSS circuit. The vehicle is then driven on a set of rollers and the WSS output is monitored for proper operation.

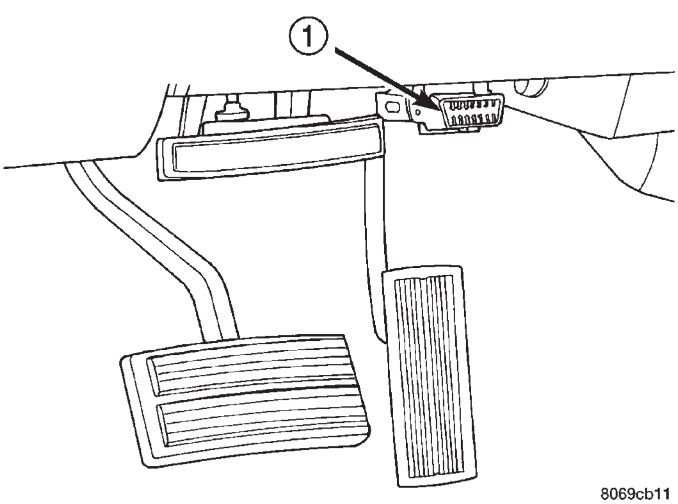


Fig. 4 Data Link Connector - Typical

1 – 16–WAY DATA LINK CONNECTOR

ABS WARNING LAMP

DESCRIPTION

The amber ABS warning lamp and red warning lamp are located in the instrument cluster. The amber ABS warning lamp illuminates at start-up to perform a self check. The lamp goes out when the self check program determines the system is operating normal. The red brake warning lamp is used to alert the driver of a hydraulic fault or that the parking brake is applied.

OPERATION

If an ABS component exhibits a fault the CAB will illuminate the ABS warning lamp and register a trouble code in the microprocessor. The lamp is controlled by the CAB. The CAB controls the lamp sending a message to the instrument cluster.

If red warning lamp is illuminate with the amber warning lamp, this may indicate a electronic brake distribution fault.

The red warning lamp will illuminate if an ABS component exhibits a fault and the amber lamp is burned out.

DIAGNOSIS AND TESTING

ANTILOCK BRAKES

The ABS brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the systems input and output circuits to verify the system is operating correctly. If the on board diagnostic system senses that a circuit is malfunctioning the system will set a trouble code in its memory.

NOTE: An audible noise may be heard during the self-test. This noise should be considered normal.

NOTE: The MDS or DRB III scan tool is used to diagnose the ABS system. For additional information refer to the Antilock Brake section in Group 8W. For test procedures refer to the Chassis Diagnostic Manual.

SERVICE PROCEDURES

BLEEDING ABS BRAKE SYSTEM

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second base brake bleed-

SERVICE PROCEDURES (Continued)

ing procedure is then required to remove any air remaining in the system.

(1) Perform base brake bleeding. Refer to base brake section for procedure.

(2) Connect scan tool to the Data Link Connector.

(3) Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then BLEED BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.

(4) Perform base brake bleeding a second time. Refer to base brake section for procedure.

(5) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

REMOVAL AND INSTALLATION

CONTROLLER ANTILOCK BRAKES

NOTE: If the CAB needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new CAB. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile refer to Group 22 Tire and Wheels. To program the CAB refer to the Chassis Diagnostic Manual.

REMOVAL

(1) Disconnect battery negative cable.

(2) Push the harness connector locks to release the locks, (Fig. 5) then remove the connectors from the CAB.

(3) Disconnect the pump motor connector (Fig. 6).

(4) Remove screws attaching CAB to the HCU (Fig. 7).

(5) Remove the CAB.

INSTALLATION

(1) Place the CAB onto the HCU.

NOTE: Insure the CAB seal is in position before installation.

(2) Install the mounting screws and tighten to 4-4.7 N·m (36-42 in. lbs.).

(3) Connect the pump motor harness.

(4) Connect the harnesses to the CAB and lock the connectors.

(5) Connect battery.

ANTILOCK CONTROL ASSEMBLY

NOTE: If the antilock control assembly needs to be replaced, the rear axle type and tire revolutions per mile must be programed into the new CAB. For axle type refer to Group 3 Differential and Driveline. For tire revolutions per mile refer to Group 22 Tire and Wheels. To program the CAB refer to the Chassis Diagnostic Manual.

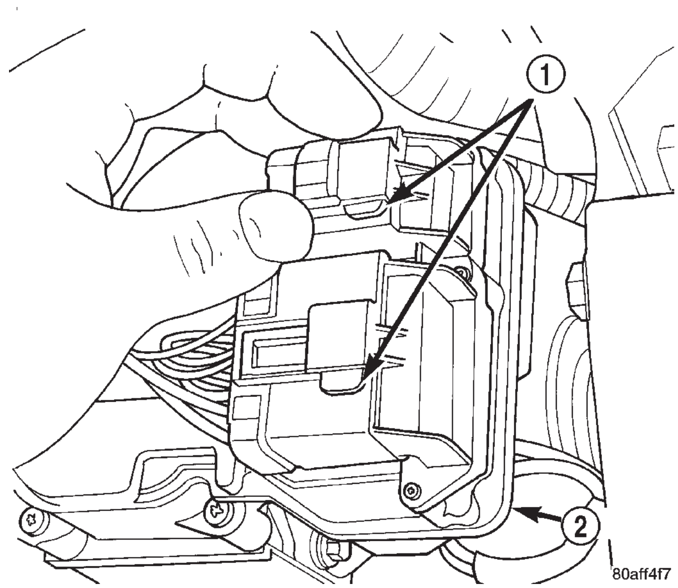


Fig. 5 Harness Connector Locks

1 – CONNECTOR LOCK
2 – CAB

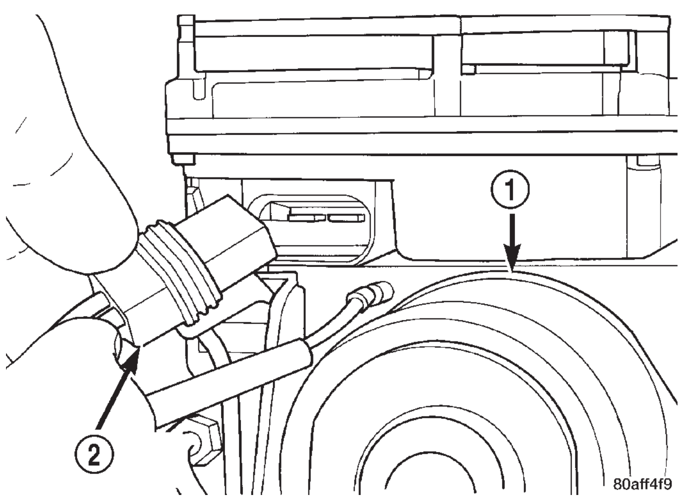


Fig. 6 Pump Motor Connector

1 – PUMP MOTOR
2 – PUMP CONNECTOR

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove the brake lines from HCU (Fig. 8).

(3) Push the harness connector locks to release the locks, (Fig. 5) then remove the connectors from the CAB.

(4) Remove the nuts which attaches the assembly to the mounting bracket (Fig. 9).

REMOVAL AND INSTALLATION (Continued)

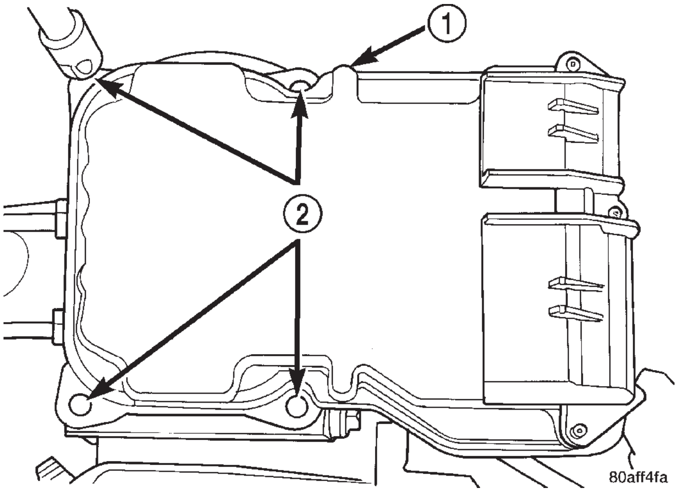


Fig. 7 Controller Mounting Screws

1 – CAB
2 – MOUNTING LOCATIONS

(5) Remove the assembly from the vehicle.

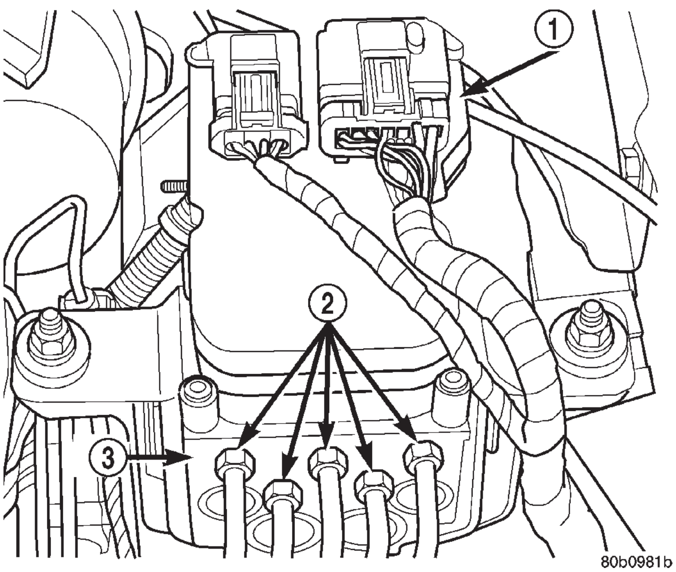


Fig. 8 HCU Brake Lines

1 – CAB
2 – BRAKE LINES
3 – HCU

INSTALLATION

(1) Install the antilock assembly into the bracket and tighten bolts to 14-15 N·m (10-12 ft. lbs.).

(2) Connect the CAB harnesses.

(3) Connect the brake lines to the HCU. Tighten brake line fittings to 19 N·m (170 in. lbs.).

(4) Connect battery.

(5) Bleed brake system.

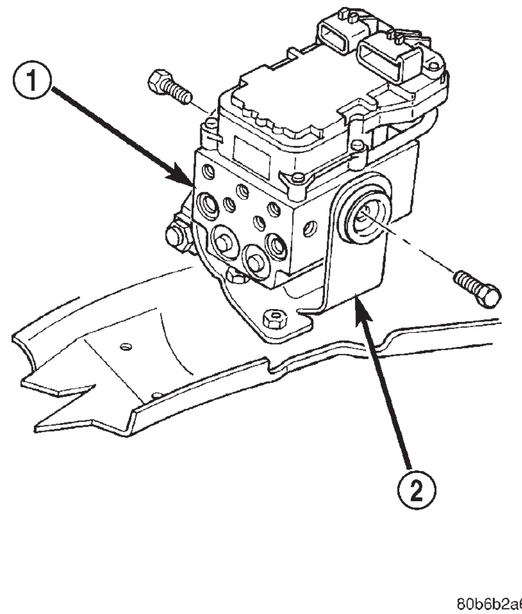


Fig. 9 Mounting Bracket

1 – ANTILOCK CONTROL ASSEMBLY
2 – MOUNTING BRACKET

FRONT WHEEL SPEED SENSOR - 4x2

CAUTION: Special bolts are used to attach the front sensor. The bolts have a special shoulder, thread length and surface treatment. If the original bolts must be replaced, use only factory replacement part. Do not use substitute bolts under any circumstances.

REMOVAL

(1) Raise and support vehicle.

(2) Remove bolt attaching sensor to the steering knuckle (Fig. 10).

(3) Remove clamps securing sensor wire to control arm and inner fender panel.

(4) In engine compartment, disconnect sensor wire from harness and remove sensor.

INSTALLATION

(1) Position sensor in the knuckle and install sensor attaching bolts. Tighten bolts to 21 N·m (190 in. lbs.).

(2) Secure sensor wire retaining clamps to control arm and fender panel.

(3) In engine compartment, connect sensor wire to harness connector. Make sure wire is routed away from hot or rotating underhood components.

(4) Turn steering wheel back and forth to verify that wire is clear of steering and suspension components.

(5) Remove supports and lower vehicle.

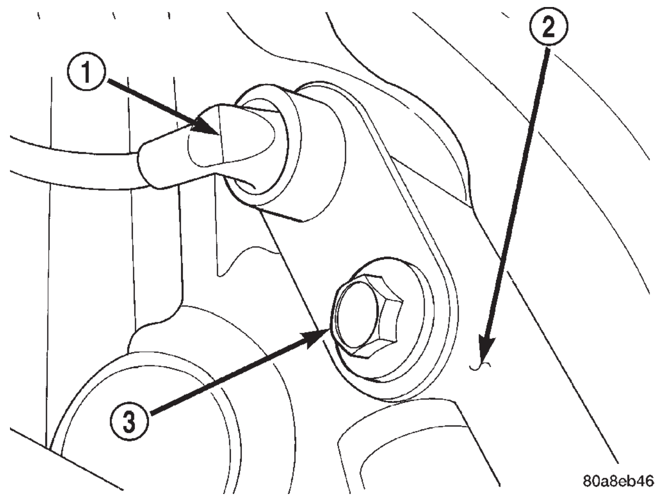


Fig. 10 Front Wheel Speed Sensor - 4x2

1 – WHEEL SPEED SENSOR
2 – KNUCKLE
3 – MOUNTING BOLT

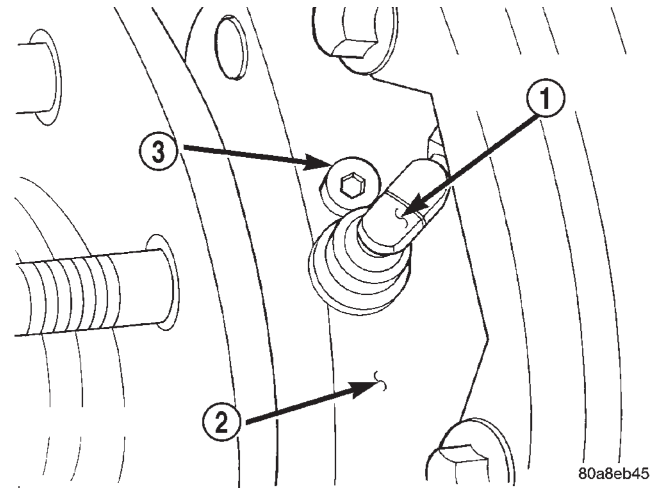


Fig. 11 Front Wheel Speed Sensor - 4x4

1 – WHEEL SPEED SENSOR
2 – HUB/BEARING
3 – MOUNTING BOLTS

FRONT WHEEL SPEED SENSOR - 4x4

CAUTION: Special bolts are used to attach the front sensor. The bolts have a special shoulder, thread length and surface treatment. If the original bolts must be replaced, use only factory replacement bolts. Do not use substitute bolt under any circumstances.

REMOVAL

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Remove brake caliper and rotor.
(4) Remove bolts attaching sensor to hub/bearing (Fig. 11).
(5) Remove clamps securing sensor wire to control arm and inner fender panel.
(6) In engine compartment, disconnect sensor wire and remove sensor.

INSTALLATION

(1) Guide sensor wire around upper control arm.
(2) Position sensor on hub/bearing and install attaching bolts. Tighten bolt to 18-25 N·m (160-220 in. lbs.).
(3) Secure sensor wire retaining clamps to control arm and fender panel with original hardware.
(4) In engine compartment, connect sensor wire to harness connector. Insure wire is routed away from hot or rotating underhood components.
(5) Install brake rotor and caliper.
(6) Install wheel and tire assembly.
(7) Turn steering wheel back and forth to verify that wire is clear of steering and suspension components.
(8) Remove supports and lower vehicle.

TONE WHEEL

The tone wheel for the front speed sensor is located on the hub/bearing on 2-wheel drive models (Fig. 12). On 4-wheel drive models, the tone wheel is located in the hub/bearing housing.

The tone wheel is not a serviceable component. To replace the tone wheel the hub/bearing must be replaced. Refer to Group 2 Suspension for the service procedure.

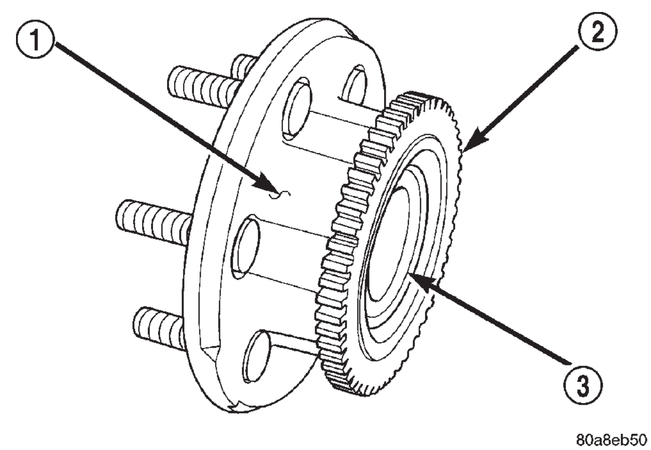


Fig. 12 Tone Wheel 4x2

1 – HUB
2 – TONE WHEEL
3 – BEARING

REMOVAL AND INSTALLATION (Continued)

REAR WHEEL SPEED SENSOR

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove brake line mounting nut and remove the brake line from the sensor stud.

(3) Remove mounting stud from the sensor and shield (Fig. 13).

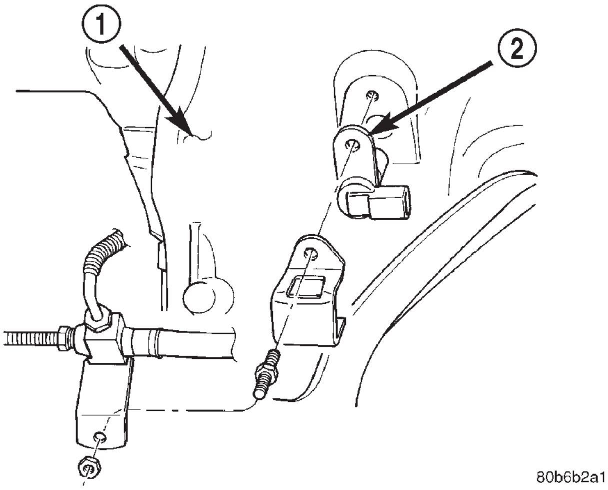


Fig. 13 Rear Speed Sensor Mounting

1 – DIFFERENTIAL HOUSING
2 – WHEEL SPEED SENSOR

(4) Remove sensor and shield from differential housing.

(5) Disconnect sensor wire harness and remove sensor.

INSTALLATION

(1) Connect harness to sensor. **Be sure seal is securely in place between sensor and wiring connector.**

(2) Install O-ring on sensor (if removed).

(3) Insert sensor in differential housing.

(4) Install sensor shield.

(5) Install the sensor mounting stud and tighten to 24 N·m (200 in. lbs.).

(6) Install the brake line on the sensor stud and install the nut.

(7) Lower vehicle.

EXCITER RING

The exciter ring is mounted on the differential case. If the ring is damaged refer to Group 3 Differential and Driveline for service procedures.

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
ABS Assembly	
Bracket bolts	14-15 N·m (10-12 ft. lbs.)
Mounting Nuts	12 N·m (102 in. lbs.)
CAB Screws	4-4.7 N·m (36-42 in. lbs.)
Brake Line Fittings	19 N·m (170 in. lbs.)
Wheel Speed Sensors	
Front Sensor Bolt	21 N·m (190 in. lbs.)
Rear Sensor Bolt	22.5 N.m (200 in. lbs.)

CLUTCH

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
CLUTCH 1
FLYWHEEL 2
CLUTCH DISC. 2
CLUTCH PRESSURE PLATE 2
CLUTCH RELEASE BEARING 3
HYDRAULIC CLUTCH LINKAGE 4
CLUTCH DISC APPLICATION 4
CLUTCH PEDAL POSITION SWITCH 5
DIAGNOSIS AND TESTING
SAFETY PRECAUTIONS 5
INSTALLATION METHODS AND PARTS USAGE 5
CLUTCH DIAGNOSTIC INFORMATION 5
CLUTCH CONTAMINATION 5
IMPROPER CLUTCH RELEASE OR ENGAGEMENT 7
CLUTCH MISALIGNMENT. 7
CLUTCH HOUSING MISALIGNMENT 7
CLUTCH FLYWHEEL RUNOUT 7
CLUTCH COVER AND DISC RUNOUT 7
CLUTCH DIAGNOSIS CHARTS 8
SERVICE PROCEDURES
CLUTCH COMPONENT LUBRICATION 10
CLUTCH HYDRAULIC FLUID 11
CLUTCH FLUID LEVEL 11
FLYWHEEL 11
REMOVAL AND INSTALLATION
CLUTCH COVER AND DISC 12
CLUTCH HOUSING REPLACEMENT 13
RELEASE BEARING 14
PILOT BEARING 14
CLUTCH HYDRAULIC LINKAGE 15
CLUTCH PEDAL 16
SPECIFICATIONS
TORQUE 16

DESCRIPTION AND OPERATION

CLUTCH

DESCRIPTION

The clutch mechanism consists of a flywheel, a single, dry-type disc, and a diaphragm style clutch cover (Fig. 1). A hydraulic linkage is used to operate the clutch release bearing and fork. The flywheel is bolted to the rear flange of the crankshaft. The clutch pressure plate is bolted to the flywheel with the clutch disc located between these two components. The clutch system provides the mechanical, but still easily detachable, link between the engine and the transmission. The system is designed to ensure that the full torque output of the engine is transfered to the transmission while isolating the transmission from the engine firing pulses to minimize concerns such as gear rattle.

OPERATION

Leverage, clamping force, and friction are what make the clutch work. The disc serves as the friction element and a diaphragm spring and pressure plate provide the clamping force. The clutch pedal, hydrau-

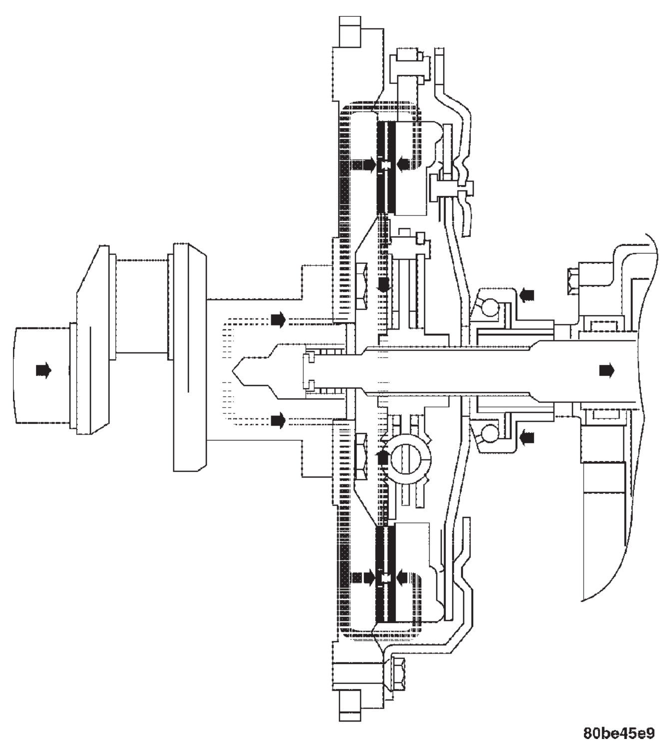


Fig. 1 Engine Powerflow

DESCRIPTION AND OPERATION (Continued)

lic linkage, release lever and bearing provide the leverage.

The clutch master cylinder push rod is connected to the clutch pedal. When the clutch pedal is depressed, the slave cylinder is operated by the clutch master cylinder mounted on the dash panel. The release fork is actuated by the hydraulic slave cylinder mounted on the transmission housing. The release bearing is operated by a release fork pivoting on a ball stud mounted in the transmission housing. The release bearing then depresses the pressure plate spring fingers, thereby releasing pressure on the clutch disc and allowing the engine crankshaft to spin independently of the transmission input shaft (Fig. 2).

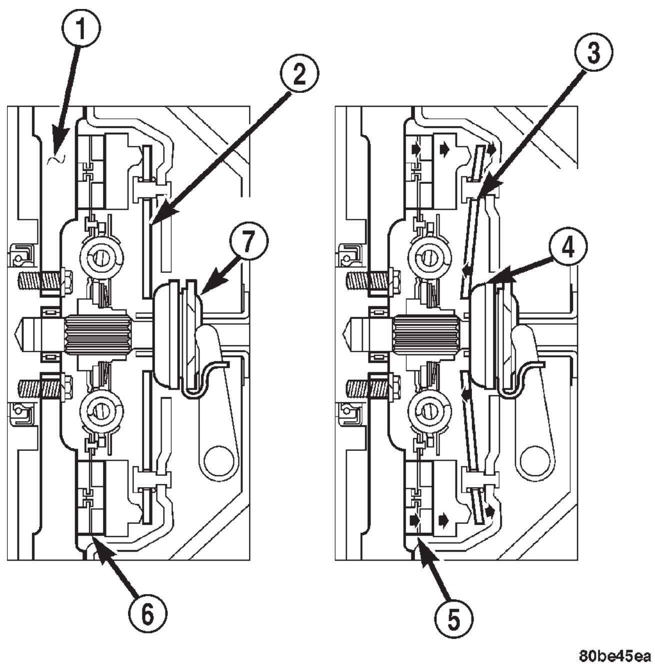


Fig. 2 Clutch Operation

1 – FLYWHEEL
2 – PRESSURE PLATE FINGERS
3 – PIVOT POINT
4 – RELEASE BEARING PUSHED IN
5 – CLUTCH DISC ENGAGED
6 – CLUTCH DISC ENGAGED
7 – RELEASE BEARING

FLYWHEEL

DESCRIPTION

The flywheel (Fig. 3) is a heavy plate bolted to the rear of the crankshaft. The flywheel incorporates the ring gear around the outer circumference to mesh with the starter to permit engine cranking. The rear face of the flywheel serves as the driving member to the clutch disc.

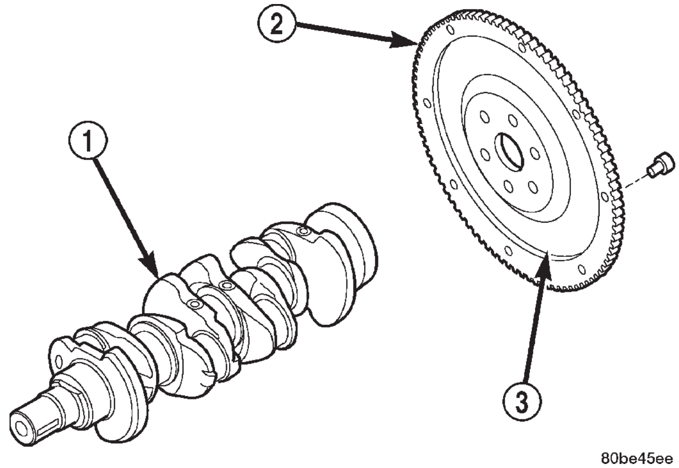


Fig. 3 Flywheel

1 – CRANKSHAFT
2 – RING GEAR
3 – FLYWHEEL

OPERATION

The flywheel serves to dampen the engine firing pulses. The heavy weight of the flywheel relative to the rotating mass of the engine components serves to stabilize the flow of power to the remainder of the drivetrain. The crankshaft has the tendency to attempt to speed up and slow down in response to the cylinder firing pulses. The flywheel dampens these impulses by absorbing energy when the crankshaft speeds and releasing the energy back into the system when the crankshaft slows down.

CLUTCH DISC

DESCRIPTION

The clutch disc friction material is riveted to the disc hub (Fig. 4). The hub bore is splined for installation on the transmission input shaft. The clutch disc has cushion springs in the disc hub to dampen disc vibrations during application and release of the clutch.

OPERATION

The clutch disc is held onto the surface of the flywheel by the force exerted by the pressure plate's diaphragm spring. The friction material of the clutch disc then transfers the engine torque from the flywheel and pressure plate to the input shaft of the transmission.

CLUTCH PRESSURE PLATE

DESCRIPTION

The clutch pressure plate assembly is a diaphragm type with a one-piece spring and multiple release fin-

DESCRIPTION AND OPERATION (Continued)

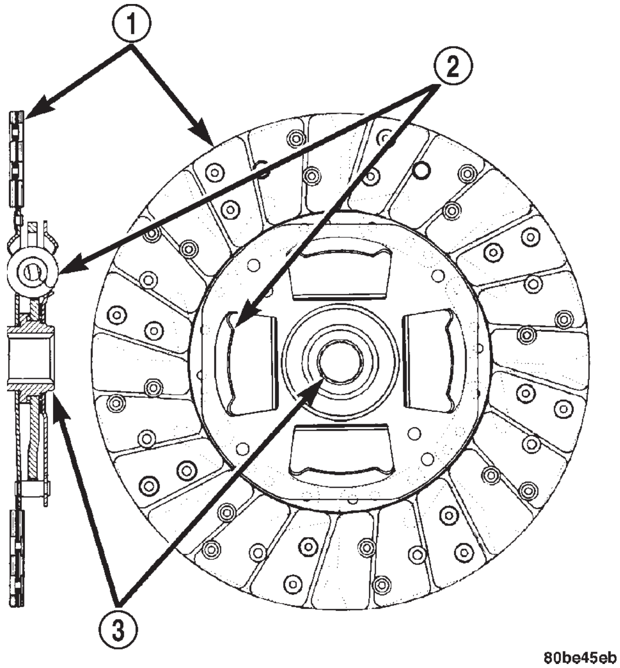


Fig. 4 Clutch Disc-Typical

1 – FACING MATERIAL
2 – DAMPER SPRINGS
3 – HUB

gers (Fig. 5). The pressure plate release fingers are preset during manufacture and are not adjustable. The assembly also contains the cover, pressure plate, and fulcrum components.

OPERATION

The clutch pressure plate assembly clamps the clutch disc against the flywheel. When the release bearing is depressed by the shift fork, the pressure exerted on the clutch disc by the pressure plate spring is decreased. As additional force is applied, the bearing presses the diaphragm spring fingers inward on the fulcrums. This action moves the pressure plate rearward relieving clamp force on the disc. The clutch disc is disengaged and freewheeling at this point.

CLUTCH RELEASE BEARING

DESCRIPTION

A conventional release bearing (Fig. 6) is used to engage and disengage the clutch pressure plate assembly. The clutch release bearing is mounted on the transmission front bearing retainer. The bearing is attached to the release fork, which moves the bearing into contact with the clutch cover diaphragm spring.

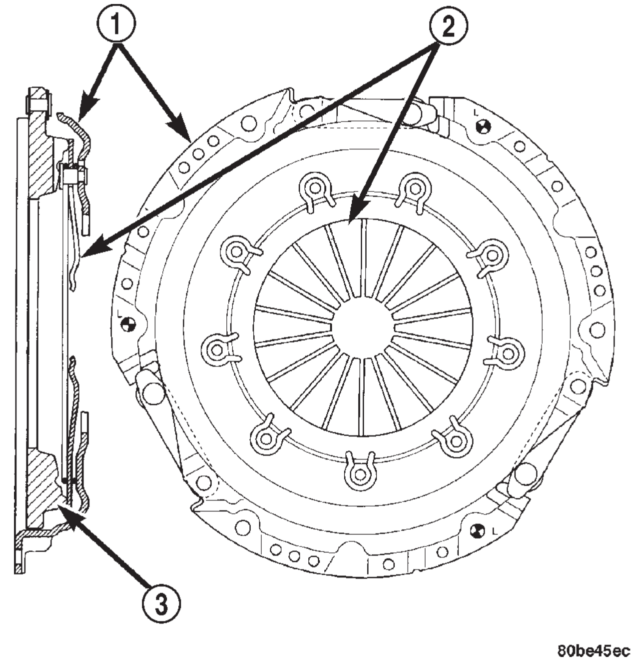


Fig. 5 Clutch Pressure Plate-Typical

1 – COVER
2 – RELEASE FINGERS
3 – PRESSURE PLATE

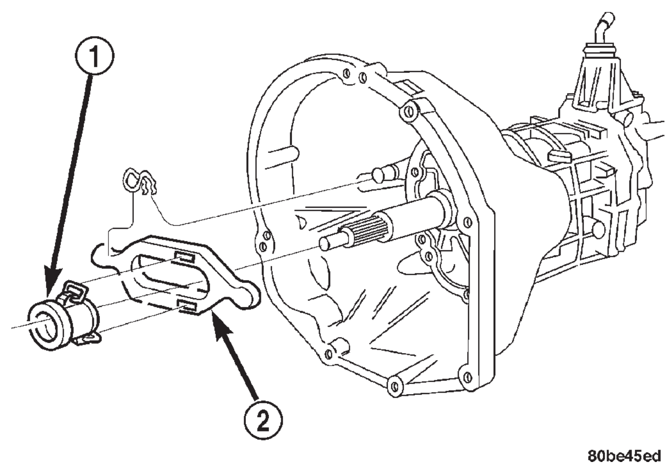


Fig. 6 Clutch Release Bearing

1 – RELEASE BEARING
2 – RELEASE FORK

OPERATION

The release bearing is operated by a release fork in the clutch housing. Slave cylinder force causes the release lever to move the release bearing into contact with the diaphragm spring. As additional force is applied, the bearing presses the diaphragm spring fingers inward on the fulcrums. This action moves the pressure plate rearward relieving clamp force on the disc. Releasing pedal pressure removes clutch hydraulic pressure. The release bearing then moves

DESCRIPTION AND OPERATION (Continued)

away from the diaphragm spring which allows the pressure plate to exert clamping force on the clutch disc.

HYDRAULIC CLUTCH LINKAGE

DESCRIPTION

The hydraulic linkage consists of a clutch master cylinder, reservoir, a clutch slave cylinder and an interconnecting fluid line.

The clutch master cylinder push rod is connected to the clutch pedal. The slave cylinder push rod is connected to the clutch release fork. The master cylinder is mounted on the driver side of the dash panel adjacent to the brake master cylinder and booster assembly.

The factory installed hydraulic linkage has a quick disconnect at the slave cylinder. This fitting should not be disconnected or tampered with. The hydraulic linkage is serviced as an assembly only. The individual components that form the linkage assembly cannot be overhauled or serviced separately.

OPERATION

The clutch linkage uses hydraulic pressure to operate the clutch. Depressing the clutch pedal develops fluid pressure in the clutch master cylinder. This pressure is transmitted to the slave cylinder through a connecting line. In turn, the slave cylinder operates the clutch release lever.

The slave cylinder has an integral spring which preloads the release bearing against the clutch diaphragm fingers to maintain zero free-play.

Slave cylinder force causes the release lever to move the release bearing into contact with the diaphragm spring. As additional force is applied, the bearing presses the diaphragm spring fingers inward on the fulcrums. This action moves the pressure plate rearward relieving clamp force on the disc.

CLUTCH DISC APPLICATION

DESCRIPTION

Various size and design of clutches are used for the different engine transmission combinations. The cur-

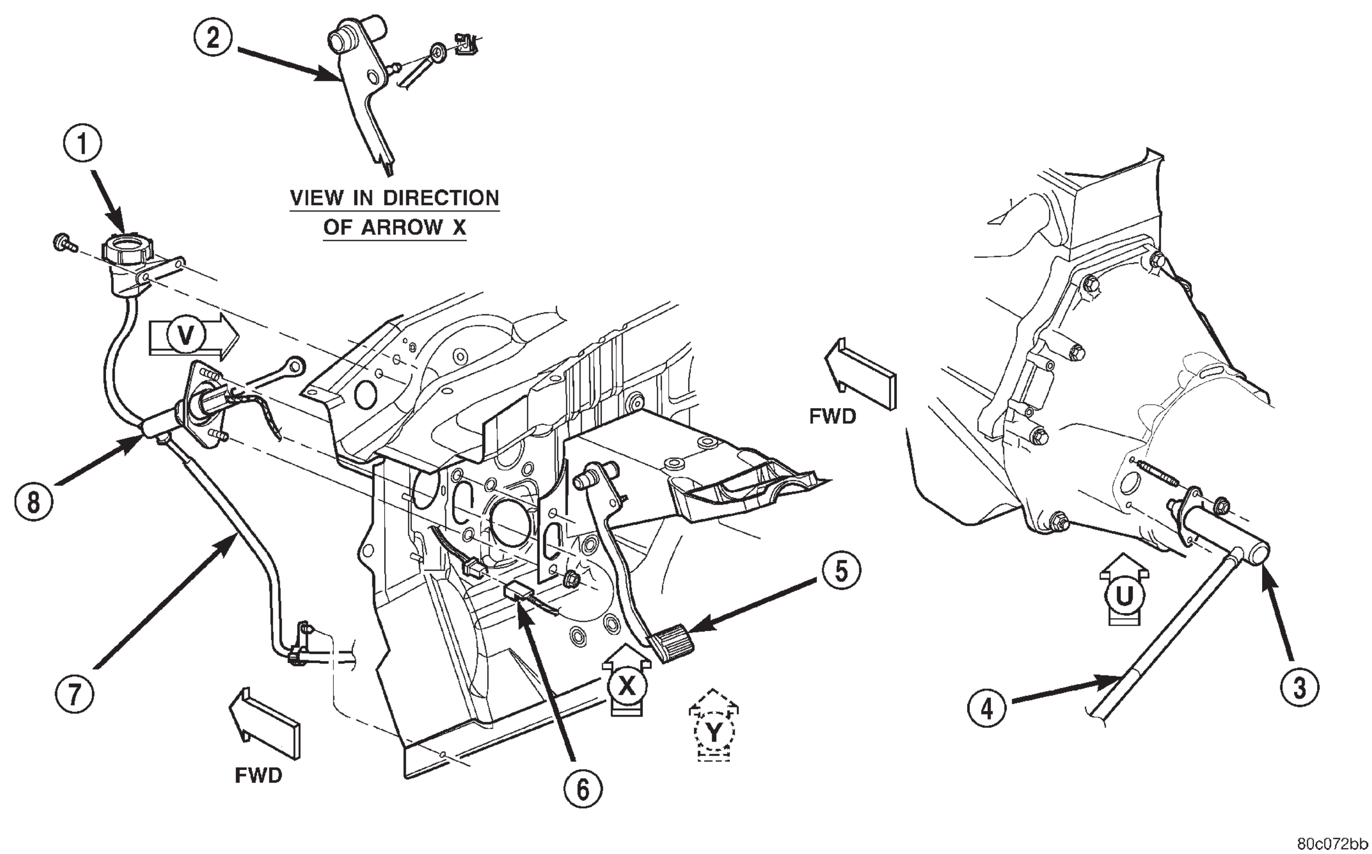


Fig. 7 Clutch Hydraulic Linkage

1 – CLUTCH FLUID RESERVOIR
2 – CLUTCH PEDAL
3 – CLUTCH SAVE CYLINDER
4 – CLUTCH HYDRAULIC LINE
5 – CLUTCH PEDAL
6 – CLUTCH PEDAL POSITION SWITCH CONNECTOR
7 – CLUTCH HYDRAULIC LINE
8 – CLUTCH MASTER CYLINDER

DESCRIPTION AND OPERATION (Continued)

rently used clutches and applications are listed below.

A 232 mm (9.13 in.) diameter clutch disc and cover are used for 2.5L (I4) engine applications.

A 265 mm (10.4 in.) diameter clutch disc and cover are used for 3.9L (V6) engine applications.

A 280 mm (11.02 in.) diameter clutch disc and cover are used for 5.2L (V8) engine applications.

OPERATION

The different size and design of clutches are used to tune the feel of the clutch application for each drivetrain combination. The variables involved in choosing a clutch for a specific combination include engine torque and power, vehicle weight, and intended vehicle usage (towing versus non-towing).

CLUTCH PEDAL POSITION SWITCH

DESCRIPTION

A clutch pedal position switch is in the starter circuit. The switch is located on the clutch master cylinder push rod.

OPERATION

The switch, which is in circuit with the starter solenoid, requires that the clutch pedal be fully depressed in order to start the engine. Switch circuitry and operation is provided in section 8W of Group 8.

DIAGNOSIS AND TESTING

SAFETY PRECAUTIONS

WARNING: EXERCISE CARE WHEN SERVICING CLUTCH COMPONENTS. FACTORY INSTALLED CLUTCH DISCS DO NOT CONTAIN ASBESTOS FIBERS. DUST AND DIRT ON CLUTCH PARTS MAY CONTAIN ASBESTOS FIBERS FROM AFTERMARKET COMPONENTS. BREATHING EXCESSIVE CONCENTRATIONS OF THESE FIBERS CAN CAUSE SERIOUS BODILY HARM. WEAR A RESPIRATOR DURING SERVICE AND NEVER CLEAN CLUTCH COMPONENTS WITH COMPRESSED AIR OR WITH A DRY BRUSH. EITHER CLEAN THE COMPONENTS WITH A WATER DAMPENED RAGS OR USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR REMOVING ASBESTOS FIBERS AND DUST. DO NOT CREATE DUST BY SANDING A CLUTCH DISC. REPLACE THE DISC IF THE FRICTION MATERIAL IS DAMAGED OR CONTAMINATED. DISPOSE OF ALL DUST AND DIRT CONTAINING ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS. THIS WILL HELP MINIMIZE EXPOSURE TO YOURSELF AND TO OTHERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL SAFETY AGENCY (EPA), FOR THE HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

INSTALLATION METHODS AND PARTS USAGE

Distortion of clutch components during installation and the use of non-standard components are common causes of clutch malfunction.

Improper clutch cover bolt tightening can distort the cover. The usual result is clutch grab, chatter and rapid wear. Tighten the cover bolts as described in Removal and Installation section.

An improperly seated flywheel and/or clutch housing are additional causes of clutch failure. Improper seating will produce misalignment and additional clutch problems.

The use of non-standard or low quality parts will also lead to problems and wear. Use recommended factory quality parts to avoid comebacks.

A cocked pilot bearing is another cause of clutch noise, drag, hard shifting, and rapid bearing wear. Always use an alignment tool to install a new bearing. This practice helps avoid cocking the bearing during installation.

CLUTCH DIAGNOSTIC INFORMATION

Unless the cause of a clutch problem is obvious, accurate problem diagnosis will usually require a road test to confirm a problem. Component inspection (Fig. 8) will then be required to determine the actual problem cause.

During a road test, drive the vehicle at normal speeds. Shift the transmission through all gear ranges and observe clutch action. If chatter, grab, slip, or improper release is experienced, remove and inspect the clutch components. However, if the problem is noise or hard shifting, further diagnosis may be needed as the transmission or another driveline component may be at fault. Careful observation during the test will help narrow the problem area.

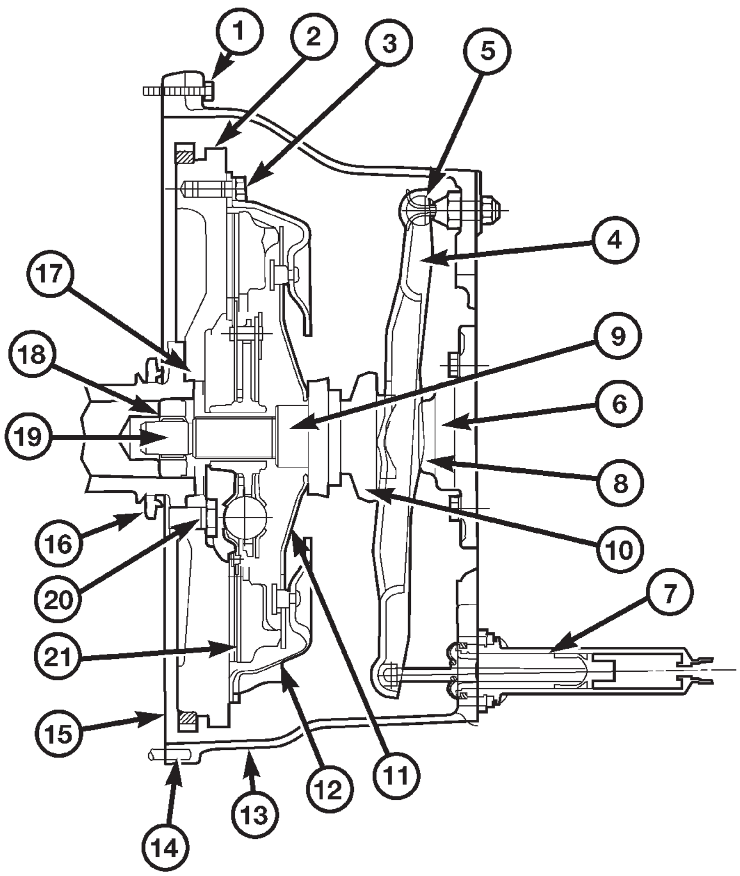
CLUTCH CONTAMINATION

Fluid contamination is a frequent cause of clutch malfunctions. Oil, water, or clutch fluid on the clutch disc and pressure plate surfaces will cause chatter, slip and grab.

During inspection, note if any components are contaminated with oil, hydraulic fluid, or water/road splash.

Oil contamination indicates a leak at either the rear main seal or transmission input shaft. Oil leakage produces a residue of oil on the housing interior and on the clutch cover and flywheel. Heat buildup

DIAGNOSIS AND TESTING (Continued)



1 Check clutch housing bolts. Tighten if loose. Be sure housing is fully seated on engine block.

2 Check flywheel. Scuff sand face to remove glaze. Clean surface with wax and grease remover. Replace flywheel if severely scored, worn or cracked. Secure flywheel with new bolts (if removed). Do not reuse old bolts. Use Mopar Lock N'Seal on bolts.

3 Tighten clutch cover bolts 2-3 threads at a time, alternately and evenly (in a star pattern) to specified torque. Failure to do so could warp the cover.

4 Check release fork. Replace fork if bent or worn. Make sure pivot and bearing contact surfaces are lubricated.

5 Check release fork pivot (in housing). Be sure pivot is secure and ball end is lubricated.

6 Transmission input shaft bearing will cause noise, chatter, or improper release if damaged. Check condition before installing transmission.

7 Check slave cylinder. Replace it if leaking. Be sure cylinder is properly secured in housing and cylinder piston is seated in release fork.

8 Check input shaft seal if clutch cover and disc were oil covered. Replace seal if worn, or cut.

9 Inspect release bearing slide surface of trans. front bearing retainer. Surface should be smooth, free of nicks, scores. Replace retainer if necessary. Lubricate slide surface before installing release bearing.

10 Do not replace release bearing unless actually faulty. Replace bearing only if seized, noisy, or damaged.

11 Check clutch cover diaphragm spring and release fingers. Replace cover if spring or fingers are bent, warped, broken, cracked. Do not tamper with factory spring setting as clutch problems will result.

12 Check condition of clutch cover. Replace clutch cover if plate surface is deeply scored, warped, worn, or cracked. Be sure cover is correct size and properly aligned on disc and flywheel.

13 Inspect clutch housing. Be sure bolts are tight. Replace housing if damaged.

14 Verify that housing alignment dowels are in position before installing housing.

15 Clean engine block surface before installing clutch housing. Dirt, grime can produce misalignment.

16 Check rear main seal if clutch disc and cover were oil covered. Replace seal if necessary.

17 Check crankshaft flange (if flywheel is removed). Be sure flange is clean and flywheel bolt threads are in good condition.

18 Check pilot bearing. Replace bearing if damaged. Pilot bearing is lubed for life. Do not add additional grease.

19 Check tranmsmission input shaft. Disc must slide freely on shaft splines. Lightly grease splines before installation. Replace shaft if splines or pilot bearing hub are damaged.

20 Check flywheel bolt torque. If bolts are loose, replace them. Use Mopar Lock N'Seal to secure new bolts

21 Check clutch disc facing. Replace disc if facing is charred, scored, flaking off, or worn. Also check runout of new disc. Runout should not exceed 0.5 mm (0.02 in.).

80c07108

Fig. 8 Clutch Components And Inspection

DIAGNOSIS AND TESTING (Continued)

caused by slippage between the cover, disc and flywheel, can sometimes bake the oil residue onto the components. The glaze-like residue ranges in color from amber to black.

Road splash contamination means dirt/water is entering the clutch housing due to loose bolts, housing cracks, or through hydraulic line openings. Driving through deep water puddles can force water/road splash into the housing through such openings.

Clutch fluid leaks are usually from damaged slave cylinder push rod seals. This type of leak can only be confirmed by visual inspection.

IMPROPER CLUTCH RELEASE OR ENGAGEMENT

Clutch release or engagement problems are caused by wear, or damage to one or more clutch components. A visual inspection of the release components will usually reveal the problem part.

Release problems can result in hard shifting and noise. Items to look for are: leaks at the clutch cylinders and interconnecting line; loose slave cylinder bolts; worn/loose release fork and pivot stud; damaged release bearing; and a worn clutch disc, or pressure plate.

Normal condensation in vehicles that are stored or out of service for long periods of time can generate enough corrosion to make the disc stick to the flywheel, or pressure plate. If this condition is experienced, correction only requires that the disc be loosened manually through the inspection plate opening.

Engagement problems usually result in slip, chatter/shudder, and noisy operation. The primary causes are clutch disc contamination; clutch disc wear; misalignment, or distortion; flywheel damage; or a combination of the foregoing. A visual inspection is required to determine the part actually causing the problem.

CLUTCH MISALIGNMENT

Clutch components must be in proper alignment with the crankshaft and transmission input shaft. Misalignment caused by excessive runout or warpage of any clutch component will cause grab, chatter and improper clutch release.

CLUTCH HOUSING MISALIGNMENT

Clutch housing alignment is important to proper clutch operation. The housing maintains alignment between the crankshaft and transmission input shaft. Misalignment can cause clutch noise, hard shifting, incomplete release and chatter. It can also result in premature wear of the pilot bearing, cover release fingers and clutch disc. In severe cases, misalignment can also cause premature wear of the transmission input shaft and front bearing.

Housing misalignment is generally caused by incorrect seating on the engine or transmission, loose housing bolts, missing alignment dowels, or housing damage. Infrequently, misalignment may also be caused by housing mounting surfaces that are not completely parallel. Misalignment can be corrected with shims.

CLUTCH FLYWHEEL RUNOUT

Check flywheel runout whenever misalignment is suspected. Flywheel runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the indicator on the rear face of the engine block.

Common causes of runout are:

- heat warpage
- improper machining
- incorrect bolt tightening
- improper seating on crankshaft flange shoulder
- foreign material on crankshaft flange

Flywheel machining is not recommended. The flywheel clutch surface is machined to a unique contour and machining will negate this feature. However, minor flywheel scoring can be cleaned up by hand with 180 grit emery, or with surface grinding equipment. Remove only enough material to reduce scoring (approximately 0.001 - 0.003 in.). Heavy stock removal is **not recommended.** Replace the flywheel if scoring is severe and deeper than 0.076 mm (0.003 in.). Excessive stock removal can result in flywheel cracking or warpage after installation; it can also weaken the flywheel and interfere with proper clutch release.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout. Use new bolts when remounting a flywheel and secure the bolts with Mopar® Lock And Seal. Tighten flywheel bolts to specified torque only. Overtightening can distort the flywheel hub causing runout.

CLUTCH COVER AND DISC RUNOUT

Check the clutch disc before installation. Axial (face) runout of a **new** disc should not exceed 0.50 mm (0.020 in.). Measure runout about 6 mm (1/4 in.) from the outer edge of the disc facing. Obtain another disc if runout is excessive.

Check condition of the clutch before installation. A warped cover or diaphragm spring will cause grab and incomplete release or engagement. Be careful when handling the cover and disc. Impact can distort the cover, diaphragm spring, release fingers and the hub of the clutch disc.

DIAGNOSIS AND TESTING (Continued)

Use an alignment tool when positioning the disc on the flywheel. The tool prevents accidental misalignment which could result in cover distortion and disc damage.

A frequent cause of clutch cover distortion (and consequent misalignment) is improper bolt tightening.

CLUTCH DIAGNOSIS CHARTS

The diagnosis charts describe common clutch problems, causes and correction. Fault conditions are listed at the top of each chart. Conditions, causes and corrective action are outlined in the indicated columns.

The charts are provided as a convenient reference when diagnosing faulty clutch operation.

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
Disc facing worn out	1. Normal wear. 2. Driver frequently rides (slips) the clutch. Results in rapid overheating and wear. 3. Insufficient clutch cover diaphragm spring tension.	1. Replace cover and disc. 2. Replace cover and disc. 3. Replace cover and disc.
Clutch disc facing contaminated with oil, grease, or clutch fluid.	1. Leak at rear main engine seal or transmission input shaft seal. 2. Excessive amount of grease applied to the input shaft splines. 3. Road splash, water entering housing. 4. Slave cylinder leaking.	1. Replace appropriate seal. 2. Remove grease and apply the correct amount of grease. 3. Replace clutch disc. Clean clutch cover and reuse if in good condition. 4. Replace hydraulic clutch linkage.
Clutch is running partially disengaged.	1. Release bearing sticking or binding and does not return to the normal running position.	1. Verify failure. Replace the release bearing and transmission front bearing retainer as necessary.
Flywheel below minimum thickness specification.	1. Improper flywheel machining. Flywheel has excessive taper or excessive material removal.	1. Replace flywheel.
Clutch disc, cover and/or diaphragm spring warped or distorted.	1. Rough handling. Impact bent cover, spring, or disc. 2. Improper bolt tightening procedure.	1. Replace disc or cover as necessary. 2. Tighten clutch cover using proper procedure.
Facing on flywheel side of disc torn, gouged, or worn.	1. Flywheel surface scored or nicked. 2. Clutch disc sticking or binding on transmission input shaft.	2. Correct surface condition if possible. Replace flywheel and disc as necessary. 2. Inspect components and correct/replace as necessary.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Clutch disc facing burnt. Flywheel and cover pressure plate surfaces heavily glazed.	1. Frequent operation under high loads or hard acceleration conditions.	1. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.
	2. Driver frequently rides (slips) clutch. Results in rapid wear and overheating of disc and cover.	2. Correct condition of flywheel and pressure plate surface. Replace clutch cover and disc. Alert driver to problem cause.
Clutch disc binds on input shaft splines.	1. Clutch disc hub splines damaged during installation.	1. Clean, smooth, and lubricate hub splines if possible. Replace disc if necessary.
	2. Input shaft splines rough, damaged, or corroded.	2. Clean, smooth, and lubricate shaft splines if possible. Replace input shaft if necessary.
Clutch disc rusted to flywheel and/or pressure plate.	1. Clutch not used for and extended period of time (e.g. long term vehicle storage).	1. Sand rusted surfaces with 180 grit sanding paper. Replace clutch cover and flywheel if necessary.
Pilot bearing seized, loose, or rollers are worn.	1. Bearing cocked during installation.	1. Install a new bearing.
	2. Bearing defective.	2. Install a new bearing.
	3. Bearing not lubricated.	3. Install a new bearing.
	4. Clutch misalignment.	4. Inspect clutch and correct as necessary. Install a new bearing.
Clutch will not disengage properly.	1. Low clutch fluid level.	1. Replace hydraulic linkage assembly.
	2. Clutch cover loose.	2. Follow proper bolt tightening procedure.
	3. Clutch disc bent or distorted.	3. Replace clutch disc.
	4. Clutch cover diaphragm spring bent or warped.	4. Replace clutch cover.
	5. Clutch disc installed backwards.	5. Remove and install clutch disc correctly.
	6. Release fork bent or fork pivot loose or damaged.	6. Replace fork or pivot as necessary.
	7. Clutch master or slave cylinder failure.	7. Replace hydraulic linkage assembly.
	8. Slave cylinder pushrod not engaged in the release lever.	8. Remove the slave cylinder and re-install while ensuring that the pushrod properly engages the release lever.
	9. Loose master cylinder and/or slave cylinder bolts.	9. Tighten the master cylinder and/or slave cylinder bolts.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
Clutch pedal squeak.	1. Pivot pin loose.	1. Tighten pivot pin if possible. Replace clutch pedal if necessary.
	2. Master cylinder bushing not lubricated.	2. Lubricate master cylinder bushing.
	3. Pedal bushings worn out or cracked.	3. Replace and lubricate bushings.
	4. Clutch pedal position switch.	4. Remove the clutch pedal switch cover and lubricate the master cylinder pushrod inside the switch. Use Mopar® Dielectric Grease
Clutch master or slave cylinder plunger dragging andør binding	1. Master or slave cylinder components worn or corroded.	1. Replace clutch hydraulic linkage assembly.
Release bearing is noisy.	1. Release bearing defective or damaged.	1. Replace release bearing.
Contact surface of release bearing damaged.	1. Clutch cover incorrect or release fingers bent or distorted.	1. Replace clutch cover and release bearing.
	2. Release bearing defective or damaged.	2. Replace the release bearing.
	3. Release bearing misaligned.	3. Check and correct runout of clutch components. Check front bearing sleeve for damage/ alignment. Repair as necessary.
Partial engagement of clutch disc. One side of disc is worn and the other side is glazed and lightly worn.	1. Clutch pressure plate position incorrect.	1. Replace clutch disc and cover.
	2. Clutch cover, spring, or release fingers bent or distorted.	2. Replace clutch disc and cover.
	3. Clutch disc damaged or distorted.	2. Replace clutch disc.
	4. Clutch misalignment.	4. Check alignment and runout of flywheel, disc, pressure plate, andør clutch housing. Correct as necessary.

SERVICE PROCEDURES

CLUTCH COMPONENT LUBRICATION

Proper clutch component lubrication is important to satisfactory operation. Using the correct lubricant and not over lubricating are equally important. Apply recommended lubricant sparingly to avoid disc and pressure plate contamination.

Clutch and transmission components requiring lubrication are:

- Release lever pivot ball stud.
- Release lever contact surfaces.
- Release bearing bore.
- Clutch disc hub splines.
- Clutch pedal pivot shaft bore.
- Clutch pedal bushings.
- Input shaft splines.
- Input shaft pilot hub.
- Transmission front bearing retainer slide surface.

NOTE: Never apply grease to any part of the clutch cover, or disc.

RECOMMENDED LUBRICANTS

Use Mopar® multi-purpose grease for the clutch pedal bushings and pivot shaft. Use Mopar® high temperature grease (or equivalent) for all other lubri-

SERVICE PROCEDURES (Continued)

cation requirements. Apply recommended amounts and do not over lubricate.

CLUTCH HYDRAULIC FLUID

If inspection or diagnosis indicates additional fluid may be needed, it will be necessary to replace the complete hydraulic linkage assembly.

CLUTCH FLUID LEVEL

The clutch fluid reservoir, master cylinder, slave cylinder and fluid lines are pre-filled with fluid at the factory during assembly operations.

The hydraulic system should not require additional fluid under normal circumstances. **The reservoir fluid level will actually increase as normal clutch wear occurs. Avoid overfilling, or removing fluid from the reservoir.**

Clutch fluid level is checked at the master cylinder reservoir. An indicator ring is provided on the outside of the reservoir. With the cap and diaphragm removed, fluid level should not be above indicator ring.

To avoid contaminating the hydraulic fluid during inspection, wipe reservoir and cover clean before removing the cap.

FLYWHEEL

Inspect the flywheel whenever the clutch disc, cover and housing are removed for service. Check condition of the flywheel face, hub, ring gear teeth, and flywheel bolts.

Minor scratches, burrs, or glazing on the flywheel face can be reduced with 180 grit emery cloth. However, the flywheel should be replaced if the disc contact surface is severely scored, heat checked, cracked, or obviously worn.

Flywheel machining is not recommended. The flywheel surface is manufactured with a unique contour that would be negated by machining. However, cleanup of minor flywheel scoring can be performed by hand with 180 grit emery, or with surface grinding equipment. Replace the flywheel if scoring is deeper than 0.0762 mm (0.003 in.).

Heavy stock removal by grinding is **not recommended.** Excessive stock removal can result in flywheel cracking or warpage after installation. It can also weaken the flywheel and interfere with proper clutch release.

Check flywheel runout if misalignment is suspected. Runout should not exceed 0.08 mm (0.003 in.). Measure runout at the outer edge of the flywheel face with a dial indicator. Mount the dial indicator on a stud installed in place of one of the clutch housing attaching bolts.

Clean the crankshaft flange before mounting the flywheel. Dirt and grease on the flange surface may cock the flywheel causing excessive runout.

Check condition of the flywheel hub and attaching bolts. Replace the flywheel if the hub exhibits cracks in the area of the attaching bolt holes.

Install new attaching bolts whenever the flywheel is replaced and use Mopar® Lock N' Seal, or Loctite 242 on the replacement bolt threads.

Recommended flywheel bolt torques are:

Inspect the teeth on the starter ring gear. **If the teeth are worn or damaged, the flywheel should be replaced as an assembly. This is the recommended and preferred method of repair.**

In cases where a new flywheel is not readily available, a replacement ring gear can be installed. However, the following precautions must be observed to avoid damaging the flywheel and replacement gear.

(1) Mark position of the old gear for alignment reference on the flywheel. Use a scriber for this purpose.

(2) Wear protective goggles or approved safety glasses. Also wear heat resistent gloves when handling a heated ring gear.

(3) Remove the old gear by cutting most of the way through it (at one point) with an abrasive cut-off wheel. Then complete removal with a cold chisel or punch.

(4) The ring gear is a shrink fit on the flywheel. This means the gear must be expanded by heating in order to install it. **The method of heating and expanding the gear is extremely important.** Every surface of the gear must be heated at the same time to produce uniform expansion. An oven or similar enclosed heating device must be used. Temperature required for uniform expansion is approximately 375° F.

CAUTION: Do not use an oxy/acetylene torch to remove the old gear, or to heat and expand a new gear. The high temperature of the torch flame can cause localized heating that will damage the flywheel. In addition, using the torch to heat a replacement gear will cause uneven heating and expansion. The torch flame can also anneal the gear teeth resulting in rapid wear and damage after installation.

(5) The heated gear must be installed evenly to avoid misalignment or distortion. A shop press and suitable press plates should be used to install the gear if at all possible.

(6) Be sure to wear eye and hand protection. Heat resistent gloves and safety goggles are needed for personal safety. Also use metal tongs, vise grips, or similar tools to position the gear as necessary for installation.

SERVICE PROCEDURES (Continued)

(7) Allow the flywheel and ring gear to cool down before installation. Set the assembly on a workbench and let it cool in normal shop air.

CAUTION: Do not use water, or compressed air to cool the flywheel. The rapid cooling produced by water or compressed air can distort, or crack the gear and flywheel.

REMOVAL AND INSTALLATION

CLUTCH COVER AND DISC

REMOVAL

(1) Raise vehicle.

(2) Remove transmission and clutch housing as assembly. Refer to Group 21, Transmission and Transfer Case, for proper procedures.

(3) If clutch cover is only being removed for access to another component, mark position of cover on flywheel with small punch marks (Fig. 9).

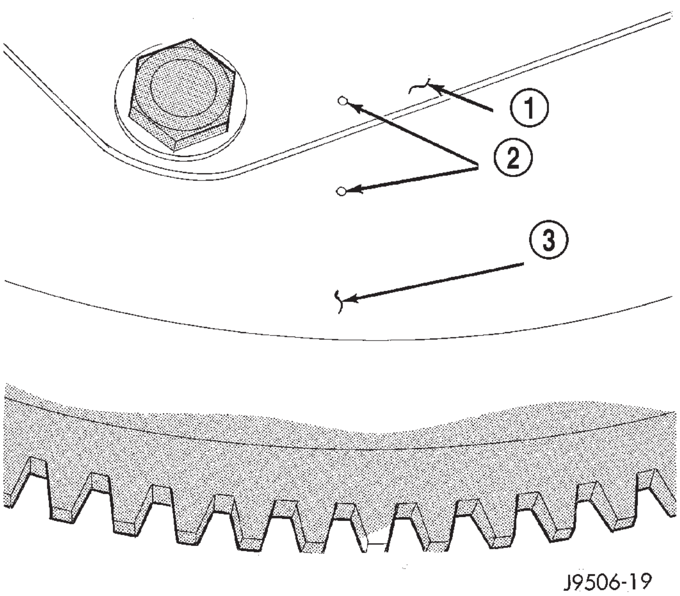


Fig. 9 Typical Method Of Marking Clutch Cover Position

1 – CLUTCH COVER
2 – PUNCH MARKS
3 – FLYWHEEL

(4) Loosen clutch cover bolts evenly and in rotation to relieve spring tension. Loosen bolts a few threads at a time to avoid warping cover.

(5) Completely remove cover bolts, clutch cover, and clutch disc.

INSTALLATION

(1) Clean flywheel surface with solvent. Scuff sand surface with 120/180 grit emery cloth to remove minor scratches and glazing.

(2) Check new clutch disc for runout and free operation on input shaft splines.

(3) Lubricate crankshaft pilot bearing with Mopar® high temperature bearing grease, or equivalent.

(4) Position clutch disc to flywheel.

(5) Insert alignment tool or spare input shaft through clutch disc and into pilot bearing (Fig. 10).

(6) Verify that disc hub is positioned correctly. The raised portion of the hub faces away from the flywheel (Fig. 11).

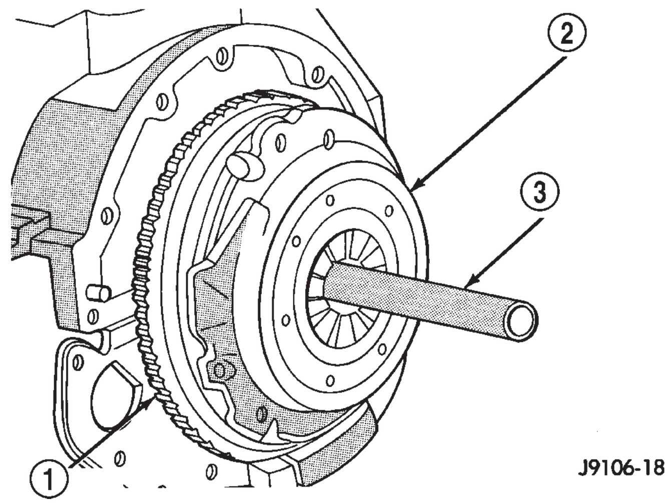


Fig. 10 Typical Method Of Aligning Clutch Disc

1 – FLYWHEEL
2 – CLUTCH COVER AND DISC
3 – CLUTCH DISC ALIGNMENT TOOL

(7) Position clutch cover over disc and on flywheel.

(8) Install all clutch cover bolts finger tight.

(9) Tighten cover bolts evenly (and in rotation) a few threads at a time. Cover bolts must be tightened evenly and to specified torque to avoid distorting cover.

(10) Tighten clutch cover bolts to following torque:

- 2.5L bolts to 28 N·m (250 in. lbs.).
- 5/16 in. diameter bolts to 23 N·m (17 ft. lbs.).
- 3/8 in. diameter bolts to 41 N·m (30 ft. lbs.).

(11) Apply light coat of Mopar® high temperature bearing grease to splines of transmission input shaft and to release bearing slide surface of front bearing retainer. Do not overlubricate shaft splines. This could result in grease contamination of disc.

(12) Install transmission and clutch housing as assembly. Refer to Group 21, Transmission and Transfer Case, for proper procedures.

REMOVAL AND INSTALLATION (Continued)

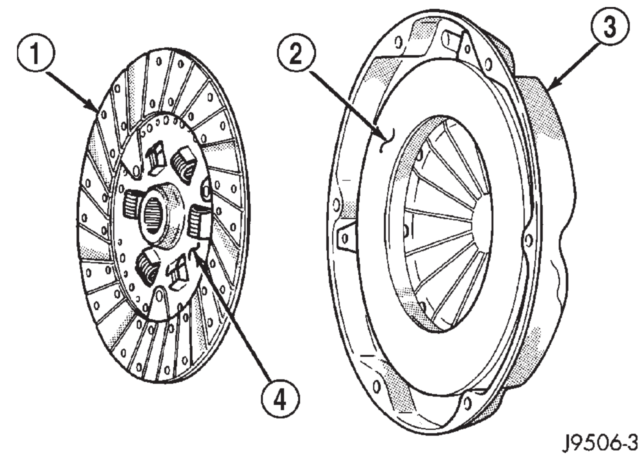


Fig. 11 Clutch Disc Position

1 – DISC
2 – INSPECT THIS SURFACE
3 – CLUTCH COVER
4 – “FLYWHEEL SIDE” STAMPED ON THIS SURFACE

CLUTCH HOUSING REPLACEMENT

REMOVAL

(1) Raise vehicle and support vehicle.

(2) Remove transmission and clutch housing as assembly. Refer to Group 21, Transmission and Transfer Case, for proper procedures.

(3) Remove release bearing, release fork, and fork boot from input shaft and clutch housing.

(4) Remove bolts attaching clutch housing to transmission (Fig. 12).

INSTALLATION

(1) Clean mounting surfaces of transmission and clutch housing. Use a wire brush if necessary followed by a wax and grease remover, or similar solvent. Also clean engine block surface as well.

(2) Position clutch housing on transmission and install housing attaching bolts. Tighten bolts (A bolts in (Fig. 12)) to 38 N·m (28 ft. lbs.) torque.

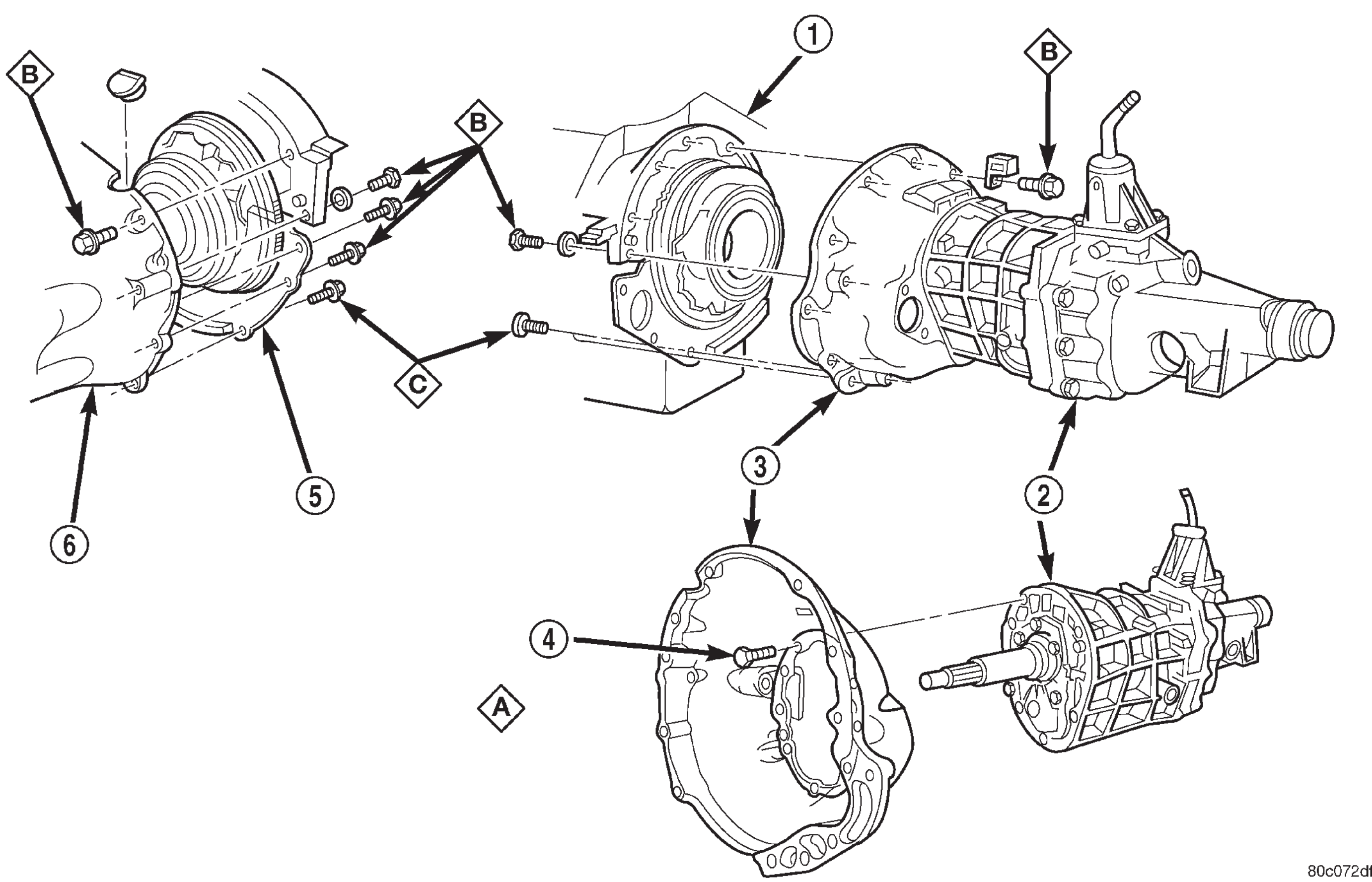


Fig. 12 Clutch Housing Attachment—Typical

1 – ENGINE
2 – TRANSMISSION
3 – CLUTCH HOUSING
4 – CLUTCH HOUSING BOLTS
5 – ENGINE
6 – CLUTCH HOUSING

REMOVAL AND INSTALLATION (Continued)

(3) Install release fork pivot ball stud to housing, if necessary.

(4) Lubricate release bearing bore, release fork contact surfaces, and release fork pivot stud with Mopar® high temperature bearing grease. Also lubricate transmission input shaft splines, pilot hub and bearing retainer slide surface with light coat of same grease.

(5) Install release fork, bearing, and boot in housing. Be sure release fork boot is properly seated in housing.

(6) Install transmission. Refer to Group 21, Transmission and Transfer Case, for proper procedures. Tighten the upper transmission bolts (B bolts in (Fig. 12)) to 75 N·m (55 ft.lbs). Tighten all lower transmission bolts (C bolts in (Fig. 12)) to 50 N·m (37 ft.lbs.).

RELEASE BEARING

REMOVAL

(1) Remove transmission. Refer to Group 21, Transmission and Transfer Case, for proper procedures.

(2) Disconnect release bearing from fork and remove bearing (Fig. 13).

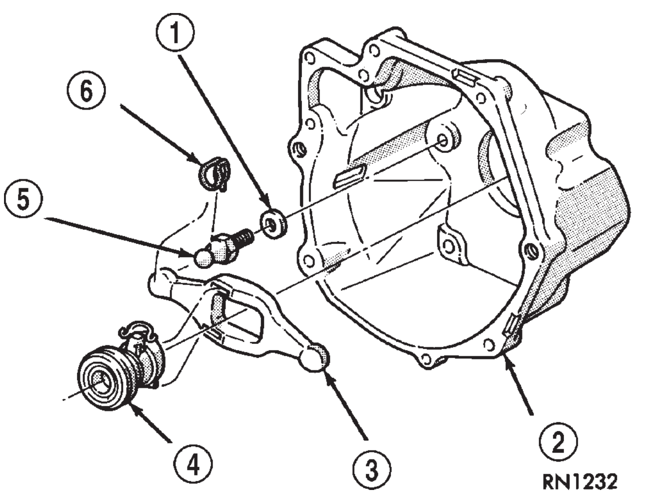


Fig. 13 Release Bearing And Release Fork Mounting

1 – CONED WASHER
2 – CLUTCH HOUSING
3 – RELEASE FORK
4 – RELEASE BEARING AND SLEEVE
5 – PIVOT 23 N·m (200 IN. LBS.)
6 – SPRING

INSTALLATION

(1) Inspect release bearing slide surface of transmission front bearing retainer. Replace retainer if slide surface is scored, worn or cracked.

(2) Inspect release fork and fork pivot (Fig. 13). Be sure pivot is secure and in good condition. Be sure fork is not distorted or worn. Replace release fork retainer spring if bent or damaged in any way.

(3) Lightly lubricate pilot bearing, input shaft splines, bearing retainer slide surface, fork pivot and release fork pivot surface with Mopar® high temperature bearing grease.

(4) Install release fork and bearing. Be sure fork and bearing are properly secured.

(5) Install transmission. Refer to Group 21, Transmission and Transfer Case, for proper procedures.

PILOT BEARING

REMOVAL

(1) Remove transmission, transfer case, if equipped, and clutch housing. Refer to Group 21, Transmission and Transfer Case, for proper procedures.

(2) Remove clutch cover and disc.

(3) Using a suitable blind hole puller, remove pilot bearing.

INSTALLATION

(1) Clean bearing bore with solvent and wipe dry with shop towel.

(2) Install new bearing with clutch alignment tool (Fig. 14). Keep bearing straight during installation. Do not allow bearing to become cocked. Tap bearing into place until flush with edge of bearing bore. Do not recess bearing.

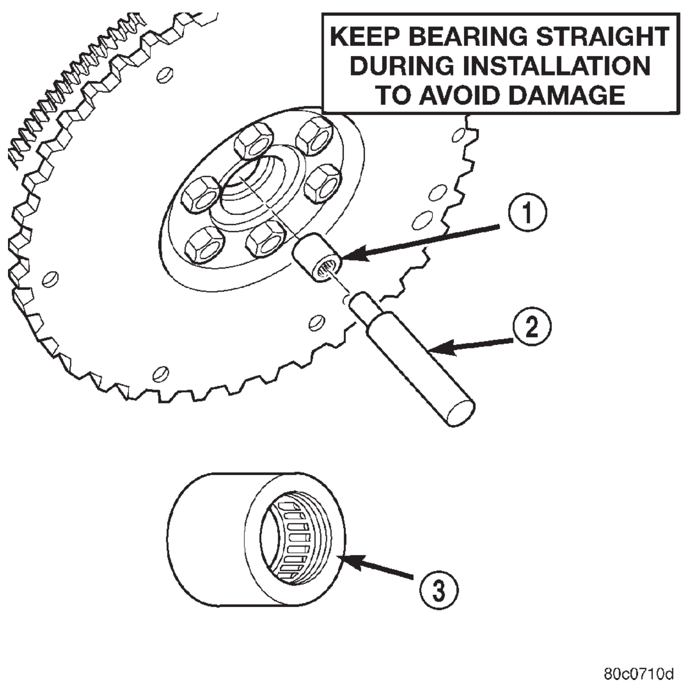


Fig. 14 Typical Method Of Installing Pilot Bearing

1 – PILOT BEARING
2 – ALIGNMENT TOOL
3 – LETTER SIDE MUST FACE TRANSMISSION

(3) Install clutch cover and disc.

REMOVAL AND INSTALLATION (Continued)

(4) Install clutch housing, transmission and transfer case, if equipped. Refer to Group 21, Transmission and Transfer Case, for proper procedures.

CLUTCH HYDRAULIC LINKAGE

The factory installed hydraulic linkage has a quick disconnect at the slave cylinder. This fitting should not be disconnected or tampered with. The hydraulic linkage is serviced as an assembly only. The individual components that form the linkage assembly cannot be overhauled or serviced separately.

REMOVAL

(1) Raise and support vehicle.
(2) Remove nuts attaching slave cylinder to clutch housing (Fig. 15).
(3) Remove slave cylinder from housing.
(4) Remove hydraulic fluid line clip from the lower dash panel flange.
(5) Lower vehicle.
(6) Remove clip holding clutch master cylinder push rod to clutch pedal (Fig. 15).
(7) Slide clutch master cylinder push rod off clutch pedal pin.
(8) Disconnect clutch pedal position switch connector from wiring harness.
(9) Remove nuts holding clutch master cylinder to dash panel.
(10) Verify that cap on clutch master cylinder reservoir is tight to avoid undue spillage during removal.
(11) Remove screws attaching clutch fluid reservoir to dash panel.
(12) Pull clutch master cylinder from dash panel.
(13) Remove hydraulic linkage components from vehicle.

INSTALLATION

(1) Tighten cap on clutch fluid reservoir to avoid spillage during installation.
(2) Position cylinders, connecting lines, and reservoir in vehicle (Fig. 15).
(3) Insert clutch master cylinder in dash panel.

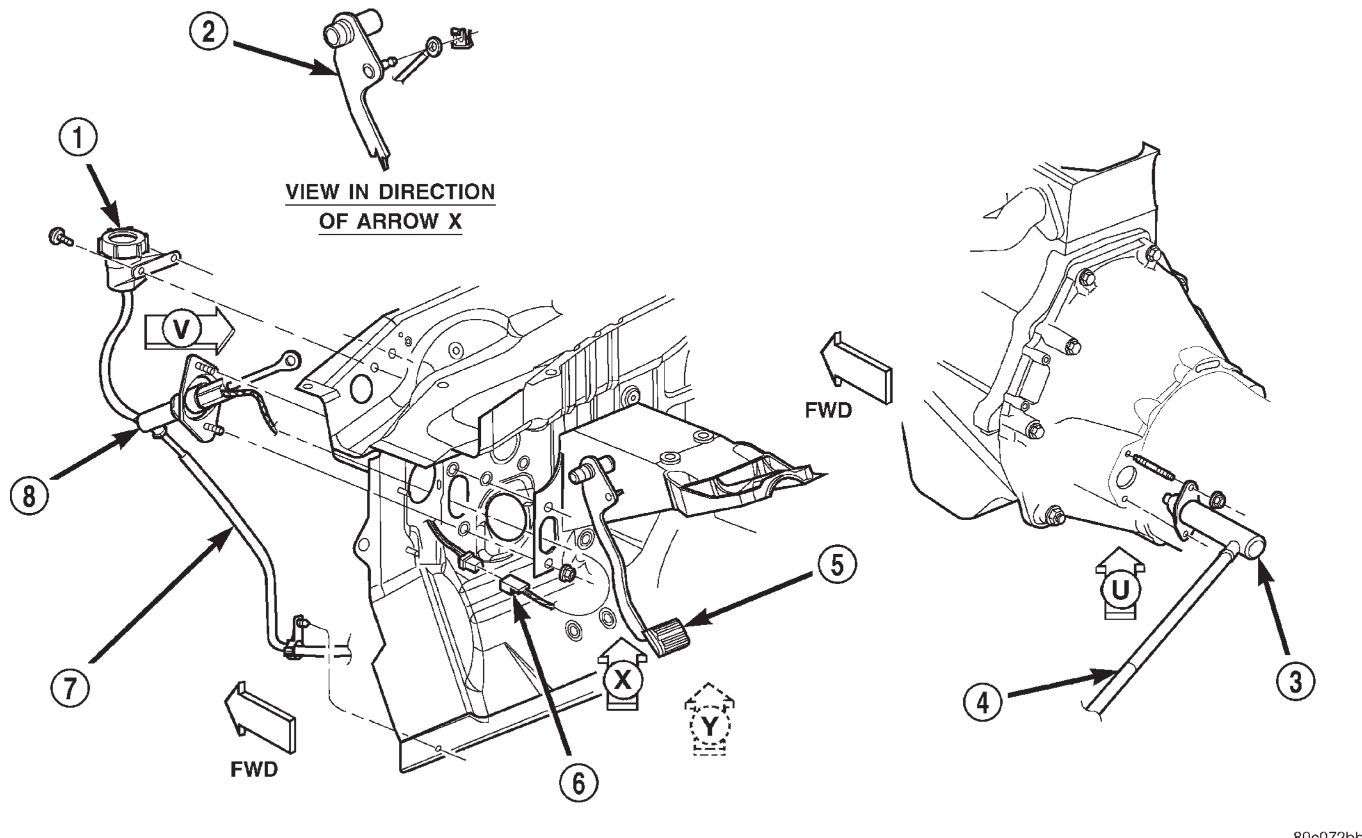


Fig. 15 Clutch Hydraulic Linkage

1 – CLUTCH FLUID RESERVOIR
2 – CLUTCH PEDAL
3 – CLUTCH SAVE CYLINDER
4 – CLUTCH HYDRAULIC LINE
5 – CLUTCH PEDAL
6 – CLUTCH PEDAL POSITION SWITCH CONNECTOR
7 – CLUTCH HYDRAULIC LINE
8 – CLUTCH MASTER CYLINDER

REMOVAL AND INSTALLATION (Continued)

(4) Position reservoir on dash panel and install reservoir screws. Tighten screws to 5 N·m (40 in. lbs.) torque.

(5) Install nuts that hold clutch master cylinder to dash panel. Tighten nuts to 54 N·m (40 ft. lbs.).

(6) Apply light coating of grease to the inner diameter of the master cylinder push–rod and the outer diameter of the clutch pedal pin.

(7) Install clutch master cylinder push rod on clutch pedal pin (Fig. 15). Secure rod with retaining clip.

(8) Connect clutch pedal position switch connector from wiring harness.

(9) Raise vehicle.

(10) Insert slave cylinder push rod through clutch housing opening and into release lever. Be sure end of rod is securely engaged in release lever. Check this before installing cylinder attaching nuts.

NOTE: If a new clutch linkage is being installed, do not remove the plastic shipping strap from the slave cylinder push rod. The shipping strap will break on its own upon the first clutch application.

(11) Install and tighten slave cylinder attaching nuts to 23 N·m (200 in. lbs.) torque.

(12) Install the hydraulic fluid line clip into the hole in the lower dash panel flange.

(13) Verify that fluid line from master cylinder to slave cylinder is properly routed.

CLUTCH PEDAL

REMOVAL

(1) Remove retaining clip securing push rod on clutch pedal (Fig. 16).

(2) Slide push rod off clutch pedal pin.

(3) Remove snap ring and washer attaching clutch pedal to the pivot shaft.

(4) Slide pedal off pivot shaft and remove pedal.

(5) Remove and inspect bushings in pedal bore. Replace bushings if worn or cracked.

INSTALLATION

(1) Lubricate pedal bushings and shaft with a silicone grease or with Mopar® multi-mileage grease.

(2) Install bushings in pedal bore and on pin.

(3) Install pedal on pivot shaft.

(4) Secure pedal on shaft with washer and snap ring.

(5) Apply light coating of grease to the inner diameter of the master cylinder push–rod and the outer diameter of the clutch pedal pin.

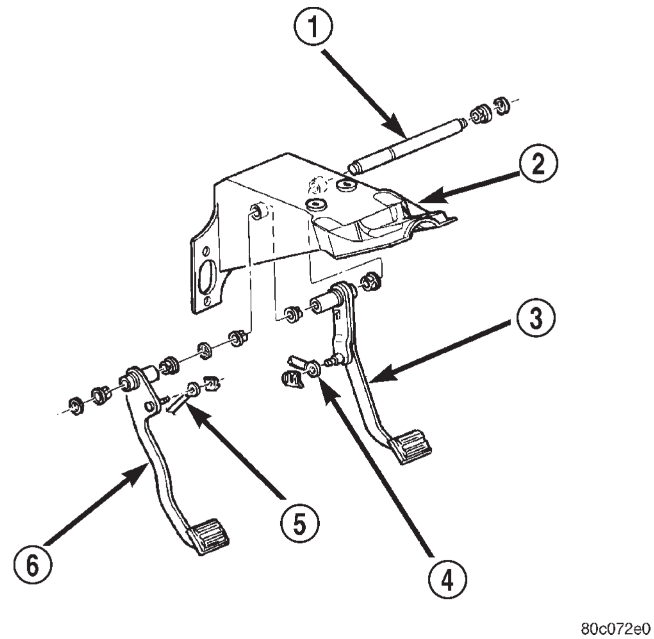


Fig. 16 Clutch Pedal

1 – PIVOT ROD
2 – PEDAL SUPPORT
3 – BRAKE PEDAL
4 – BOOSTER ROD
5 – CLUTCH ROD
6 – CLUTCH PEDAL

(6) Connect push rod to pedal and secure rod with retaining clip.

SPECIFICATIONS

TORQUE

DESCRIPTION	TORQUE
Bolts, Clutch Cover–2.5L	28 N·m (250 in. lbs.)
Bolts, Clutch Cover–5/16 Bolt	23 N·m (17 ft. lbs.)
Bolts, Clutch Cover–3/8 Bolt	41 N·m (30 ft. lbs.)
Bolts, Clutch Housing–NV1500	38 N·m (28 ft. lbs.)
Screws, Master Cylinder Reservoir	5 N·m (40 in. lbs.)
Nuts, Master Cylinder	54 N·m (40 ft. lbs.)
Nuts, Slave Cylinder	23 N·m (200 in.lbs.)
Bolt, Dust Shield	12 N·m (105 in. lbs.)
Bolts, Flywheel–2.5L	95 N·m (70 ft. lbs.)
Bolts, Flywheel–3.9/5.2L	75 N·m (55 ft. lbs.)

COOLING SYSTEM

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
COOLING SYSTEM 2
COOLANT RESERVE/OVERFLOW SYSTEM 5
ENGINE ACCESSORY DRIVE BELTS. 5
RADIATOR 5
WATER PUMP 6
WATER PUMP BYPASS—4.7L. 6
WATER PUMP BYPASS—3.9/5.9L ENGINES. . . . 6
THERMOSTAT—3.9L/5.9L ENGINES 7
THERMOSTAT—4.7L ENGINE 7
AUTOMATIC TRANSMISSION OIL COOLERS. . . . 8
AUTOMATIC BELT TENSIONER 8
BLOCK HEATER 9
RADIATOR PRESSURE CAP 10
HOSE CLAMPS. 10
VISCOUS FAN DRIVE 11
COOLING SYSTEM FAN 11
DIAGNOSIS AND TESTING
ON-BOARD DIAGNOSTICS (OBD) 12
DRB SCAN TOOL 13
WATER PUMP TESTS. 13
PRELIMINARY CHECKS 14
COOLING SYSTEM 15
ELECTRIC COOLING FAN 20
RADIATOR COOLANT FLOW CHECK 21
COOLING SYSTEM—TESTING FOR LEAKS 21
VISCOUS FAN DRIVE—3.9L/4.7L and 5.9L ENGINES 23
ACCESSORY DRIVE BELT DIAGNOSIS. 24
THERMOSTAT 26
RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF CHECK. 26
RADIATOR CAP—PRESSURE TESTING. 26
COOLANT—LOW LEVEL AERATION 27
COOLING SYSTEM—DEAERATION 27
SERVICE PROCEDURES
COOLANT—ROUTINE LEVEL CHECK. 27
COOLANT SERVICE 27
COOLANT—ADDING ADDITIONAL. 28

page

COOLANT LEVEL CHECK 28
COOLING SYSTEM—DRAINING AND FILLING 28
COOLING SYSTEM—CLEANING/REVERSE FLUSHING 29
COOLANT 30
COOLANT SELECTION AND ADDITIVES 30
REMOVAL AND INSTALLATION
COOLANT RESERVE/OVERFLOW TANK 30
WATER PUMP—2.5L ENGINE 30
WATER PUMP—3.9L/5.9L ENGINES 32
WATER PUMP 4.7L ENGINES 35
WATER PUMP BYPASS HOSE—3.9/5.9L ENGINES 37
THERMOSTAT—3.9L/5.9L ENGINES 39
THERMOSTAT—2.5L ENGINE 42
THERMOSTAT— 4.7L ENGINE. 43
TRANSMISSION OIL COOLER LINES. 44
RADIATOR 44
ENGINE BLOCK HEATER 46
ACCESSORY DRIVE BELT—2.5L ENGINE 47
ACCESSORY BELT REPLACEMENT—4.7L ENGINE 48
ACCESSORY DRIVE BELT—3.9L/5.9L ENGINES 49
ACCESSORY DRIVE BELT TENSIONER—2.5L . . 50
AUTOMATIC BELT TENSIONER 3.9L/5.9L ENGINES 50
AUTOMATIC BELT TENSIONER—4.7L ENGINE 51
IDLER PULLEY—2.5L/3.9L/5.9L ENGINES 51
IDLER PULLEY—4.7L ENGINE NON A/C. 52
RADIATOR DRAINCOCK 52
VISCOUS FAN DRIVE 53
ELECTRIC FAN 54
CLEANING AND INSPECTION
RADIATOR CAP 55
RADIATOR 55
WATER PUMP 55

FAN BLADE 55
SPECIFICATIONS
COOLING SYSTEM CAPACITIES. 56
ACCESSORY DRIVE BELT TENSION—2.5L ENGINE 56
TORQUE SPECIFICATIONS 56
SPECIAL TOOLS
COOLING 57

DESCRIPTION AND OPERATION

COOLING SYSTEM

DESCRIPTION

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid (if equipped). The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

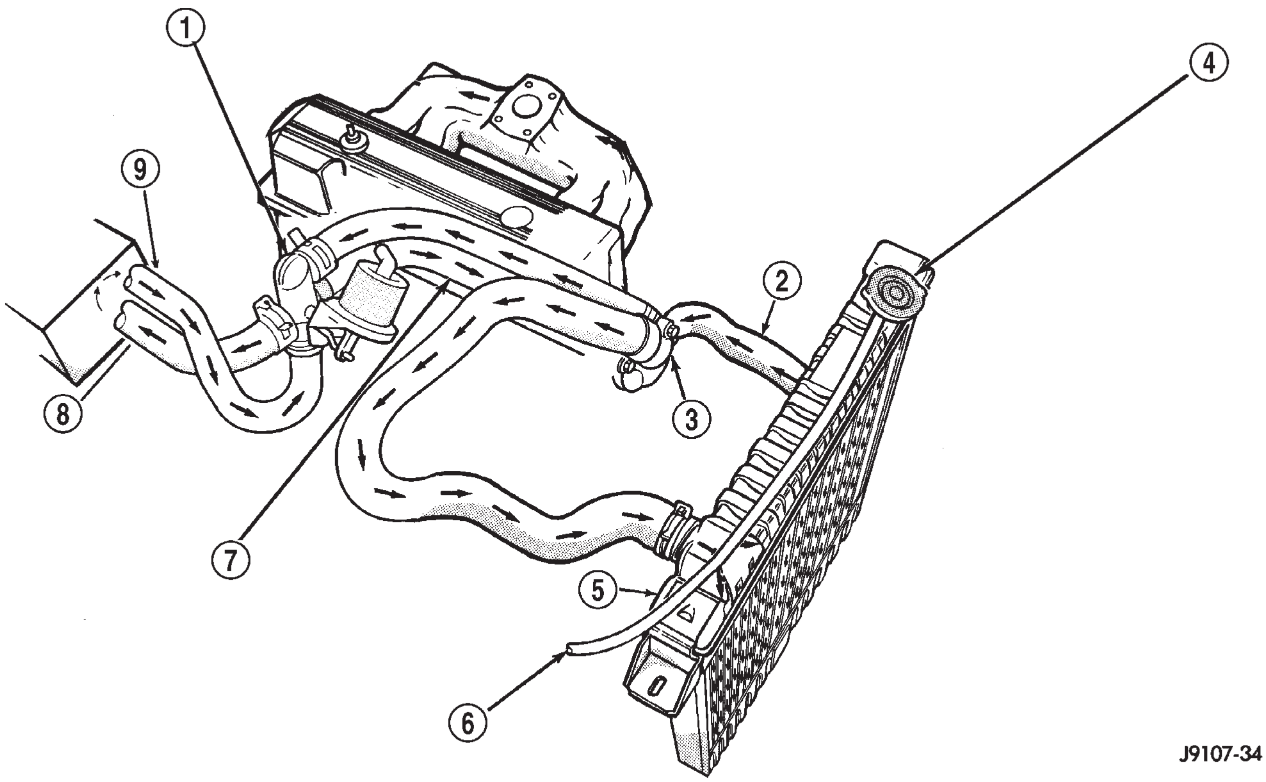


Fig. 1 Engine Cooling System Flow—2.5L Engine—Typical

1 – WATER CONTROL VALVE
2 – TO WATER PUMP
3 – THERMOSTAT HOUSING
4 – RADIATOR CAP
5 – RADIATOR
6 – TO COOLANT RESERVE BOTTLE
7 – TO WATER PUMP
8 – TO HEATER CORE
9 – FROM HEATER CORE

DESCRIPTION AND OPERATION (Continued)

An optional factory installed maximum duty cooling package is available on most models. This package will provide additional cooling capacity for vehicles used under extreme conditions such as trailer towing in high ambient temperatures.

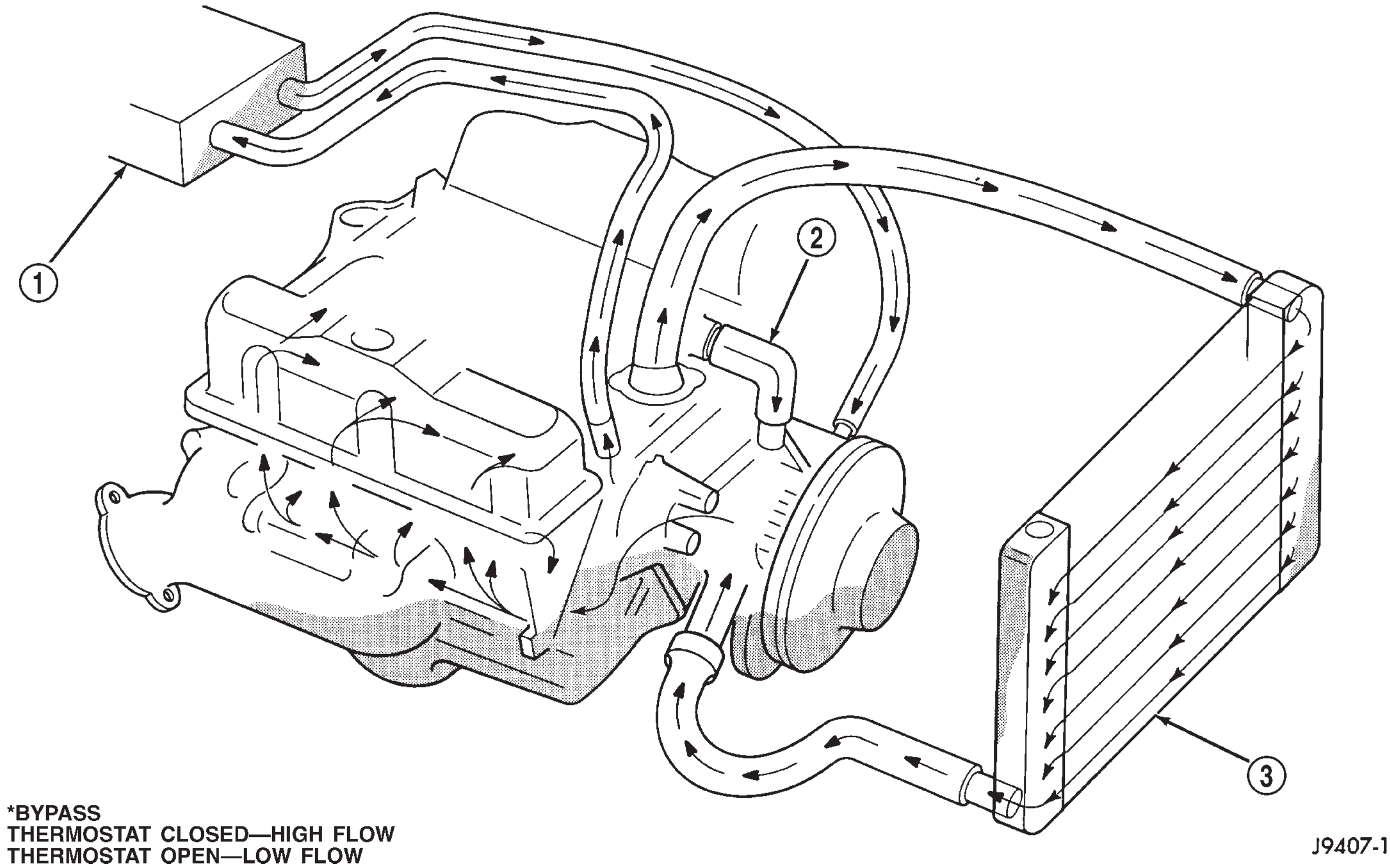


Fig. 2 Engine Cooling System Flow—3.9L/5.9L Engines—Typical

1 – HEATER
2 – BYPASS*
3 – CROSSFLOW RADIATOR

DESCRIPTION AND OPERATION (Continued)

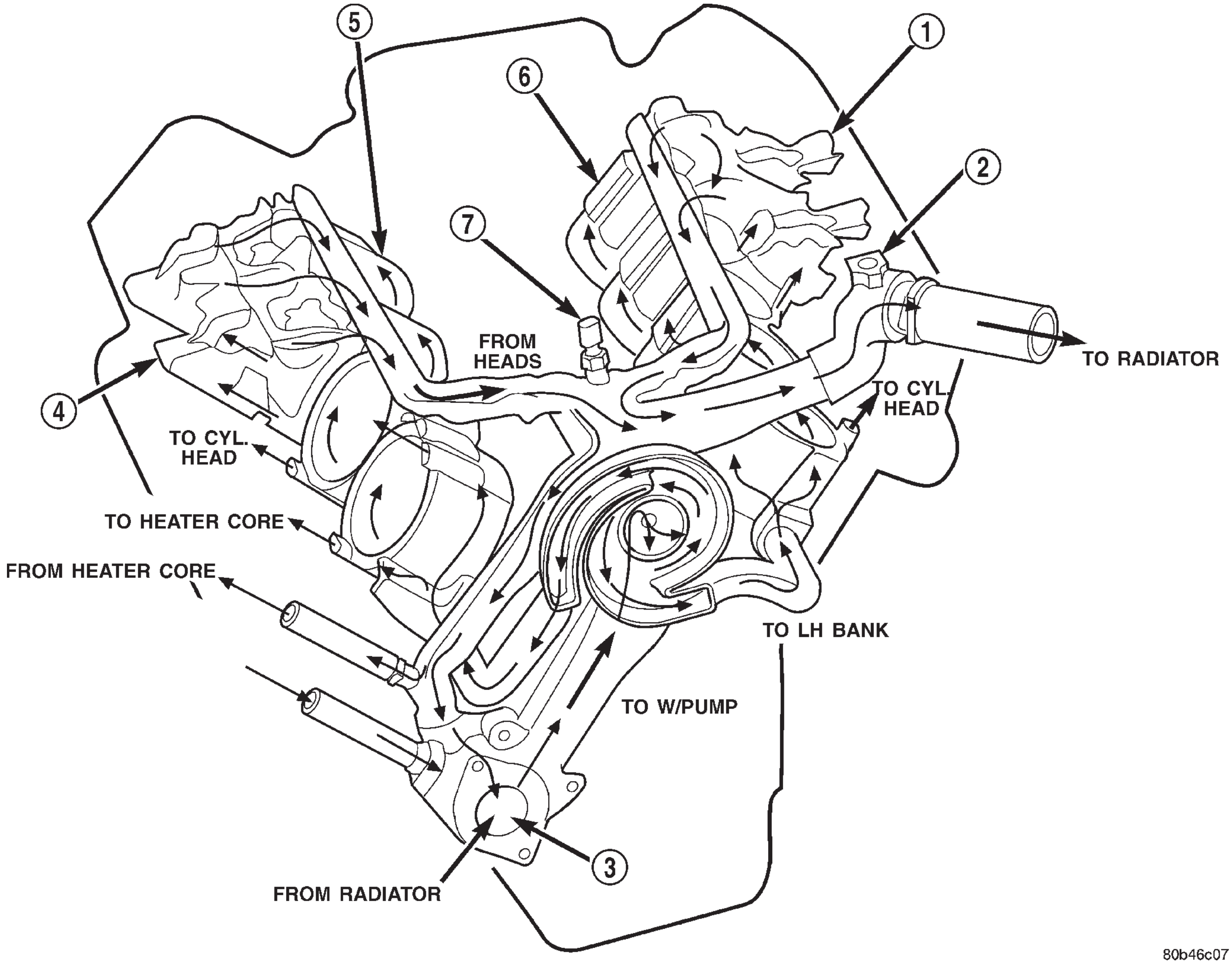


Fig. 3 Engine Cooling System Flow—4.7L Engine—Typical

1 – LH CYL. HEAD
2 – BLEED
3 – THERMOSTAT LOCATION
4 – RH CYL. HEAD
5 – RH BANK CYL. BLOCK
6 – LH BANK CYL. BLOCK
7 – COOLANT TEMP. SENSOR

DESCRIPTION AND OPERATION (Continued)

COOLANT RESERVE/OVERFLOW SYSTEM

DESCRIPTION

The coolant reserve/overflow tank is integral to the upper fan shroud assembly and is made of high temperature plastic.

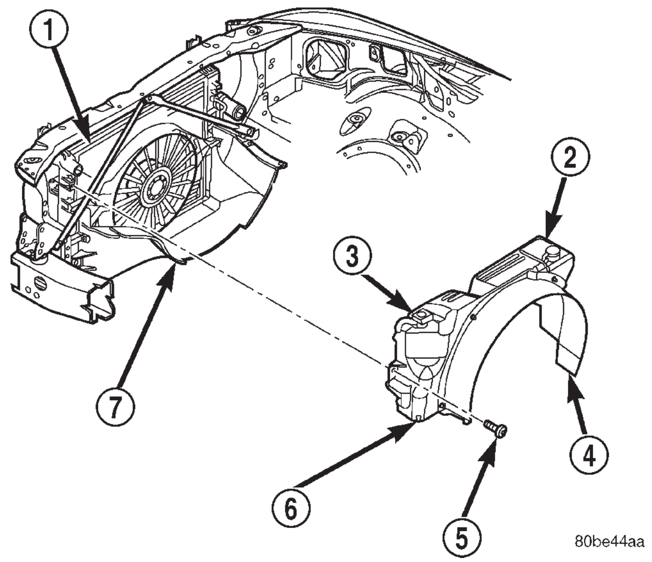


Fig. 4 Upper Fan Shroud with Integral Coolant Reserve/Overflow System

1 – RADIATOR
2 – WASHER FLUID RESERVOIR
3 – COOLANT OVERFLOW/RESERVOIR
4 – FAN SHROUD (UPPER)
5 – SCREW
6 – INTERLOCKING PINS
7 – FAN SHROUD (LOWER)

OPERATION

The coolant reserve/overflow system works in conjunction with the radiator pressure cap. It utilizes thermal expansion and contraction of coolant to keep coolant free of trapped air. It provides a volume for expansion and contraction of coolant. It also provides a convenient and safe method for checking coolant level and adjusting level at atmospheric pressure. This is done without removing the radiator pressure cap. The system also provides some reserve coolant to the radiator to cover minor leaks and evaporation or boiling losses.

As the engine cools, a vacuum is formed in the cooling system of both the radiator and engine. Coolant will then be drawn from the coolant tank and returned to a proper level in the radiator.

ENGINE ACCESSORY DRIVE BELTS

DESCRIPTION

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to water pump rotating in wrong direction. Refer to the appropriate engine Belt Schematic in this Section for the correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment.

The accessory drive belt is made of rubber and has grooves in only one side, these grooves mate to the grooves in the accessories pulleys for maximum belt contact and belt alignment.

The accessory drive components are operated by a single, crankshaft driven, serpentine drive belt on all engines. An automatic belt tensioner is also used to maintain correct belt tension at all times.

RADIATOR

DESCRIPTION

The radiator is a aluminum cross-flow design with horizontal tubes through the radiator core and vertical plastic side tanks.

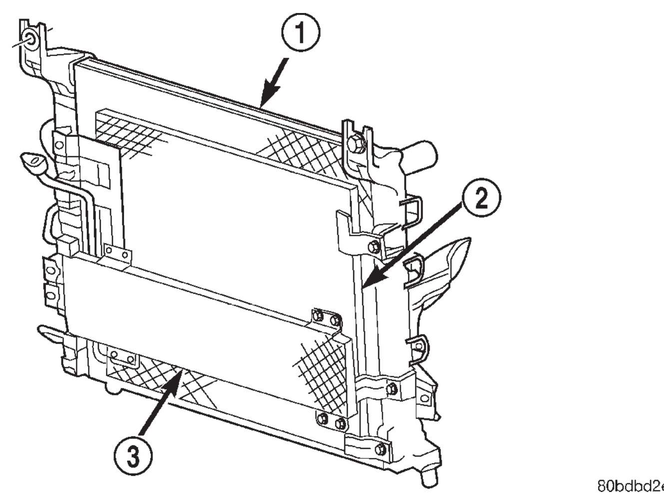


Fig. 5 Radiator—Typical

1 – RADIATOR
2 – A/C CONDENSER (IF EQUIPPED)
3 – TRANSMISSION AUXILIARY OIL COOLER

OPERATION

The radiator supplies sufficient heat transfer using the cooling fins interlaced between the horizontal tubes in the radaitor core to cool the engine and automatic transmission oil (if equipped).

DESCRIPTION AND OPERATION (Continued)

WATER PUMP

DESCRIPTION

The water pump is located on the engine front cover, and has an integral pulley attached (Fig. 6).

The water pump impeller is pressed onto the rear of a shaft that rotates in a bearing pressed into the water pump body. The body has a small hole for ventilation. The water pump seals are lubricated by antifreeze in the coolant mixture. Additional lubrication is not necessary.

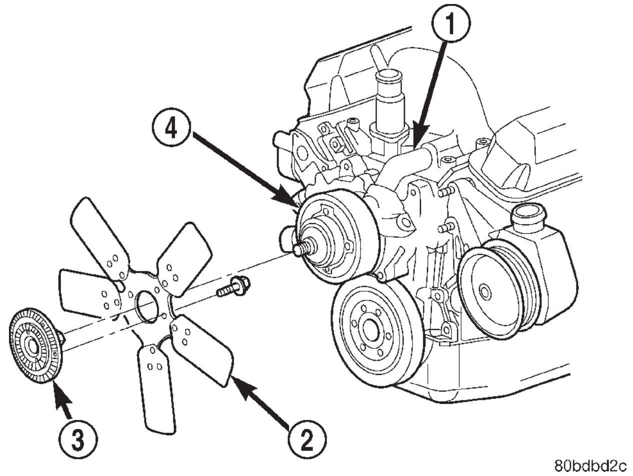


Fig. 6 Water Pump Location—Typical

1 – WATER PUMP BYPASS HOSE
2 – FAN BLADE ASSEMBLY
3 – VISCOUS FAN DRIVE
4 – WATER PUMP AND PULLEY

OPERATION

A centrifugal water pump circulates coolant through the water jackets, passages, intake manifold, radiator core, cooling system hoses and heater core, this coolant absorbs the heat generated when the engine is running. The pump is driven by the engine crankshaft via a drive belt.

WATER PUMP BYPASS—4.7L

DESCRIPTION

The 4.7L engine uses an internal water/coolant bypass system. The design uses galleries in the timing chain cover to circulate coolant during engine warm-up preventing the coolant from flowing through the radiator. The thermostat uses a stub shaft located at the rear of the thermostat (Fig. 7) to control flow through the bypass gallery.

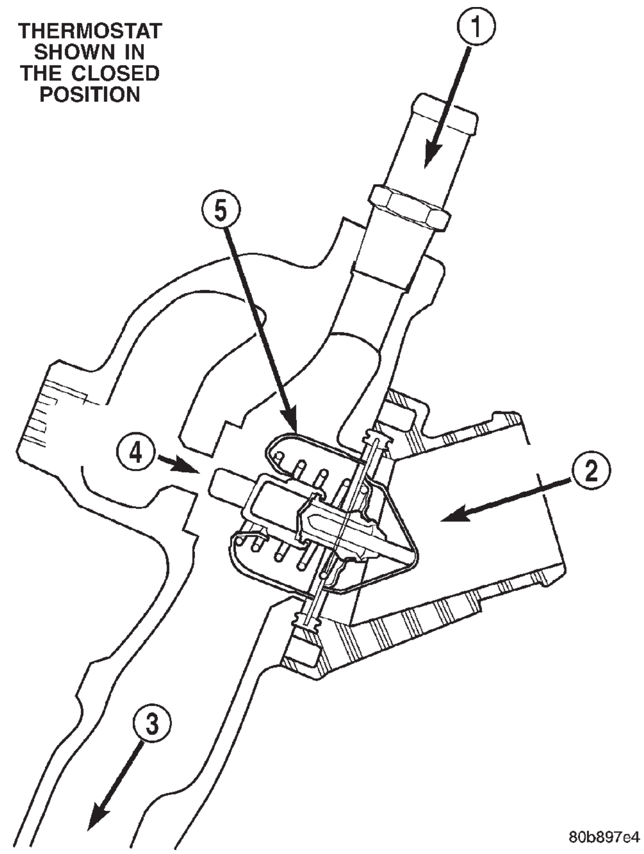


Fig. 7 Water/Coolant Bypass Flow and Thermostat—4.7L Engine

1 – FROM HEATER
2 – FROM RADIATOR
3 – TO WATER PUMP
4 – ENGINE BYPASS
5 – THERMOSTAT

OPERATION

When the thermostat is in the closed position the bypass gallery is not obstructed allowing 100% flow. When the thermostat is in the open position the stub shaft enters the bypass gallery obstructing bypass coolant flow by 50%. This design allows the coolant to reach operating temperature quickly when cold, while adding extra cooling during normal temperature operation.

WATER PUMP BYPASS—3.9/5.9L ENGINES

DESCRIPTION

A rubber water pump bypass hose (Fig. 8) is used between the intake manifold and water pump on all 3.9/5.9L engines.

DESCRIPTION AND OPERATION (Continued)

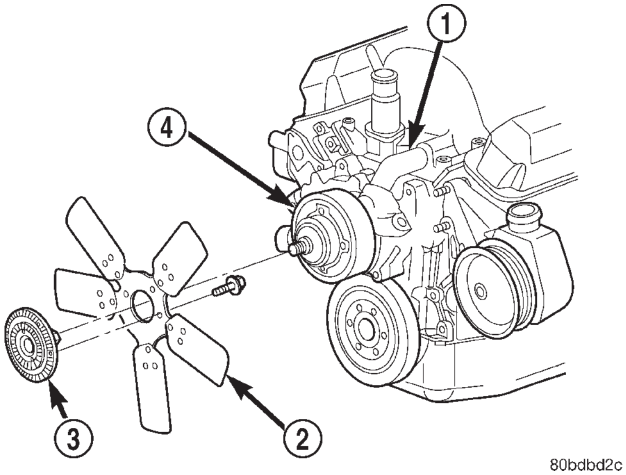


Fig. 8 Water Pump Bypass Hose—3.9L/5.9L Engines

1 – WATER PUMP BYPASS HOSE
2 – FAN BLADE ASSEMBLY
3 – VISCOUS FAN DRIVE
4 – WATER PUMP AND PULLEY

OPERATION

When the thermostat is in the closed position the bypass hose allows the water pump to circulate the engine coolant through the cylinder block while at the same time preventing the coolant from flowing through the radiator, this allows the coolant to heat up quicker thus bring the engine to operating temperature faster.

THERMOSTAT—3.9L/5.9L ENGINES

DESCRIPTION

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

The thermostat on all gas powered engines is located beneath the thermostat housing at the front of the intake manifold (Fig. 9).

The thermostat is a wax pellet driven, reverse poppet choke type.

Coolant leakage into the pellet container will cause the thermostat to fail in the open position. Thermostats very rarely stick. Do not attempt to free a thermostat with a prying device.

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation that can result in sludge formation.

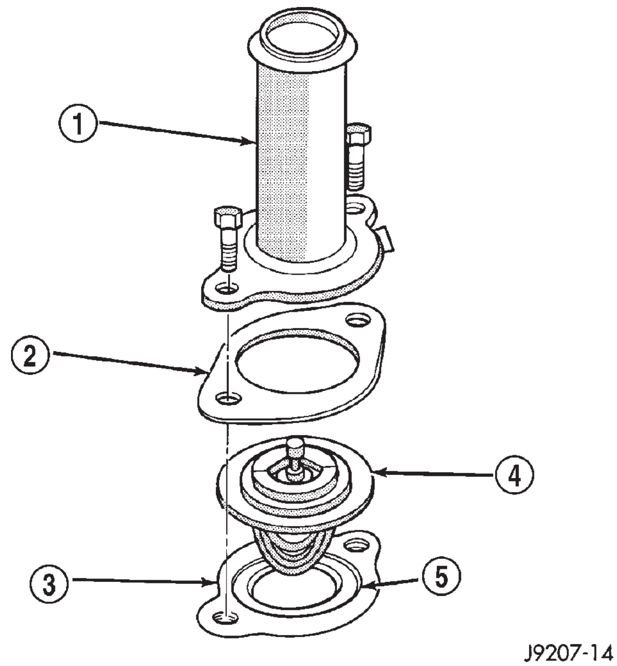


Fig. 9 Thermostat—3.9L V-6 or 5.9L V-8 Gas Powered Engines

1 – THERMOSTAT HOUSING
2 – GASKET
3 – INTAKE MANIFOLD
4 – THERMOSTAT
5 – MACHINED GROOVE

OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

THERMOSTAT—4.7L ENGINE

DESCRIPTION

CAUTION: Do not operate an engine without a thermostat, except for servicing or testing.

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. On all engines the thermostat is closed below 195°F (90°C). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warm up and overall temperature control. On the 4.7L engine the thermostat is designed to block the flow of the coolant bypass journal by 50% instead of completely blocking the flow. This design controls coolant temperature more accurately (Fig. 10).

The same thermostat is used for winter and summer seasons. An engine should not be operated without a thermostat, except for servicing or testing.

DESCRIPTION AND OPERATION (Continued)

Operating without a thermostat causes other problems. These are: longer engine warmup time, unreliable warmup performance, increased exhaust emissions and crankcase condensation. This condensation can result in sludge formation.

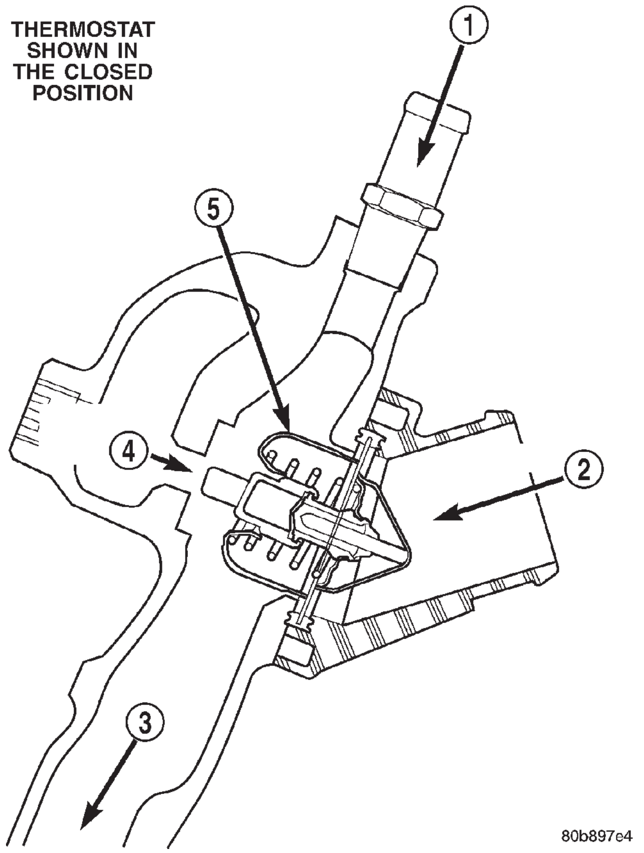


Fig. 10 Thermostat Cross Section View 4.7L

1 – FROM HEATER
2 – FROM RADIATOR
3 – TO WATER PUMP
4 – ENGINE BYPASS
5 – THERMOSTAT

OPERATION

The wax pellet is located in a sealed container at the spring end of the thermostat. When heated, the pellet expands, overcoming closing spring tension and water pump pressure to force the valve to open.

AUTOMATIC TRANSMISSION OIL COOLERS

DESCRIPTION

CAUTION: On in-radiator type oil coolers, if transmission oil cooler is leaking, engine coolant may enter cooler, or transmission oil may enter engine cooling system. Both engine cooling system and transmission oil circuit should be drained, flushed, and inspected.

There are two types of transmission oil coolers used. One type of cooler is the in-radiator type or oil to coolant type. This type oil cooler is not serviceable. The second type used is a remote type auxiliary oil cooler or oil to air cooler. The oil to air type cooler is located in front of the radiator, and is serviceable.

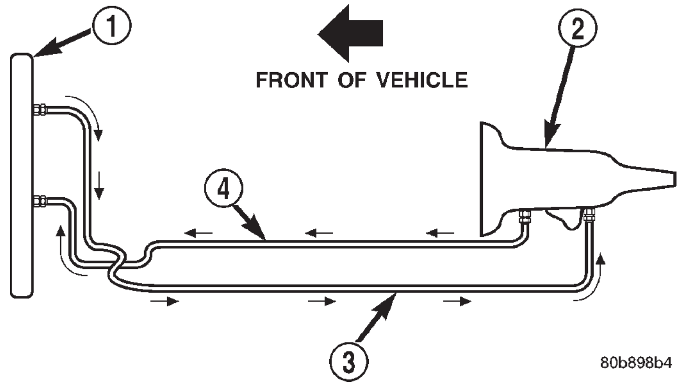


Fig. 11 Oil Flow to Cooler—Top View (Typical)

1 – TRANSMISSION OIL COOLER
2 – AUTOMATIC TRANSMISSION
3 – RETURN LINE
4 – PRESSURE LINE

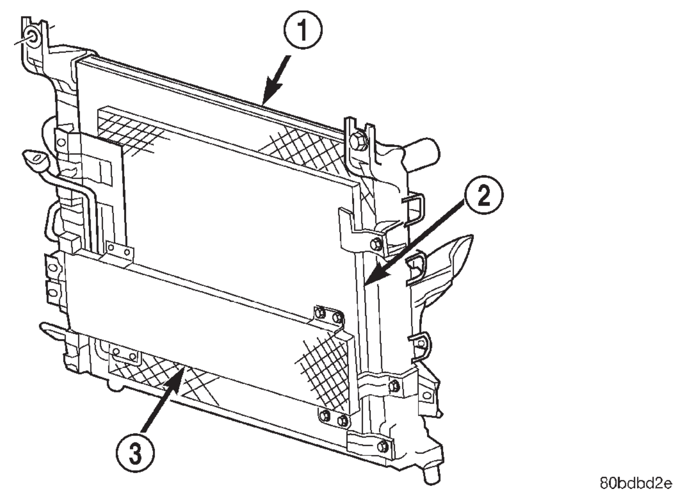


Fig. 12 Auxiliary Transmission Oil Cooler—Typical

1 – RADIATOR
2 – A/C CONDENSER (IF EQUIPPED)
3 – TRANSMISSION AUXILIARY OIL COOLER

AUTOMATIC BELT TENSIONER

DESCRIPTION

Correct drive belt tension is required to ensure optimum performance of the belt driven engine accessories. If specified tension is not maintained, belt slippage may cause; engine overheating, lack of power steering assist, loss of air conditioning capacity, reduced generator output rate, and greatly reduced belt life.

DESCRIPTION AND OPERATION (Continued)

It is not necessary to adjust belt tension on the 3.9L, 4.7L or 5.9L engines. These engines are equipped with an automatic belt tensioner (Fig. 13) (Fig. 14). The tensioner maintains correct belt tension at all times. Due to use of this belt tensioner, do not attempt to use a belt tension gauge on 3.9L, 4.7L or 5.9L engines.

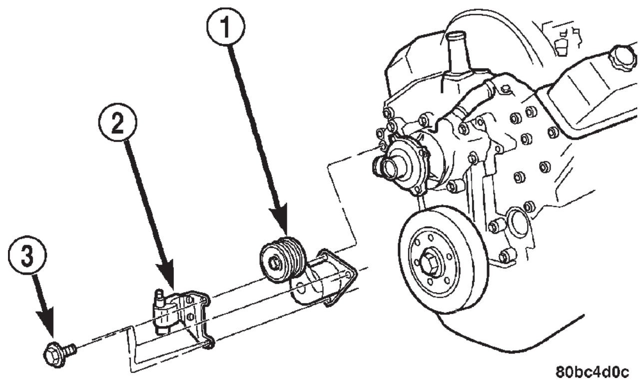


Fig. 13 Automatic Belt Tensioner—3.9L and 5.9L Engines

1 – AUTOMATIC TENSIONER
2 – COIL AND BRACKET
3 – SCREW AND WASHER

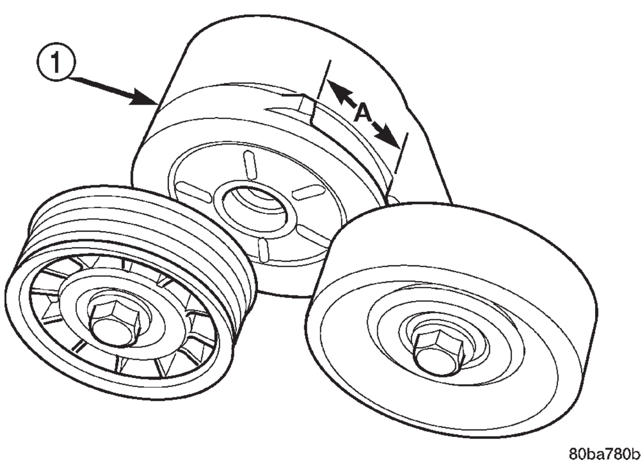


Fig. 14 Automatic Belt Tensioner—4.7L Engine

1 – AUTOMATIC TENSIONER ASSEMBLY

OPERATION

The automatic belt tensioner maintains belt tension by using internal spring pressure, a pivoting arm and pulley to press against the drive belt.

BLOCK HEATER

DESCRIPTION

WARNING: DO NOT OPERATE ENGINE UNLESS BLOCK HEATER CORD HAS BEEN DISCONNECTED FROM POWER SOURCE AND SECURED IN PLACE. THE POWER CORD MUST BE SECURED IN ITS RETAINING CLIPS AND ROUTED AWAY FROM EXHAUST MANIFOLDS AND MOVING PARTS.

An optional engine block heater is available for all models. The heater is equipped with a power cord. The cord is attached to an engine compartment component with tie-straps. The heater is mounted in a core hole of the engine cylinder block in place of a freeze plug with the heating element immersed in engine coolant.

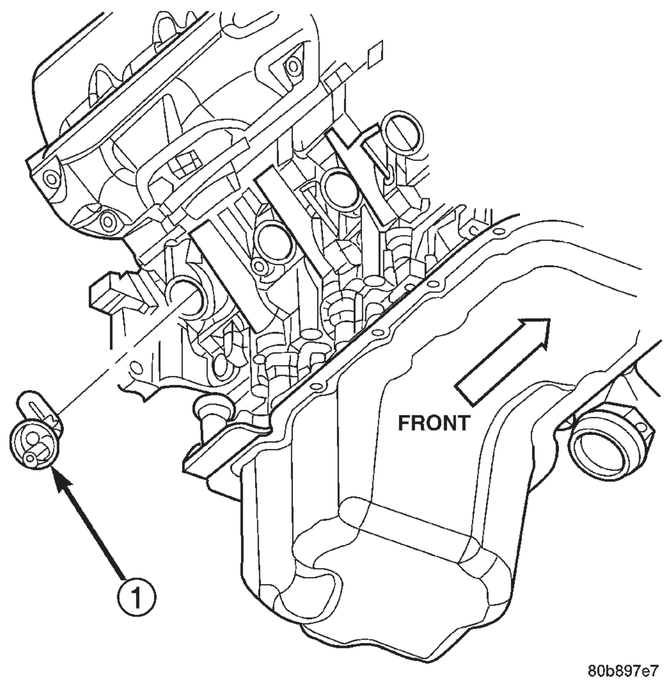


Fig. 15 Block Heater—4.7L

1 – ENGINE BLOCK HEATER

OPERATION

The heater warms the engine providing easier engine starting and faster warm-up in low temperatures. The power cord must be connected to a grounded 110-120 volt AC electrical outlet with a grounded, three wire extension cord, this provides the electricity to warm the heating element.

RADIATOR PRESSURE CAP

DESCRIPTION

All radiators are equipped with a pressure cap. This cap releases pressure at some point within a range of 124-to-145 kPa (18-to-21 psi). The pressure relief point (in pounds) is engraved on top of the cap

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-to-145 kPa (18-to-21 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

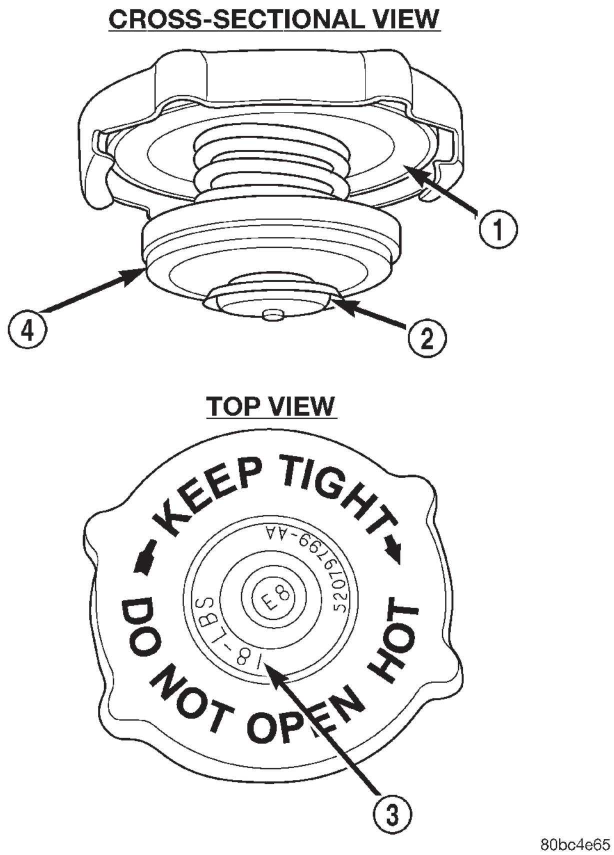


Fig. 16 Radiator Pressure Cap—Typical

1 – FILLER NECK SEAL
2 – VACUUM VENT VALVE
3 – PRESSURE RATING
4 – PRESSURE VALVE

OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. As the coolant cools, it contracts and creates a vacuum in cooling system. This causes the vacuum valve to open and coolant in reserve/overflow tank to be drawn through connecting hose into radiator. If the vacuum valve is stuck shut, or overflow hose is kinked, radiator hoses will collapse on cool-down.

HOSE CLAMPS

DESCRIPTION

The cooling system utilizes both worm drive and spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 17).

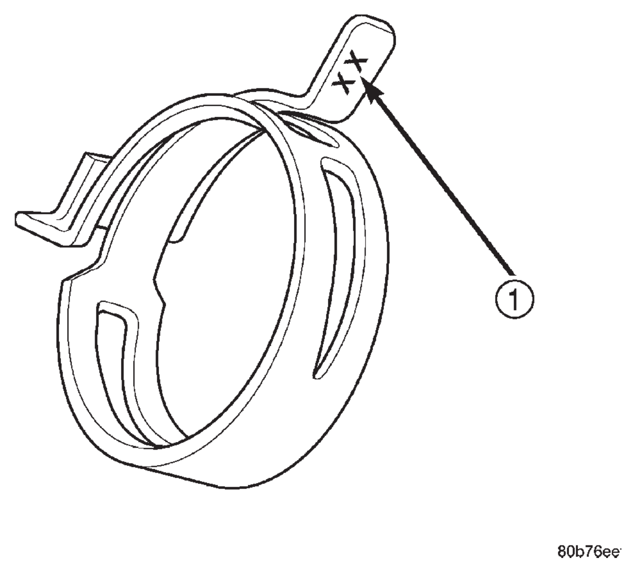


Fig. 17 Spring Clamp Size Location

1 – SPRING CLAMP SIZE LOCATION

OPERATION

The worm type hose clamp uses a specified torque value to maintain proper tension on a hose connection.

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, only use constant tension clamp pliers designed to compress the hose clamp.

DESCRIPTION AND OPERATION (Continued)

VISCOUS FAN DRIVE

DESCRIPTION

CAUTION: Engines equipped with accessory drive belts have reverse rotating fans and viscous fan drives. They are marked with the word REVERSE to designate their usage. Installation of the wrong fan or viscous fan drive can result in engine overheating.

The thermal viscous fan drive is a silicone-fluid-filled coupling used to connect the fan blades to the water pump shaft. The coupling allows the fan to be driven in a normal manner. This is done at low engine speeds while limiting the top speed of the fan to a predetermined maximum level at higher engine speeds.

On all 3.9L, 5.9L and 4.7L an electrical cooling fan located in the fan shroud aids in low speed cooling, It is designed to augment the viscous fan, However, it does not replace the viscous fan.

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit. This spring coil reacts to the temperature of the radiator discharge air. It engages the viscous fan drive for higher fan speed if the air temperature from the radiator rises above a certain point. Until additional engine cooling is necessary, the fan will remain at a reduced rpm regardless of engine speed.

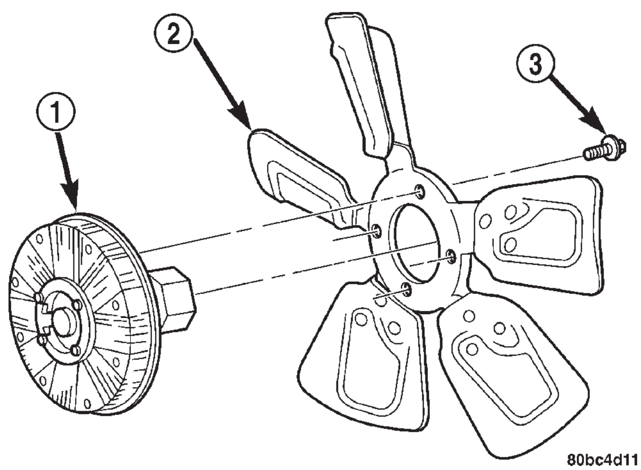


Fig. 18 Fan Blade/Viscous Fan Drive—3.9L/4.7L/5.9L Engines

1 – VISCOUS FAN DRIVE
2 – FAN BLADE
3 – SCREW AND WASHER

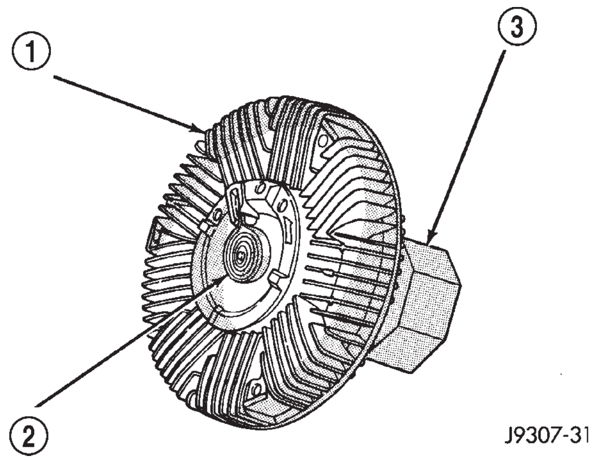


Fig. 19 Viscous Fan Drive—3.9L/4.7L/5.9L Engines—Typical

1 – VISCOUS FAN DRIVE
2 – THERMOSTATIC SPRING
3 – MOUNTING NUT TO WATER PUMP HUB

OPERATION

When sufficient heat is present, the viscous fan drive will engage. This is when the air flowing through the radiator core causes a reaction to the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

Once the engine has cooled, the radiator discharge temperature will drop. The bimetallic coil again reacts and the fan speed is reduced to the previous disengaged speed.

COOLING SYSTEM FAN

DESCRIPTION

The fan is electrically controlled by the powertrain control module (PCM) through the fan control relay. This relay is located in the power distribution center (PDC). For the location of the relay within the PDC, refer to label on PDC cover.

DESCRIPTION AND OPERATION (Continued)

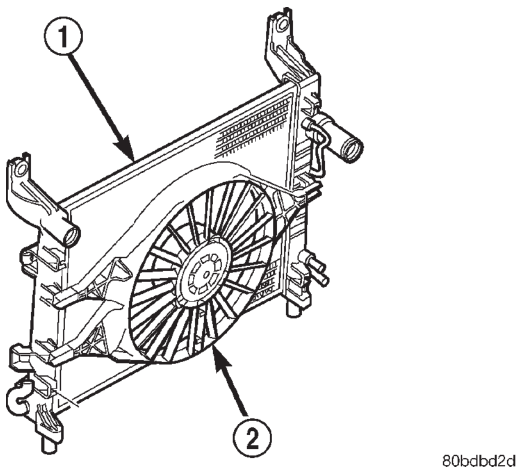


Fig. 20 Electric Fan Assembly—Typical

1 – RADIATOR
2 – ELECTRIC FAN ASSEMBLY

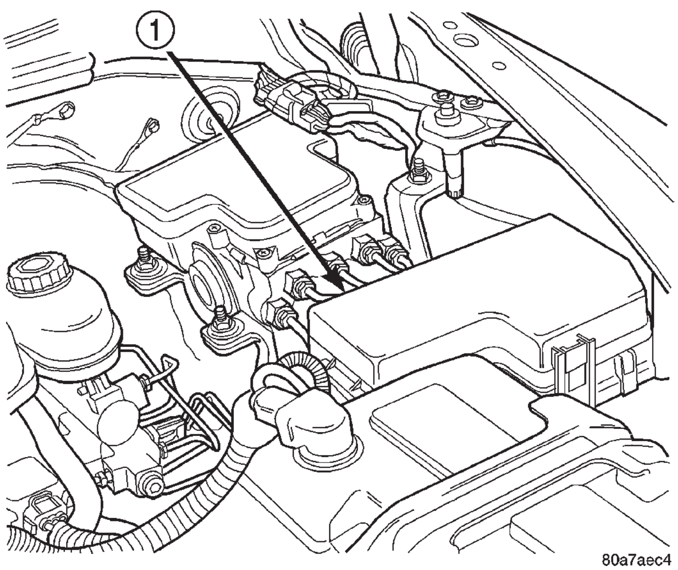


Fig. 21 Power Distribution Center (PDC)

1 – POWER DISTRIBUTION CENTER (PDC)

OPERATION

The PCM regulates fan operation based on input from the engine coolant temperature sensor and vehicle speed.

The fan is not energized during engine cranking regardless of the electrical input from the engine coolant temperature sensor. However, if engine operating conditions warrant fan engagement, the fan will run once engine starts.

The fan is energized whenever the engine is running and the air conditioning is selected on the temperature control panel.

If the A/C is not selected the fan operates when the coolant temperature is above 104° C (220° F). The same is true for vehicles not equipped with A/C. The fan will turn off when coolant temperature drops to 102° C (216° F).

DIAGNOSIS AND TESTING

ON-BOARD DIAGNOSTICS (OBD)

FOR CERTAIN COOLING SYSTEM COMPONENTS

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

NOTE: If the engine has remained cool for too long a period, such as with a stuck open thermostat, a Diagnostic Trouble Code (DTC) number 17 can be observed at the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 22).

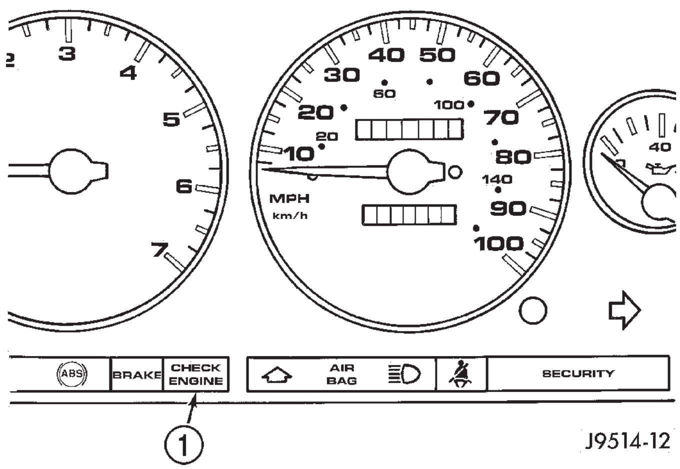


Fig. 22 Check Engine Lamp Location

1 – CHECK ENGINE LAMP

If the problem is sensed in a monitored circuit often enough to indicate an actual problem, a DTC is stored. The DTC will be stored in the PCM memory for eventual display to the service technician. If the problem is repaired or ceases to exist, the PCM cancels the DTC after 51 engine starts.

Certain criteria must be met for a DTC to be entered into PCM memory. The criteria may be a specific range of engine rpm, engine temperature and/or input voltage to the PCM.

A DTC indicates that the PCM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but never identify the failed component directly.

It is possible that a DTC for a monitored circuit may not be entered into memory even though a malfunction has occurred. Refer to On- Board Diagnos-

DIAGNOSIS AND TESTING (Continued)

tics (OBD) in Group 25, Emission Control Systems for additional information.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored Diagnostic Trouble Code (DTC) can be displayed by cycling the ignition key On-Off-On-Off-On within three seconds and observing the malfunction indicator lamp. This lamp is displayed on the instrument panel as the CHECK ENGINE lamp (Fig. 22).

They can also be displayed through the use of the Diagnostic Readout Box (DRB) scan tool. The DRB connects to the data link connector, left of the steering column above the brake pedal (Fig. 23). For operation of the DRB, refer to the appropriate Powertrain Diagnostic Procedures service manual.

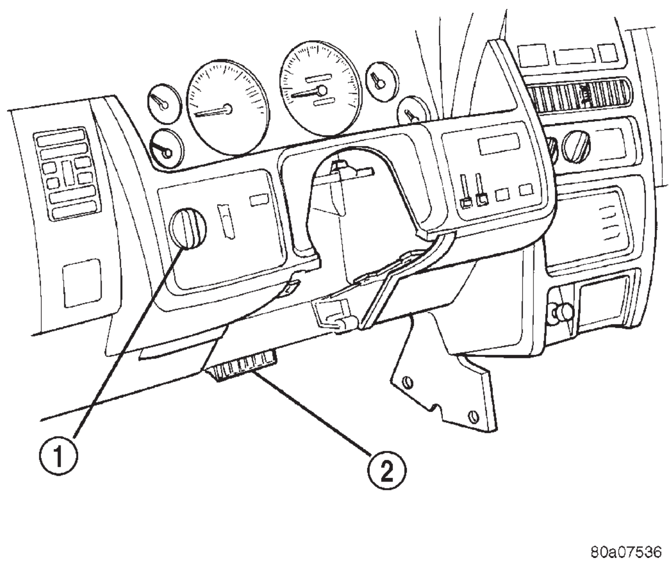


Fig. 23 Data Link Connector Location

1 – HEADLAMP SWITCH
2 – DATA LINK CONNECTOR (LEFT SIDE OF COLUMN ABOVE BRAKE PEDAL)

EXAMPLES:

- If the lamp (Fig. 22) flashes 1 time, pauses and flashes 2 more times, a flashing Diagnostic Trouble Code (DTC) number 12 is indicated. If this code is observed, it is indicating that the battery has been disconnected within the last 50 key-on cycles. It could also indicate that battery voltage has been disconnected to the PCM. In either case, other DTC's may have been erased.
- If the lamp flashes 1 time, pauses and flashes 7 more times, a flashing Diagnostic Trouble Code (DTC) number 17 is indicated.

After any stored DTC information has been observed, the display will end with a flashing DTC number 55. This will indicate the end of all stored information.

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB scan tool to erase a DTC. Refer to the appropriate Powertrain Diagnostic Procedures service manual for operation of the DRB scan tool.

DRB SCAN TOOL

For operation of the DRB scan tool, refer to the appropriate Powertrain Diagnostic Procedures service manual.

WATER PUMP TESTS

LOOSE IMPELLER—4.7L

NOTE: Due to the design of the 4.7L engine water pump, testing the pump for a loose impeller must be done by verifying coolant flow in the radiator. To accomplish this refer to the following procedure.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(1) Drain coolant until the first row of cores is visible in the radiator.

(2) Leaving the radiator cap off, start the engine

(3) While looking into the radiator through the radiator fill neck, raise engine rpm to 2000 RPM. Observe the flow of coolant from the first row of cores.

(4) If there is no flow or very little flow visable, replace the water pump.

INSPECTING FOR INLET RESTRICTIONS

Inadequate heater performance may be caused by a metal casting restriction in the heater hose inlet.

DO NOT WASTE reusable coolant. If solution is clean, drain the coolant into a clean container for reuse.

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(1) Drain sufficient coolant from the radiator to decrease the level below the heater hose inlet. On 4.7L engines this requires complete draining.

(2) Remove the heater hose.

(3) Inspect the inlet for metal casting flash or other restrictions.

NOTE: On 4.7L engine remove the fitting from the timing chain cover, If the restriction is in the timing chain cover, remove the timing chain cover. Refer to Timing Chain Cover in Group 9 Engine, for procedure.

DIAGNOSIS AND TESTING (Continued)

PRELIMINARY CHECKS

ENGINE COOLING SYSTEM OVERHEATING

Establish what driving conditions caused the complaint. Abnormal loads on the cooling system such as the following may be the cause:

PROLONGED IDLE, VERY HIGH AMBIENT TEMPERATURE, SLIGHT TAIL WIND AT IDLE, SLOW TRAFFIC, TRAFFIC JAMS, HIGH SPEED, OR STEEP GRADES.

Driving techniques that avoid overheating are:

- Idle with A/C off when temperature gauge is at end of normal range.
- If vehicle is equipped with a 2.5L 4-cylinder engine, do not increase engine speed for more air flow. Cooling systems with electric cooling fans do not respond to engine rpm. The added cooling from higher coolant flow is more than offset by increased heat from higher engine output.
- If vehicle is equipped with a V-6 or V-8 engine, increasing engine speed for more air flow is recommended.

(1) TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

(2) AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

(3) RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts. Incorrect water pump, or pump rotating in wrong direction due to belt not correctly routed
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to following Cooling System Diagnosis charts.

These charts are to be used as a quick-reference only. Refer to the group text for information.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open thermostat?	1. Refer to Group 25, Emission Systems for On-Board Diagnostics and DTC information. Replace thermostat if necessary.
	2. Is the temperature sending unit connected?	2. Check the temperature sensor connector. Refer to Group 8E. Repair connector if necessary.
	3. Is the temperature gauge operating OK?	3. Check gauge operation. Refer to Group 8E. Repair as necessary.
	4. Coolant level low in cold ambient temperatures accompanied with poor heater performance.	4. Check coolant level in the coolant reserve/overflow tank and the radiator. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for WARNINGS and CAUTIONS associated with removing the radiator cap.
	5. Improper operation of internal heater doors or heater controls.	5. Inspect heater and repair as necessary. Refer to Group 24, Heating and Air Conditioning for procedures.
TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM	1. Trailer is being towed, a steep hill is being climbed, vehicle is operated in slow moving traffic, or engine is being idled with very high ambient (outside) temperatures and the air conditioning is on. Higher altitudes could aggravate these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and attempt to drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause for overheating and repair. Refer to Possible Causes (2-20).
	2. Is the temperature gauge reading correctly?	2. Check gauge. Refer to Group 8E. Repair as necessary.
	3. Is the temperature warning illuminating unnecessarily?	3. Check warning lamp operation. Refer to Group 8E. Repair as necessary.
	4. Coolant low in coolant reserve/ overflow tank and radiator?	4. Check for coolant leaks and repair as necessary. Refer to Testing Cooling System for Leaks in this Group.
	5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following Step 6.	5. Tighten cap

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM (cont)	6. Poor seals at the radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator Cap. Replace cap if necessary.
	(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.	
	7. Coolant level low in radiator but not in coolant reserve/overflow tank. This means the radiator is not drawing coolant from the coolant reserve/overflow tank as the engine cools	7. (a) Check condition of radiator cap and cap seals. Refer to Radiator Cap in this Group. Replace cap if necessary.
		(b) Check condition of radiator filler neck. If neck is bent or damaged, replace radiator.
		(c) Check condition of the hose from the radiator to the coolant tank. It should fit tight at both ends without any kinks or tears. Replace hose if necessary.
		(d) Check coolant reserve/overflow tank and tanks hoses for blockage. Repair as necessary.
	8. Incorrect coolant concentration	8. Check coolant. Refer to Coolant section in this Group for correct coolant/water mixture ratio.
	9. Coolant not flowing through system	9. Check for coolant flow at radiator filler neck with some coolant removed, engine warm and thermostat open. Coolant should be observed flowing through radiator. If flow is not observed, determine area of obstruction and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Remove insects and debris. Refer to Radiator Cleaning in this Group.
	11. Radiator core is corroded or plugged.	11. Have radiator re-cored or replaced.
	12. Aftermarket A/C installed without proper radiator.	12. Install proper radiator.
	13. Fuel or ignition system problems.	13. Refer to Fuel and Ignition System Groups for diagnosis.
	14. Dragging brakes.	14. Check and correct as necessary. Refer to Group 5, Brakes for correct procedures.
	15. Bug screen or cardboard is being used, reducing airflow.	15. Remove bug screen or cardboard.
	16. Thermostat partially or completely shut.	16. Check thermostat operation and replace as necessary. Refer to Thermostats in this Group.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH OR THE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM THE COOLING SYSTEM (cont)	17. Viscous fan drive not operating properly.	17. Check fan drive operation and replace as necessary. Refer to Viscous Fan Drive in this Group.
	18. Electric cooling fan not operating properly (vehicles equipped with 2.5L engine)	18. Check electric fan operation and repair as necessary. Refer to Electric Cooling Fan in this Group.
	19. Cylinder head gasket leaking.	19. Check for cylinder head gasket leaks. Refer to Cooling System-Testing For Leaks in this Group. For repair, refer to Group 9, Engines.
	20. Heater core leaking.	20. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary.
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. On vehicles equipped with an electric fan, the gauge may cycle up and down. This is due to the cycling of the electric radiator fan.	1. This is a normal condition. No correction is necessary unless the gauge cycles into the red (overheat) zone. Refer to Electric Cooling Fan Diagnosis and Testing in this group.
	2. During cold weather operation, with the heater blower in the high position, the gauge reading may drop slightly.	2. A normal condition. No correction is necessary.
	3. Temperature gauge or engine mounted gauge sensor defective or shorted. Also, corroded or loose wiring in this circuit.	3. Check operation of gauge and repair if necessary. Refer to Group 8E, Instrument Panel and Gauges.
	4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running)	4. A normal condition. No correction is necessary. Gauge should return to normal range after vehicle is driven.
	5. Gauge reading high after re-starting a warmed up (hot) engine.	5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
	6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	6. Check and correct coolant leaks. Refer to Cooling System-Testing for leaks in this group.
	7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system causing a thermostat to open late.	7. (a) Check for cylinder head gasket leaks. Refer to Cooling System-Testing for Leaks in this group.
		(b) Check for coolant in the engine oil. Inspect for white steam emitting from the exhaust system. Repair as necessary.
	8. Water pump impeller loose on shaft.	8. Check water pump and replace as necessary. Refer to water Pumps in this group.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	9. Loose accessory drive belt. (water pump slipping) 10. Air leak on the suction side of the water pump allows air to build up in cooling system causing thermostat to open late.	9. Refer to Accessory Drive Belts in this group. Check and correct as necessary. 10. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT TO COOLANT TANK. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT RESERVE/ OVERFLOW TANK	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and cap seals. Refer to Radiator Caps in this group. Replace cap as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE READING HIGH OR HOT	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. Refer to Cooling System-Testing For Leaks in this group.
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. engine overheating. 2. Freeze point of coolant not correct. Mixture is too rich or too lean.	1. Check reason for overheating and repair as necessary. 2. Check coolant concentration. Refer to the Coolant section of this group and adjust ratio as required.
HOSE OR HOSES COLLAPSE WHILE ENGINE IS RUNNING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reserve/overflow system.	1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this group. Replace if necessary (b) Hose between coolant reserve/overflow tank and radiator is kinked. Repair as necessary. (c) Vent at coolant reserve/overflow tank is plugged. Clean vent and repair as necessary. (d) Reserve/overflow tank is internally blocked or plugged. Check for blockage and repair as necessary.
ELECTRIC RADIATOR FAN RUNS ALL OF THE TIME	1. Fan relay, powertrain control module (PCM) or coolant temperature sensor defective.	1. Refer to Electric Cooling Fan Diagnosis and Testing. Also refer to Group 8W, Wiring Diagrams. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ELECTRIC RADIATOR FAN WILL NOT RUN AT ALL. GAUGE READING HIGH OR HOT	1. Blown Fuse in Power Distribution Center (PDC)	1. Determine reason for blown fuse and repair as necessary.
	2. Fan relay, powertrain control module (PCM) or coolant temperature sensor defective.	2. Refer to Electric Cooling Fan Diagnosis and Testing. Also refer to Group 8W, Wiring Diagrams. Repair as necessary.
	3. Fan Motor Defective	3. Refer to Electric Cooling Fan Diagnosis and Testing. Also refer to Group 8W, Wiring Diagrams. Repair as necessary.
NOISY VISCOUS FAN/DRIVE	1. Fan blades loose.	1. Replace fan blade assembly. Refer to Cooling System Fans in this Group
	2. Fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or air conditioning condenser.	3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser.
	4. Thermal viscous fan drive has defective bearing.	4. Replace fan drive. Bearing is not serviceable. Refer to Viscous Fan Drive in this group.
	5. A certain amount of fan noise may be evident on models equipped with a thermal viscous fan drive. Some of this noise is normal.	5. Refer to Viscous Fan Drive in this group for an explanation of normal fan noise.
INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION	1. Has a Diagnostic trouble Code (DTC) been set?	1. Refer to Group 25, Emissions for correct procedures and replace thermostat if necessary
	2. Coolant level low	2. Refer to Cooling System-Testing For Leaks in this group.
	3. Obstructions in heater hose/ fittings	3. Remove heater hoses at both ends and check for obstructions
	4. Heater hose kinked	4. Locate kinked area and repair as necessary
	5. Water pump is not pumping water to/through the heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. If only one of the hoses is hot, the water pump may not be operating correctly or the heater core may be plugged. Accessory drive belt may be slipping causing poor water pump operation.	5. Refer to Water Pump in this group. If a slipping belt is detected, refer to Accessory Drive Belts in this group. If heater core obstruction is detected, refer to Group 24, Heating and Air Conditioning.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
STEAM IS COMING FROM THE FRONT OF VEHICLE NEAR THE GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP AND RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. Refer to Coolant in this group for coolant concentration information. Adjust coolant mixture as necessary.
COOLANT LEVEL CHANGES IN COOLANT RESERVE/OVERFLOW TANK. TEMPERATURE GAUGE IS IN NORMAL RANGE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the tank was between the FULL and ADD marks at normal operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

ELECTRIC COOLING FAN

The powertrain control module (PCM) will set a diagnostic trouble code (DTC) in memory if it detects a problem in the electric cooling fan relay or circuit. Refer to On-Board Diagnostics in Group 25, Emission Control Systems for more information on accessing a DTC.

The DTC can also be accessed through the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnostic information and operation of the DRB scan tool.

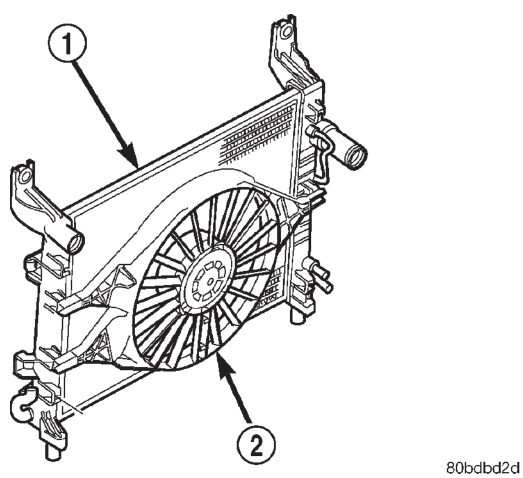


Fig. 24 Electrical Fan Assembly—Typical

1 – RADIATOR
2 – ELECTRIC FAN ASSEMBLY

DIAGNOSIS AND TESTING (Continued)

RADIATOR FAN MOTOR INOPERATIVE

Equipment Required:

- DRB Scan Tool
- Volt/Ohm meter
- Wiring Diagrams section of this manual

Test Procedure:

(1) Inspect 10A fuse in junction block and 40A maxi fuse in PDC (Fig. 25).

(2) Remove Cooling Fan Relay from the PDC and make the following checks at the relay connector:

- Apply 12 volts (using a fused 14-gauge wire) to circuit C25 (relay terminal 87). If fan does not come on, check for open in circuit C25 or Z1. If circuits are o.k., replace the cooling fan motor.
- With the ignition key “off” check for battery voltage at circuit C28 (relay terminal 30). If no battery voltage present check for open/shorted circuit C28 between the PDC and relay.
- With the ignition key in the “run” position check for battery voltage at circuit F18 (relay terminal 86). If no battery voltage present, check for open/short in circuit F18 between the junction block and the relay.
- If no problems are detected, install the DRB (refer to the appropriate Powertrain Diagnostic Procedures manual for DRB scan tool operating instructions) and start the engine. Clip a 12V test light to the battery positive terminal and probe circuit C27 (relay terminal 85). When the engine temperature reaches 110° C (230° F), or A/C is selected, the test light should light. If not, check circuit C27 for open.
- If no problems are detected at this point, replace the cooling fan relay.

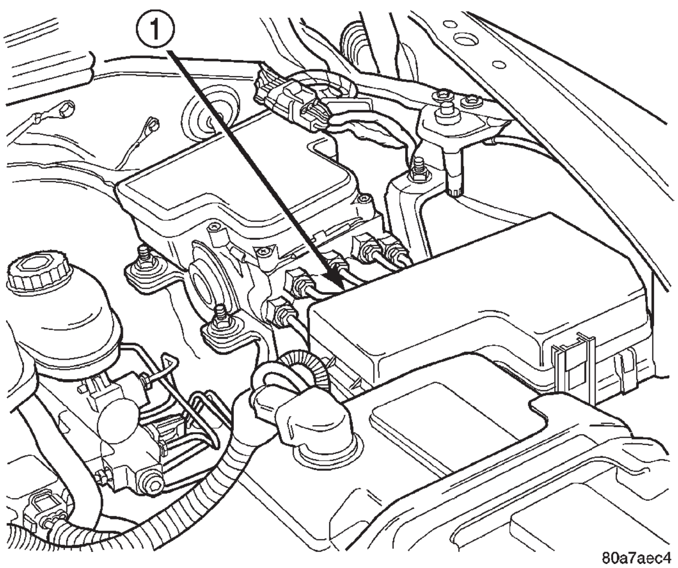


Fig. 25 Power Distribution Center (PDC)

1 – POWER DISTRIBUTION CENTER (PDC)

RADIATOR COOLANT FLOW CHECK

Use the following procedure to determine if coolant is flowing through cooling system.

(1) Idle engine until operating temperature is reached. If upper radiator hose is warm to the touch, thermostat is opening and coolant is flowing to radiator.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. USING A RAG TO COVER RADIATOR PRESSURE CAP, OPEN RADIATOR CAP SLOWLY TO FIRST STOP. ALLOW ANY BUILT-UP PRESSURE TO VENT TO THE RESERVE/ OVERFLOW TANK. AFTER PRESSURE BUILD-UP HAS BEEN RELEASED, REMOVE CAP FROM FILLER NECK.

(2) Drain a small amount of coolant from radiator until ends of radiator tubes are visible through filler neck. Idle engine at normal operating temperature. If coolant is flowing past exposed tubes, coolant is circulating.

COOLING SYSTEM—TESTING FOR LEAKS

ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause additive to glow a bright green color.

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist (Fig. 26).

PRESSURE TESTER METHOD

The engine should be at normal operating temperature. Recheck the system cold if cause of coolant loss is not located during the warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

Carefully remove radiator pressure cap from filler neck and check coolant level. Push down on cap to disengage it from stop tabs. Wipe inside of filler neck and examine lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect radiator-to- reserve/overflow tank hose for internal obstructions. Insert a wire through the hose to be sure it is not obstructed.

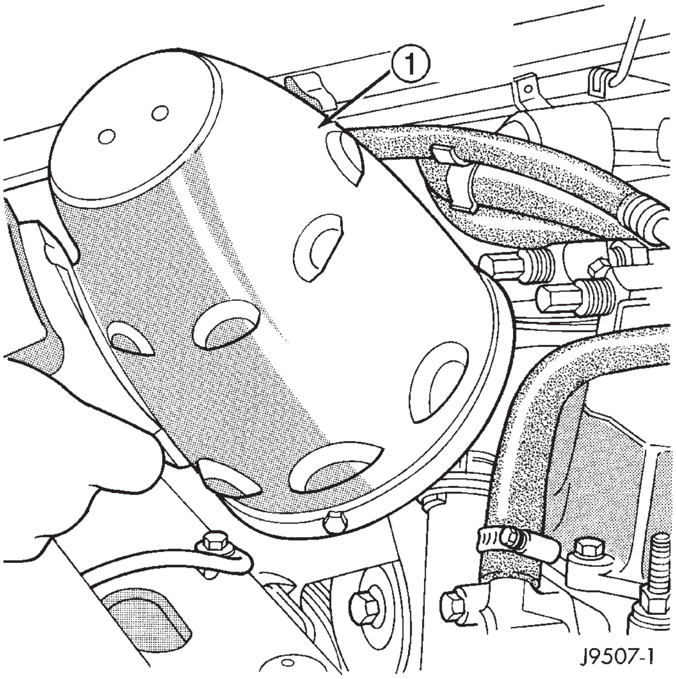


Fig. 26 Leak Detection Using Black Light—Typical

1 – TYPICAL BLACK LIGHT TOOL

Inspect cams on outside of filler neck. If cams are damaged, seating of pressure cap valve and tester seal will be affected.

Attach pressure tester (7700 or an equivalent) to radiator filler neck (Fig. 27).

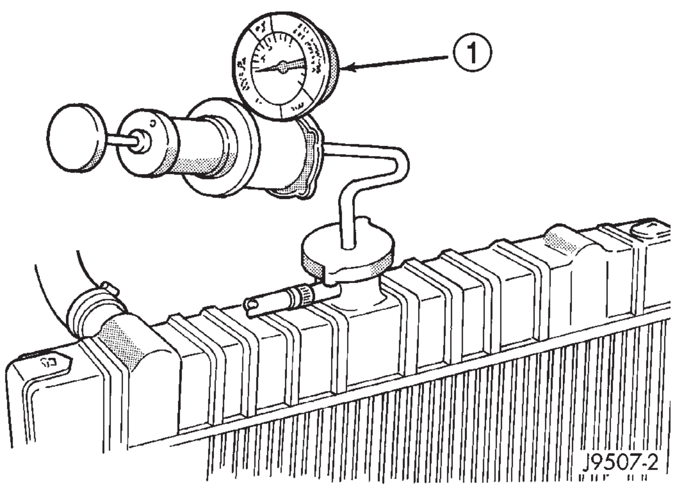


Fig. 27 Pressure Testing Cooling System—Typical

1 – TYPICAL COOLING SYSTEM PRESSURE TESTER

Operate tester pump to apply 103.4 kPa (15 psi) pressure to system. If hoses enlarge excessively or bulges while testing, replace as necessary. Observe gauge pointer and determine condition of cooling system according to following criteria:

Holds Steady: If pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test.

Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

Drops Quickly: Indicates that serious leakage is occurring. Examine system for external leakage. If leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect transmission dipstick for water globules and transmission fluid cooler for leakage.

WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 110 KPA (20 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.

Operate engine without pressure cap on radiator until thermostat opens. Attach a Pressure Tester to filler neck. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

DIAGNOSIS AND TESTING (Continued)

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

COMBUSTION LEAKAGE TEST—WITHOUT PRESSURE TESTER

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Drain sufficient coolant to allow thermostat removal. Refer to Thermostat Replacement. Disconnect water pump drive belt.

Add coolant to radiator to bring level to within 6.3 mm (1/4 in) of top of thermostat housing.

CAUTION: Avoid overheating. Do not operate engine for an excessive period of time. Open draincock immediately after test to eliminate boil over.

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

VISCOUS FAN DRIVE—3.9L/4.7L and 5.9L ENGINES

If the fan assembly free-wheels without drag (the fan blades will revolve more than five turns when spun by hand), replace the fan drive. This spin test must be performed when the engine is cool.

For the following test, the cooling system must be in good condition. It also will ensure against excessively high coolant temperature.

WARNING: BE SURE THAT THERE IS ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.

(1) Drill a 3.18-mm (1/8-in) diameter hole in the top center of the fan shroud between the washer and coolant reservoirs along the pinch flange. Be careful not to pierce the reservoirs..

(2) Obtain a dial thermometer with an 8 inch stem (or equivalent). It should have a range of -18° to 105°C (0° to 220° F). Insert thermometer through the hole in the shroud. Be sure that there is adequate clearance from the fan blades.

(3) Connect a tachometer and an engine ignition timing light (timing light is to be used as a strobe light).

(4) Block the air flow through the radiator. Secure a sheet of plastic in front of the radiator (or air conditioner condenser). Use tape at the top to secure the plastic and be sure that the air flow is blocked.

(5) Be sure that the air conditioner (if equipped) is turned off.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(6) Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 96° C (205° F). Fan drive **engagement** should have started to occur at between 88° to 96° C (190° to 205° F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring). The timing light also will indicate an increase in the speed of the fan.

(7) When the air temperature reaches 96° C (205° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 57° to 79° C (135° to 175° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

DIAGNOSIS AND TESTING (Continued)

ACCESSORY DRIVE BELT DIAGNOSIS

VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 28), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 28). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to the Accessory Drive Belt Diagnosis charts for further belt diagnosis.

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for alignment, glazing, or excessive end play.

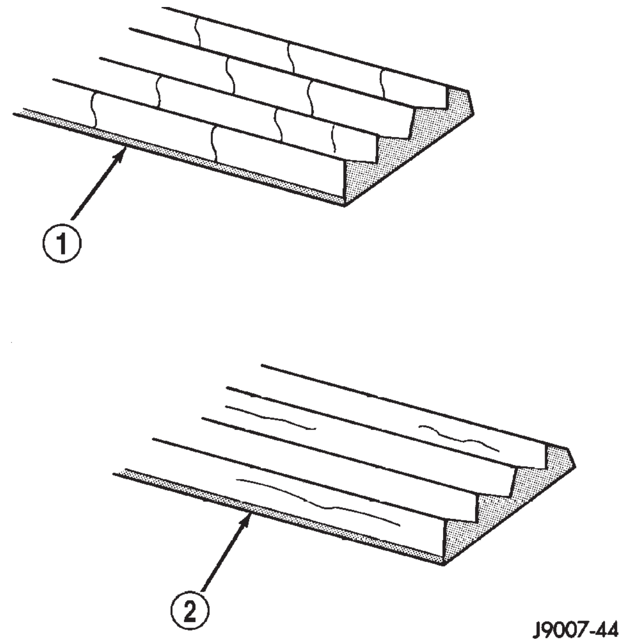


Fig. 28 Belt Wear Patterns

1 – NORMAL CRACKS BELT OK
2 – NOT NORMAL CRACKS REPLACE BELT

ACCESSORY DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (One or more ribs has separated from belt body)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage	2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned	1. Align pulley(s)
	2. Abrasive environment	2. Clean pulley(s). Replace belt if necessary
	3. Rusted pulley(s)	3. Clean rust from pulley(s)
	4. Sharp or jagged pulley groove tips	4. Replace pulley. Inspect belt.
	5. Belt rubber deteriorated	5. Replace belt

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BELT SLIPS	1. Belt slipping because of insufficient tension	1. Adjust tension (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines)
	2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol)	2. Replace belt and clean pulleys
	3. Driven component bearing failure (seizure)	3. Replace faulty component or bearing
	4. Belt glazed or hardened from heat and excessive slippage	4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove	1. Replace belt
	2. Pulley groove tip has worn away rubber to tensile member	2. Replace belt
″GROOVE JUMPING” (Belt does not maintain correct position on pulley)	1. Belt tension either too low or too high	1. Adjust belt tension (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines)
	2. Pulley(s) not within design tolerance	2. Replace pulley(s)
	3. Foreign object(s) in grooves	3. Remove foreign objects from grooves
	4. Pulley misalignment	4. Align component
	5. Belt cordline is broken	5. Replace belt
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Excessive tension (2.5L)	1. Replace belt and adjust tension to specification
	2. Tensile member damaged during belt installation	2. Replace belt
	3. Severe misalignment	3. Align pulley(s)
	4. Bracket, pulley, or bearing failure	4. Replace defective component and belt
NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation)	1. Belt slippage	1. Adjust belt (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines)
	2. Bearing noise	2. Locate and repair
	3. Belt misalignment	3. Align belt/pulley(s)
	4. Belt to pulley mismatch	4. Install correct belt
	5. Driven component induced vibration	5. Locate defective driven component and repair
	6. System resonant frequency induced vibration	6. Vary belt tension within specifications.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object	1. Correct rubbing condition
	2. Excessive heat causing woven fabric to age	2. Replace belt
	3. Tension sheeting splice has fractured	3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Excessive tension	1. Adjust belt tension (2.5L). Replace tensioner (3.9L/4.7L/5.9L Engines)
	2. Belt contacting stationary object	2. Replace belt
	3. Pulley(s) out of tolerance	3. Replace pulley
	4. Insufficient adhesion between tensile member and rubber matrix	4. Replace belt and adjust tension to specifications

THERMOSTAT

All models are equipped with On-Board Diagnostics for certain cooling system components. Refer to On-Board Diagnostics (OBD) in the Diagnosis section of this group for additional information. If the powertrain control module (PCM) detects low engine coolant temperature, it may record a Diagnostic Trouble Code (DTC) in the PCM memory. Do not change a thermostat for lack of heat as indicated by the instrument panel gauge or heater performance unless a DTC is present. Refer to the Diagnosis section of this group for other probable causes. For other DTC numbers, refer to On-Board Diagnostics in the Group 25, Emission Control Systems.

The DTC can also be accessed through the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnostic information and operation of the DRB scan tool.

RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF CHECK

The pressure cap upper gasket (seal) pressure relief can be tested by removing overflow hose from radiator filler neck nipple. Attach hose of pressure tester tool 7700 (or equivalent) to nipple. It will be necessary to disconnect hose from its adapter for filler neck. Pump air into radiator. The pressure cap upper gasket should relieve at 69-124 kPa (10-18 psi) and hold pressure at a minimum of 55 kPa (8 psi).

WARNING: THE WARNING WORDS —DO NOT OPEN HOT— ON RADIATOR PRESSURE CAP, ARE A SAFETY PRECAUTION. WHEN HOT, PRESSURE BUILDS UP IN COOLING SYSTEM. TO PREVENT SCALDING OR INJURY, RADIATOR CAP SHOULD NOT BE REMOVED WHILE SYSTEM IS HOT AND/OR UNDER PRESSURE.

Do not remove radiator cap at any time **except** for the following purposes:

(1) Check and adjust antifreeze freeze point.
(2) Refill system with new antifreeze.
(3) Conducting service procedures.
(4) Checking for vacuum leaks.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT AT LEAST 15 MINUTES BEFORE REMOVING RADIATOR CAP. WITH A RAG, SQUEEZE RADIATOR UPPER HOSE TO CHECK IF SYSTEM IS UNDER PRESSURE. PLACE A RAG OVER CAP AND WITHOUT PUSHING CAP DOWN, ROTATE IT COUNTERCLOCKWISE TO FIRST STOP. ALLOW FLUID TO ESCAPE THROUGH THE COOLANT RESERVE/OVERFLOW HOSE INTO RESERVE/OVERFLOW TANK. SQUEEZE RADIATOR UPPER HOSE TO DETERMINE WHEN PRESSURE HAS BEEN RELEASED. WHEN COOLANT AND STEAM STOP BEING PUSHED INTO TANK AND SYSTEM PRESSURE DROPS, REMOVE RADIATOR CAP COMPLETELY.

RADIATOR CAP—PRESSURE TESTING

Remove cap from radiator. Be sure that sealing surfaces are clean. Moisten rubber gasket with water and install cap on pressure tester 7700 or an equivalent (Fig. 29).

Operate tester pump to bring pressure to 117 kPa (17 psi) on gauge. If pressure cap fails to hold pressure of at least 110 kPa (16 psi) replace cap. Refer to following **CAUTION**.

The pressure cap may test properly while positioned on tool 7700 (or equivalent). It may not hold pressure or vacuum when installed on radiator. If so, inspect radiator filler neck and cap's top gasket for

DIAGNOSIS AND TESTING (Continued)

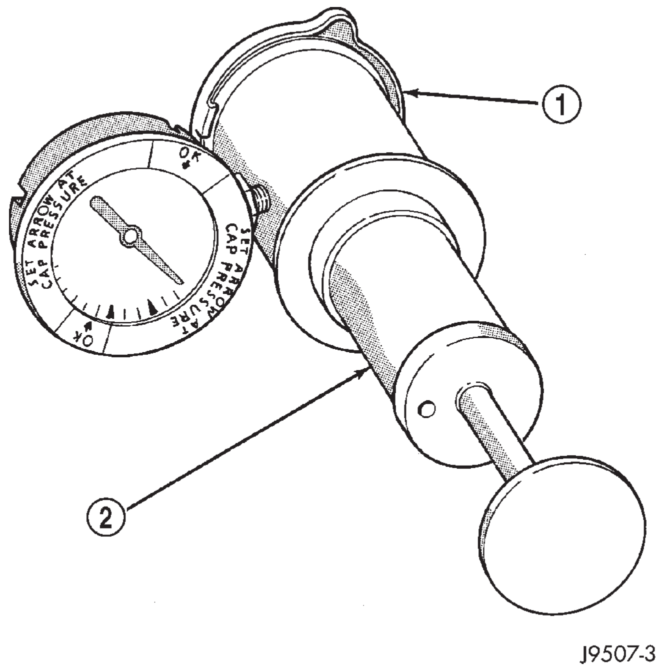


Fig. 29 Pressure Testing Radiator Cap—Typical

1 – PRESSURE CAP
2 – TYPICAL COOLING SYSTEM PRESSURE TESTER

damage. Also inspect for dirt or distortion that may prevent cap from sealing properly.

CAUTION: Radiator pressure testing tools are very sensitive to small air leaks, which will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to tool. Turn tool upside down and recheck pressure cap to confirm that cap needs replacement.

COOLANT—LOW LEVEL AERATION

If the coolant level in radiator drops below top of radiator core tubes, air will enter cooling system. On 2.5L engines, air can gather in the water box containing the thermostat.

Low coolant level can cause thermostat pellet to be suspended in air instead of coolant. This will cause thermostat to open later, which in turn causes higher coolant temperature. Air trapped in cooling system also reduces amount of coolant circulating in heater core resulting in low heat output.

COOLING SYSTEM—DEAERATION

As the engine operates, any air trapped in cooling system gathers under the radiator cap. The next time the engine is operated, thermal expansion of coolant will push any trapped air past radiator cap into the coolant reserve/overflow tank. Here it escapes to the atmosphere into the tank. When the engine cools down the coolant, it will be drawn from the reserve/overflow tank into the radiator to replace any removed air.

SERVICE PROCEDURES

COOLANT—ROUTINE LEVEL CHECK

NOTE: Do not remove radiator cap for routine coolant level inspections. The coolant level can be checked at coolant recovery bottle (Fig. 30).

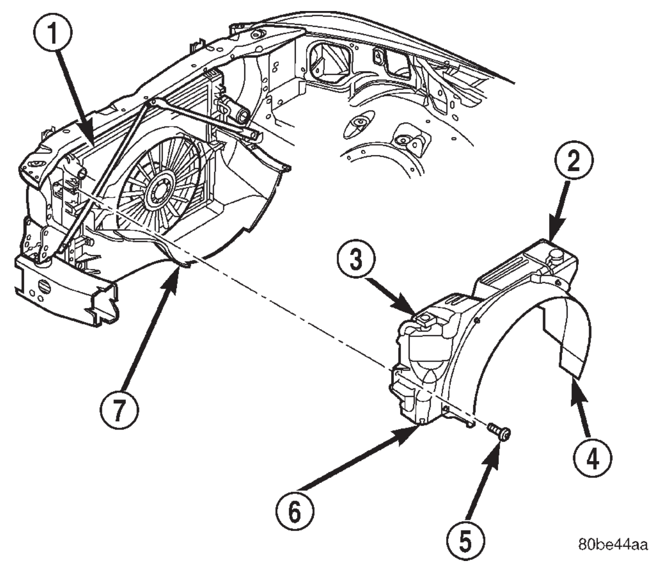


Fig. 30 Coolant Recovery Bottle Location

1 – RADIATOR
2 – WASHER FLUID RESERVOIR
3 – COOLANT OVERFLOW/RESERVOIR
4 – FAN SHROUD (UPPER)
5 – SCREW
6 – INTERLOCKING PINS
7 – FAN SHROUD (LOWER)

The coolant reserve/overflow system provides a quick method for determining coolant level without removing radiator pressure cap. With engine not running, open the coolant recovery bottle cap and remove coolant level indicator dipstick to observe coolant level in coolant recovery bottle. The coolant level should be between ADD and FULL marks. If the coolant level is at or below the ADD mark, fill the recovery bottle with a 50/50 mixture of antifreeze and water ONE QUART AT A TIME. Repeat this procedure until the coolant level is at the FULL mark.

COOLANT SERVICE

For cooling system flush and fill maintenance intervals, refer to Group 0, Lubrication and Maintenance.

SERVICE PROCEDURES (Continued)

COOLANT—ADDING ADDITIONAL

Do not remove radiator cap to add coolant to system. When adding coolant to maintain correct level, do so at coolant reserve/overflow tank. Use a 50/50 mixture of ethylene glycol antifreeze containing Alugard 340-2 ™ and low mineral content water. Remove radiator cap only for testing or when refilling system after service. Removing cap unnecessarily can cause loss of coolant and allow air to enter system, which produces corrosion.

COOLANT LEVEL CHECK

The cooling system is closed and designed to maintain coolant level to top of radiator.

WARNING: DO NOT OPEN RADIATOR DRAINCOCK WITH ENGINE RUNNING OR WHILE ENGINE IS HOT AND COOLING SYSTEM IS UNDER PRESSURE.

Remove radiator cap. The coolant level should be to top of radiator. If not, and if coolant level in coolant recovery bottle is at ADD mark, check for:

- An air leak in coolant reserve/overflow tank or its hose
- An air leak in radiator filler neck
- Leak in pressure cap seal to radiator filler neck

COOLING SYSTEM—DRAINING AND FILLING

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

DRAINING

(1) Remove radiator pressure cap.

(2) Loosen radiator petcock.

(3) Remove cylinder block drain plugs. Refer to (Fig. 31) (Fig. 32) (Fig. 33).

REFILLING

NOTE: This procedure does not apply to the 4.7L engine.

Clean cooling system prior to refilling. Refer to Cooling System Cleaning section of this group.

(1) Install cylinder block drain plugs. Coat the threads with Mopar® Thread Sealant with Teflon.

(2) Close radiator petcock.

(3) Fill cooling system with a 50/50 mixture of water and antifreeze. Be sure that antifreeze contains Alugard 340-2 ™ as specified in Coolant section of this group.

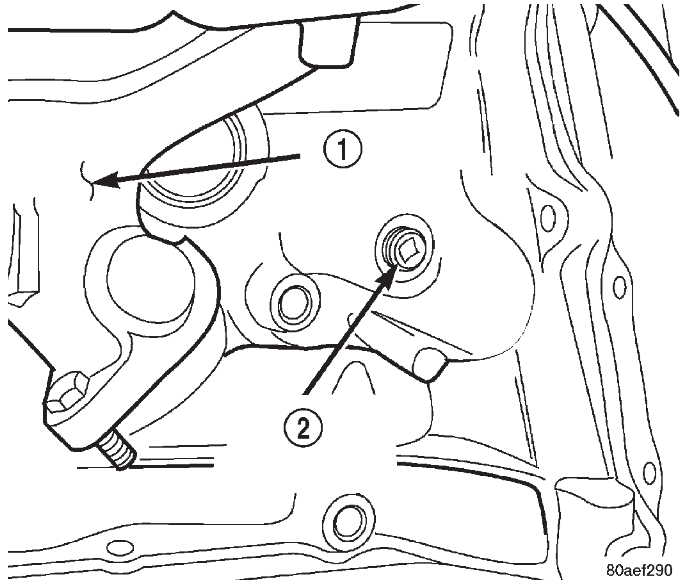


Fig. 31 Cylinder Block Drain Plug—2.5L Engine

1 – EXHAUST MANIFOLD

2 – CYLINDER BLOCK COOLANT DRAIN PLUG

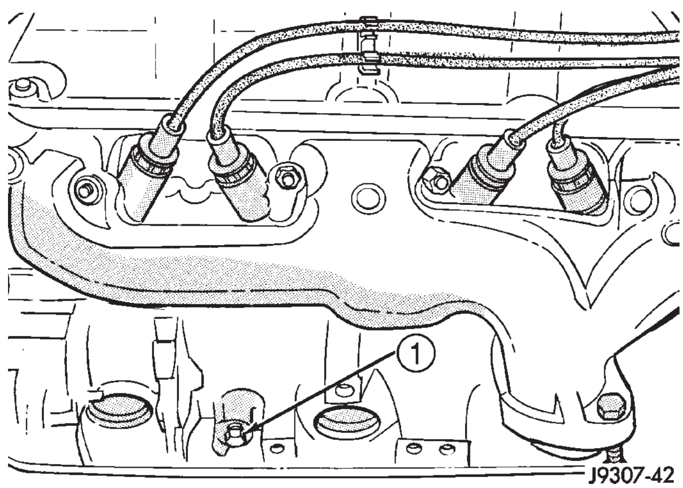


Fig. 32 Cylinder Block Drain Plug—3.9L/5.9L Engines—Typical

1 – BLOCK DRAIN PLUG

(4) Fill coolant reserve/overflow tank to FULL mark on indicator stick.

(5) Start and operate engine until thermostat opens (upper radiator hose warm to touch).

(6) If necessary, add a 50/50 water and antifreeze mixture to the coolant reserve/overflow tank. This is done to maintain coolant level between the FULL and ADD marks. The level in the reserve/overflow tank may drop below the ADD mark after three or four warm-up and cool-down cycles.

SERVICE PROCEDURES (Continued)

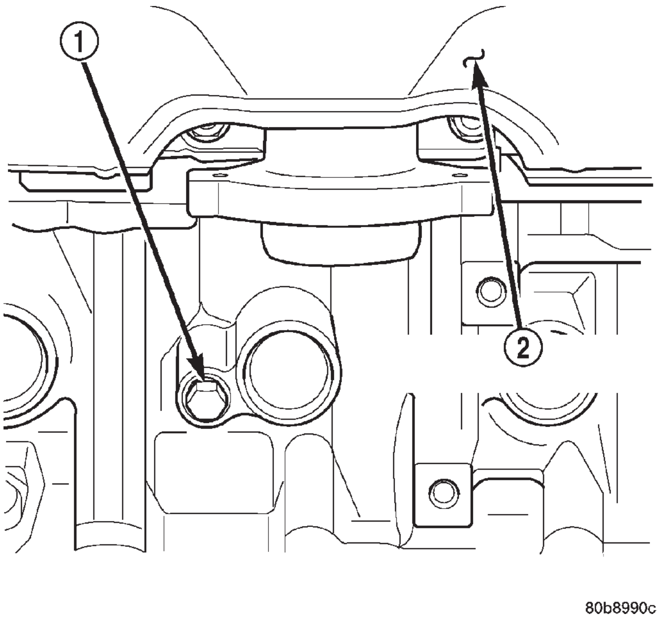


Fig. 33 Cylinder Block Drain Plug—4.7L Engine—Typical

1 – CYLINDER BLOCK DRAIN PLUG
2 – EXHAUST MANIFOLD AND HEAT SHIELD

REFILLING 4.7L ENGINE

CAUTION: Failure to follow the procedure outlined below, can result in engine overheating conditions and sever damage to engine.

(1) Tighten the radiator draincock and the cylinder block drain plug(s) (if removed).

(2) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water.

(3) Fill coolant reservoir to FULL mark.

(4) Install radiator cap and reservoir cap.

(5) Start engine and run at 3000 RPM for 10 seconds.

(6) Shut engine off.

(7) Remove radiator cap.

(8) Fill radiator to full level.

(9) Install the radiator cap.

COOLING SYSTEM—CLEANING/REVERSE FLUSHING

CLEANING

Drain cooling system and refill with water. Run engine with radiator cap installed until upper radiator hose is hot. Stop engine and drain water from system. If water is dirty, fill system with water, run engine and drain system. Repeat until water drains clean.

REVERSE FLUSHING

Reverse flushing of cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

REVERSE FLUSHING RADIATOR

Disconnect radiator hoses from radiator inlet and outlet. Attach a section of radiator hose to radiator bottom outlet fitting and insert flushing gun. Connect a water supply hose and air supply hose to flushing gun.

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result.

Allow radiator to fill with water. When radiator is filled, apply air in short blasts. Allow radiator to refill between blasts. Continue this reverse flushing until clean water flows out through rear of radiator cooling tube passages. Have radiator cleaned more extensively by a radiator repair shop.

REVERSE FLUSHING ENGINE

Drain cooling system. Remove thermostat housing and thermostat. Install thermostat housing. Disconnect radiator upper hose from radiator and attach flushing gun to hose. Disconnect radiator lower hose from water pump and attach a lead-away hose to water pump inlet fitting.

CAUTION: On vehicles equipped with a heater water control valve, be sure heater control valve is closed (heat off). This will prevent coolant flow with scale and other deposits from entering heater core.

Connect water supply hose and air supply hose to flushing gun. Allow engine to fill with water. When engine is filled, apply air in short blasts, allowing system to fill between air blasts. Continue until clean water flows through the lead away hose.

Remove lead away hose, flushing gun, water supply hose and air supply hose. Remove thermostat housing and install thermostat. Install thermostat housing with a replacement gasket. Refer to Thermostat Replacement. Connect radiator hoses. Refill cooling system with correct antifreeze/water mixture. Refer to Refilling the Cooling System.

CHEMICAL CLEANING

In some instances, use a radiator cleaner (Mopar Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid flushing operation.

CAUTION: Follow manufacturers instructions when using these products.

SERVICE PROCEDURES (Continued)

COOLANT

DESCRIPTION

ETHYLENE-GLYCOL MIXTURES

CAUTION: Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300) deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

OPERATION

ETHYLENE-GLYCOL MIXTURES

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

COOLANT SELECTION AND ADDITIVES

The presence of aluminum components in the cooling system requires strict corrosion protection. Maintain coolant at specified level with a mixture of ethylene-glycol based antifreeze and water. DaimlerChrysler Corporation recommends Mopar Antifreeze or equivalent. If coolant becomes contaminated or looses color, drain and flush cooling system and fill with correctly mixed solution.

CAUTION: Do not use coolant additives that are claimed to improve engine cooling.

REMOVAL AND INSTALLATION

COOLANT RESERVE/OVERFLOW TANK

NOTE: The coolant reservoir/overflow tank is integeral to the upper fan shroud. Refer to Fan Shroud in this section for proper removal/installation procedures.

WATER PUMP—2.5L ENGINE

REMOVAL

CAUTION: The 2.5L engine has a reverse (counter-clockwise) rotating water pump. The letter R is stamped into the back of the water pump impeller (Fig. 34) to identify. Engines from previous model years, depending upon application, may be equipped with a forward (clockwise) rotating water pump. Installation of the wrong water pump will cause engine over heating.

REMOVAL AND INSTALLATION (Continued)

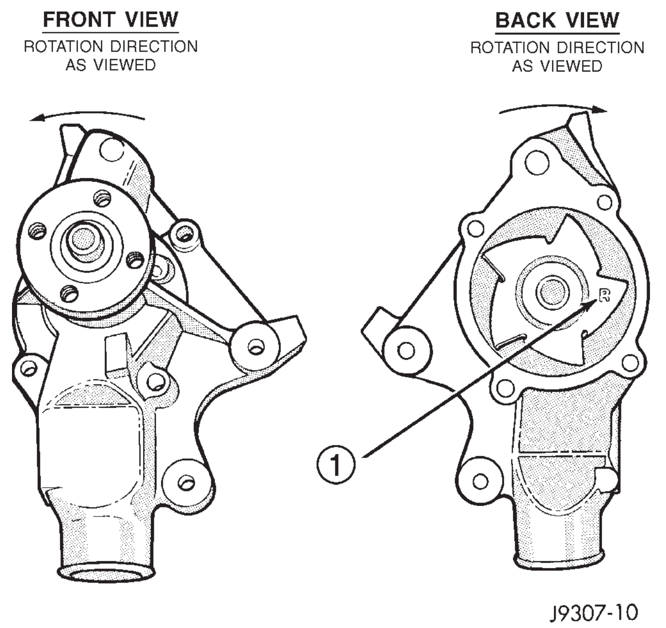


Fig. 34 Reverse Rotating Water Pump—Typical

1 – R STAMPED INTO IMPELLER

The water pump can be removed without discharging the air conditioning system (if equipped).

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The water pump is serviced only as a complete assembly.

WARNING: DO NOT REMOVE THE BLOCK DRAIN PLUG(S) OR LOOSEN RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain coolant into a clean container for reuse.

(1) Disconnect the battery negative cable.

(2) Drain the cooling system.

(3) Remove the accessory drive belt.

(4) Remove power steering pump (Fig. 35), refer to Group 19 Steering for the correct procedure.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 36) SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 37). If replacement is necessary, use only an original equipment clamp with matching number or letter.

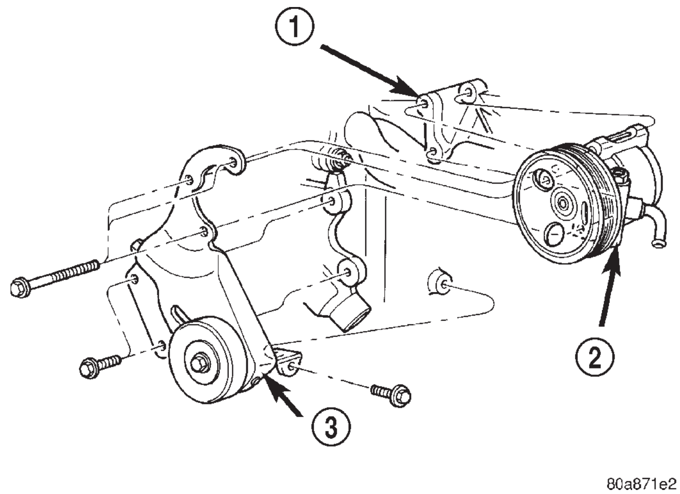


Fig. 35 Power Steering Pump Attachment

1 – INTAKE MANIFOLD
2 – PUMP ASSEMBLY 2.5L
3 – PUMP BRACKET

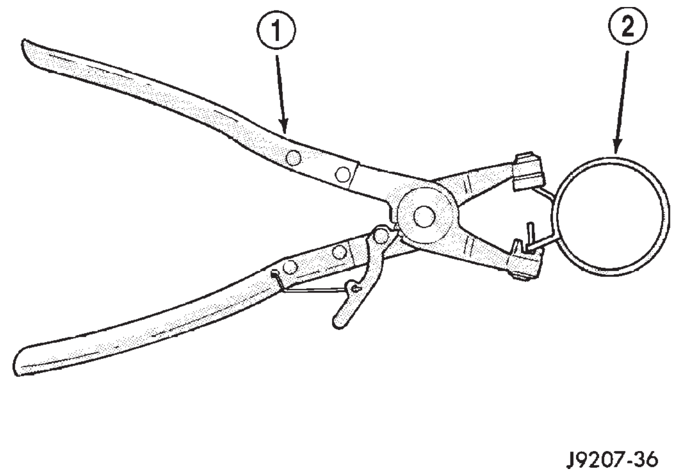


Fig. 36 Hose Clamp Tool—Typical

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

(5) Remove lower radiator hose from water pump. Remove heater hose from water pump fitting.

(6) Remove the four pump mounting bolts (Fig. 38) and remove pump from vehicle. Discard old gasket. Note that one of the four bolts is longer than the other bolts.

(7) If pump is to be replaced, the heater hose fitting must be removed and transferred to the new pump. Note position of fitting before removal.

INSTALLATION

(1) If pump is being replaced, install the heater hose fitting to the pump. Use a sealant on the fitting

REMOVAL AND INSTALLATION (Continued)

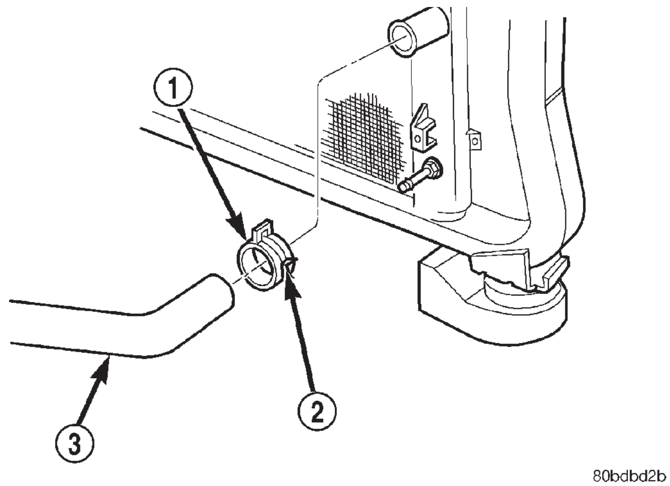


Fig. 37 Clamp Number/Letter Location

1 – CONSTANT TENSION HOSE CLAMP
2 – CLAMP NUMBER/LETTER LOCATION
3 – HOSE

such as Mopar™ Thread Sealant With Teflon. Refer to the directions on the package.

(2) Clean the gasket mating surfaces. If the original pump is used, remove any deposits or other foreign material. Inspect the cylinder block and water pump mating surfaces for erosion or damage from cavitation.

(3) Install the gasket and water pump. The silicone bead on the gasket should be facing the water pump. Also, the gasket is installed dry. Tighten mounting bolts to 30 N·m (22 ft. lbs.) torque. Rotate the shaft by hand to be sure it turns freely.

(4) Connect the radiator and heater hoses to the water pump.

(5) Position water pump pulley to water pump hub.

(6) Install power steering pump.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction. Refer to the Belt Removal and Installation in this group for appropriate belt routing. You may also refer to the Belt Routing Label in the vehicle engine compartment.

(7) Adjust accessory drive belt, refer to Accessory Drive Belt removal and installation in this group.

(8) Fill cooling system with coolant and check for leaks. Refer to Refilling Cooling System in this group.

(9) Connect battery battery negative cable.

(10) Start and warm the engine. Check for leaks.

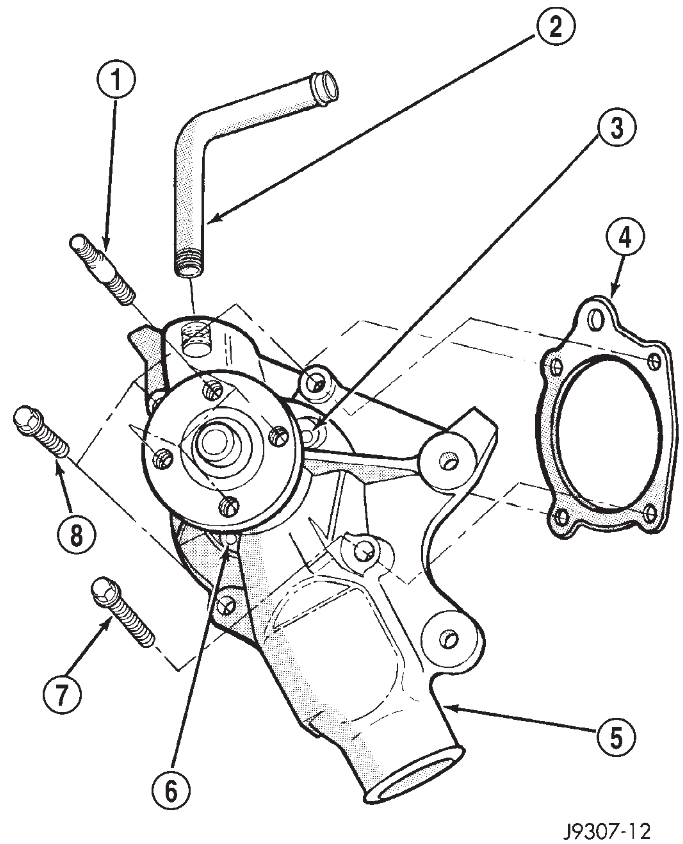


Fig. 38 Water Pump Remove/Install—Typical

1 – (4) PULLEY MOUNTING STUDS
2 – HEATER HOSE FITTING
3 – UPPER VENT HOLE
4 – PUMP GASKET
5 – WATER PUMP
6 – LOWER VENT HOLE
7 – LONG BOLT
8 – BOLTS (3) SHORT

WATER PUMP—3.9L/5.9L ENGINES

REMOVAL

The water pump can be removed and installed without discharging the air conditioning system (if equipped).

(1) Disconnect battery negative cable.

(2) Drain cooling system. Refer to Cooling System—Draining and Filling in this group.

(3) Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

REMOVAL AND INSTALLATION (Continued)

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 36). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 37). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(4) Remove upper radiator hose clamp and hose at radiator.

(5) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft (Fig. 40). Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) and Special Tool 6958 Spanner Wrench with Adapter Pins 8346 can be used. Place Special Tool 6958 Spanner Wrench onto the water pump pulley with Adapter Pins 8346 inserted into the holes on the pulley (Fig. 39) to prevent pulley from rotating. Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

(6) If water pump is being replaced, do not unbolt fan blade assembly (Fig. 40) from thermal viscous fan drive.

(7) Remove fan shroud attaching hardware (two bolts at bottom-two clips at top).

(8) Remove fan shroud and fan blade/viscous fan drive assembly from vehicle as a complete unit.

(9) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

(10) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic tensioner (Fig. 41). Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 41). When all belt tension has been relaxed, remove accessory drive belt.

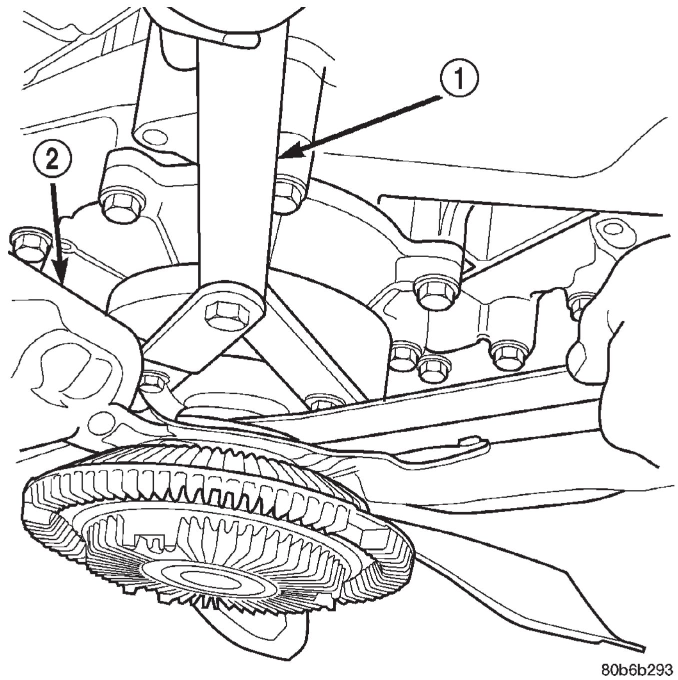


Fig. 39 Viscous Fan Drive Removal / Installation

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

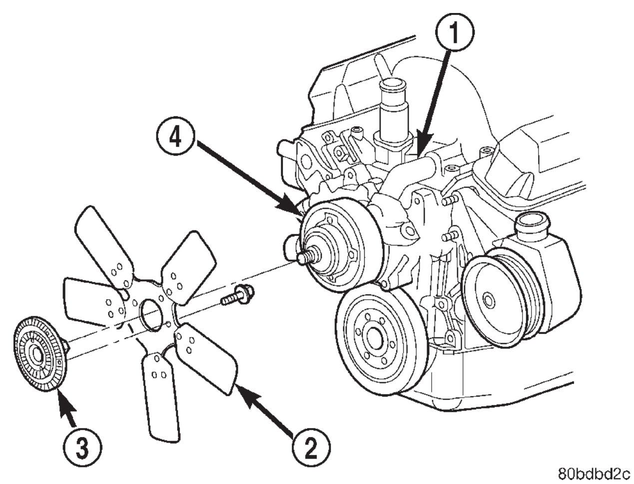


Fig. 40 Fan Blade and Viscous Fan Drive—3.9L/5.9L Engines

1 – WATER PUMP BYPASS HOSE
2 – FAN BLADE ASSEMBLY
3 – VISCOUS FAN DRIVE
4 – WATER PUMP AND PULLEY

REMOVAL AND INSTALLATION (Continued)

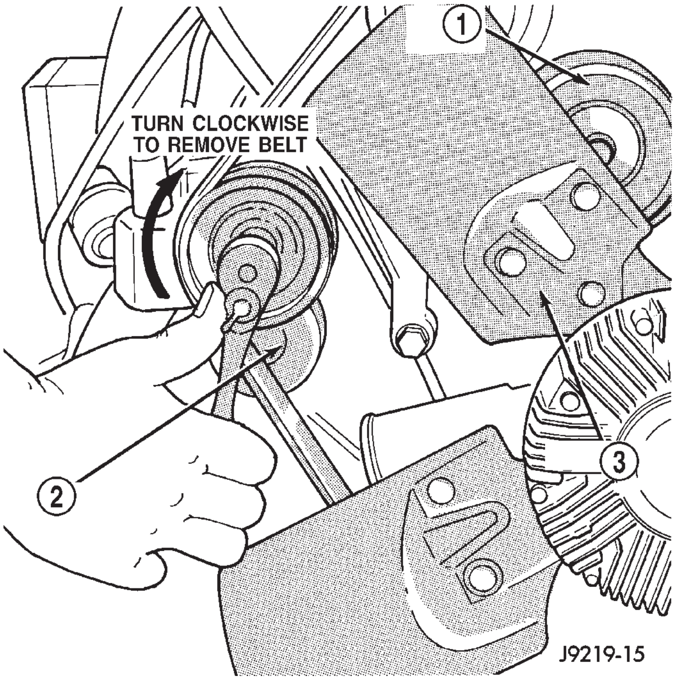


Fig. 41 Automatic Belt Tensioner Assembly—3.9L/5.9L Engines

1 – IDLER PULLEY
2 – TENSIONER
3 – FAN BLADE

(11) Remove lower radiator hose clamp and remove lower hose at water pump.

(12) Remove heater hose clamp and heater hose from heater hose coolant return tube.

(13) Loosen heater hose coolant return tube mounting bolt (Fig. 42) and remove tube from water pump. Discard the old tube O-ring.

(14) Remove seven water pump mounting bolts.

(15) Loosen clamp at water pump end of bypass hose (Fig. 40). Slip bypass hose from water pump while removing pump from vehicle. Discard old gasket.

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

INSTALLATION

(1) Clean gasket mating surfaces.

(2) Using a new gasket, install water pump to engine as follows: Guide water pump nipple into bypass hose as pump is being installed. Install water pump bolts. Tighten water pump mounting bolts to 40 N·m (30 ft. lbs.) torque.

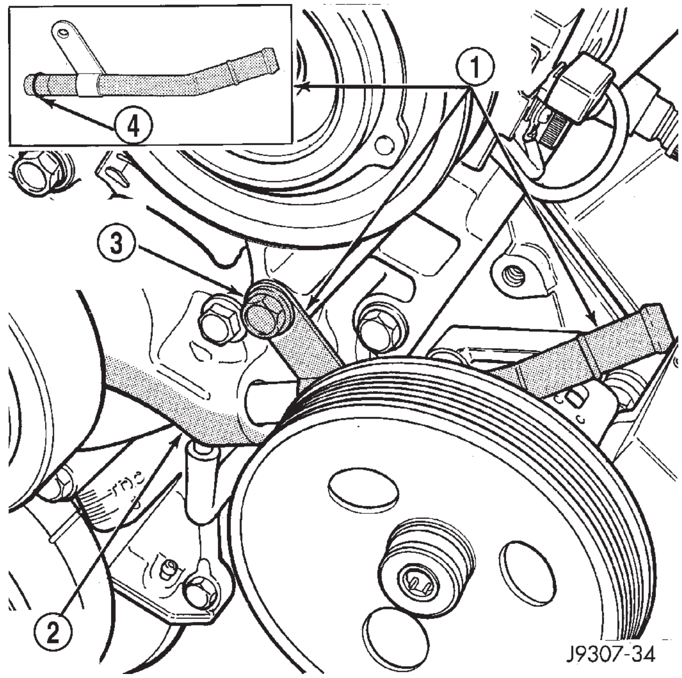


Fig. 42 Coolant Return Tube—3.9L/5.9L Engines—Typical

1 – COOLANT RETURN TUBE
2 – WATER PUMP
3 – TUBE MOUNTING BOLT
4 – O-RING

(3) Position bypass hose clamp to bypass hose.

(4) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(5) Install a new O-ring to the heater hose coolant return tube (Fig. 42). Coat the new O-ring with antifreeze before installation.

(6) Install coolant return tube and its mounting bolt to engine (Fig. 42). Be sure the slot in tube bracket is bottomed to mounting bolt. This will properly position return tube.

(7) Connect radiator lower hose to water pump.

(8) Connect heater hose and hose clamp to coolant return tube.

(9) Relax tension from belt tensioner (Fig. 41). Install accessory drive belt.

CAUTION: When installing the serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 43) for correct belt routing. The correct belt with correct length must be used.

REMOVAL AND INSTALLATION (Continued)

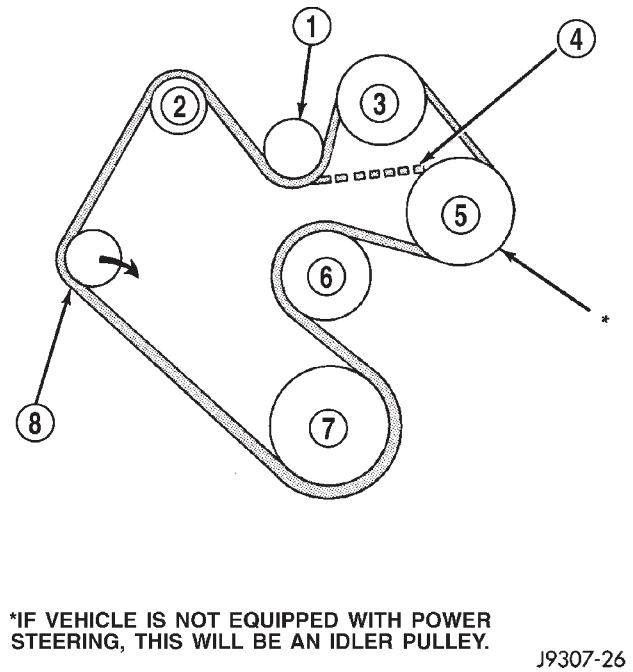


Fig. 43 Belt Routing—3.9L/5.9L Engines

1 – IDLER PULLEY
2 – GEN.
3 – A/C COMP.
4 – IF W/OUT A/C
5 – PWR. STRG. PUMP
6 – WAT. PUMP
7 – CRANK PULLEY
8 – AUTOMATIC TENSIONER

(10) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

(11) Install fan shroud.

(12) Install fan blade/viscous fan drive assembly to water pump shaft.

(13) Fill cooling system. Refer to Cooling System—Draining and Refilling in this group.

(14) Connect battery negative cable.

(15) Start and warm the engine. Check for leaks.

WATER PUMP 4.7L ENGINES

The water pump on 4.7L engines is bolted directly to the engine timing chain case/cover.

A gasket is used as a seal between the water pump and timing chain case/cover.

If water pump is replaced because of bearing/shaft damage, or leaking shaft seal, the mechanical cooling fan assembly should also be inspected. Inspect for fatigue cracks, loose blades, or loose rivets that could have resulted from excessive vibration. Replace fan if any of these conditions are found. Also check condition of the thermal viscous fan drive. Refer to Viscous Fan Drive in this group.

The water pump can be removed without discharging the air conditioning system (if equipped).

REMOVAL

(1) Disconnect negative battery cable from battery.

(2) Drain cooling system. Refer to Draining Cooling System in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. Remove fan/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** Using special tool spanner wrench 6958 with adapter pins 8346 and a suitable fan wrench loosen the fan drive (Fig. 44). Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

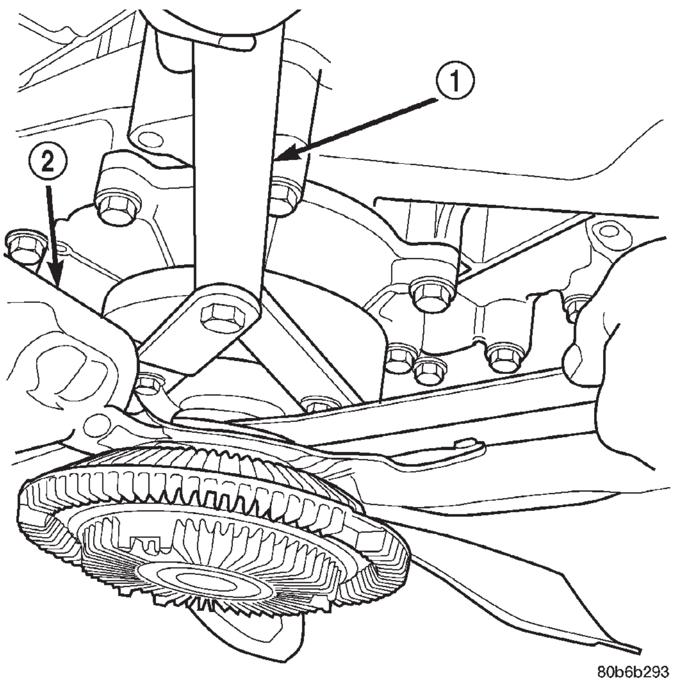


Fig. 44 Viscous Fan and Fan Drive 4.7L

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only an original equipment clamp with matching number or letter.

REMOVAL AND INSTALLATION (Continued)

(4) If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.

(5) Remove two fan shroud-to-radiator screws (Fig. 45). Disconnect the coolant overflow hose, windshield washer fluid hose and washer pump electrical connector.

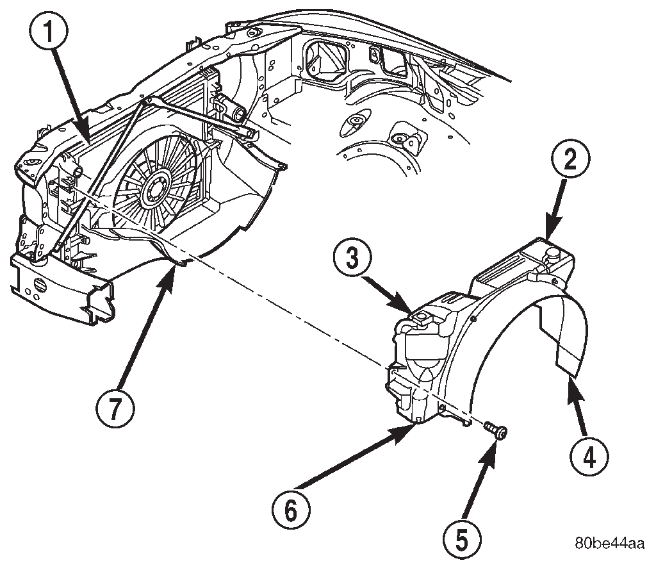


Fig. 45 Upper Fan Shroud, Coolant reservoir and Washer Fluid Reservoir

1 – RADIATOR
2 – WASHER FLUID RESERVOIR
3 – COOLANT OVERFLOW/RESERVOIR
4 – FAN SHROUD (UPPER)
5 – SCREW
6 – INTERLOCKING PINS
7 – FAN SHROUD (LOWER)

(6) Remove upper fan shroud and fan blade/viscous fan drive assembly from vehicle.

(7) After removing fan blade/viscous fan drive assembly, **do not** place thermal viscous fan drive in horizontal position. If stored horizontally, silicone fluid in viscous fan drive could drain into its bearing assembly and contaminate lubricant.

(8) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic belt tensioner. Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 46). When all belt tension has been relaxed, remove accessory drive belt.

(9) Remove lower radiator hose clamp and remove lower hose at water pump.

(10) Remove seven water pump mounting bolts and one stud bolt.

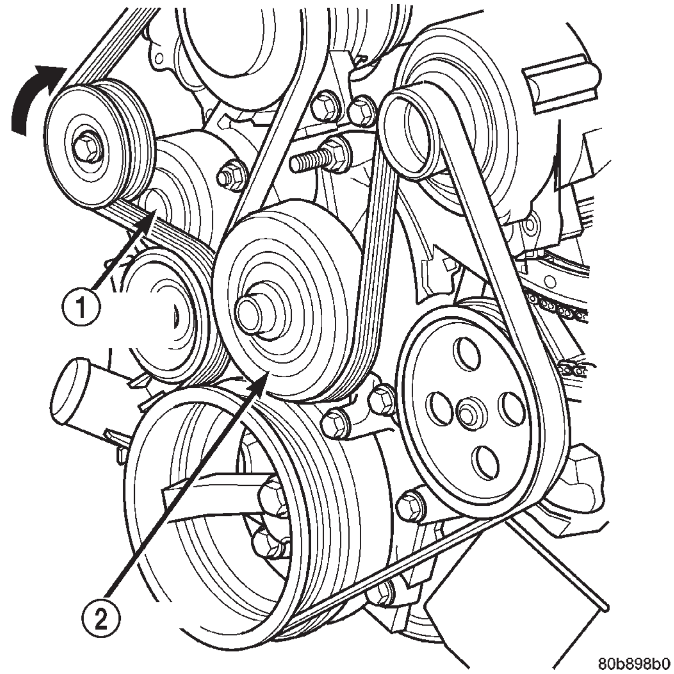


Fig. 46 Automatic Belt Tensioner—4.7L

1 – AUTOMATIC TENSIONER
2 – WATER PUMP PULLEY

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

(11) Remove water pump and gasket. Discard gasket.

INSTALLATION

(1) Clean gasket mating surfaces.

(2) Using a new gasket, position water pump and install mounting bolts as shown. (Fig. 47). Tighten water pump mounting bolts to 54 N·m (40 ft. lbs.) torque.

(3) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(4) Connect radiator lower hose to water pump.

(5) Relax tension from belt tensioner (Fig. 46). Install drive belt.

CAUTION: When installing the serpentine accessory drive belt, belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 48) for correct belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.

REMOVAL AND INSTALLATION (Continued)

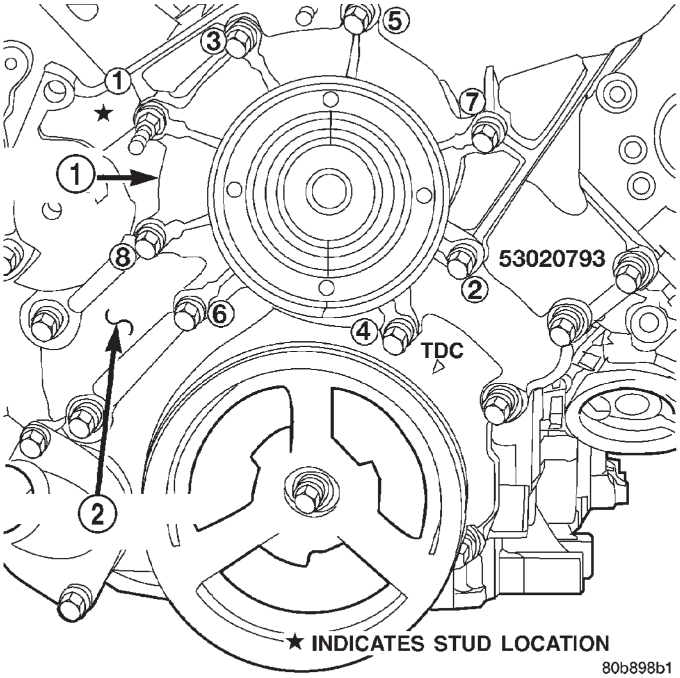


Fig. 47 Water Pump Installation—4.7L

1 – WATER PUMP
2 – TIMING CHAIN COVER

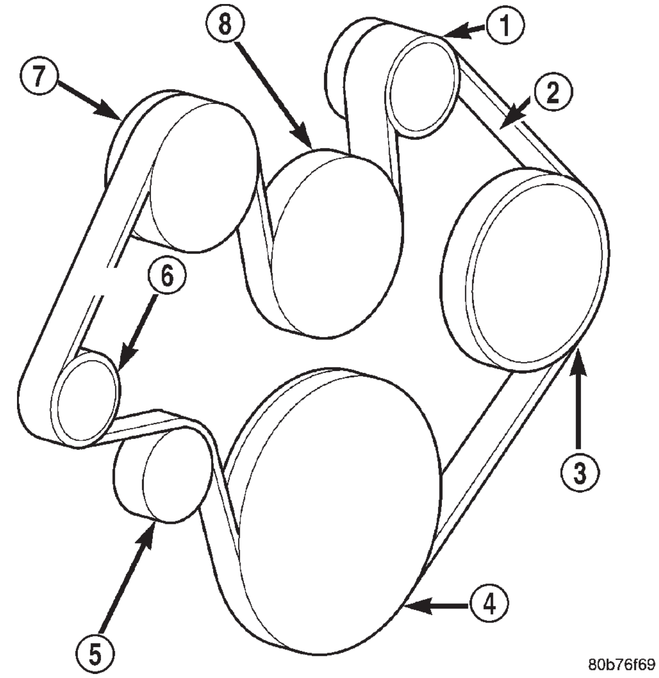


Fig. 48 Belt Routing 4.7L

1 – GENERATOR
2 – ACCESSORY DRIVE BELT
3 – POWER STEERING PUMP PULLEY
4 – CRANKSHAFT PULLEY
5 – IDLER PULLEY
6 – TENSIONER PULLEY
7 – A/C COMPRESSOR PULLEY
8 – WATER PUMP PULLEY

(6) Position upper fan shroud and fan blade/viscous fan drive assembly.

(7) Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.

(8) Install two fan shroud-to-radiator screws (Fig. 45).

(9) Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(10) Install fan blade/viscous fan drive assembly to water pump shaft.

(11) Fill cooling system. Refer to Refilling the Cooling System in this group.

(12) Connect negative battery cable.

(13) Start and warm the engine. Check for leaks.

WATER PUMP BYPASS HOSE—3.9/5.9L ENGINES

REMOVAL WITHOUT AIR CONDITIONING

(1) Partially drain cooling system. Refer to Draining Cooling System in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 49). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 50). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(2) Loosen both bypass hose clamps (Fig. 49) and position to center of hose. Remove hose from vehicle.

INSTALLATION

(1) Position bypass hose clamps (Fig. 49) to center of hose.

(2) Install bypass hose to engine.

(3) Secure both hose clamps (Fig. 49).

(4) Fill cooling system. Refer to Refilling the Cooling System in this group.

(5) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

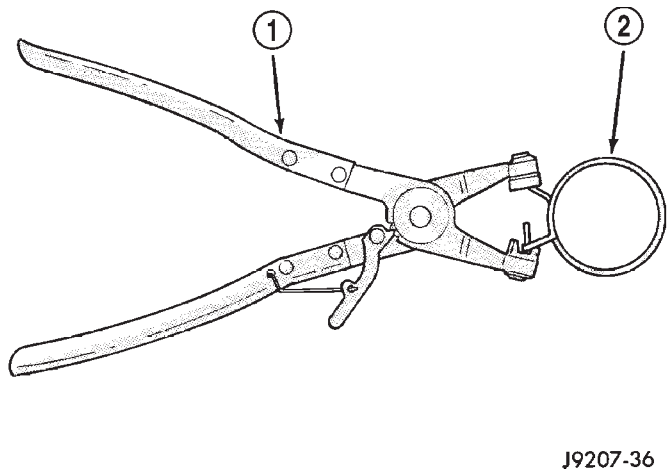


Fig. 49 Hose Clamp Tool—Typical

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

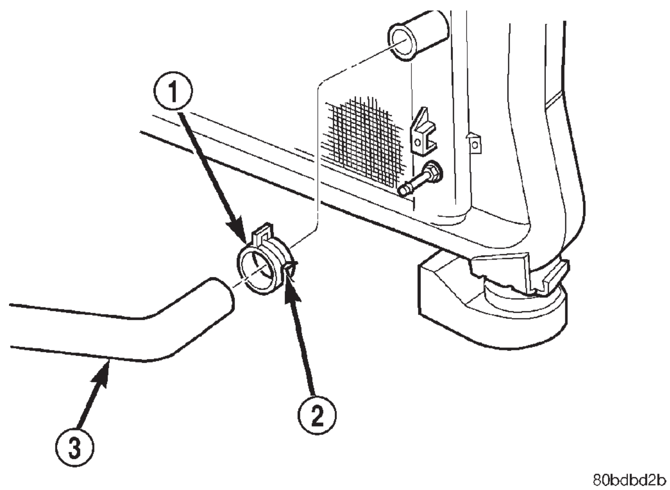


Fig. 50 Clamp Number/Letter Location

1 – CONSTANT TENSION HOSE CLAMP
2 – CLAMP NUMBER/LETTER LOCATION
3 – HOSE

REMOVAL WITH AIR CONDITIONING

If equipped with A/C, the generator and A/C compressor along with their common mounting bracket (Fig. 51) must be partially removed. Removing generator or A/C compressor from their mounting bracket is not necessary. Also, discharging A/C system is not necessary. **Do not** remove any refrigerant lines from A/C compressor.

WARNING: THE A/C SYSTEM IS UNDER PRESSURE EVEN WITH ENGINE OFF. REFER TO REFRIGERANT WARNINGS IN GROUP 24, HEATING AND AIR CONDITIONING.

(1) Disconnect battery negative cable.

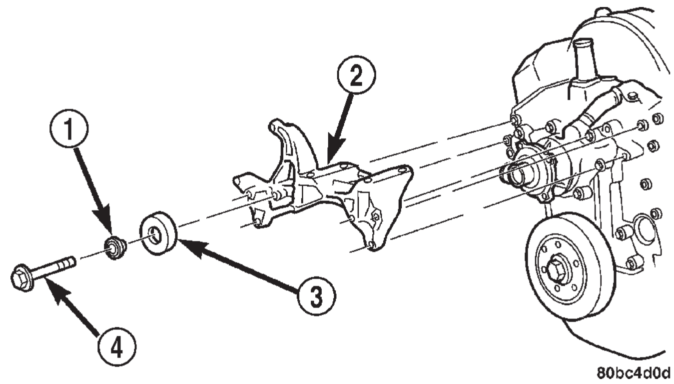


Fig. 51 Generator—A/C Compressor Mounting Bracket—3.9/5.9L Engine

1 – IDLER PULLEY BUSHING
2 – A/C AND/OR GENERATOR MOUNTING BRACKET
3 – IDLER PULLEY
4 – SCREW AND WASHER

(2) Partially drain cooling system. Refer to Cooling System—Draining and Filling in this group.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(3) Remove upper radiator hose clamp (Fig. 49) and hose at radiator.

(4) Unplug wiring harness from A/C compressor.

(5) Remove air cleaner assembly.

(6) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic tensioner (Fig. 52). Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 52). When all belt tension has been relaxed, remove accessory drive belt.

(7) The drive belt idler pulley must be removed to gain access to one of A/C compressor/generator bracket mounting bolts. Remove idler pulley bolt and remove idler pulley (Fig. 51).

(8) Remove oil dipstick tube mounting bolt at side of A/C-generator mounting bracket.

(9) Disconnect throttle body control cables. Refer to Accelerator Pedal and Throttle Cable in Group 14, Fuel System.

(10) Remove heater hose clamp and heater hose from heater hose coolant return tube.

(11) Remove heater hose coolant return tube mounting bolt (Fig. 53) and remove tube from engine. Discard the old tube O-ring.

(12) Remove bracket-to-intake manifold bolts (number 1 and 2— (Fig. 51).

(13) Remove six bracket bolts (number 3— (Fig. 51).

(14) Lift and position generator and A/C compressor (along with their common mounting bracket) to gain access to bypass hose. A block of wood may be used to hold assembly in position.

REMOVAL AND INSTALLATION (Continued)

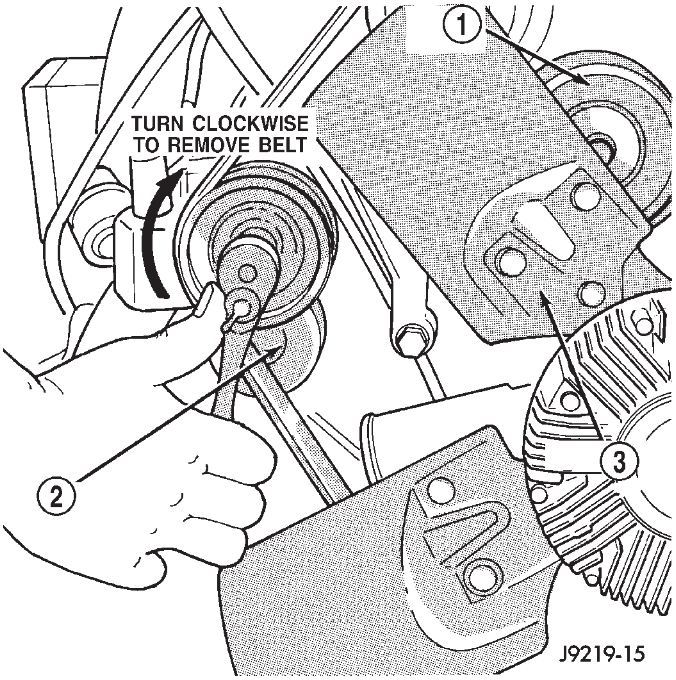


Fig. 52 Automatic Belt Tensioner Assembly

1 – IDLER PULLEY
2 – TENSIONER
3 – FAN BLADE

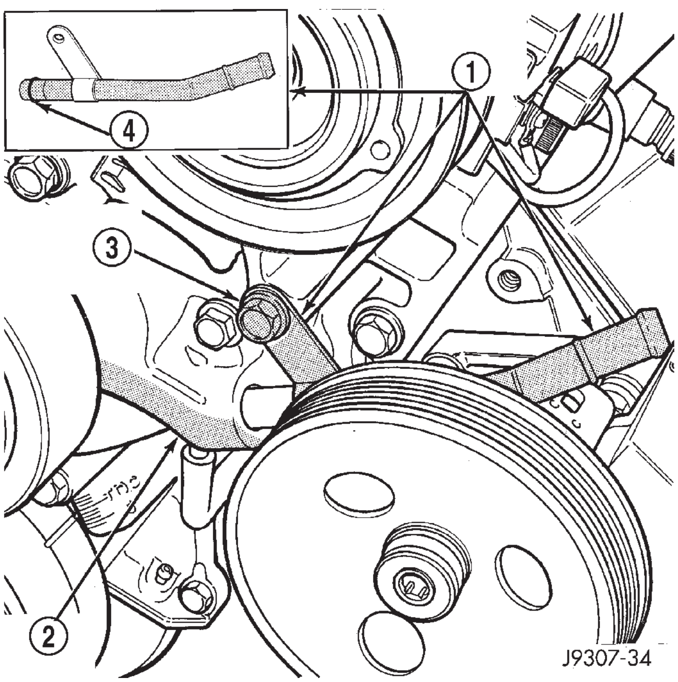


Fig. 53 Coolant Return Tube—3.9/5.9L Engines—Typical

1 – COOLANT RETURN TUBE
2 – WATER PUMP
3 – TUBE MOUNTING BOLT
4 – O-RING

(15) Loosen and position both hose clamps to center of bypass hose. Remove hose from vehicle.

INSTALLATION

(1) Position bypass hose clamps to center of hose.
(2) Install bypass hose to engine.
(3) Secure both hose clamps (Fig. 49).
(4) Install generator-A/C mounting bracket assembly to engine. Tighten bolts (number 1 and 2— (Fig. 51) to 54 N·m (40 ft. lbs.) torque. Tighten bolts (number 3— (Fig. 51) to 40 N·m (30 ft. lbs.) torque.
(5) Install a new O-ring to the heater hose coolant return tube (Fig. 53). Coat the new O-ring with antifreeze before installation.
(6) Install coolant return tube and its mounting bolt to engine (Fig. 53).
(7) Connect throttle body control cables.
(8) Install oil dipstick mounting bolt.
(9) Install idler pulley. Tighten bolt to 54 N·m (40 ft. lbs.) torque.
(10) Relax tension from belt tensioner (Fig. 52). Install drive belt.

CAUTION: When installing serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 54) for correct belt routing. The correct belt with correct length must be used.

(11) Install air cleaner assembly.
(12) Install upper radiator hose to radiator.
(13) Connect wiring harness to A/C compressor.
(14) Connect battery negative cable.
(15) Fill cooling system. Refer to Refilling the Cooling System in this group.
(16) Start and warm the engine. Check for leaks.

THERMOSTAT—3.9L/5.9L ENGINES

REMOVAL

WARNING: DO NOT LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

Factory installed thermostat housings on 3.9L/5.9L engines are installed on a gasket with an anti-stick coating. This will aid in gasket removal and clean-up.

(1) Disconnect negative battery cable at battery.

REMOVAL AND INSTALLATION (Continued)

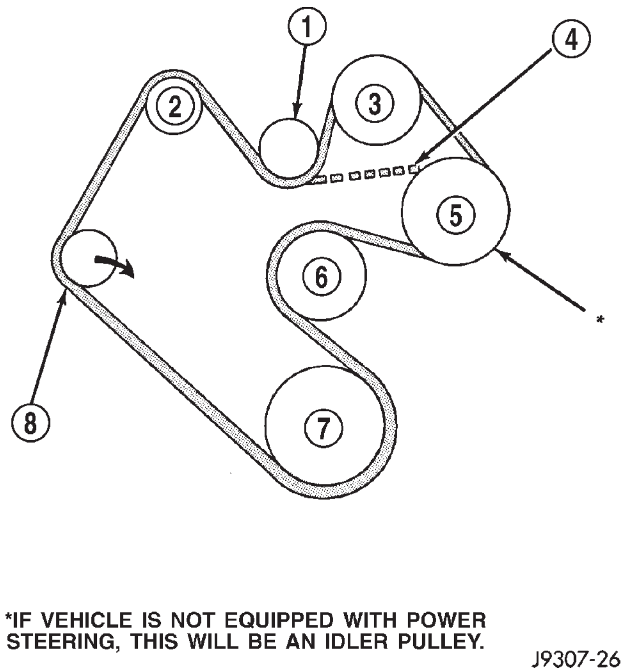


Fig. 54 Belt Routing—3.9/5.9L Engines

1 – IDLER PULLEY
2 – GEN.
3 – A/C COMP.
4 – IF W/OUT A/C
5 – PWR. STRG. PUMP
6 – WAT. PUMP
7 – CRANK PULLEY
8 – AUTOMATIC TENSIONER

(2) Drain cooling system until coolant level is below thermostat. Refer to Draining Cooling System in this group.

(3) Air Conditioned vehicles: Remove support bracket (generator mounting bracket-to-intake manifold) located near rear of generator (Fig. 55).

(4) On air conditioning equipped vehicles, the generator must be partially removed.

(a) Remove generator drive belt as follows: Drive belts on both 3.9L and 5.9L engines are equipped with a spring loaded automatic belt tensioner (Fig. 56).

(b) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 56).

(c) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

(d) Remove belt from vehicle.

(e) Remove two generator mounting bolts. Do not remove any wiring at generator. If equipped with 4WD, unplug 4WD indicator lamp wiring harness (located near rear of generator).

(f) Remove generator. Position generator to gain access for thermostat gasket removal.

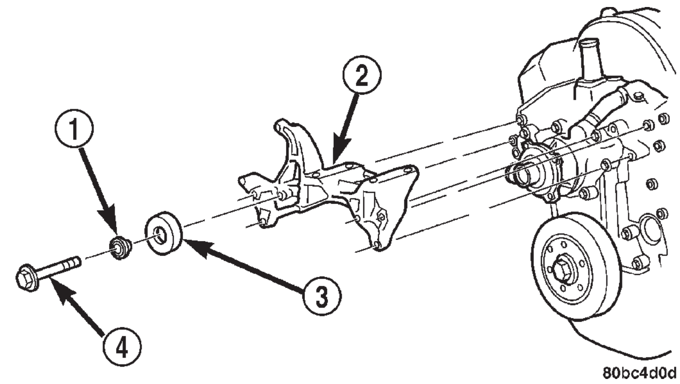


Fig. 55 Generator Support Bracket—3.9L/5.9L Engine

1 – IDLER PULLEY BUSHING
2 – A/C AND/OR GENERATOR MOUNTING BRACKET
3 – IDLER PULLEY
4 – SCREW AND WASHER

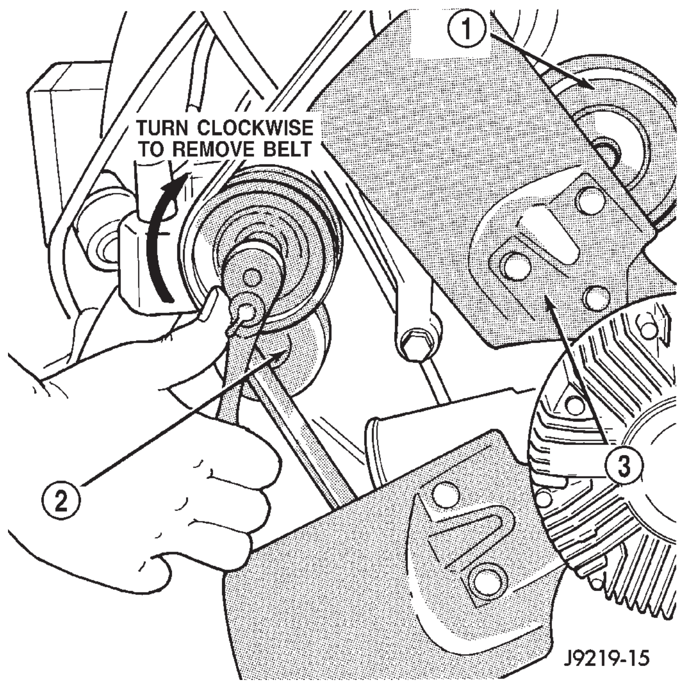


Fig. 56 Automatic Belt Tensioner—3.9L/5.9L Engines

1 – IDLER PULLEY
2 – TENSIONER
3 – FAN BLADE

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 36). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

REMOVAL AND INSTALLATION (Continued)

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 37). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(5) Remove upper radiator hose clamp and upper radiator hose at thermostat housing.

(6) Position wiring harness (behind thermostat housing) to gain access to thermostat housing.

(7) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 57). Discard old gasket.

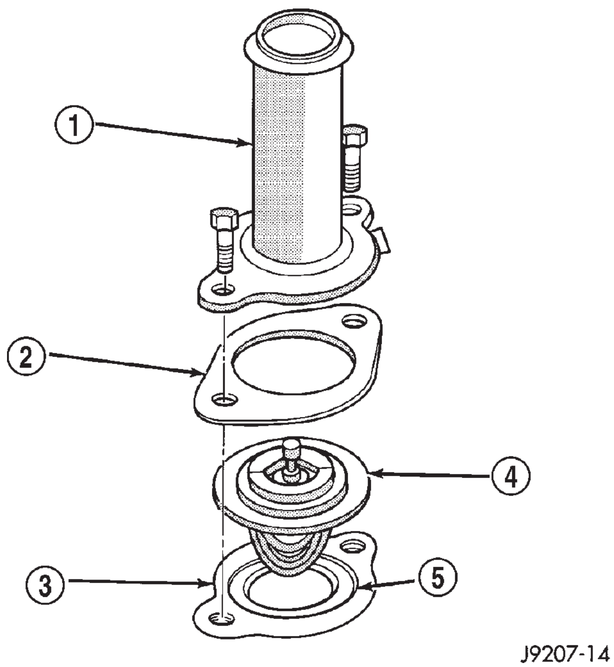


Fig. 57 Thermostat—3.9L/5.9L Engines

1 – THERMOSTAT HOUSING
2 – GASKET
3 – INTAKE MANIFOLD
4 – THERMOSTAT
5 – MACHINED GROOVE

INSTALLATION

(1) Clean mating areas of intake manifold and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on intake manifold (Fig. 57).

(3) Install gasket on intake manifold and over thermostat (Fig. 57).

(4) Position thermostat housing to intake manifold. Note the word FRONT stamped on housing (Fig. 58). For adequate clearance, this **must** be placed towards front of vehicle. The housing is slightly angled forward after installation to intake manifold.

(5) Install two housing-to-intake manifold bolts. Tighten bolts to 23 N·m (200 in. lbs.) torque.

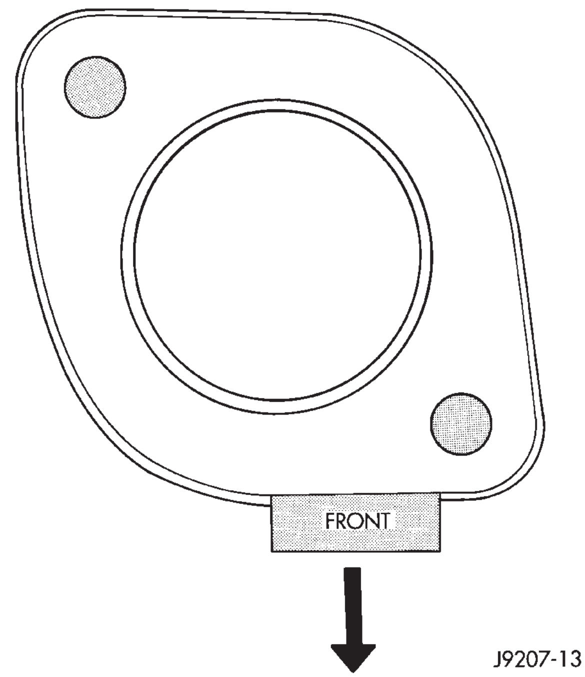


Fig. 58 Thermostat Position—3.9L/5.9L Engines

(6) Install upper radiator hose to thermostat housing.

(7) Air Conditioned vehicles:

CAUTION: When installing the serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 59) for correct 3.9/5.2L engine belt routing. The correct belt with correct length must be used.

(a) Install generator. Tighten bolts to 41 N·m (30 ft. lbs.).

(b) Install support bracket (generator mounting bracket-to-intake manifold) (Fig. 55). Tighten bolts to 54 N·m (40 ft. lbs.) torque.

(c) Position drive belt over all pulleys **except** idler pulley (located between generator and A/C compressor).

(d) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 56).

(e) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(8) Fill cooling system. Refer to Refilling Cooling System in this group.

(9) Connect battery negative cable.

(10) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

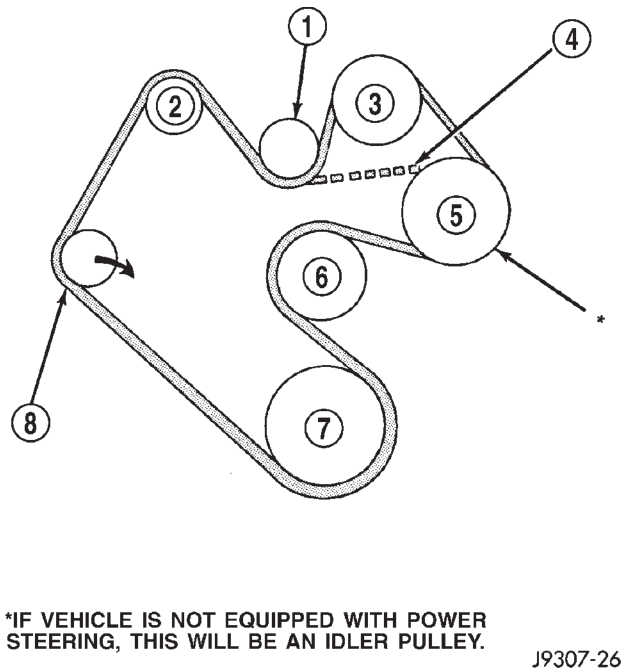


Fig. 59 Belt Routing—3.9L/5.9L Engines

1 – IDLER PULLEY
2 – GEN.
3 – A/C COMP.
4 – IF W/OUT A/C
5 – PWR. STRG. PUMP
6 – WAT. PUMP
7 – CRANK PULLEY
8 – AUTOMATIC TENSIONER

THERMOSTAT—2.5L ENGINE

REMOVAL

WARNING: DO NOT LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(1) Disconnect battery negative cable.

(2) Drain the coolant from the radiator until the level is below the thermostat housing.

(3) Remove radiator upper hose and heater hose at thermostat housing.

(4) Disconnect wiring connector at engine coolant temperature sensor.

(5) Remove thermostat housing mounting bolts, thermostat housing, gasket and thermostat (Fig. 60). Discard old gasket.

(6) Clean the gasket mating surfaces.

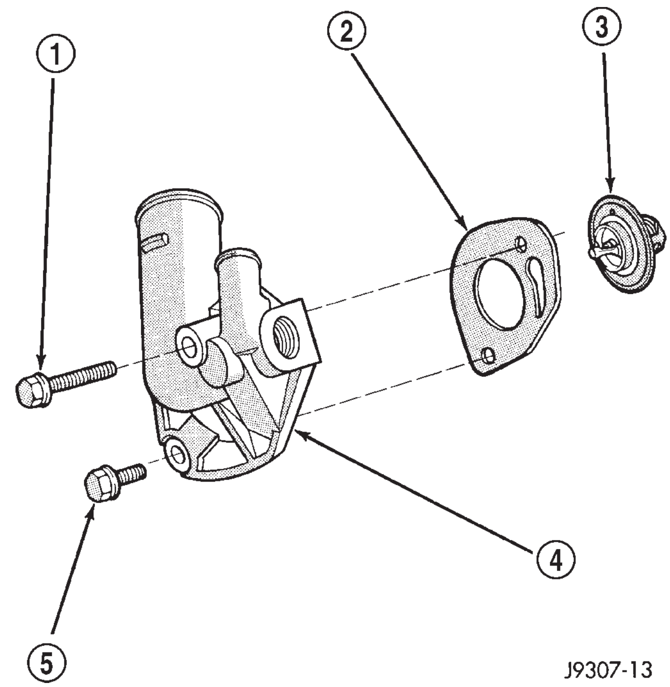


Fig. 60 2.5LThermostat Removal/Installation

1 – LONG BOLT
2 – GASKET
3 – THERMOSTAT
4 – THERMOSTAT HOUSING
5 – SHORT BOLT

INSTALLATION

(1) Install the replacement thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate the proper installed position.

(a) Observe the recess groove in the engine cylinder head (Fig. 61).

(b) Position thermostat into this groove with arrow and air bleed hole on outer flange pointing up.

(2) Install replacement gasket and thermostat housing.

CAUTION: Tightening the thermostat housing unevenly or with the thermostat out of its recess may result in a cracked housing.

(3) Tighten the housing bolts to 20 N·m (15 ft. lbs.) torque.

(4) Install hoses to thermostat housing.

(5) Install electrical connector to coolant temperature sensor.

(6) Connect battery negative cable.

(7) Be sure that the radiator draincock is tightly closed. Fill the cooling system to the correct level with the required coolant mixture. Refer to Cooling System—Draining and Refilling in this group.

(8) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

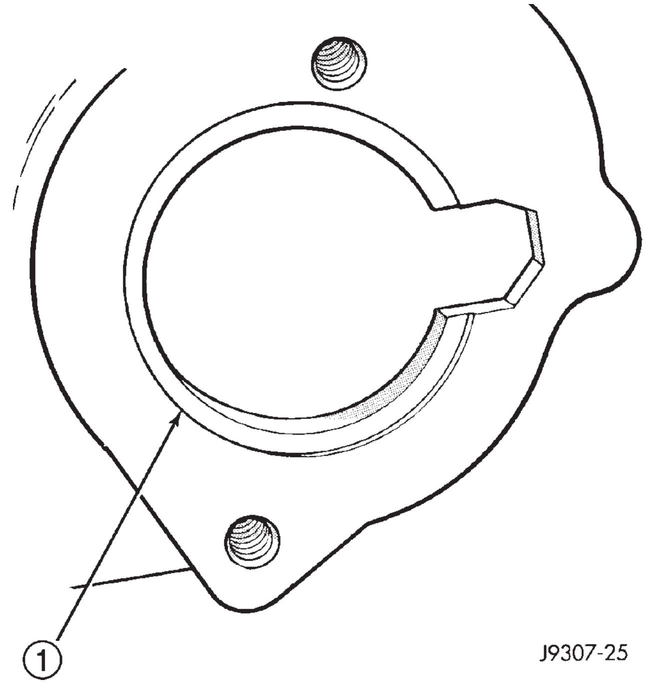


Fig. 61 Thermostat Recess

1 – GROOVE

THERMOSTAT— 4.7L ENGINE

REMOVAL

WARNING: DO NOT LOOSEN RADIATOR DRAIN-COCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Do not waste reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

If thermostat is being replaced, be sure that replacement is specified thermostat for vehicle model and engine type.

(1) Disconnect negative battery cable at battery.

(2) Drain cooling system. Refer to Draining Cooling System in this section.

(3) Raise vehicle on hoist.

(4) Remove splash shield.

(5) Remove lower radiator hose clamp and lower radiator hose at thermostat housing.

(6) Remove thermostat housing mounting bolts, thermostat housing and thermostat (Fig. 62).

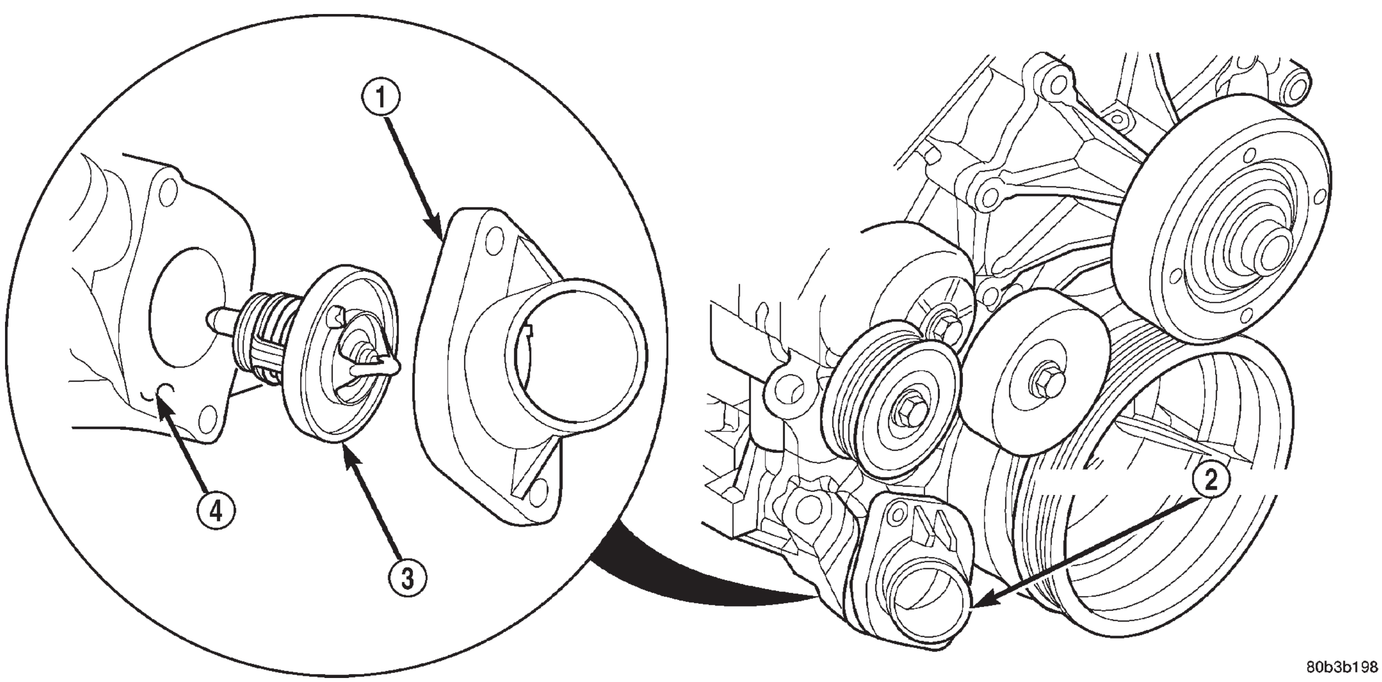


Fig. 62 Thermostat and Thermostat Housing 4.7L

1 – THERMOSTAT HOUSING
2 – THERMOSTAT LOCATION
3 – THERMOSTAT AND GASKET
4 – TIMING CHAIN COVER

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Clean mating areas of timing chain cover and thermostat housing.

(2) Install thermostat (spring side down) into recessed machined groove on timing chain cover (Fig. 62).

(3) Position thermostat housing on timing chain cover.

(4) Install two housing-to-timing chain cover bolts. Tighten bolts to 13 N·m (115 in. lbs.) torque.

CAUTION: Housing must be tightened evenly and thermostat must be centered into recessed groove in timimg chain cover. If not, it may result in a cracked housing, damaged timing chain cover threads or coolant leaks.

(5) Install lower radiator hose on thermostat housing.

(6) Install splash shield.

(7) Lower vehicle.

(8) Fill cooling system. Refer to Refilling Cooling System in this section.

(9) Connect negative battery cable to battery.

(10) Start and warm the engine. Check for leaks.

TRANSMISSION OIL COOLER LINES

REMOVAL

(1) Raise vehicle on hoist.

(2) Place a drain pan under the cooler line connections at the radiator.

(3) Disconnect the cooler lines at the radiator and the transmission.

(4) Disconnect the routing brackets.

(5) Remove two mounting nuts, power steering oil cooler and the routing bracket from two mounting studs (Fig. 63).

(6) Remove the cooler lines from the vehicle.

INSTALLATION

(1) Position the cooler lines into the vehicle.

NOTE: Transmission oil cooler lines must not contact other items other than the routing brackets, oil cooler lines resting against, or in contact with other items may cause wear, allowing cooler lines to leak.

(2) Position the routing bracket over two studs then position the power steering oil cooler and install two mounting nuts (Fig. 63).

(3) Position the two remaining routing brackets.

(4) Install the cooler lines to the transmission and radiator.

(5) Lower vehicle.

(6) Start engine check for leaks.

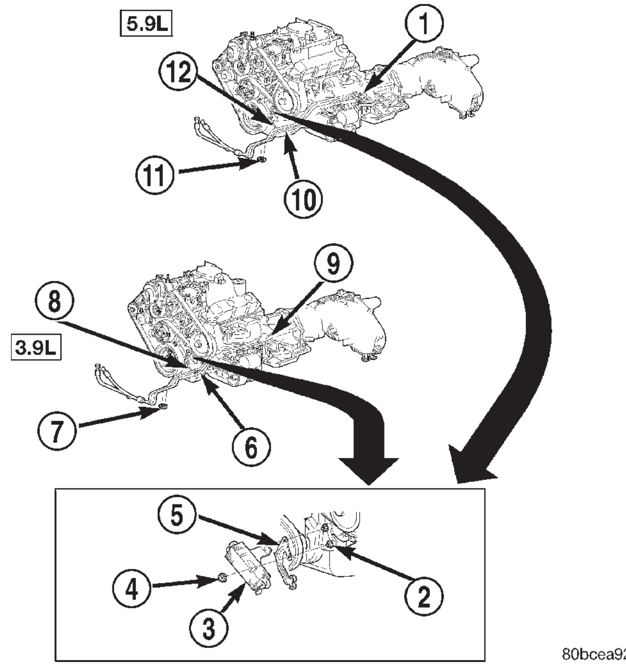


Fig. 63 Transmission Oil Cooler Lines Routing—3.9L and 5.9L Engines

1 – ROUTING BRACKET
2 – MOUNTING STUDS
3 – POWER STEERING OIL COOLER
4 – MOUNTING NUT
5 – ROUTING BRACKET
6 – TRANSMISSION OIL COOLER LINES
7 – RETAINER CLIP
8 – ROUTING BRACKET
9 – ROUTING BRACKET
10 – TRANSMISSION OIL COOLER LINES
11 – RETAINER CLIP
12 – ROUTING BRACKET

RADIATOR

REMOVAL

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAIN-COCK WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Disconnect battery negative cable.

(2) Drain cooling system. Refer to Draining and Filling Cooling System in this section.

REMOVAL AND INSTALLATION (Continued)

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP, SUCH AS SPECIAL CLAMP TOOL (NUMBER 6094) (Fig. 64). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 65). If replacement is necessary, use only an original equipment clamp with matching number or letter.

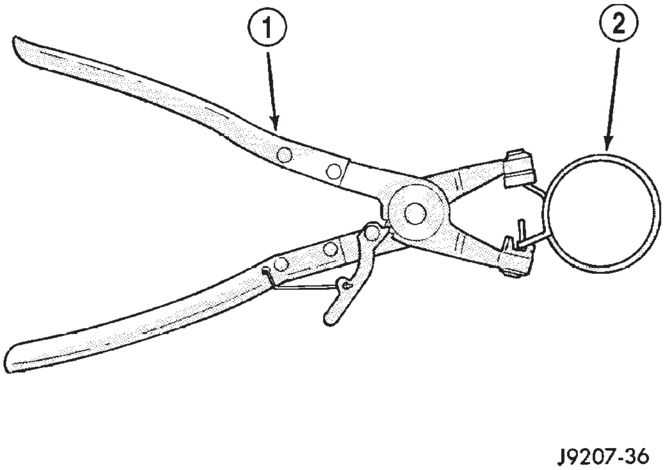


Fig. 64 Hose Clamp Tool—Typical

1 – HOSE CLAMP TOOL 6094
2 – HOSE CLAMP

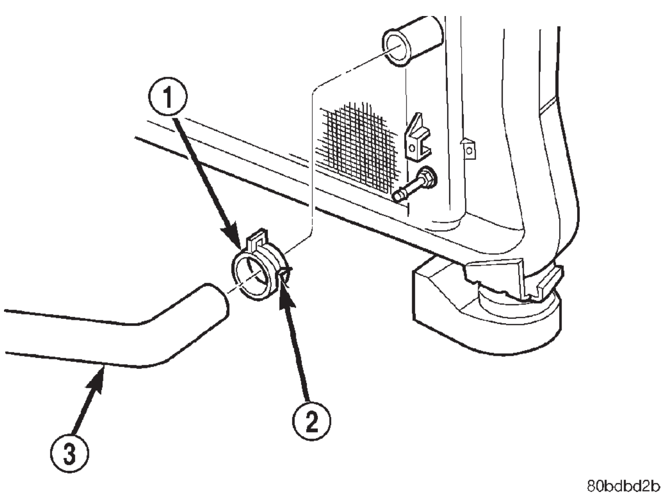


Fig. 65 Clamp Number/Letter Location

1 – CONSTANT TENSION HOSE CLAMP
2 – CLAMP NUMBER/LETTER LOCATION
3 – HOSE

(3) Remove hose clamps (Fig. 64) and hoses from radiator. Disconnect coolant reserve/overflow tank hose and washer bottle electrical connector and hose.

(4) Remove upper fan shroud mounting screws Lift upper fan shroud assembly up and out of engine compartment.

(5) Disconnect electric cooling fan motor connector.

(6) Remove radiator upper mounting screws (Fig. 67). Lift radiator upward and away from vehicle. Do not allow cooling fins of radiator to contact any other vehicle component. Radiator fin damage could result.

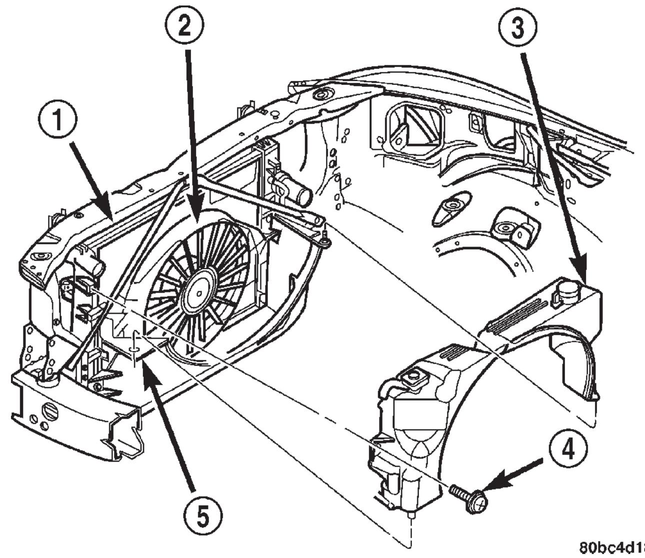


Fig. 66 Radiator Upper Fan Shroud Removal/ Installation—Typical

1 – RADIATOR
2 – ELECTRIC COOLING FAN
3 – UPPER SHROUD AND OVERFLOW BOTTLE
4 – SCREW
5 – LOWER SHROUD

INSTALLATION

The radiator has two isolator pins on bottom of both tanks. These fit into alignment holes in radiator lower support (Fig. 67).

(1) Position isolator pins into alignment holes in radiator lower support.

(2) Install and tighten radiator mounting bolts to 23 N·m (200 in. lbs.) (Fig. 67).

(3) Connect fan motor electrical connector to harness connector.

(4) Position upper fan shroud onto lower fan shroud and radiator.

(5) Install retaining screws into shroud.

(6) Install radiator hoses. reconnect coolant reserve/overflow tank hose.

(7) Connect battery negative cable.

(8) Fill cooling system. Refer to Draining and Filling Cooling System in this section.

(9) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

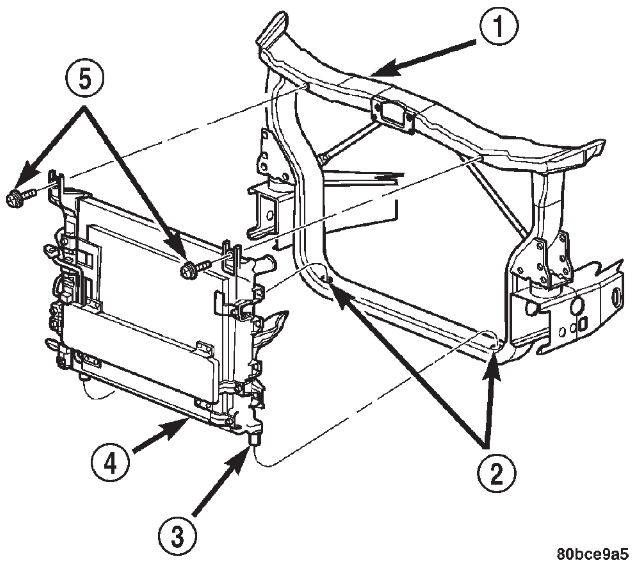


Fig. 67 Radiator Removal/Installation—Typical

1 – CORE SUPPORT
2 – LOWER ISOLATOR MOUNTS
3 – ISOLATOR PINS
4 – RADIATOR ASSEMBLY
5 – SCREWS

ENGINE BLOCK HEATER

REMOVAL

(1) Disconnect negative battery cable from battery.

(2) Drain coolant from radiator and cylinder block. Refer to Draining Cooling System in this group.

(3) Remove power cord from block heater (Fig. 68).

(4) Loosen screw at center of block heater. Remove heater assembly.

INSTALLATION

(1) Thoroughly clean cylinder block core hole and block heater seat.

(2) **(all except 4.7L Engine).** Insert block heater assembly with element loop pointing down (Fig. 68).

(3) **4.7L Engine Only,** Insert block heater assembly with element loop pointing upward (12 O'clock) (Fig. 69).

(4) With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.

(5) Fill cooling system with recommended coolant. Refer to Filling Cooling System section in this group.

(6) Start and warm the engine. Check for leaks.

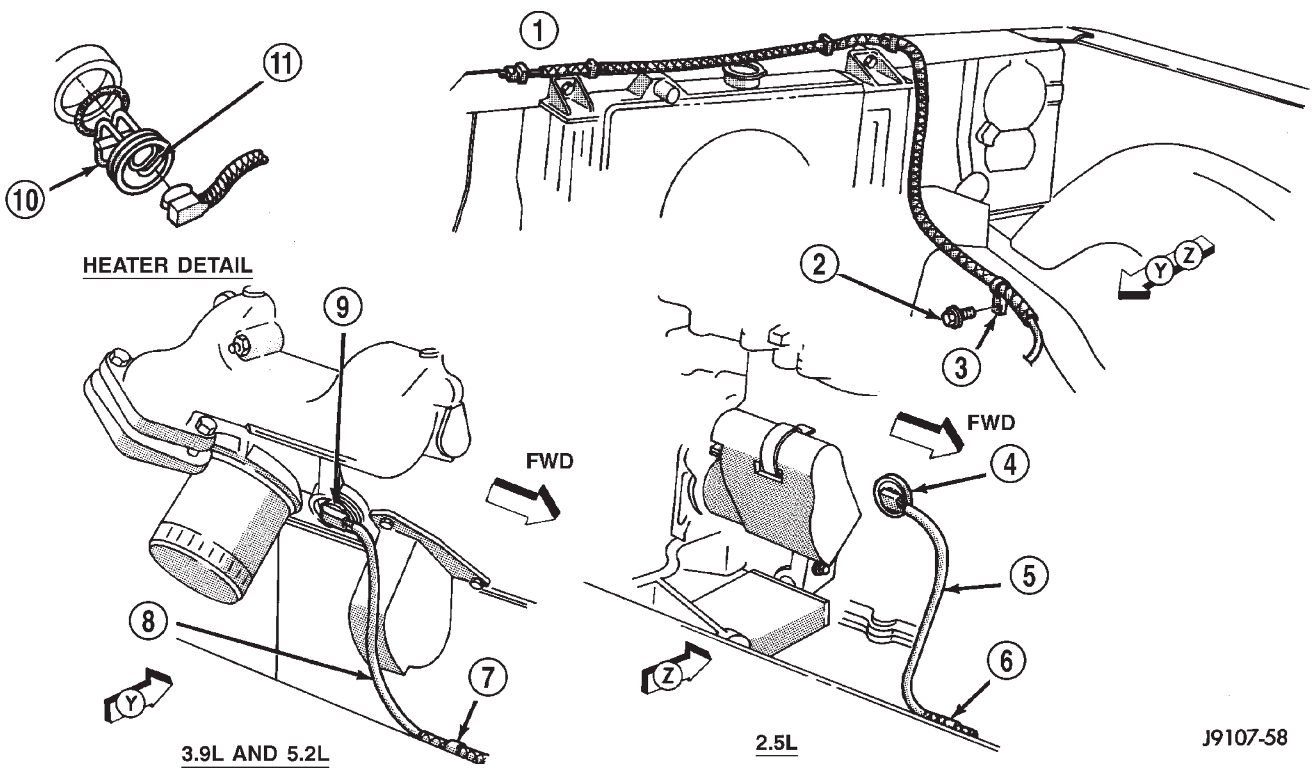


Fig. 68 Block Heater Removal/Installation

1 – CLIP
2 – SCREW 14 N·m (120 IN. LBS.)
3 – CLIP
4 – HEATER ASSEMBLY
5 – CORD ASSEMBLY
6 – CLIP
7 – CLIP
8 – CORD ASSEMBLY
9 – HEATER ASSEMBLY
10 – ELEMENT POINTS DOWN
11 – TIGHTEN SCREW TO SECURE HEATER

REMOVAL AND INSTALLATION (Continued)

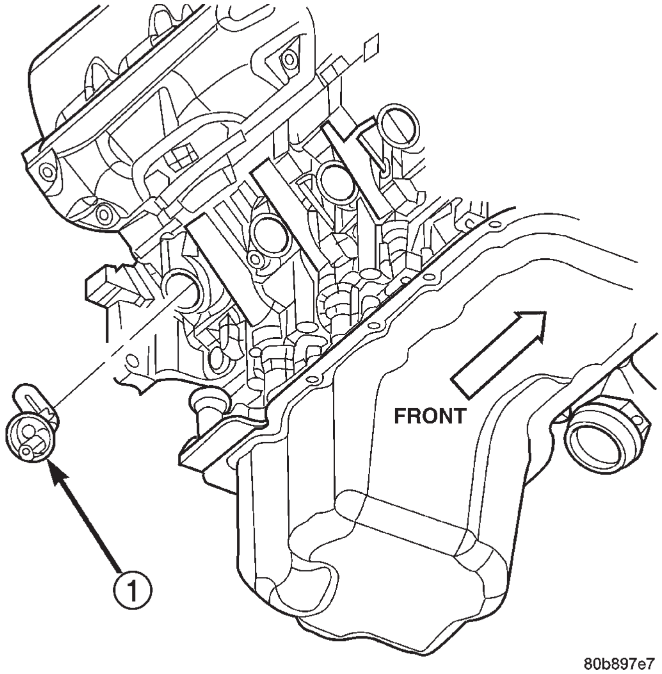


Fig. 69 Engine Block Heater—4.7L

1 – ENGINE BLOCK HEATER

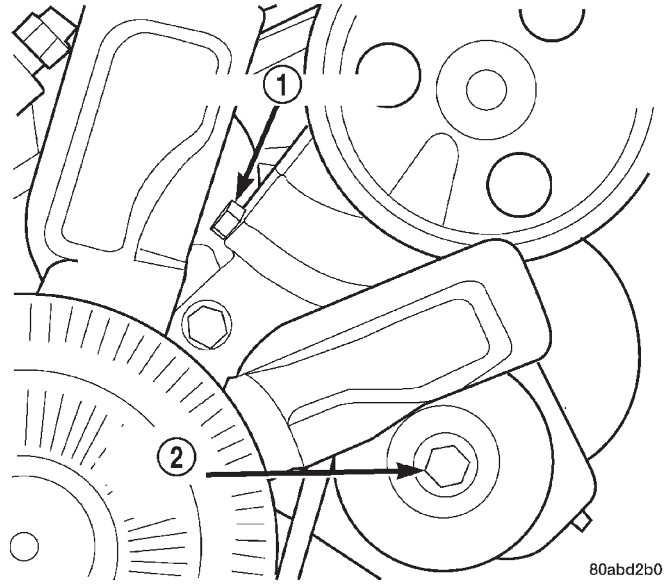


Fig. 70 Power Steering Pump Bracket and Idler Pulley

1 – ADJUSTING BOLT
2 – IDLER PULLEY BOLT

ACCESSORY DRIVE BELT—2.5L ENGINE

REMOVAL

Belt tension is adjusted at the power steering pump bracket and idler pulley assembly.

(1) Disconnect battery negative cable.

(2) Loosen the belt tension at idler pulley (Fig. 70) by loosening the pulley center bolt and then loosening the tension adjusting bolt.

(3) Remove accessory drive belt.

INSTALLATION

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 71) or (Fig. 72).

(1) Check condition of all pulleys.

(2) Install new belt. Refer to the end of this group for Drive Belt Tension specifications. Tension belt to specification and tighten center pulley bolt (Fig. 70) to 57 N·m (42 ft. lbs.)

(3) After power steering pump bracket and idler pulley has been tightened into position, recheck belt tension. Adjust if necessary.

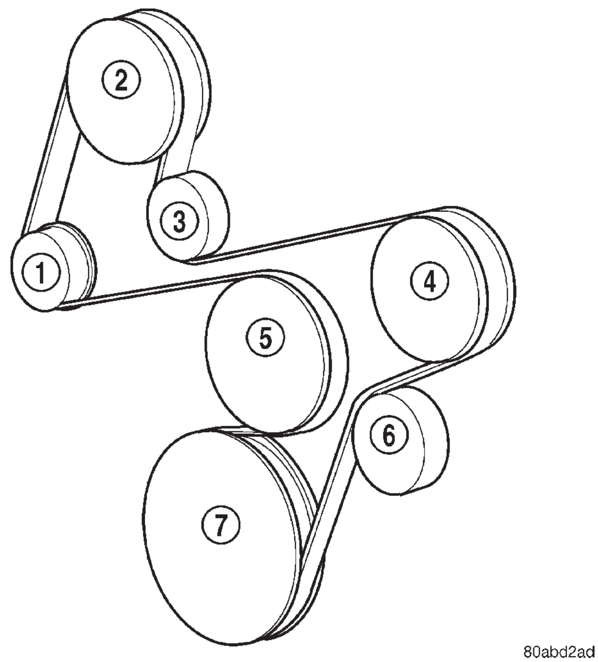


Fig. 71 Belt Routing—2.5L Engine With A/C

1 – GENERATOR
2 – A/C COMPRESSOR PULLEY
3 – IDLER PULLEY
4 – POWER STEERING PUMP PULLEY
5 – WATER PUMP AND FAN PULLEY
6 – IDLER PULLEY
7 – CRANK SHAFT PULLEY

REMOVAL AND INSTALLATION (Continued)

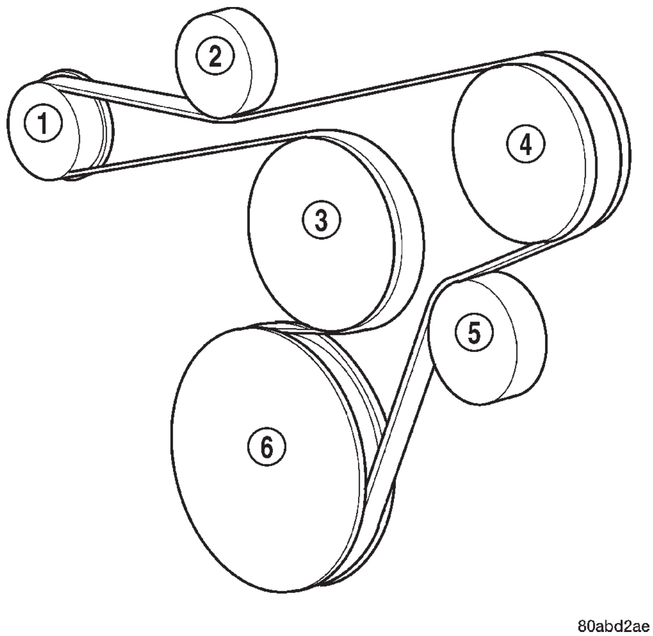


Fig. 72 Belt Routing—2.5L Engine Without A/C

1 – GENERATOR
2 – IDLER PULLEY
3 – WATER PUMP AND FAN PULLEY
4 – POWER STEERING PUMP PULLEY
5 – IDLER PULLEY
6 – CRANKSHAFT PULLEY

ACCESSORY BELT REPLACEMENT—4.7L ENGINE

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

REMOVAL

CAUTION: DO NOT LET TENSIONER ARM SNAP BACK TO THE FREEARM POSITION, SEVER DAMAGE MAY OCCUR TO THE TENSIONER.

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Rotate belt tensioner until it contacts it's stop. Remove belt, then slowly rotate the tensioner into the freearm position. (Fig. 73).

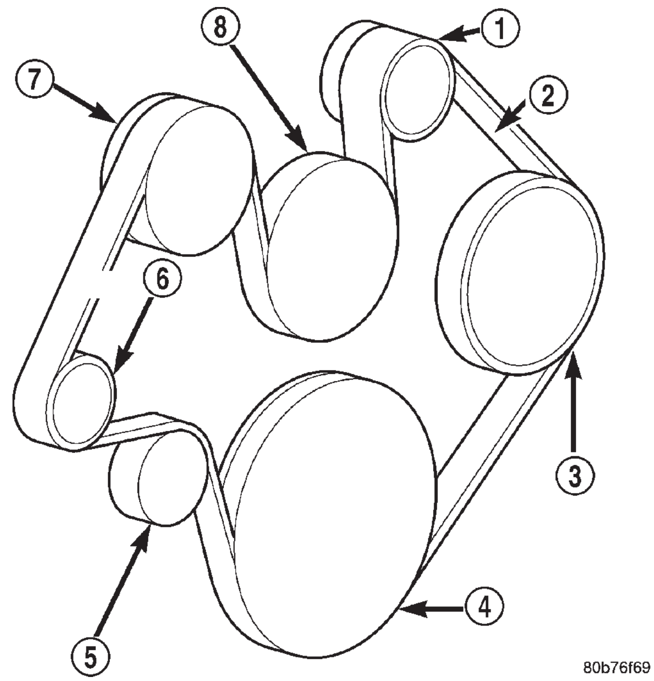


Fig. 73 Belt Routing—4.7L

1 – GENERATOR
2 – ACCESSORY DRIVE BELT
3 – POWER STEERING PUMP PULLEY
4 – CRANKSHAFT PULLEY
5 – IDLER PULLEY
6 – TENSIONER PULLEY
7 – A/C COMPRESSOR PULLEY
8 – WATER PUMP PULLEY

INSTALLATION

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Check condition of all pulleys.

CAUTION: When installing the serpentine accessory drive belt, the belt MUST be routed correctly. If not, the engine may overheat due to the water pump rotating in the wrong direction (Fig. 73).

(2) Install new belt (Fig. 73). Route the belt around all pulleys except the idler pulley. Rotate the tensioner arm until it contacts it's stop position. Route the belt around the idler and slowly let the tensioner rotate into the belt. Make sure the belt is seated onto all pulleys.

(3) With the drive belt installed, inspect the belt wear indicator (Fig. 74). On 4.7L Engines only, the gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches). If the measurement exceedes this specification replace the serpentine accessory drive belt.

REMOVAL AND INSTALLATION (Continued)

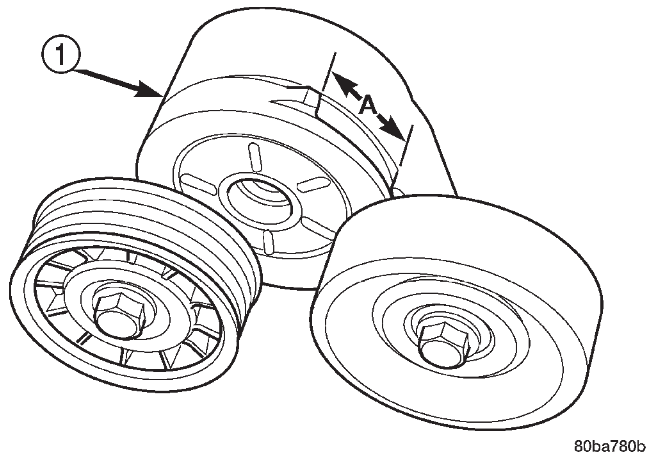


Fig. 74 Accessory Drive Belt Wear Indicator—4.7L Engine

1 – AUTOMATIC TENSIONER ASSEMBLY

ACCESSORY DRIVE BELT—3.9L/5.9L ENGINES

REMOVAL

Drive belts on both 3.9L and 5.9L engines are equipped with a spring loaded automatic belt tensioner (Fig. 75). This belt tensioner will be used on all belt configurations, such as with or without power steering or air conditioning. For more information, refer to Automatic Belt Tensioner—3.9/5.9L Engines, proceeding in this group.

(1) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 75).

(2) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

(3) Remove belt from idler pulley first.

(4) Remove belt from vehicle.

INSTALLATION

CAUTION: When installing serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 76) for correct 3.9L/5.9L engine belt routing. The correct belt with correct length must be used.

(1) Position drive belt over all pulleys **except** idler pulley. This pulley is located between generator and A/C compressor.

(2) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 75).

(3) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

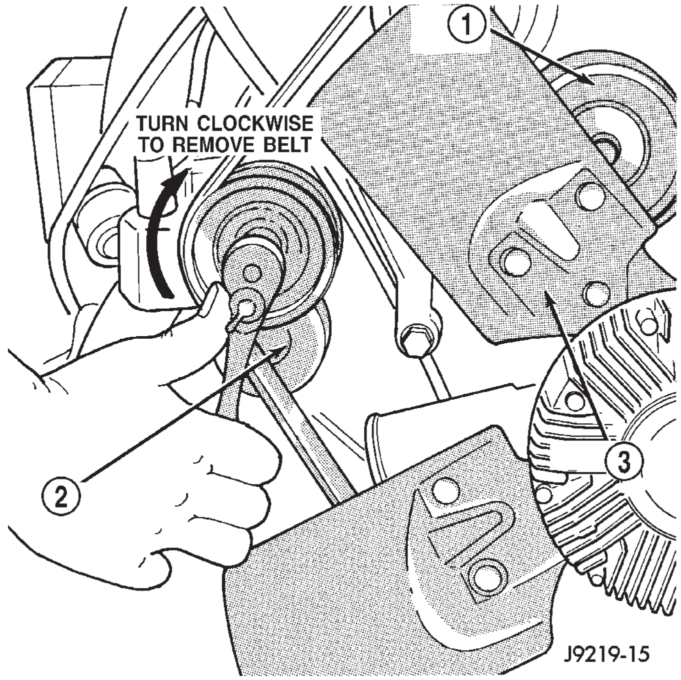


Fig. 75 Automatic Belt Tensioner—Belt Removal/Installation

1 – IDLER PULLEY
2 – TENSIONER
3 – FAN BLADE

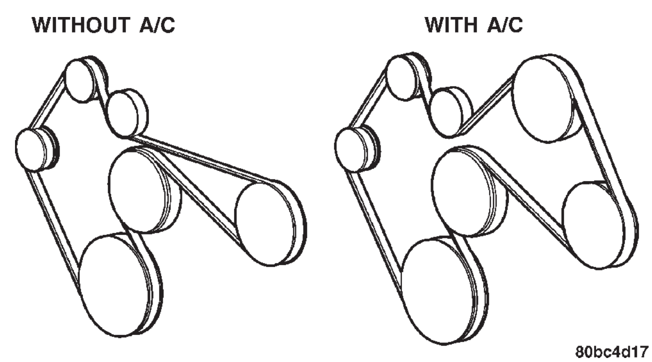


Fig. 76 Belt Routing—3.9L/5.9L Engine

(4) Check belt indexing marks. Refer to the proceeding Automatic Belt Tensioner—3.9L/5.9L Engine for more belt information.

The tensioner is equipped with an indexing arrow on back of tensioner and an indexing mark on tensioner housing. If a new belt is being installed, arrow must be within approximately 3 mm (1/8 in.) of indexing mark. Belt is considered new if it has been used 15 minutes or less. If this specification cannot be met, check for:

- The wrong belt being installed (incorrect length/width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)

REMOVAL AND INSTALLATION (Continued)

- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed. Refer to (Fig. 76)

A used belt should be replaced if tensioner indexing arrow has moved beyond the minimum tension mark.

ACCESSORY DRIVE BELT TENSIONER—2.5L

REMOVAL

(1) Remove accessory drive belt. Refer to procedure in this section.

(2) Remove the pulley bolt, bushing, pulley and spacer.

(3) Remove the tensioner adjustment bolt and tensioner collar.

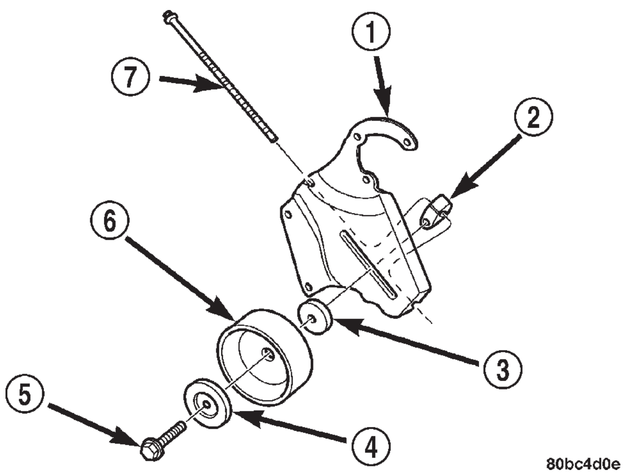


Fig. 77 Accessory Drive Belt Tensioner—2.5L Engine

1 – TENSIONER BRACKET
2 – TENSIONER COLLAR
3 – SPACER
4 – BUSHING
5 – BOLT
6 – IDLER PULLEY
7 – TENSIONER ADJUSTMENT BOLT

INSTALLATION

(1) Position tensioner collar and install the tensioner adjustment bolt.

(2) Position the spacer, idler pulley, bushing and bolt.

(3) Install the accessory drive belt.

AUTOMATIC BELT TENSIONER 3.9L/5.9L ENGINES

REMOVAL

(1) Attach a socket/wrench to mounting bolt of automatic tensioner pulley bolt (Fig. 75).

(2) Rotate tensioner assembly clockwise (as viewed from front) until tension has been relieved from belt.

(3) Remove belt from idler pulley first.

(4) Remove belt from other pulleys.

(5) Disconnect wiring and secondary cable from ignition coil.

(6) Remove two mounting bolts and ignition coil from engine (Fig. 78).

(7) Remove mounting bolt and tensioner assembly from engine (Fig. 78).

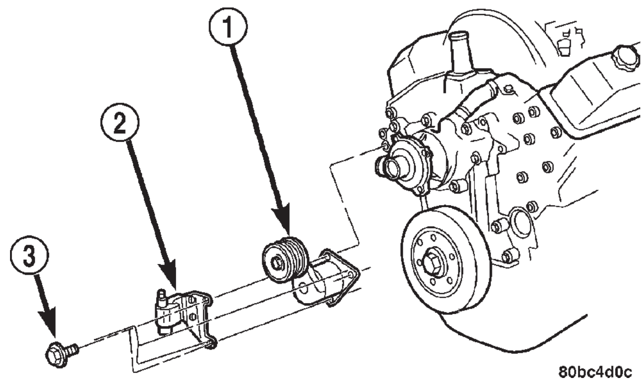


Fig. 78 Automatic Belt Tensioner Removal/ Installation 3.9L/5.9L Engines

1 – AUTOMATIC TENSIONER
2 – COIL AND BRACKET
3 – SCREW AND WASHER

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY).

(8) Remove pulley bolt. Remove pulley from tensioner.

INSTALLATION

(1) Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.).

(2) Position tensioner assembly and install mounting screw tighten screw to 67 N·m (50 ft. lbs.).

(3) Connect all wiring to ignition coil.

(4) Position coil to tensioner assembly, install two mounting screws. Tighten to 11 N·m (100 in. lbs.) (Fig. 78).

CAUTION: To prevent damage to coil case, coil mounting bolts must be torqued.

(5) Position drive belt over all pulleys **except** idler pulley (located between generator and A/C compressor).

REMOVAL AND INSTALLATION (Continued)

CAUTION: When installing serpentine accessory drive belt, the belt must be routed correctly. If not, engine may overheat due to water pump rotating in wrong direction. Refer to (Fig. 76) for correct 3.9L/ 5.9L engine belt routing. The correct belt with correct length must be used

(6) Attach a socket/wrench to pulley mounting bolt of automatic tensioner (Fig. 75).

(7) Rotate socket/wrench clockwise. Place belt over idler pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys.

(8) Check belt indexing marks.

AUTOMATIC BELT TENSIONER—4.7L ENGINE

On 4.7L engines, the tensioner is equipped with an indexing tang on back of tensioner and an indexing stop on tensioner housing. If a new belt is being installed, tang must be within approximately 24 mm (.94 inches) of indexing stop. Belt is considered new if it has been used 15 minutes or less.

If the above specification cannot be met, check for:

- The wrong belt being installed (incorrect length/ width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

NOTE: A used belt should be replaced if tensioner indexing arrow has moved to the minmum tension indicator. Tensioner travel stops at this point.

REMOVAL

(1) Remove accessory drive belt. Refer to Accessory Drive Belt in this section.

(2) Remove tensioner assembly from mounting bracket (Fig. 79).

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY EXCEPT FOR PULLEY ON TENSIONER.

(3) Remove pulley bolt. Remove pulley from tensioner.

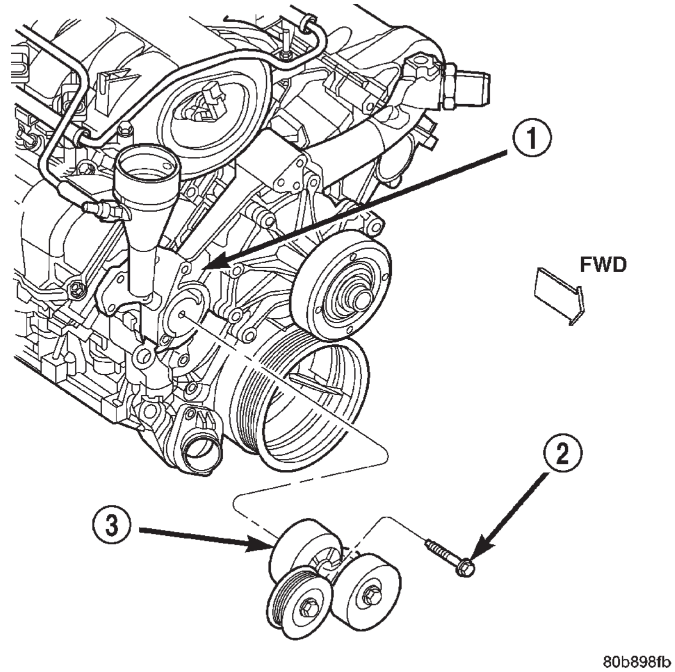


Fig. 79 Automatic Belt Tensioner—4.7L Engine

1 – TIMING CHAIN COVER
2 – BOLT TORQUE TO 41 N·m (30 FT LBS)
3 – AUTOMATIC BELT TENSIONER

INSTALLATION

(1) Install pulley and pulley bolt to tensioner. Tighten bolt to 61 N·m (45 ft. lbs.) torque.

(2) An indexing slot is located on back of tensioner. Align this slot to the head of the bolt on the front cover. Install the mounting bolt. Tighten bolt to 41 N·m (30 ft. lbs.).

(3) Install accessory drive belt.

(4) Check belt indexing marks.

IDLER PULLEY—2.5L/3.9L/5.9L ENGINES

REMOVAL

(1) Remove the accessory drive belt. Refer to Accessory Drive Belt in this section.

(2) Remove the screw and washer, pulley bushing and idler pulley from the mounting bracket (Fig. 80) (Fig. 81).

INSTALLATION

(1) Position the idler pulley and bushing onto the mounting bracket.

(2) Install the idler pulley mounting bolt, tighten bolt to 57 N·m (42 ft. lbs.).

(3) Install the accessory drive belt.

REMOVAL AND INSTALLATION (Continued)

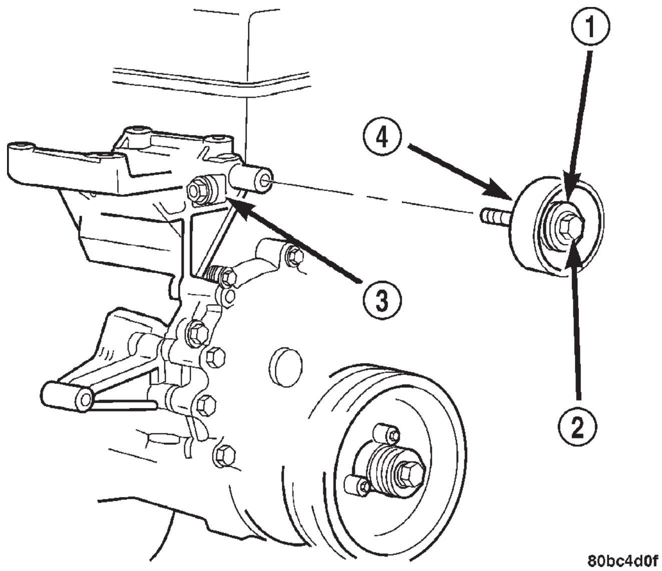


Fig. 80 Idler Pulley 2.5L Engine

1 – BUSHING
2 – SCREW AND WASHER
3 – A/C AND GENERATOR MOUNTING BRACKET
4 – IDLER PULLEY

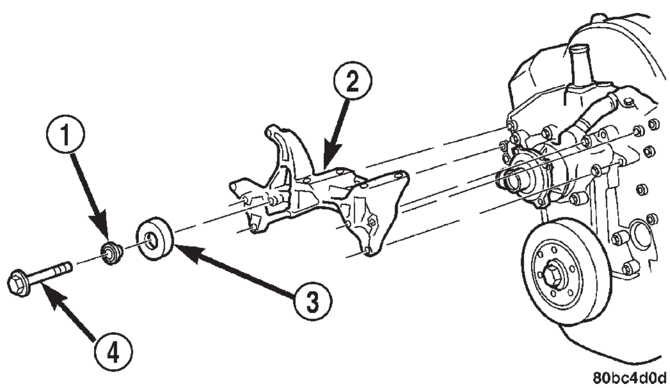


Fig. 81 Idler Pulley 3.9L and 5.9L Engines

1 – IDLER PULLEY BUSHING
2 – A/C AND/OR GENERATOR MOUNTING BRACKET
3 – IDLER PULLEY
4 – SCREW AND WASHER

IDLER PULLEY—4.7L ENGINE NON A/C

REMOVAL

(1) Disconnect the negative battery cable from battery.

(2) Remove the accessory drive belt. Refer to procedure in this section.

(3) Remove the two bolts retaining the idler pulley assembly to the engine (Fig. 82).

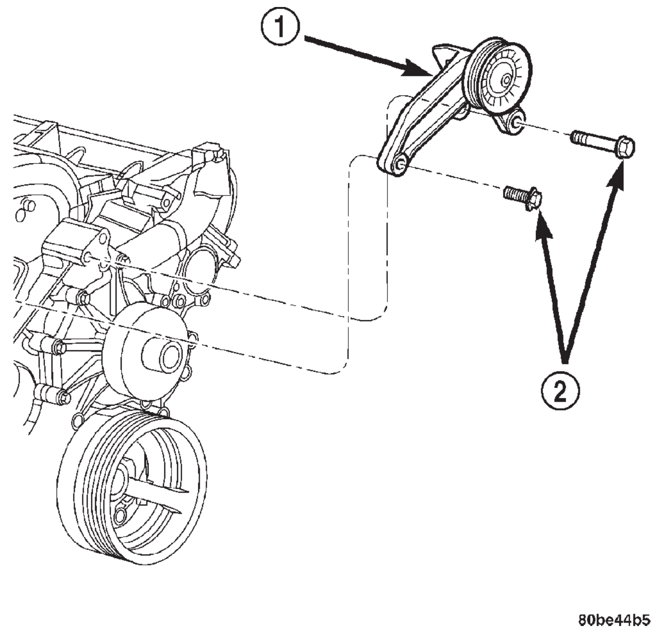


Fig. 82 Idler Pulley Removal and Installation

1 – IDLER PULLEY AND BRACKET
2 – BOLT (2)

INSTALLATION

(1) Position the idler pulley assembly onto the engine and install the two retaining bolts. Tighten the bolts to 55 N·m (40 ft. lbs.).

(2) Install the accessory drive belt.

(3) Connect the negative battery cable.

RADIATOR DRAINCOCK

REMOVAL

WARNING: DO NOT LOOSEN RADIATOR DRAINCOCK WITH SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Unscrew draincock stem (counterclockwise rotation). When stem is completely unscrewed, pull it from radiator tank and draincock body (Fig. 83).

(2) Using a pair of needle nose pliers, compress draincock body and pull straight out of radiator (Fig. 84).

INSTALLATION

(1) Install draincock stem loosely into body (Fig. 85). The draincock assembly cannot be installed if stem is threaded into the body.

(2) Push draincock assembly into opening in radiator tank. It will snap into place when fully seated.

(3) Tighten draincock (clockwise) to 2.0 to 2.7 N·m (18-25 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

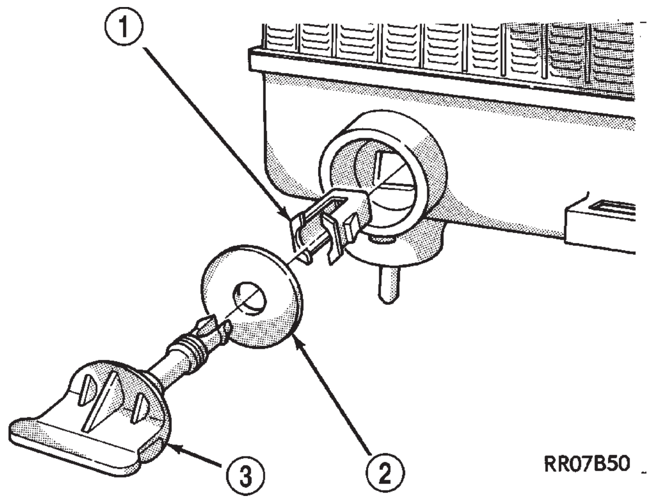


Fig. 83 Draincock Assembly

1 – BODY
2 – SEAL
3 – STEM

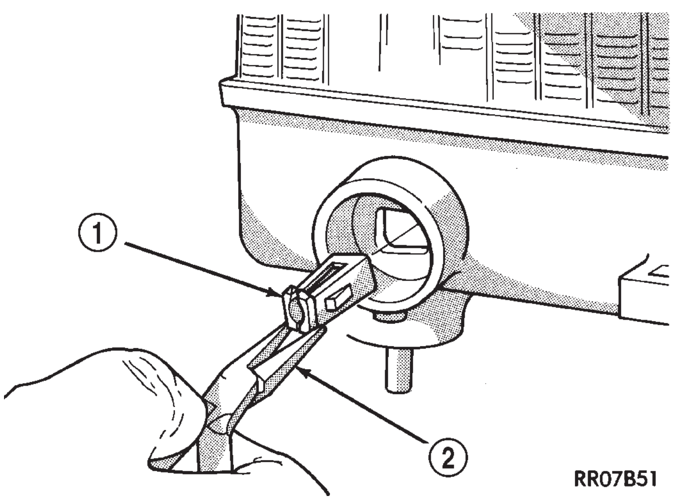


Fig. 84 Draincock Body Removal

1 – DRAINCOCK BODY
2 – NEEDLE NOSE PLIERS

VISCOUS FAN DRIVE

REMOVAL

(1) Disconnect battery negative cable.

(2) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft (Fig. 87). Remove fan blade/viscous fan drive assembly from water pump by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** A Snap-On 36 MM Fan Wrench (number SP346 from Snap-On Cummins Diesel Tool Set number 2017DSP) and Special Tool 6958 Spanner Wrench with Adapter Pins

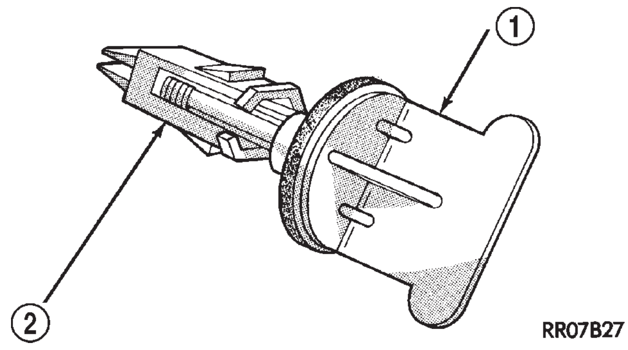


Fig. 85 Draincock Assembled for Installation

1 – STEM
2 – BODY LOOSE ON STEM

8346 can be used to hold the pulley still. (Fig. 86) to prevent pulley from rotating.

(3) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

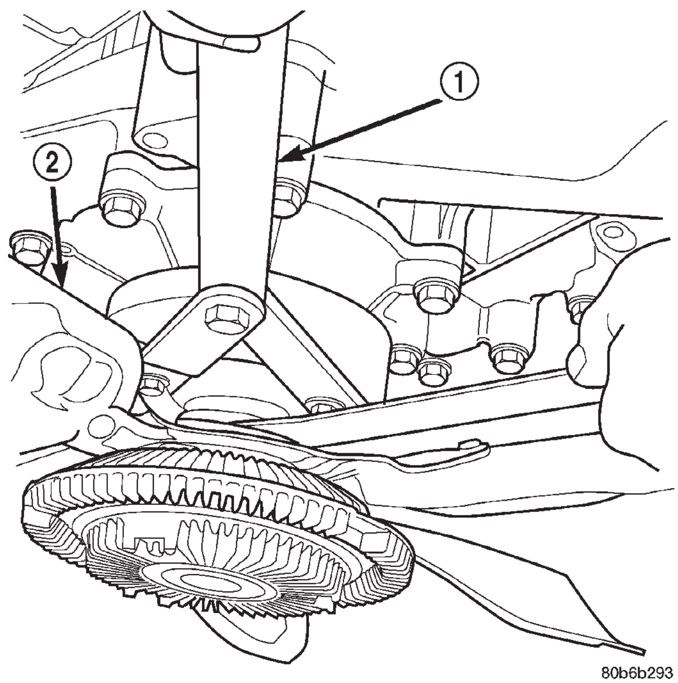


Fig. 86 Fan Blade and Viscous Fan Drive Removal

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

(4) Do not unbolt fan blade assembly (Fig. 88) from viscous fan drive at this time.

(5) Remove upper fan shroud attaching hardware (Fig. 89).

(6) Remove upper fan shroud and fan blade/viscous fan drive from vehicle.

(7) After removing fan blade/viscous fan drive assembly, **do not** place viscous fan drive in horizontal position. If stored horizontally, silicone fluid in

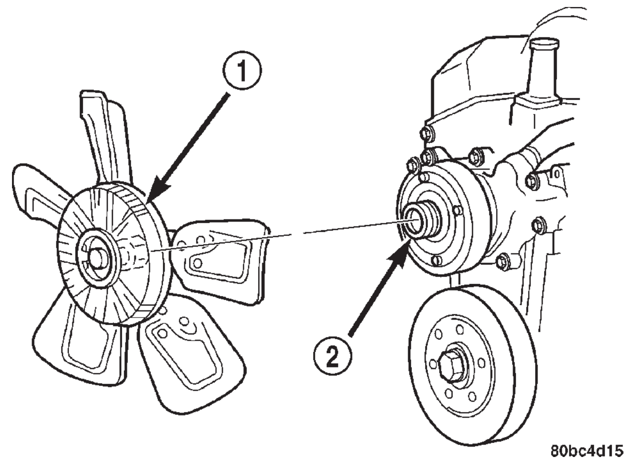


Fig. 87 Fan Blade/Viscous Fan Drive

1 – FAN AND VISCOUS DRIVE
2 – WATER PUMP THREADED SHAFT

the viscous fan drive could drain into its bearing assembly and contaminate lubricant.

CAUTION: Do not remove water pump pulley-to-water pump bolts (Fig. 87). This pulley is under spring tension.

(8) Remove four bolts securing fan blade assembly to viscous fan drive (Fig. 88).

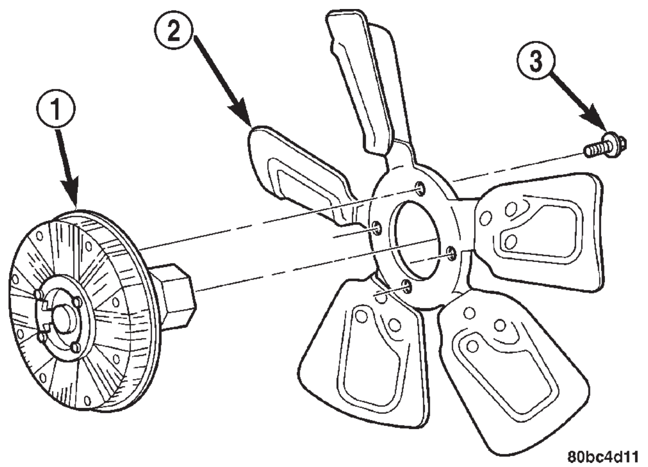


Fig. 88 Viscous Fan Drive and Fan Blade

1 – VISCOUS FAN DRIVE
2 – FAN BLADE
3 – SCREW AND WASHER

INSTALLATION

(1) Install fan blade assembly to viscous fan drive. Tighten bolts (Fig. 88) to 23 N·m (17 ft. lbs.) torque.

(2) Position fan blade/viscous fan drive assembly and upper shroud into vehicle.

(3) Install fan shroud retaining screws (Fig. 89).

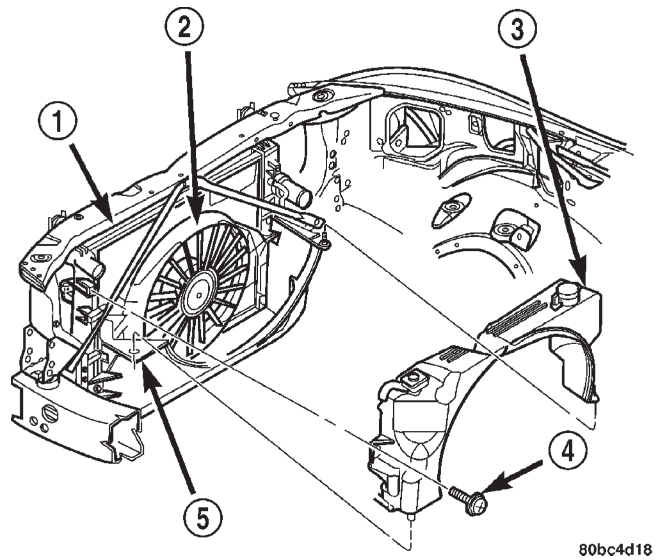


Fig. 89 Upper Fan Shroud Removal/Installation

1 – RADIATOR
2 – ELECTRIC COOLING FAN
3 – UPPER SHROUD AND OVERFLOW BOTTLE
4 – SCREW
5 – LOWER SHROUD

(4) Install fan blade/viscous fan drive assembly to water pump shaft (Fig. 87).

(5) Connect battery negative cable.

ELECTRIC FAN

REMOVAL

If the fan blade is bent, warped, cracked or damaged in any way, it must be replaced **only** with a replacement fan blade. **Do not attempt to repair a damaged fan blade.**

(1) Disconnect battery negative cable.

(2) Disconnect fan motor wire connector.

(3) Remove the two fan shroud mounting clips connecting the upper part of fan shroud to the radiator (Fig. 90).

(4) Remove fan assembly from radiator.

INSTALLATION

(1) Install fan assembly onto the radiator. Tighten bolts 5 N·m (45 in. lbs.).

(2) Connect fan motor wire connector to harness connector.

(3) Connect battery negative cable.

(4) Start engine and check fan operation.

REMOVAL AND INSTALLATION (Continued)

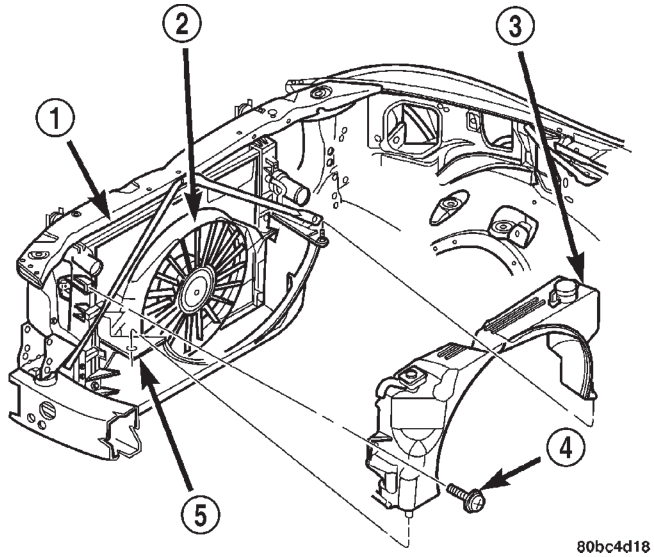


Fig. 90 Fan Shroud—Typical

1 – RADIATOR
2 – ELECTRIC COOLING FAN
3 – UPPER SHROUD AND OVERFLOW BOTTLE
4 – SCREW
5 – LOWER SHROUD

CLEANING AND INSPECTION

RADIATOR CAP

CLEANING

Use only a mild soap and water to clean the radiator cap. Using any type solvent may cause damage to the seal in the radiator cap.

INSPECTION

Hold cap at eye level, right side up. The vent valve (Fig. 29) at bottom of cap should open. If rubber gasket has swollen and prevents vent valve from opening, replace cap.

Hold cap at eye level, upside down. If any light can be seen between vent valve and rubber gasket, replace cap. **Do not use a replacement cap that has a spring to hold vent shut.** A replacement cap must be the type designed for a coolant reserve/overflow system with a completely sealed diaphragm spring and a rubber gasket. This gasket is used to seal to radiator filler neck top surface. Use of proper cap will allow coolant return to radiator.

RADIATOR

CLEANING

Clean radiator fins With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

INSPECTION

The radiator cooling fins should be checked for damage or deterioration. Inspect cooling fins to make sure they are not bent or crushed, these areas result in reduced heat exchange causing the cooling system to operate at higher temperatures. Inspect the plastic end tanks for cracks, damage or leaks.

Inspect the radiator neck for damage or distortion.

WATER PUMP

CLEANING

Clean the gasket mating surface. Use caution not to damage the gasket sealing surface.

INSPECTION

Inspect the water pump assembly for cracks in the housing, Water leaks from shaft seal, Loose or rough turning bearing or Impeller rubbing either the pump body or timing chain case/cover.

FAN BLADE

CLEANING

Clean the fan blades using a mild soap and water. Do not use an abrasive to clean the blades.

INSPECTION

WARNING: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF FAN IS NOT WITHIN SPECIFICATIONS.

CAUTION: If fan blade assembly is replaced because of mechanical damage, water pump and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

(1) Remove fan blade assembly from viscous fan drive unit (four bolts).

(2) Lay fan on a flat surface with leading edge facing down. With tip of blade touching flat surface, replace fan if clearance between opposite blade and surface is greater than 2.0 mm (.090 inch). Rocking motion of opposite blades should not exceed 2.0 mm (.090 inch). Test all blades in this manner.

(3) Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

SPECIFICATIONS

COOLING SYSTEM CAPACITIES

ENGINE	CAPACITY
2.5L	*9.3L (9.8 Qts.)
3.9L	*13.3L (14.0 Qts)
4.7L	*12.3L (13.0 Qts.)
5.9L	*13.7L (14.6 Qts)

* Nominal refill capacities are shown. A variation may be observed from vehicle due to manufacturing tolerances and refill procedures.

* Capacities shown include vehicles with air conditioning and/or heavy duty cooling systems.

ACCESSORY DRIVE BELT TENSION—2.5L ENGINE

BELT	TENSION
**NEW SERPENTINE BELT	800-900 N (180-200 lbs.)
USED SERPENTINE BELT	623-712 N (140-160 lbs.)
**Belt is considered new if it has been used 15 minutes or less.	
Specifications for use with a belt tension gauge. Refer to operating instructions supplied with gauge.	

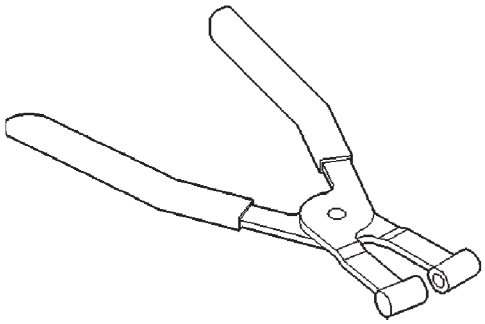
NOTE: Do not attempt to check belt tension on vehicles equipped with the 3.9L/4.7L/5.9L engines. They are equipped with an automatic belt tensioner.

TORQUE SPECIFICATIONS

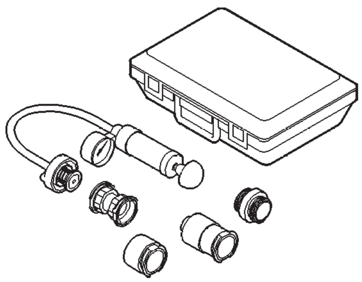
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Automatic Belt Tensioner to Mounting Bracket Bolts (3.9L/5.9L)	67	50	—
Automatic Belt Tensioner to Block Bolts (3.9L/4.7L/5.9L)	41	30	—
Automatic Belt Tensioner Pulley Bolt (3.9L/4.7L/5.9L)	61	45	—
Belt Tensioner Bracket to Block Bolts (2.5L)	47	35	—
Belt Idler Pulley Fixed Pulley Bolt (2.5L)	57	42	—
Belt Tensioner Pulley Bolt (2.5L)	57	42	—
Block Heater Bolt (2.5L)	4	—	32
Block Heater Bolt (3.9L/4.7L/5.9L)	2	—	17
Radiator to Support Bolts	23	—	200
Thermostat Housing Bolts (2.5L)	22	16	—
Thermostat Housing Bolts (3.9L/5.9L)	22	16	—
Thermostat Housing Bolts (4.7L)	13	—	115
Transmission Auxiliary Oil Cooler Bolts	10	—	90
Upper Radiator Closure Panel Bolts	10	—	90
Water Pump Bolts (2.5L)	30	22	—
Water Pump Bolts (3.9L/5.9L)	40	30	—
Water Pump Bolts (4.7L)	54	40	—
Fan Shroud Bolts	6	—	50
Electric Fan to Radiator Bolts	5	—	45

SPECIAL TOOLS

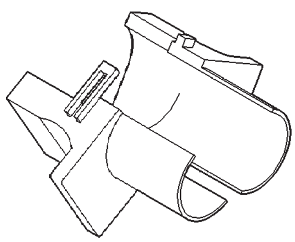
COOLING



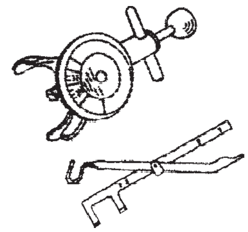
Pliers Constant Pressure Hose Clamp—6094



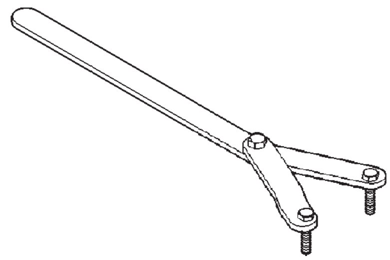
Pressure Tester—7700A



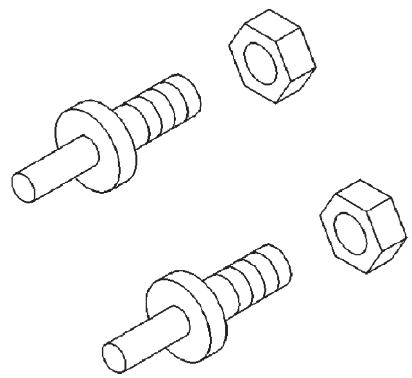
3/8” Disconnect Tool—6935



Belt Tension Gauge —C4162



Spanner Wrench 6958



Adapter Pins 8346

BATTERY

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
BATTERY . . . 1
BATTERY CABLES . . . 3
BATTERY HOLD DOWNS . . . 4
BATTERY TRAY . . . 4
DIAGNOSIS AND TESTING
BATTERY . . . 5
BATTERY CABLES . . . 14
SERVICE PROCEDURES
BATTERY CHARGING . . . 16
REMOVAL AND INSTALLATION
BATTERY HOLD DOWNS . . . 18
BATTERY . . . 19
BATTERY TRAY . . . 20
CLEANING AND INSPECTION
BATTERY . . . 21
SPECIFICATIONS
BATTERY . . . 22

DESCRIPTION AND OPERATION

BATTERY

DESCRIPTION

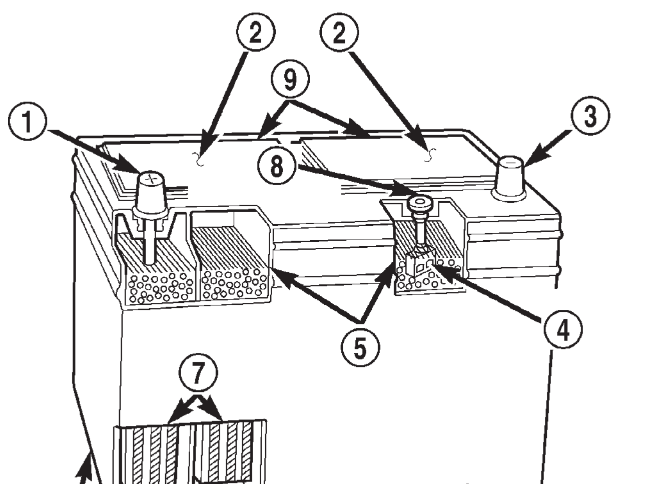


Fig. 1 Maintenance-Free Battery - Typical

1 – POSITIVE POST
2 – VENT CAPS
3 – NEGATIVE POST
4 – GREEN BALL
5 – ELECTROLYTE LEVEL
6 – MAINTENANCE-FREE BATTERY
7 – PLATE GROUPS
8 – TEST INDICATOR
9 – VENTS

A large capacity, maintenance-free storage battery (Fig. 1) is standard factory-installed equipment on this model. Male post type terminals made of a soft lead material protrude from the top of the molded plastic battery case to provide the means for connecting the battery to the vehicle electrical system. The battery positive terminal post is visibly larger in diameter than the negative terminal post, for easy identification. The letters **POS** and **NEG** are also molded into the top of the battery case adjacent to their respective positive and negative terminal posts for additional identification confirmation. Refer to **Battery Cables** in the index of this service manual for the location of more information on the battery cables that connect the battery to the vehicle electrical system.

This battery is designed to provide a safe, efficient and reliable means of storing electrical energy in a chemical form. This means of energy storage allows the battery to produce the electrical energy required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating. The battery is made up of six individual cells that are connected in series. Each cell contains positively charged plate groups that are connected with lead straps to the positive terminal post, and negatively charged plate groups that are connected with lead straps to the negative terminal post. Each plate consists of a stiff mesh framework or grid coated with lead dioxide (positive plate) or sponge lead (negative plate). Insulators or plate separators made of a non-conductive material are inserted between the positive and negative plates to prevent them from contacting or shorting against one another. These dissimilar metal plates are submerged in a sulfuric acid and water solution called an electrolyte.

The factory-installed battery has a built-in test indicator (hydrometer). The color visible in the sight glass of the indicator will reveal the battery condi-

DESCRIPTION AND OPERATION (Continued)

tion. For more information on the use of the built-in test indicator, refer to **Battery** in the index of this service manual for the location of the proper battery diagnosis and testing procedures. **The factory-installed maintenance-free battery has non-removable battery vent caps.** Water cannot be added to this battery. The chemical composition of the metal coated plates within the maintenance-free battery reduces battery gassing and water loss, at normal charge and discharge rates. Therefore, the battery should not require additional water in normal service. If the electrolyte level in this battery does become low, the battery must be replaced. However, rapid loss of electrolyte can be caused by an overcharging condition. Be certain to diagnose the charging system after replacing the battery for a low electrolyte condition and before returning the vehicle to service. Refer to **Charging System** in the index of this service manual for the location of the proper charging system diagnosis and testing procedures.

For battery maintenance schedules and jump starting procedures, see the owner's manual in the vehicle glove box. Optionally, refer to **Maintenance Schedules** and **Jump Starting, Towing and Hoisting** in the index of this service manual for the location of the recommended battery maintenance schedules and the proper battery jump starting procedures. While battery charging can be considered a maintenance procedure, the battery charging procedures and information are located in the service procedures section of this service manual. This was done because the battery must be fully-charged before any battery diagnosis or testing procedures can be performed. Refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures.

BATTERY SIZE AND RATINGS

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced. Refer to **Battery** in the index of this service manual for the location of the proper factory-installed battery specifications. Battery sizes and ratings are discussed in more detail below.

- Group Size

The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.

- Cold Cranking Amperage

The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. The CCA required is generally higher as engine displacement increases, depending also upon the starter current draw requirements.

- Reserve Capacity

The Reserve Capacity (RC) rating specifies the time (in minutes) it takes for battery terminal voltage to fall below 10.5 volts, at a discharge rate of 25 amperes. RC is determined with the battery fully-charged at 26.7° C (80° F). This rating estimates how long the battery might last after a charging system failure, under minimum electrical load.

- Ampere-Hours

The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.

OPERATION

When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. As the battery discharges, a gradual chemical change takes place within each cell. The sulfuric acid in the electrolyte combines with the plate materials, causing both plates to slowly change to lead sulfate. At the same time, oxygen from the positive plate material combines with hydrogen from the sulfuric acid, causing the electrolyte to become mainly water. The chemical changes within the battery are caused by the movement of excess or free electrons between the positive and negative plate groups. This movement of electrons produces a flow of electrical current through the load device attached to the battery terminals.

As the plate materials become more similar chemically, and the electrolyte becomes less acid, the voltage potential of each cell is reduced. However, by charging the battery with a voltage higher than that of the battery itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead dioxide, and the water back into sulfuric acid. This action restores the difference in the electron charges deposited on the plates, and the voltage potential of the battery cells. For a battery to remain useful, it must be able to produce high-amperage current over an extended period. A battery must also be able to accept a charge, so that its voltage potential may be restored.

DESCRIPTION AND OPERATION (Continued)

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite. If the electrolyte level is low, the battery may arc internally and explode. If the battery is equipped with removable cell caps, add distilled water whenever the electrolyte level is below the top of the plates. If the battery cell caps cannot be removed, the battery must be replaced if the electrolyte level becomes low.

In addition to producing and storing electrical energy, the battery serves as a capacitor and voltage stabilizer for the electrical system of the vehicle. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components in the vehicle.

BATTERY CABLES

DESCRIPTION

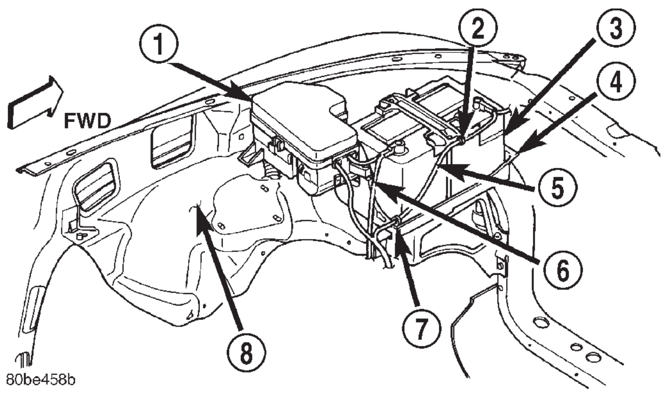


Fig. 2 Battery Cables

1 – POWER DISTRIBUTION CENTER
2 – CLIP
3 – BATTERY
4 – TRAY
5 – NEGATIVE CABLE
6 – POSITIVE CABLE
7 – CLIP
8 – WHEELHOUSE INNER PANEL

The battery cables (Fig. 2) are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity. Refer to **Wiring Diagrams** in the index of this service manual for the location of the proper battery cable wire gauge information.

The battery cables cannot be repaired and, if damaged or faulty they must be replaced. Both the battery positive and negative cables are available for service replacement only as a unit with the battery positive cable wire harness or the battery negative cable wire harness, which may include portions of the wiring circuits for the generator and other components on some models. Refer to **Wiring Diagrams** in the index of this service manual for the location of more information on the various wiring circuits included in the battery cable wire harnesses for the vehicle being serviced.

The battery cables feature a stamped brass clamping type female battery terminal crimped onto one end of the battery cable wire and then solder-dipped. A square headed pinch-bolt and hex nut are installed at the open end of the female battery terminal clamp. The battery positive cable also includes a red molded rubber protective cover for the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then solder-dipped. The battery positive cable wires have a red insulating jacket to provide visual identification and feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires have a black insulating jacket and a smaller female battery terminal clamp.

OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a return path for electrical current generated by the charging system for restoring the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the ends of the battery cable wires opposite the female battery terminal clamps provide secure and reliable connection of the battery to the vehicle electrical system.

The battery positive cable terminal clamp is crimped onto the ends of two wires. One wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the Power Distribution Center (PDC), and the other wire has an eyelet terminal that connects the battery positive cable to the B(+) terminal stud of the engine starter motor solenoid. The battery negative cable terminal clamp is also crimped onto the ends of two wires. One wire has an eyelet terminal that connects the battery negative cable to the vehicle powertrain through a ground screw or stud on the engine. The other wire has an eyelet terminal that connects the battery negative cable to the vehicle body through a weld stud located near the front of the left front fender inner shield, near the battery.

DESCRIPTION AND OPERATION (Continued)

BATTERY HOLD DOWNS

DESCRIPTION

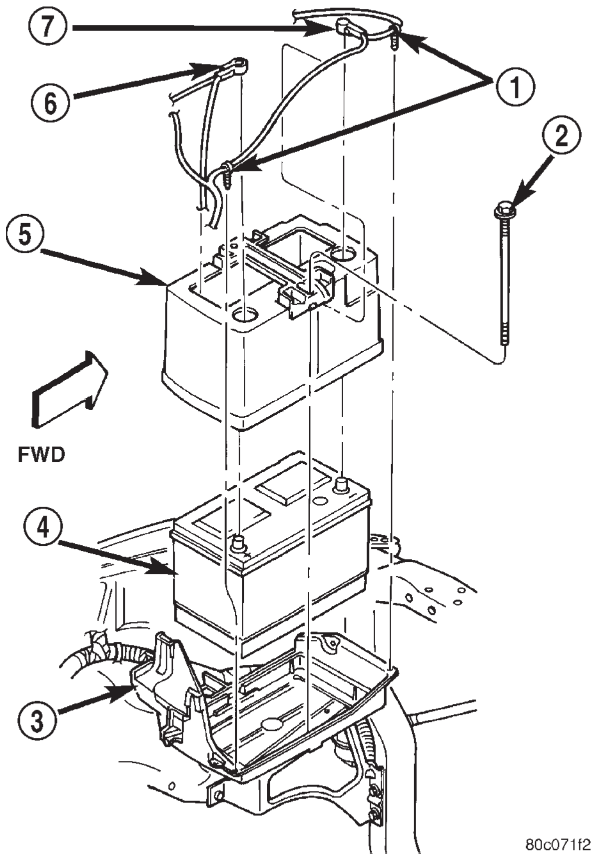


Fig. 3 Battery Hold Downs

1 – CLIPS
2 – BOLT
3 – TRAY
4 – BATTERY
5 – HOLD DOWN STRAP AND THERMOGUARD
6 – POSITIVE CABLE
7 – NEGATIVE CABLE

The battery hold down hardware (Fig. 3) includes two bolts, two U-nuts and a hold down strap/battery thermoguard unit. The molded plastic battery hold down strap is integral to the battery thermoguard unit, which encloses the sides of the battery case.

When installing a battery into the battery tray, be certain that the hold down hardware is properly installed and that the fasteners are tightened to the proper specifications. Improper hold down fastener tightness, whether too loose or too tight, can result in damage to the battery, the vehicle or both. Refer to **Battery Hold Downs** in the index of this service manual for the location of the proper battery hold down installation procedures, including the proper hold down fastener tightness specifications.

OPERATION

The battery hold down hardware secures the battery to the battery tray in the engine compartment. This hardware is designed to prevent battery movement during vehicle operation. Unrestrained battery movement during vehicle operation can result in damage to the vehicle, the battery or both. The battery thermoguard protects the battery from engine compartment temperature extremes. The air trapped between the thermoguard and the battery case creates a dead air space, which helps to insulate the sides of the battery case from the surrounding engine compartment air temperature.

The two hold down U-nuts are installed onto the battery tray before the tray is installed in the engine compartment. The U-nuts are installed over a hole in a molded formation integral to each side of the battery tray. After the battery is properly positioned in the battery tray, the hold down strap/battery thermoguard unit is installed over the top of the battery case. A long hold down bolt is then installed through a hole on each end of the battery hold down strap and threaded into the U-nuts on the battery tray. The hold down bolts are then tightened to securely hold down the battery in the battery tray.

BATTERY TRAY

DESCRIPTION

The battery is mounted in a molded plastic tray (Fig. 4) located in the left front corner of the engine compartment. The battery tray is secured on the inboard side with screws to a stamped steel battery tray support located on the left side of the radiator, on the outboard side with screws to the front extension of the left front wheelhouse inner panel and at the front to the front closure panel on the left side of the radiator yoke. The battery tray support is secured at the front with screws to the left side of the radiator yoke, and at the rear with a screw to the front extension of the left front wheelhouse inner panel.

A hole in the bottom of the battery tray is fitted with a battery temperature sensor. Refer to **Battery Temperature Sensor** in the index of this service manual for the location of more information on the battery temperature sensor. The battery tray also includes two stanchions that are molded into the rear of the tray, which support the forward end of the Power Distribution Center (PDC). Refer to **Power Distribution Center** in the index of this service manual for the location of more information on the PDC mounting.

DESCRIPTION AND OPERATION (Continued)

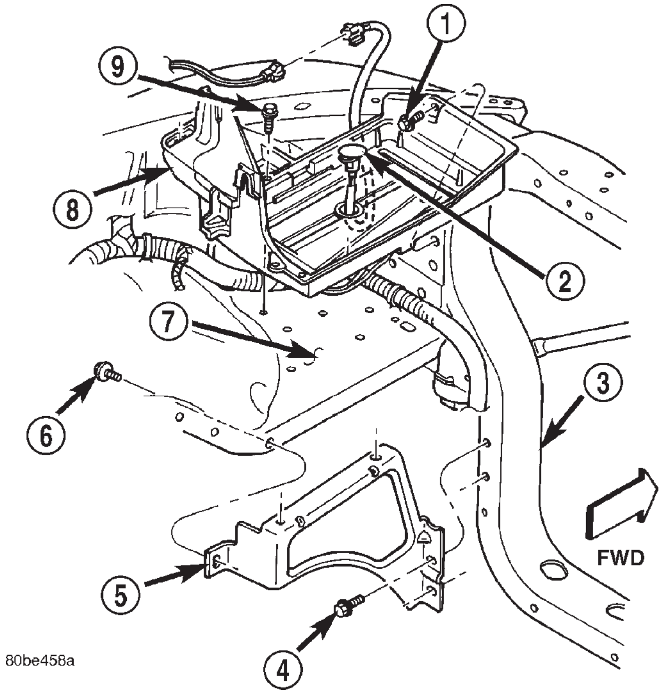


Fig. 4 Battery Tray

1 – SCREW
2 – SENSOR
3 – YOKE
4 – SCREW
5 – SUPPORT
6 – SCREW
7 – WHEELHOUSE INNER PANEL
8 – TRAY
9 – SCREW

OPERATION

The battery tray provides a mounting location and support for the vehicle battery. The battery tray also provides anchor points for the battery hold down hardware. The battery tray and the battery hold down hardware combine to secure and stabilize the battery in the engine compartment, which prevents battery movement during vehicle operation. Unrestrained battery movement during vehicle operation can result in damage to the vehicle, the battery or both.

DIAGNOSIS AND TESTING

BATTERY

DIAGNOSIS

The battery, starting system and charging system in the vehicle operate with one another, and must be tested as a complete system. In order for the engine to start and the battery to charge properly, all of the components that are used in these systems must perform within specifications. It is important that the battery, starting system and charging system be thoroughly tested and inspected any time a battery needs to be charged or replaced. The cause of abnormal discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting system and charging system include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 12-volt test lamp may be required. All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to **Charging System, On-Board Diagnostic Test** in the index of this service manual for the location of the proper on-board diagnostic test procedures.

The battery must be completely charged and the top, posts and terminal clamps should be properly cleaned and inspected before any diagnostic procedures are performed. Refer to **Battery** in the index of this service manual for the location of the proper battery cleaning and inspection procedures. Refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures.

DIAGNOSIS AND TESTING (Continued)

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.**
- **IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.**

The condition of a battery is determined by two criteria:

1. State-Of-Charge

This can be determined by checking the specific gravity of the battery electrolyte (built-in test indicator or hydrometer test), or by checking the battery voltage (open-circuit voltage test).

2. Cranking Capacity

This can be determined by performing a battery load test, which measures the ability of the battery to supply high-amperage current.

First, determine the battery state-of-charge. This can be done in one of three ways. If the battery has a built-in test indicator, view the test indicator to determine the state-of-charge. If the battery has no test indicator but does have removable cell caps, perform the hydrometer test to determine the state-of-charge. If the battery cell caps are not removable or a hydrometer is not available, perform the open-circuit voltage test to determine the state-of-charge.

The battery must be charged before proceeding with a load test if:

- The battery built-in test indicator has a black or dark color visible.
- The temperature corrected specific gravity of the battery electrolyte is less than 1.235.
- The battery open-circuit voltage is less than 12.4 volts.

A battery that will not accept a charge is faulty, and must be replaced. Further testing is not required. A fully-charged battery must be load tested to determine its cranking capacity. A battery that is fully-charged but does not pass the load test is faulty, and must be replaced.

NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Battery Charging in the index of this service manual for the location of the proper battery charging procedures.

A battery is fully-charged when:

- All battery cells are gassing freely during charging.
- A green color is visible in the sight glass of the battery built-in test indicator.
- Three corrected specific gravity tests, taken at one-hour intervals, indicate no increase in the specific gravity of the battery electrolyte.
- Open-circuit voltage of the battery is 12.4 volts or greater.

DIAGNOSIS AND TESTING (Continued)

Battery Diagnosis		
Condition	Possible Causes	Correction
The battery seems weak or dead when attempting to start the engine.	1. The battery has an incorrect size or rating for this vehicle. 2. The battery is physically damaged. 3. The battery terminal connections are loose or corroded. 4. The battery is discharged. 5. The electrical system ignition-off draw is excessive. 6. The battery is faulty. 7. The starting system is faulty. 8. The charging system is faulty.	1. Refer to Battery in the index of this service manual for the location of the proper battery specifications. Replace an incorrect battery, as required. 2. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required. 3. Refer to Voltage Drop Test in this section for the proper test procedures. Clean and tighten the battery terminal connections, as required. 4. Determine the battery state-of-charge. Refer to Built-In Test Indicator, Hydrometer Test, or Open-Circuit Voltage Test in this section for the proper test procedures. Charge the faulty battery, as required. 5. Refer to Ignition-Off Draw Test in this section for the proper test procedures. Repair the faulty electrical system, as required. 6. Determine the battery cranking capacity. Refer to Load Test in this section for the proper test procedures. Replace the faulty battery, as required. 7. Determine if the starting system is performing to specifications. Refer to Starting System in the index of this service manual for the location of the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required. 8. Determine if the charging system is performing to specifications. Refer to Charging System in the index of this service manual for the location of the proper charging system diagnosis and testing procedures. Repair the faulty charging system, as required.

DIAGNOSIS AND TESTING (Continued)

Battery Diagnosis		
Condition	Possible Causes	Correction
The battery state-of-charge cannot be maintained.	1. The battery has an incorrect size or rating for this vehicle. 2. The battery terminal connections are loose or corroded. 3. The generator drive belt is slipping. 4. The electrical system ignition-off draw is excessive. 5. The battery is faulty. 6. The starting system is faulty. 7. The charging system is faulty. 8. Electrical loads exceed the output of the charging system. 9. Slow driving or prolonged idling with high-amperage draw systems in use.	1. Refer to Battery in the index of this service manual for the location of the proper battery specifications. Replace an incorrect battery, as required. 2. Refer to Voltage Drop Test in this section for the proper test procedures. Clean and tighten the battery terminal connections, as required. 3. Refer to Accessory Drive Belt Diagnosis in the index of this service manual for the location of the proper accessory drive belt diagnosis and testing procedures. Replace or adjust the faulty generator drive belt, as required. 4. Refer to Ignition-Off Draw Test in this section for the proper test procedures. Repair the faulty electrical system, as required. 5. Determine the battery cranking capacity. Refer to Load Test in this section for the proper test procedures. Replace the faulty battery, as required. 6. Determine if the starting system is performing to specifications. Refer to Starting System in the index of this service manual for the location of the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required. 7. Determine if the charging system is performing to specifications. Refer to Charging System in the index of this service manual for the location of the proper charging system diagnosis and testing procedures. Repair the faulty charging system, as required. 8. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads. 9. Advise the vehicle operator, as required.
The battery will not accept a charge.	1. The battery is faulty.	1. Refer to Battery Charging in the index of this service manual for the location of the proper battery charging procedures. Charge or replace the faulty battery, as required.

ABNORMAL BATTERY DISCHARGING

Any of the following conditions can result in abnormal battery discharging:

1. Corroded or loose battery posts and terminal clamps.
2. A loose or worn generator drive belt.
3. Electrical loads that exceed the output of the charging system. This can be due to equipment installed after manufacture, or repeated short trip use.
4. Slow driving speeds (heavy traffic conditions) or prolonged idling, with high-amperage draw systems in use.
5. A faulty circuit or component causing excessive ignition-off draw.
6. A faulty or incorrect charging system component. Refer to **Charging System** in the index of this service manual for the location of the proper charging system diagnosis and testing procedures.
7. A faulty or incorrect starting system component. Refer to **Starting System** in the index of this service manual for the location of the proper starting system diagnosis and testing procedures.
8. A faulty or incorrect battery.

DIAGNOSIS AND TESTING (Continued)

TESTING

BUILT-IN TEST INDICATOR

A test indicator (hydrometer) built into the top of the battery case provides visual information for battery testing (Fig. 5). Like a hydrometer, the built-in test indicator measures the specific gravity of the battery electrolyte. The test indicator reveals the battery state-of-charge; however, it will not reveal the cranking capacity of the battery. A load test must be performed to determine the battery cranking capacity. Refer to **Load Test** in this section for the proper battery load testing procedures.

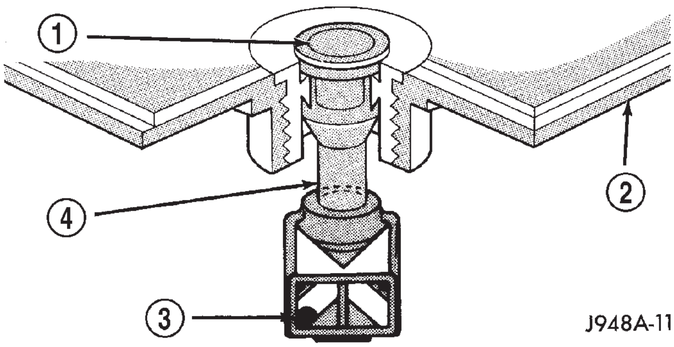


Fig. 5 Built-In Test Indicator

1 – SIGHT GLASS
2 – BATTERY TOP
3 – GREEN BALL
4 – PLASTIC ROD

WARNING:

• IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

• IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

Before testing, visually inspect the battery for any damage (a cracked case or cover, loose posts, etc.) that would cause the battery to be faulty. In order to obtain correct indications from the built-in test indicator, it is important that the battery be level and have a clean sight glass. Additional light may be required to view the indicator. **Do not use open flame as a source of additional light.**

To read the built-in test indicator, look into the sight glass and note the color of the indicator (Fig. 6). The battery condition that each color indicates is described in the following list:

• Green

Indicates 75% to 100% battery state-of-charge. The battery is adequately charged for further testing or return to service. If the starter will not crank for a minimum of fifteen seconds with a fully-charged battery, the battery must be load tested. Refer to **Load Test** in this section for the proper battery load testing procedures.

• Black or Dark

Indicates 0% to 75% battery state-of-charge. The battery is inadequately charged and must be charged until a green indication is visible in the sight glass (12.4 volts or more), before the battery is tested further or returned to service. Refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures. Also refer to **Abnormal Battery Discharging** in this section for the possible causes of the discharged battery condition.

• Clear or Bright

Indicates a low battery electrolyte level. The electrolyte level in the battery is below the test indicator. A maintenance-free battery with non-removable cell caps must be replaced if the electrolyte level is low. Water must be added to a low-maintenance battery with removable cell caps before it is charged. Refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures. A low electrolyte level may be caused by an overcharging condition. Refer to **Charging System** in the index of this service manual for the location of the proper charging system diagnosis and testing procedures.

HYDROMETER TEST

The hydrometer test reveals the battery state-of-charge by measuring the specific gravity of the electrolyte. **This test cannot be performed on maintenance-free batteries with non-removable cell caps.** If the battery has non-removable cell caps, refer to **Built-In Test Indicator** or **Open-Circuit Voltage Test** in this section for the proper procedures for performing these alternate tests of the battery state-of-charge.

DIAGNOSIS AND TESTING (Continued)

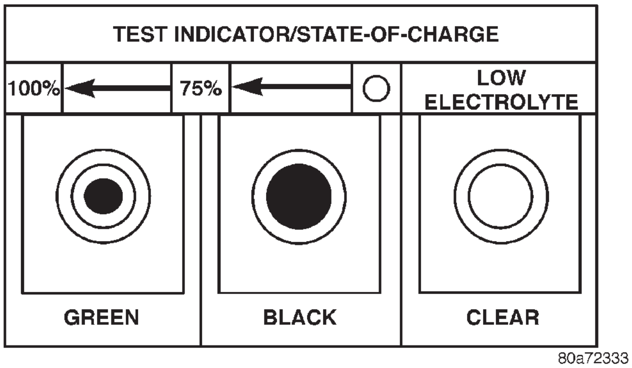


Fig. 6 Built-In Test Indicator Sight Glass

Specific gravity is a comparison of the density of the battery electrolyte to the density of pure water. Pure water has a specific gravity of 1.000, and sulfuric acid has a specific gravity of 1.835. Sulfuric acid makes up approximately 35% of the battery electrolyte by weight, or 24% by volume. In a fully-charged battery the electrolyte will have a temperature-corrected specific gravity of 1.260 to 1.290. However, a specific gravity of 1.235 or above is satisfactory for battery load testing and/or return to service.

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.**
- **IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.**

Before testing, visually inspect the battery for any damage (a cracked case or cover, loose posts, etc.) that would cause the battery to be faulty. Then remove the battery cell caps and check the electrolyte level. Add distilled water if the electrolyte level is below the top of the battery plates.

See the instructions provided by the manufacturer of the hydrometer for recommendations on the correct use of the hydrometer that you are using. Remove only enough electrolyte from the battery cell so that the float is off the bottom of the hydrometer barrel with pressure on the bulb released. To read the hydrometer correctly, hold it with the top surface of the electrolyte at eye level (Fig. 7).

CAUTION: Exercise care when inserting the tip of the hydrometer into a battery cell to avoid damaging the plate separators. Damaged plate separators can cause early battery failure.

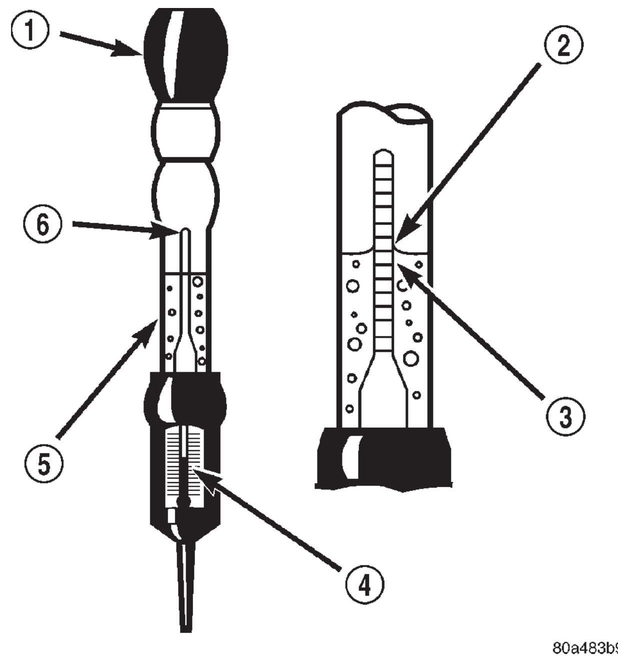


Fig. 7 Hydrometer - Typical

1 – BULB
2 – SURFACE COHESION
3 – SPECIFIC GRAVITY READING
4 – TEMPERATURE READING
5 – HYDROMETER BARREL
6 – FLOAT

Hydrometer floats are generally calibrated to indicate the specific gravity correctly only at 26.7° C (80° F). When testing the specific gravity at any other temperature, a correction factor is required. The correction factor is approximately a specific gravity value of 0.004, which may also be identified as four points of specific gravity. For each 5.5° C above 26.7° C (10° F above 80° F), add four points. For each 5.5° C below 26.7° C (10° F below 80° F), subtract four points. Always correct the specific gravity for temperature variation.

EXAMPLE: A battery is tested at -12.2° C (10° F) and has a specific gravity of 1.240. Determine the actual specific gravity as follows:

DIAGNOSIS AND TESTING (Continued)

(1) Determine the number of degrees above or below 26.7° C (80° F): **26.6° C - -12.2° C = 38.8° C (80° F - 10° F = 70° F)**

(2) Divide the result from Step 1 by 5.5° C (10° F): **38.8° C ÷ 5.5° C = 7 (70° F ÷ 10° F = 7)**

(3) Multiply the result from Step 2 by the temperature correction factor (0.004): **7 X 0.004 = 0.028**

(4) The temperature at testing was below 26.7° C (80° F); therefore, the temperature correction factor is subtracted: **1.240 - 0.028 = 1.212**

(5) The corrected specific gravity of the battery cell in this example is 1.212.

Test the specific gravity of the electrolyte in each battery cell. If the specific gravity of all cells is above 1.235, but the variation between cells is more than fifty points (0.050), the battery should be replaced. If the specific gravity of one or more cells is less than 1.235, charge the battery at a rate of approximately five amperes. Continue charging the battery until three consecutive specific gravity tests, taken at one-hour intervals, are constant. If the cell specific gravity variation is more than fifty points (0.050) at the end of the charge period, replace the battery.

When the specific gravity of all cells is above 1.235, and the cell variation is less than fifty points (0.050), the battery may be load tested to determine its cranking capacity. Refer to **Load Test** in this section for the proper battery load testing procedures.

OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the state-of-charge of a battery. This test can be used in place of the hydrometer test when a hydrometer is not available, or for maintenance-free batteries with non-removable cell caps.

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.**
- **IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.**

Before proceeding with this test, completely charge the battery. Refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures.

(1) Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps for fifteen seconds, then allow up to five minutes for the battery voltage to stabilize.

(2) Disconnect and isolate both battery cables, negative cable first.

(3) Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage (Fig. 8).

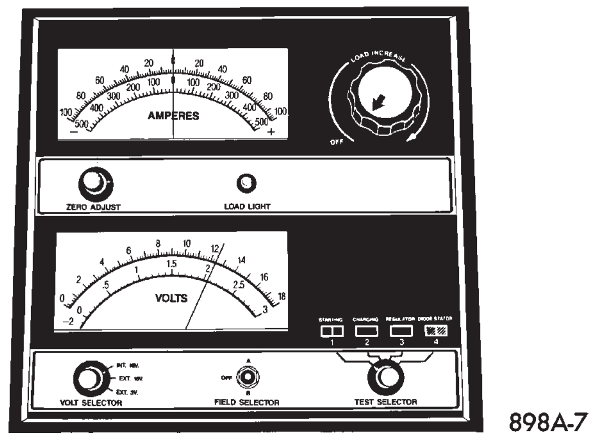


Fig. 8 Testing Open-Circuit Voltage - Typical

See the Open-Circuit Voltage chart. This voltage reading will indicate the battery state-of-charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be load tested to reveal its cranking capacity. Refer to **Load Test** in this section for the proper battery load testing procedures.

Open Circuit Voltage	
Open Circuit Volts	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	75%
12.6 volts or more	100%

LOAD TEST

A battery load test will verify the battery cranking capacity. This test is based on the Cold Cranking Amperage (CCA) rating of the battery. See the label

DIAGNOSIS AND TESTING (Continued)

affixed to the battery case, or refer to **Battery** in the index of this service manual for the location of the proper factory-installed battery specifications to determine the battery CCA rating.

WARNING:

• IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

• IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

Before proceeding with this test, completely charge the battery. Refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures.

(1) Disconnect and isolate both battery cables, negative cable first. The battery top and posts should be clean.

(2) Connect a suitable volt-ammeter-load tester (Fig. 9) to the battery posts (Fig. 10). See the instructions provided by the manufacturer of the tester you are using. Check the open-circuit voltage (no load) of the battery. Refer to **Open-Circuit Voltage Test** in this section for the proper battery open-circuit voltage testing procedures. The battery open-circuit voltage must be 12.4 volts or greater.

(3) Rotate the load control knob (carbon pile rheostat) to apply a 300 ampere load to the battery for fifteen seconds, then return the control knob to the Off position (Fig. 11). This will remove the surface charge from the battery.

(4) Allow the battery to stabilize to open-circuit voltage. It may take up to five minutes for the battery voltage to stabilize.

(5) Rotate the load control knob to maintain a load equal to 50% of the CCA rating of the battery (Fig. 12). After fifteen seconds, record the loaded voltage reading, then return the load control knob to the Off position.

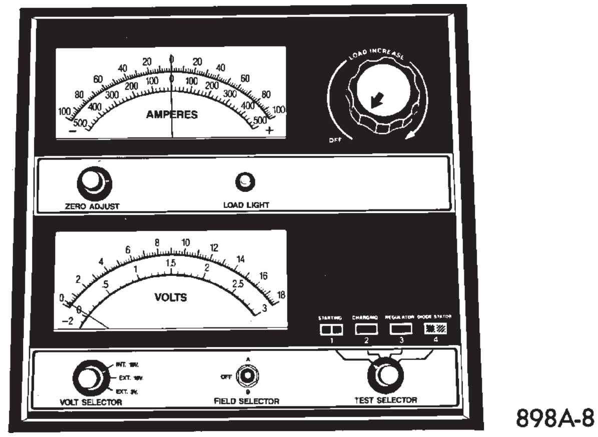


Fig. 9 Volt-Ammeter-Load Tester - Typical

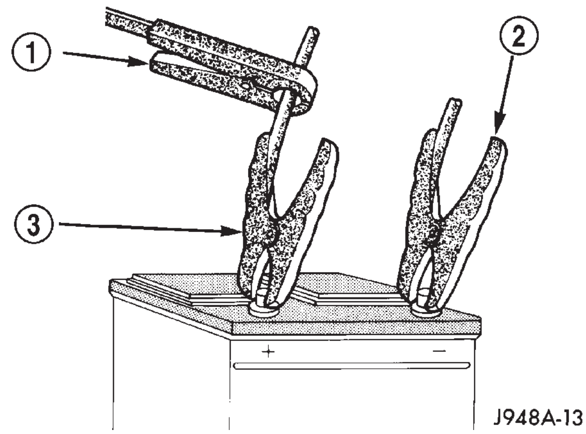


Fig. 10 Volt-Ammeter-Load Tester Connections - Typical

1 – INDUCTION AMMETER CLAMP
2 – NEGATIVE CLAMP
3 – POSITIVE CLAMP

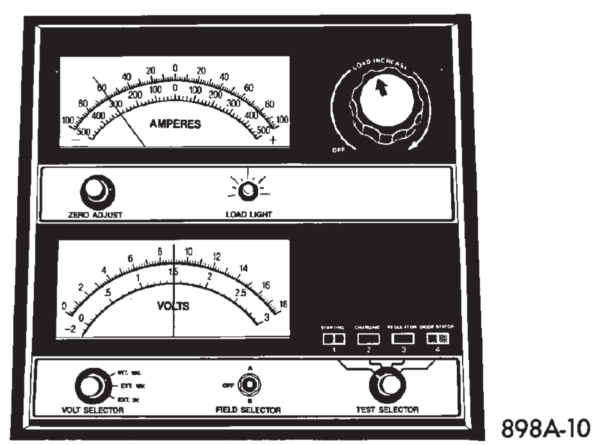


Fig. 11 Remove Surface Charge from Battery - Typical

DIAGNOSIS AND TESTING (Continued)

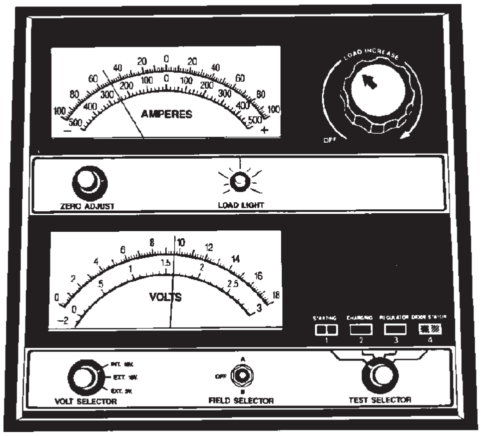


Fig. 12 Load 50% CCA Rating - Note Voltage - Typical

(6) The voltage drop will vary with the battery temperature at the time of the load test. The battery temperature can be estimated by using the ambient temperature during the past several hours. If the battery has been charged, boosted, or loaded a few minutes prior to the test, the battery will be somewhat warmer. See the Load Test Temperature chart for the proper loaded voltage reading.

Load Test Temperature		
Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

(7) If the voltmeter reading falls below 9.6 volts, at a minimum battery temperature of 21° C (70° F), the battery is faulty and must be replaced.

IGNITION-OFF DRAW TEST

The term Ignition-Off Draw (IOD) identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. A normal vehicle electrical system will draw from five to twenty-five milliamperes (0.005 to 0.025 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. The twenty-five milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), digital clock, electronically tuned radio, and other electronic modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the Junction Block (JB). This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on.
- Faulty or improperly adjusted switches.
- Faulty or shorted electronic modules and components.
- An internally shorted generator.
- Intermittent shorts in the wiring.

If the IOD is over twenty-five milliamperes, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

(1) Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes. See the Electronic Module Ignition-Off Draw table for more information.

ELECTRONIC MODULE IGNITION-OFF DRAW (IOD)			
MODULE	TIME OUT? (IF YES, INTERVAL AND WAKE-UP INPUT)	IOD	IOD AFTER TIME OUT
Radio	No	1 to 3 milliamperes	N/A
Audio Power Amplifier	No	up to 1 milliampere	N/A
Central Timer Module (CTM)	No	3.95 milliamperes	N/A

DIAGNOSIS AND TESTING (Continued)

ELECTRONIC MODULE IGNITION-OFF DRAW (IOD)			
MODULE	TIME OUT? (IF YES, INTERVAL AND WAKE-UP INPUT)	IOD	IOD AFTER TIME OUT
Powertrain Control Module (PCM)	No	0.96 milliampere	N/A
ElectroMechanical Instrument Cluster (EMIC)	No	0.42 milliampere	N/A
Combination Flasher	No	0.07 milliampere	N/A

(2) Determine that the under-hood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.

(3) Disconnect the battery negative cable.

(4) Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable terminal clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multi-meter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable terminal clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.

(5) After about three minutes, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Power Distribution Center (PDC), the Junction Block (JB) and the relay and fuse block one at a time (refer to **Power Distribution Center**, **Junction Block** and **Fuse/Fuse Block** in the index of this service manual for the location of complete PDC, JB and relay and fuse block fuse and circuit breaker identification contained in the wiring diagrams) until the amperage reading becomes very low, or nonexistent. This will isolate each circuit and identify the circuit that is the source of the high-amperage IOD. If the amperage reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, refer to **Charging System** in the index of this service manual for the location of the proper charging system diagnosis and testing procedures. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliampere scale of the multi-meter to check the low-amperage IOD.

CAUTION: Do not open any doors, or turn on any electrical accessories with the lowest milliampere scale selected, or the multi-meter may be damaged.

(6) Observe the multi-meter reading. The low-amperage IOD should not exceed twenty-five milliamperes (0.025 ampere). If the current draw exceeds twenty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in Step 5. The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

BATTERY CABLES

DIAGNOSIS

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cables. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

When performing the voltage drop test, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached. **EXAMPLE:** When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud,

DIAGNOSIS AND TESTING (Continued)

you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

TESTING

VOLTAGE DROP TEST

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.**
- **IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.**

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and load tested. Refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures. Refer to **Battery** in the index of this service manual for the location of the battery diagnosis and testing procedures, including the proper battery load test procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable terminal clamp (Fig. 13). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.

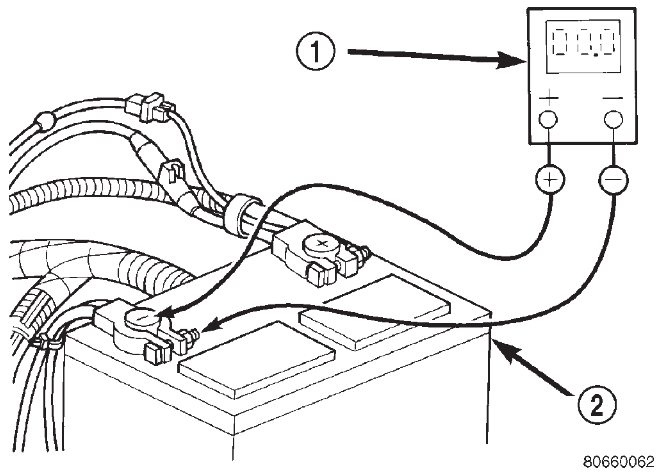


Fig. 13 Test Battery Negative Connection Resistance - Typical

1 – VOLTMETER
2 – BATTERY

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable terminal clamp (Fig. 14). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.

(3) Connect the voltmeter to measure between the battery positive cable terminal clamp and the starter solenoid B(+) terminal stud (Fig. 15). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

(4) Connect the voltmeter to measure between the battery negative cable terminal clamp and a good clean ground on the engine block (Fig. 16). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable eyelet terminal connection to the engine block.

DIAGNOSIS AND TESTING (Continued)

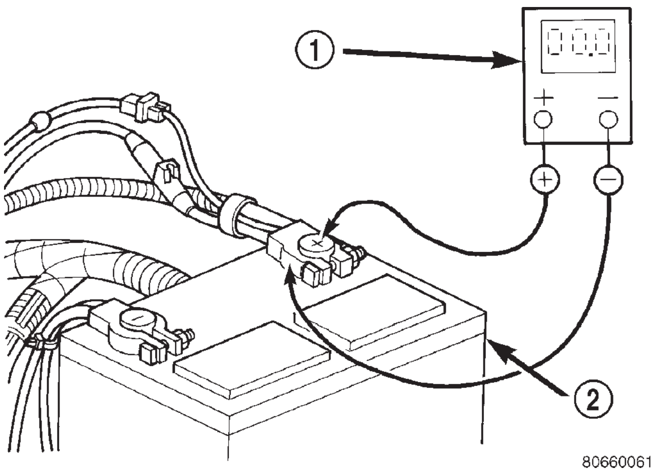


Fig. 14 Test Battery Positive Connection Resistance - Typical

1 – VOLTMETER
2 – BATTERY

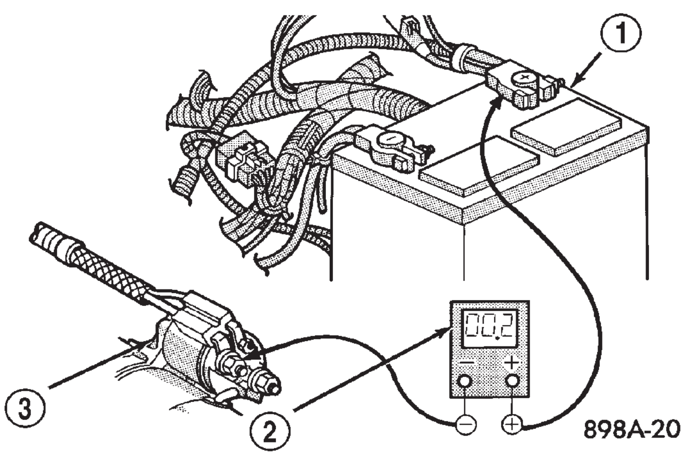


Fig. 15 Test Battery Positive Cable Resistance - Typical

1 – BATTERY
2 – VOLTMETER
3 – STARTER MOTOR

Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

SERVICE PROCEDURES

BATTERY CHARGING

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- All of the battery cells are gassing freely during battery charging.
- A green color is visible in the sight glass of the battery built-in test indicator.

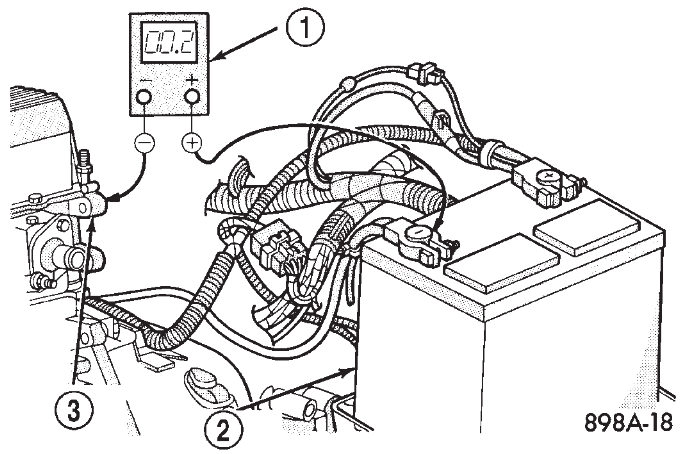


Fig. 16 Test Ground Circuit Resistance - Typical

1 – VOLTMETER
2 – BATTERY
3 – ENGINE GROUND

- Three hydrometer tests, taken at one-hour intervals, indicate no increase in the temperature-corrected specific gravity of the battery electrolyte.
- Open-circuit voltage of the battery is 12.4 volts or above.

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.**
- **IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.**

SERVICE PROCEDURES (Continued)

CAUTION:

- **Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.**
- **Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.**
- **The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.**

Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine the battery cranking capacity. Refer to **Battery** in the index of this service manual for the location of the battery diagnosis and testing procedures for more information on the proper battery load testing procedures. If the battery will endure a load test, return the battery to service. If the battery will not endure a load test, it is faulty and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing battery service. Refer to **Battery** in the index of this service manual for the location of the proper battery cleaning and inspection procedures.

CHARGING A COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless this procedure is properly followed, a good battery may be needlessly replaced.

(1) Measure the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt (Fig. 17). If the reading is below ten volts, the battery charging current will be low. It could take some time before the battery accepts a current greater than a few milliamperes. Such low current may not be detectable on the ammeters built into many battery chargers.

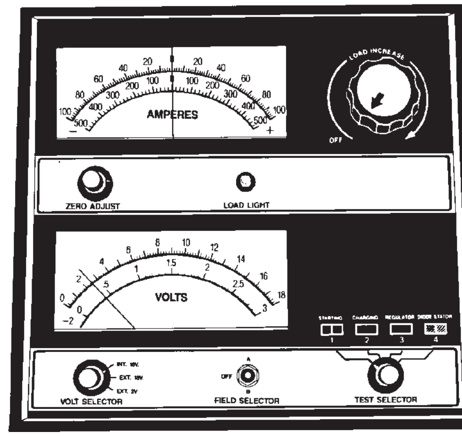


Fig. 17 Voltmeter Accurate to 1/10 Volt Connected - Typical

(2) Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the battery charger and the battery from being damaged if they are improperly connected. If the battery state-of-charge is too low for the polarity-sensing circuitry to detect, the battery charger will not operate. This makes it appear that the battery will not accept charging current. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

(3) Battery chargers vary in the amount of voltage and current they provide. The amount of time required for a battery to accept measurable charging current at various voltages is shown in the Charge Rate chart. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

Charge Rate	
Voltage	Hours
16.0 volts maximum	up to 4 hours
14.0 to 15.9 volts	up to 8 hours
13.9 volts or less	up to 16 hours

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- Battery Capacity

A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.

SERVICE PROCEDURES (Continued)

- Temperature

A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast battery charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).

- Charger Capacity

A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.

- State-Of-Charge

A completely discharged battery requires more charging time than a partially discharged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current (amperage) will be low. As the battery charges, the specific gravity of the electrolyte will gradually rise.

WARNING: NEVER EXCEED TWENTY AMPERES WHEN CHARGING A COLD (-1° C or 30° F) BATTERY. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

Battery Charging Timetable			
Charging Amperage	5 Amperes	10 Amperes	20 Amperes
Open Circuit Voltage	Hours Charging at 21° C (70° F)		
12.25 to 12.49	6 hours	3 hours	1.5 hours
12.00 to 12.24	10 hours	5 hours	2.5 hours
10.00 to 11.99	14 hours	7 hours	3.5 hours
*Below 10.00	18 hours	9 hours	4.5 hours
*Refer to Charging A Completely Discharged Battery			

REMOVAL AND INSTALLATION

BATTERY HOLD DOWNS

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(4) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(5) Remove the two hold down bolts that secure the hold down strap/battery thermoguard unit to the U-nuts in the battery tray (Fig. 18).

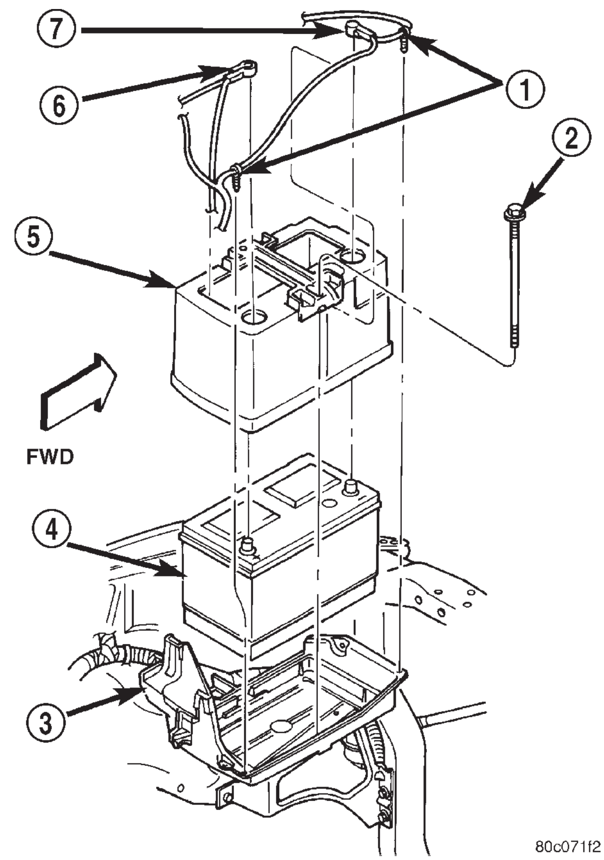


Fig. 18 Battery Hold Downs Remove/Install

1 – CLIPS
2 – BOLT
3 – TRAY
4 – BATTERY
5 – HOLD DOWN STRAP AND THERMOGUARD
6 – POSITIVE CABLE
7 – NEGATIVE CABLE

(6) Remove the hold down strap/battery thermoguard unit from the top of the battery case.

INSTALLATION

(1) Clean and inspect the battery hold down hardware. Refer to **Battery** in the index of this service manual for the location of the proper battery hold down hardware cleaning and inspection procedures.

(2) Install the hold down strap/battery thermoguard unit over the top of the battery case.

REMOVAL AND INSTALLATION (Continued)

(3) Install and tighten the two hold down bolts that secure the hold down strap/battery thermoguard unit to the U-nuts in the battery tray. Tighten the bolts to 2.1 N·m (19 in. lbs.).

(4) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 7.9 N·m (70 in. lbs.).

(5) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 7.9 N·m (70 in. lbs.).

BATTERY

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post (Fig. 19).

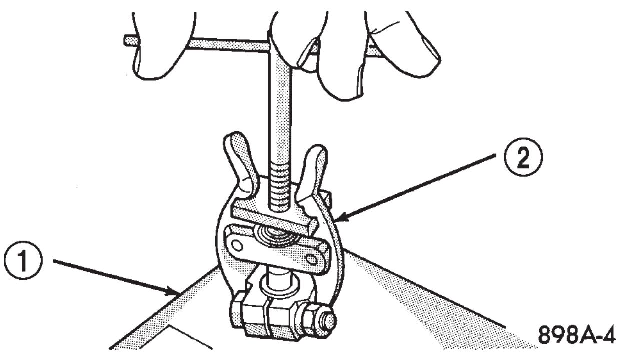


Fig. 19 Remove Battery Cable Terminal Clamp - Typical

1 – BATTERY
2 – BATTERY TERMINAL PULLER

(4) Loosen the battery positive cable terminal clamp pinch-bolt hex nut.

(5) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(6) Remove the battery hold downs from the battery. Refer to **Battery Hold Downs** in the index of this service manual for the location of the proper battery hold down removal procedures.

WARNING: WEAR A SUITABLE PAIR OF RUBBER GLOVES (NOT THE HOUSEHOLD TYPE) WHEN REMOVING A BATTERY BY HAND. SAFETY GLASSES SHOULD ALSO BE WORN. IF THE BATTERY IS CRACKED OR LEAKING, THE ELECTROLYTE CAN BURN THE SKIN AND EYES.

(7) Remove the battery from the battery tray.

INSTALLATION

(1) Clean and inspect the battery. Refer to **Battery** in the index of this service manual for the location of the proper battery cleaning and inspection procedures.

(2) Position the battery onto the battery tray. Ensure that the battery positive and negative terminal posts are correctly positioned. The battery cable terminal clamps must reach the correct battery terminal post without stretching the cables (Fig. 20).

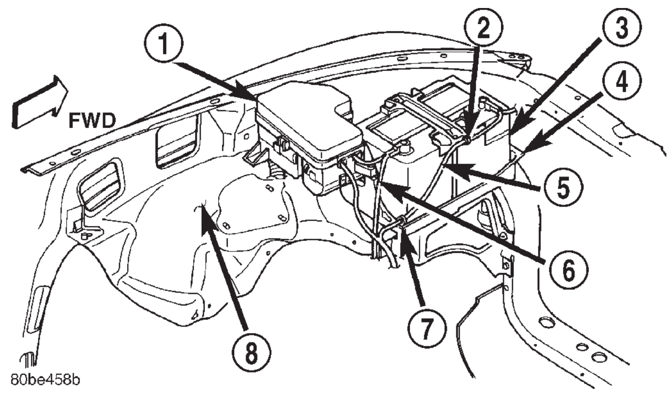


Fig. 20 Battery Cables

1 – POWER DISTRIBUTION CENTER
2 – CLIP
3 – BATTERY
4 – TRAY
5 – NEGATIVE CABLE
6 – POSITIVE CABLE
7 – CLIP
8 – WHEELHOUSE INNER PANEL

(3) Reinstall the battery hold downs onto the battery. Refer to **Battery Hold Downs** in the index of this service manual for the location of the proper battery hold down installation procedures.

CAUTION: Be certain that the battery cable terminal clamps are connected to the correct battery terminal posts. Reverse battery polarity may damage electrical components of the vehicle.

(4) Clean the battery cable terminal clamps and the battery terminal posts. Refer to **Battery** in the index of this service manual for the location of the proper battery cleaning and inspection procedures.

(5) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 7.9 N·m (70 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

(6) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 7.9 N·m (70 in. lbs.).

(7) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.

BATTERY TRAY

REMOVAL

(1) Remove the battery from the battery tray. Refer to **Battery** in the index of this service manual for the location of the proper battery removal procedures.

(2) Remove the Power Distribution Center (PDC) from the stanchions on the rear of the battery tray. Refer to **Power Distribution Center** in the index of this service manual for the location of the proper PDC removal procedures.

(3) Remove the two screws that secure the inboard side of the battery tray to the battery tray support (Fig. 21).

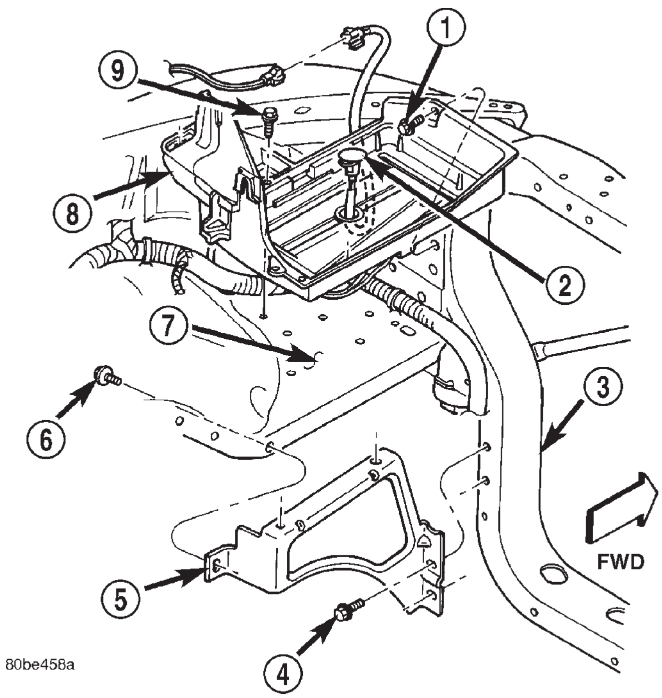


Fig. 21 Battery Tray Remove/Install

1 – SCREW
2 – SENSOR
3 – YOKE
4 – SCREW
5 – SUPPORT
6 – SCREW
7 – WHEELHOUSE INNER PANEL
8 – TRAY
9 – SCREW

(4) Remove the two screws that secure the outboard side of the battery tray to the front extension of the left front wheelhouse inner panel.

(5) Remove the one screw that secures the front of the battery tray to the front closure panel on the left side of the radiator yoke.

(6) Remove the battery temperature sensor from the battery tray. Refer to **Battery Temperature Sensor** in the index of this service manual for the location of the proper battery temperature sensor removal procedures.

(7) Remove the battery tray from the battery tray support and the front extension of the left front wheelhouse inner panel.

(8) Remove the one screw that secures the rear of the battery tray support to the front extension of the left front wheelhouse inner panel.

(9) Remove the two screws that secure the front of the battery tray support to the left side of the radiator yoke.

(10) Remove the battery tray support from the left front wheelhouse inner panel and the left side of the radiator yoke.

INSTALLATION

(1) Clean and inspect the battery tray. Refer to **Battery** in the index of this service manual for the location of the proper battery tray cleaning and inspection procedures.

(2) Position the battery tray support onto the left front wheelhouse inner panel and the left side of the radiator yoke.

(3) Install and tighten the two screws that secure the battery tray support to the left side of the radiator yoke. Tighten the screws to 11.3 N·m (100 in. lbs.).

(4) Install and tighten the one screw that secures the rear of the battery tray support to the front extension of the left front wheelhouse inner panel. Tighten the screw to 11.3 N·m (100 in. lbs.).

(5) Install the battery temperature sensor onto the battery tray. Refer to **Battery Temperature Sensor** in the index of this service manual for the location of the proper battery temperature sensor installation procedures.

(6) Position the battery tray onto the battery tray support and the front extension of the left front wheelhouse inner panel. Be certain that the battery temperature sensor wiring is properly routed.

(7) Install and tighten the two screws (rear screw first) that secure the outboard side of the battery tray to the front extension of the left front wheelhouse inner panel. Tighten the screws to 12.4 N·m (110 in. lbs.).

(8) Install and tighten the two screws that secure the inboard side of the battery tray to the battery

REMOVAL AND INSTALLATION (Continued)

tray support. Tighten the screws to 12.4 N·m (110 in. lbs.).

(9) Install and tighten the one screw that secures the front of the battery tray to the front closure panel on the left side of the radiator yoke. Tighten the screw to 12.4 N·m (110 in. lbs.).

(10) Install the Power Distribution Center (PDC) onto the stanchions on the rear of the battery tray. Refer to **Power Distribution Center** in the index of this service manual for the location of the proper PDC installation procedures.

(11) Install the battery onto the battery tray. Refer to **Battery** in the index of this service manual for the location of the proper battery installation procedures.

CLEANING AND INSPECTION

BATTERY

The following information details the recommended cleaning and inspection procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

CLEANING

(1) Clean the battery cable terminal clamps of all corrosion. Remove any corrosion using a wire brush or a post and terminal cleaning tool, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 22).

(2) Clean the battery tray and battery hold down hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal.

(3) If the removed battery is to be reinstalled, clean the outside of the battery case and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film (Fig. 23). Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes. If the battery is being replaced, refer to **Battery** in the index of this service manual for the location of the factory-installed battery specifications. Confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.

(4) Clean the battery thermoguard with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film.

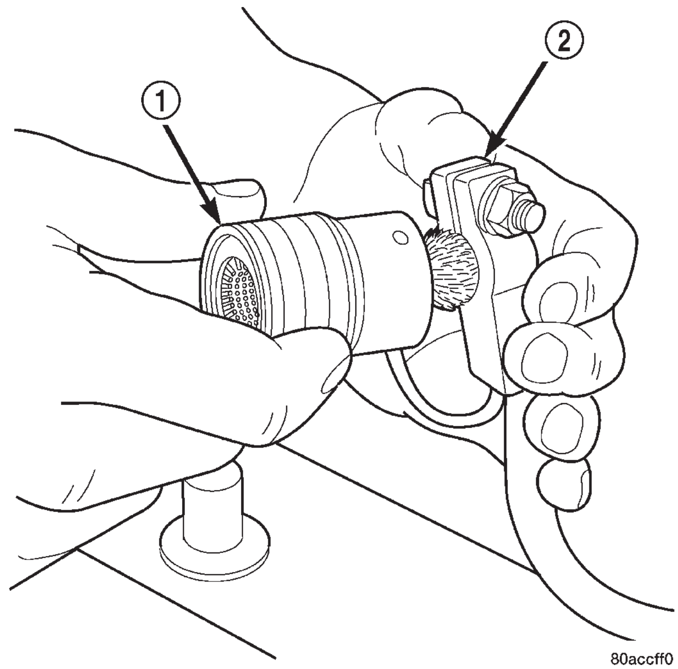


Fig. 22 Clean Battery Cable Terminal Clamp - Typical

1 – TERMINAL BRUSH
2 – BATTERY CABLE

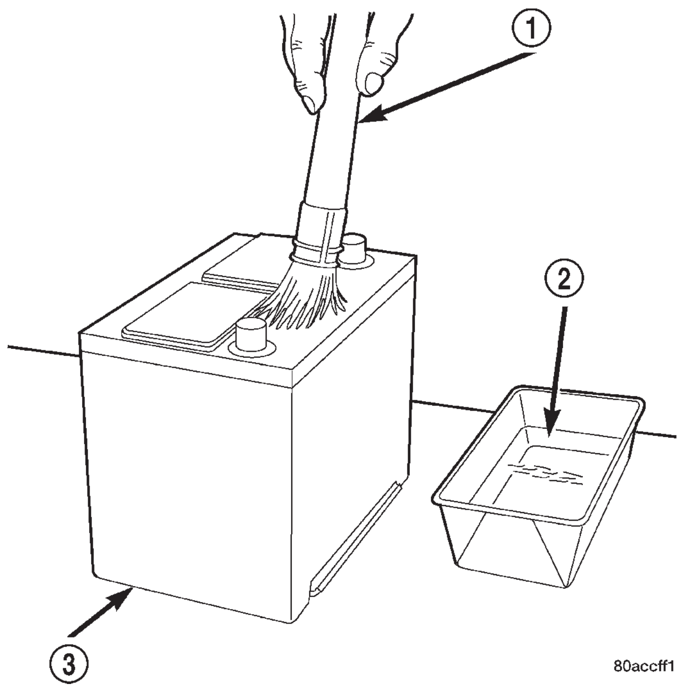


Fig. 23 Clean Battery - Typical

1 – CLEANING BRUSH
2 – WARM WATER AND BAKING SODA SOLUTION
3 – BATTERY

(5) Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal

CLEANING AND INSPECTION (Continued)

cleaner, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 24).

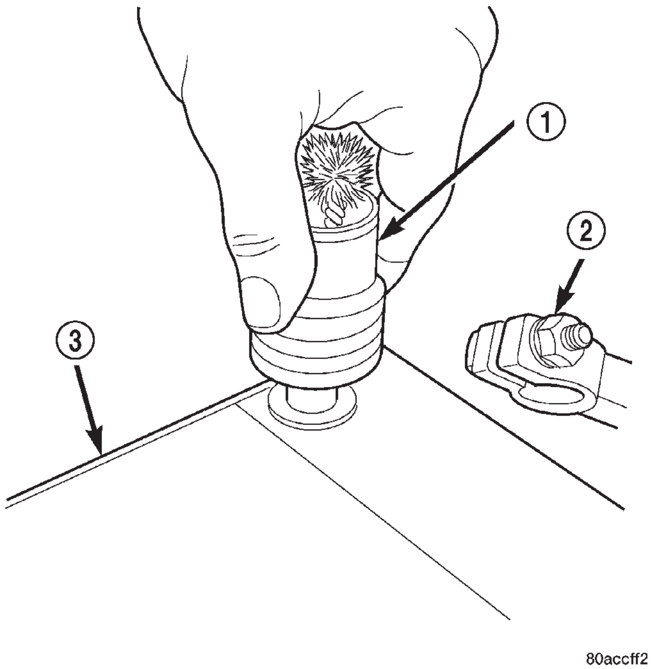


Fig. 24 Clean Battery Terminal Post - Typical

1 – TERMINAL BRUSH
2 – BATTERY CABLE
3 – BATTERY

INSPECTION

(1) Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.

(2) Inspect the battery tray and battery hold down hardware for damage. Replace any damaged parts.

(3) Remove the thermoguard from the battery case. Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.

(4) Inspect the battery thermoguard for cracks, deformation or other damage. Replace any battery thermoguard that has been damaged.

(5) Inspect the battery built-in test indicator sight glass for an indication of the battery condition. If the battery is discharged, charge as required. Refer to **Battery** in the index of this service manual for the location of the proper battery diagnosis and testing procedures for more information on the use of the battery built-in test indicator. Also refer to **Battery Charging** in the index of this service manual for the location of the proper battery charging procedures.

SPECIFICATIONS

BATTERY

Battery Classifications and Ratings					
Part Number	BCI Group Size Classification	Cold Cranking Amperage	Reserve Capacity	Ampere-Hours	Load Test Amperage
56027100	27	600	120 Minutes	66	300
56027302	27	750	150 Minutes	75	375

STARTING SYSTEMS

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
STARTING SYSTEM	1
STARTER MOTOR	2
STARTER RELAY	3
DIAGNOSIS AND TESTING	
STARTING SYSTEM	3
STARTER MOTOR	8
STARTER RELAY	8
REMOVAL AND INSTALLATION	
STARTER MOTOR	10
STARTER RELAY	12
SPECIFICATIONS	
STARTING SYSTEM	13

DESCRIPTION AND OPERATION

STARTING SYSTEM

DESCRIPTION

An electrically operated engine starting system is standard factory-installed equipment on this model. The starting system is designed to provide the vehicle operator with a convenient, efficient and reliable means of cranking and starting the internal combustion engine used to power the vehicle and all of its accessory systems from within the safe and secure confines of the passenger compartment. See the owner's manual in the vehicle glove box for more information and instructions on the recommended use and operation of the factory-installed starting system.

The starting system consists of the following components:

- Battery
- Starter relay
- Starter motor (including an integral starter solenoid)
- Ignition switch
- Clutch pedal position switch (manual transmission)
- Park/neutral position switch (automatic transmission)
- Wire harnesses and connections (including the battery cables).

This group provides complete service information for the starter motor and the starter relay. Complete service information for the other starting system components can be located as follows:

- Refer to **Battery** in the proper section of Group 8A - Battery for complete service information for the battery.
- Refer to **Ignition Switch and Key Lock Cylinder** in the proper section of Group 8D - Ignition System for complete service information for the ignition switch.
- Refer to **Clutch Pedal Position Switch** in the proper section of Group 6 - Clutch for complete service information for the clutch pedal position switch.
- Refer to **Park/Neutral Position Switch** in the proper section of Group 21 - Transmission for complete service information for the park/neutral position switch.
- Refer to the proper section of **Group 8W - Wiring Diagrams** for complete service information and circuit diagrams for the starting system wiring components.

Group 8A covers the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The battery, starting, and charging systems in the vehicle operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components that are used in these systems must perform within specifications.

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor between 150 and 350 amperes, and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor. The low-amperage control circuit components include the ignition switch, the clutch pedal position switch (manual transmission), the park/neutral position switch (automatic transmission), the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

If the vehicle is equipped with a manual transmission, it has a clutch pedal position switch installed in series between the ignition switch and the coil battery terminal of the starter relay. This normally open switch prevents the starter relay from being energized when the ignition switch is turned to the momentary Start position, unless the clutch pedal is depressed. This feature prevents starter motor operation while the clutch disc and the flywheel are engaged. The starter relay coil ground terminal is always grounded on vehicles with a manual transmission.

If the vehicle is equipped with an automatic transmission, battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the momentary Start position. The park/ neutral position switch is installed in series between the starter relay coil ground terminal and ground. This normally open switch prevents the starter relay from being energized and the starter motor from operating unless the automatic transmission gear selector is in the Neutral or Park positions.

When the starter relay coil is energized, the normally open relay contacts close. The relay contacts connect the relay common feed terminal to the relay normally open terminal. The closed relay contacts energize the starter solenoid coil windings.

The energized solenoid pull-in coil pulls in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter motor. This engages the starter overrunning clutch and pinion gear with the starter ring gear on the manual transmission flywheel or on the automatic transmission torque converter or torque converter drive plate.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit and energizes the solenoid plunger hold-in coil. Current now flows between the solenoid battery terminal and the starter motor, energizing the starter.

Once the engine starts, the overrunning clutch protects the starter motor from damage by allowing the starter pinion gear to spin faster than the pinion shaft. When the driver releases the ignition switch to the On position, the starter relay coil is de-energized. This causes the relay contacts to open. When the relay contacts open, the starter solenoid plunger hold-in coil is de-energized.

When the solenoid plunger hold-in coil is de-energized, the solenoid plunger return spring returns the plunger to its relaxed position. This causes the contact disc to open the starter feed circuit, and the shift lever to disengage the overrunning clutch and pinion gear from the starter ring gear.

Following are general descriptions of the major components in the starting system.

STARTER MOTOR

DESCRIPTION

The starter motors used for all 2.5L engines and the 4.7L engines with an automatic transmission available in this model are not interchangeable with the starter motors used for the other available engines or with each other. The starter motors used for all 3.9L engines, 5.9L engines and the 4.7L engines with a manual transmission available in this model are interchangeable.

The 2.5L starter motor is mounted with two screws to the manual transmission clutch housing on the right side of the engine. The 4.7L automatic transmission starter motor is mounted with two screws to the automatic transmission torque converter housing on the left side of the engine. The starter motors for all of the remaining engine and transmission combinations are mounted with one screw, a stud and a nut to the manual transmission clutch housing or automatic transmission torque converter housing and are located on the left side of the engine.

Each of these starter motors incorporates several of the same features to create a reliable, efficient, compact, lightweight and powerful unit. The electric motors of both starters have four brushes contacting the motor commutator. The 2.5L starter motor uses four permanent magnets for the field poles, while the other starter motors feature four electromagnetic field coils wound around four pole shoes. The 2.5L starter motor is rated at 1.2 kilowatts (about 1.6 horsepower) output at 12 volts, while the other starter motor is rated at 1.4 kilowatts (about 1.9 horsepower) output at 12 volts.

These starter motors are serviced only as a unit with their starter solenoids, and cannot be repaired. If either component is faulty or damaged, the entire starter motor and starter solenoid unit must be replaced.

DESCRIPTION AND OPERATION (Continued)

OPERATION

These starter motors are equipped with a gear reduction (intermediate transmission) system. The gear reduction system consists of a gear that is integral to the output end of the electric motor armature shaft that is in continual engagement with a larger gear that is splined to the input end of the starter pinion gear shaft. This feature makes it possible to reduce the dimensions of the starter. At the same time, it allows higher armature rotational speed and delivers increased torque through the starter pinion gear to the starter ring gear.

The starter motors for all engines are activated by an integral heavy duty starter solenoid switch mounted to the overrunning clutch housing. This electromechanical switch connects and disconnects the feed of battery voltage to the starter motor and actuates a shift fork that engages and disengages the starter pinion gear with the starter ring gear.

These starter motors use an overrunning clutch and starter pinion gear unit to engage and drive a starter ring gear that is integral to the flywheel (manual transmission), torque converter or torque converter drive plate (automatic transmission) mounted on the rear crankshaft flange.

STARTER RELAY

DESCRIPTION

The starter relay is an electromechanical device that switches battery current to the pull-in coil of the starter solenoid when the ignition switch is turned to the Start position. The starter relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for starter relay identification and location.

The starter relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The starter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING

STARTING SYSTEM

DIAGNOSIS

The battery, starting, and charging systems operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components involved in these systems must perform within specifications.

Group 8A covers the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

DIAGNOSIS AND TESTING (Continued)

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO OPERATE.	1. Battery discharged or faulty. 2. Starting circuit wiring faulty. 3. Starter relay faulty. 4. Ignition switch faulty. 5. Clutch pedal position switch faulty. 6. Park/Neutral position switch faulty or misadjusted. 7. Starter solenoid faulty. 8. Starter motor faulty.	1. Refer to Battery in the Diagnosis and Testing section of Group 8A - Battery. Charge or replace the battery, if required. 2. Refer to Starting System in Group 8W - Wiring Diagrams. Test and repair the starter feed and/or control circuits, if required. 3. Refer to Starter Relay in the Diagnosis and Testing section of this group. Replace the starter relay, if required. 4. Refer to Ignition Switch and Key Lock Cylinder in the Diagnosis and Testing section of Group 8D - Ignition System. Replace the ignition switch, if required. 5. Refer to Clutch Pedal Position Switch in the Diagnosis and Testing section of Group 6 - Clutch. 6. Refer to Park/Neutral Position Switch in the Diagnosis and Testing section of Group 21 - Transmission. Replace the park/neutral position switch, if required. 7. Refer to Starter Motor in the Diagnosis and Testing section of this group. Replace the starter motor assembly, if required. 8. If all other starting system components and circuits test OK, replace the starter motor assembly.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty. 2. Starting circuit wiring faulty. 3. Starter motor faulty. 4. Engine seized.	1. Refer to Battery in the Diagnosis and Testing section of Group 8A - Battery. Charge or replace the battery, if required. 2. Refer to Starting System in Group 8W - Wiring Diagrams. Test and repair the starter feed and/or control circuits, if required. 3. If all other starting system components and circuits test OK, replace the starter motor assembly. 4. Refer to Engine Diagnosis in the Diagnosis and Testing section of Group 9 - Engine.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Starter ring gear faulty. 2. Starter motor faulty.	1. Refer to Starter Motor in the Removal and Installation section of this group. Remove the starter motor to inspect the starter ring gear. Replace the starter ring gear, if required. 2. If all other starting system components and circuits test OK, replace the starter motor assembly.
STARTER DOES NOT DISENGAGE.	1. Starter motor improperly installed. 2. Starter relay faulty. 3. Ignition switch faulty. 4. Starter motor faulty.	1. Refer to Starter Motor in the Removal and Installation section of this group. Tighten the starter mounting hardware to the correct tightness specifications. 2. Refer to Starter Relay in the Diagnosis and Testing section of this group. Replace the starter relay, if required. 3. Refer to Ignition Switch and Key Lock Cylinder in the Diagnosis and Testing section of Group 8D - Ignition System. Replace the ignition switch, if required. 4. If all other starting system components and circuits test OK, replace the starter motor assembly.

DIAGNOSIS AND TESTING (Continued)

INSPECTION

For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams. Before removing any unit from the starting system for repair or diagnosis, perform the following inspections:

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **Battery** - Visually inspect the battery for indications of physical damage and loose or corroded cable connections. Determine the state-of-charge and cranking capacity of the battery. Charge or replace the battery, if required. Refer to **Battery** in the proper section of Group 8A - Battery for complete service information for the battery.
- **Ignition Switch** - Visually inspect the ignition switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Ignition Switch and Key Lock Cylinder** in the proper section of Group 8D - Ignition System for complete service information for the ignition switch.
- **Clutch Pedal Position Switch** - If the vehicle is equipped with a manual transmission, visually inspect the clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Clutch Pedal Position Switch** in the proper section of Group 6 - Clutch for complete service information for the clutch pedal position switch.
- **Park/Neutral Position Switch** - If the vehicle is equipped with an automatic transmission, visually inspect the park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Park/Neutral Position Switch** in the proper section of Group 21 - Transmission for complete service information for the park/neutral position switch.
- **Starter Relay** - Visually inspect the starter relay for indications of physical damage and loose or corroded wire harness connections.
- **Starter Motor** - Visually inspect the starter motor for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect the starter solenoid for indications of physical damage and loose or corroded wire harness connections.
- **Wiring** - Visually inspect the wire harnesses for damage. Repair or replace any faulty wiring, as required. Refer to the proper section of **Group 8W - Wiring Diagrams** for complete service information and circuit diagrams for the starting system wiring components.

TESTING

COLD CRANKING TEST

For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams. The battery must be fully-charged and load-tested before proceeding. Refer to **Battery** in the Diagnosis and Testing section of Group 8A - Battery for the procedures.

(1) Connect a suitable volt-ampere tester to the battery terminals (Fig. 1). See the instructions provided by the manufacturer of the volt-ampere tester being used.

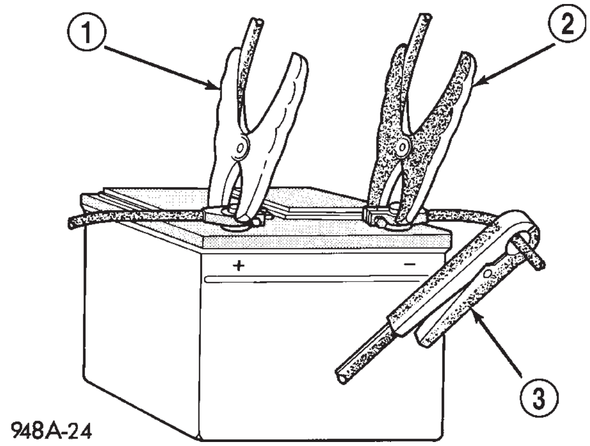


Fig. 1 Volts-Amps Tester Connections - Typical

1 – POSITIVE CLAMP
2 – NEGATIVE CLAMP
3 – INDUCTION AMMETER CLAMP

(2) Fully engage the parking brake.

(3) If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position. If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position.

(4) Verify that all lamps and accessories are turned off.

(5) To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(6) Rotate and hold the ignition switch in the Start position. Note the cranking voltage and current (amperage) draw readings shown on the volt-ampere tester.

DIAGNOSIS AND TESTING (Continued)

(a) If the voltage reads below 9.6 volts, refer to **Starter Motor** in the Diagnosis and Testing section of this group. If the starter motor is OK, refer to **Engine Diagnosis** in the Diagnosis and Testing section of Group 9 - Engine for further testing of the engine. If the starter motor is not OK, replace the faulty starter motor.

(b) If the voltage reads above 9.6 volts and the current (amperage) draw reads below specifications, refer to **Feed Circuit Test** in this section.

(c) If the voltage reads 12.5 volts or greater and the starter motor does not turn, refer to **Control Circuit Testing** in this section.

(d) If the voltage reads 12.5 volts or greater and the starter motor turns very slowly, refer to **Feed Circuit Test** in this section.

NOTE: A cold engine will increase the starter current (amperage) draw reading, and reduce the battery voltage reading.

FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in the high-amperage feed circuit. For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams.

When performing these tests, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached.

Example: When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable clamp and the cable connector at the starter solenoid. If you probe the battery positive terminal post and the cable connector at the starter solenoid, you are reading the combined voltage drop in the battery positive cable clamp-to-terminal post connection and the battery positive cable.

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing the tests, be certain that the following procedures are accomplished:

- Battery is fully-charged and load-tested. Refer to **Battery** in the Diagnosis and Testing section of Group 8A - Battery for the procedures.
- Fully engage the parking brake.
- If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and block the clutch pedal in the fully depressed position. If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable clamp (Fig. 2). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

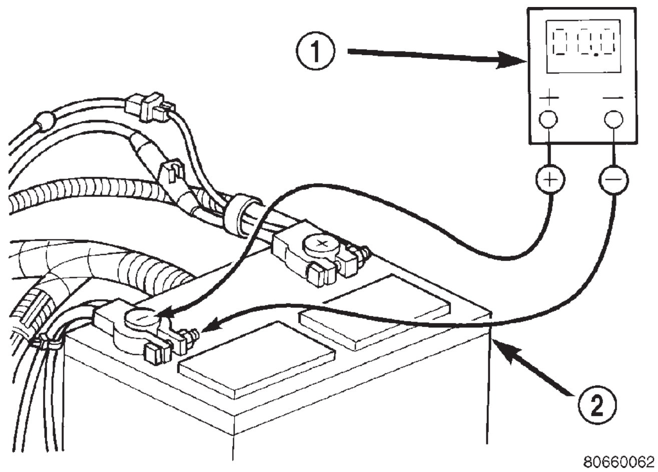


Fig. 2 Test Battery Negative Connection Resistance - Typical

1 – VOLTMETER
2 – BATTERY

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable clamp (Fig. 3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

(3) Connect the voltmeter to measure between the battery positive terminal post and the starter solenoid battery terminal stud (Fig. 4). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery cable connection at the solenoid. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

(4) Connect the voltmeter to measure between the battery negative terminal post and a good clean ground on the engine block (Fig. 5). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable attachment on the engine block. Repeat the test. If the reading is still

DIAGNOSIS AND TESTING (Continued)

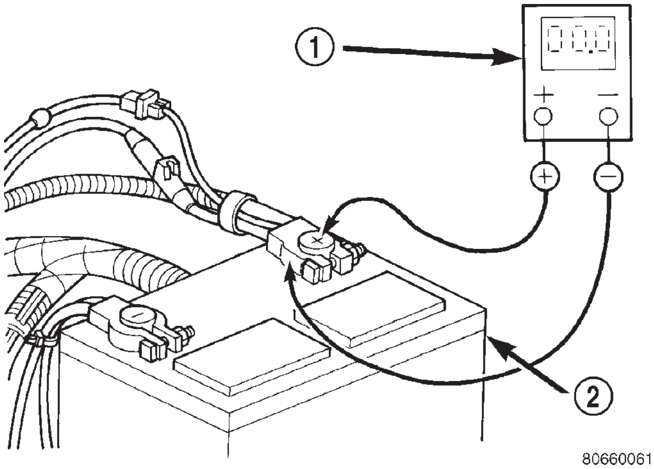


Fig. 3 Test Battery Positive Connection Resistance - Typical

1 – VOLTMETER
2 – BATTERY

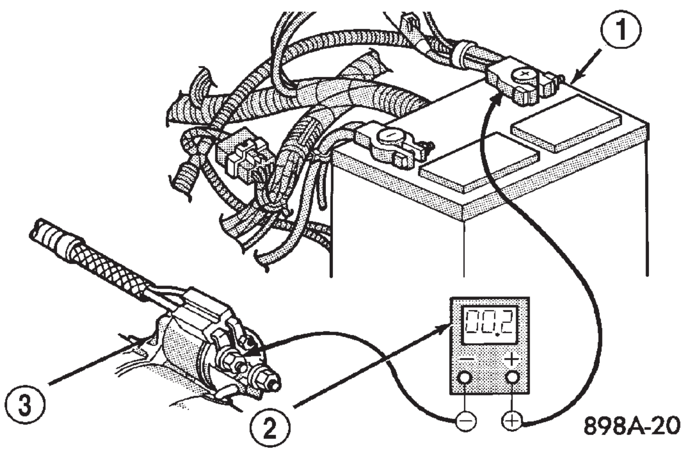


Fig. 4 Test Battery Positive Cable Resistance - Typical

1 – BATTERY
2 – VOLTMETER
3 – STARTER MOTOR

above 0.2 volt, replace the faulty battery negative cable.

(5) Connect the positive lead of the voltmeter to the starter housing. Connect the negative lead of the voltmeter to the battery negative terminal post (Fig. 6). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, correct the poor starter to engine block ground contact.

If the resistance tests detect no feed circuit problems, refer to **Starter Motor** in the Diagnosis and Testing section of this group.

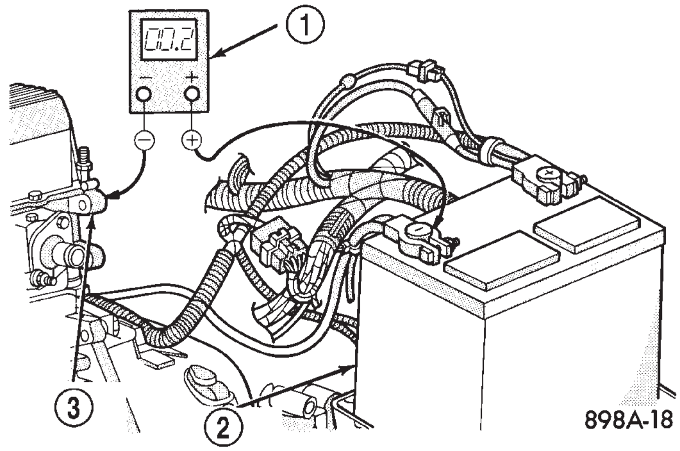


Fig. 5 Test Ground Circuit Resistance - Typical

1 – VOLTMETER
2 – BATTERY
3 – ENGINE GROUND

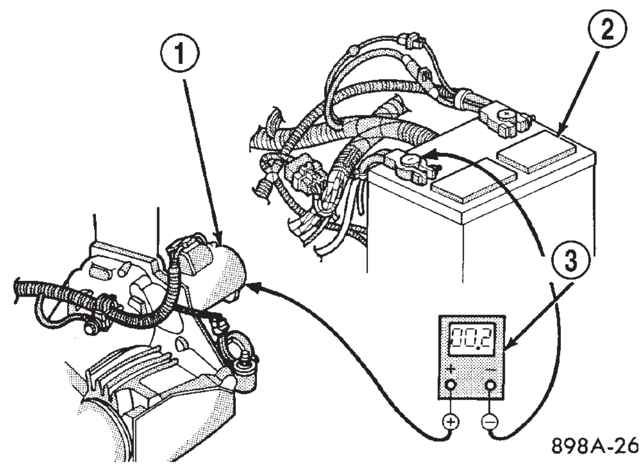


Fig. 6 Test Starter Ground - Typical

1 – STARTER MOTOR
2 – BATTERY
3 – VOLTMETER

CONTROL CIRCUIT TESTING

The starter control circuit components should be tested in the order in which they are listed, as follows:

- **Starter Relay** - Refer to **Starter Relay** in the Diagnosis and Testing section of this group for the procedures.
- **Starter Solenoid** - Refer to **Starter Motor** in the Diagnosis and Testing section of this group for the procedures.
- **Ignition Switch** - Refer to **Ignition Switch and Key Lock Cylinder** in the Diagnosis and Testing section of Group 8D - Ignition System for the procedures.

DIAGNOSIS AND TESTING (Continued)

- **Clutch Pedal Position Switch -** If the vehicle is equipped with a manual transmission, refer to **Clutch Pedal Position Switch** in the Diagnosis and Testing section of Group 6 - Clutch for the procedures.
- **Park/Neutral Position Switch -** If the vehicle is equipped with an automatic transmission, refer to **Park/Neutral Position Switch** in the Diagnosis and Testing section of Group 21 - Transmission for the procedures.
- **Wire harnesses and connections** - Refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

STARTER MOTOR

Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with the starter motor removed from the vehicle. Refer to **Starting System** in the Specifications section of this group for the starter motor specifications.

(1) Remove the starter motor from the vehicle. Refer to **Starter Motor** in the Removal and Installation section of this group for the procedures.

(2) Mount the starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on the mounting flange of the starter motor. Never clamp on the starter motor by the field frame.

(3) Connect a suitable volt-ampere tester and a 12-volt battery to the starter motor in series, and set the ammeter to the 100 ampere scale. See the instructions provided by the manufacturer of the volt-ampere tester being used.

(4) Install a jumper wire from the solenoid terminal to the solenoid battery terminal. The starter motor should operate. If the starter motor fails to operate, replace the faulty starter motor assembly.

(5) Adjust the carbon pile load of the tester to obtain the free running test voltage. Refer to **Starting System** in the Specifications section of this group for the starter motor free running test voltage specifications.

(6) Note the reading on the ammeter and compare this reading to the free running test maximum amperage draw. Refer to **Starting System** in the Specifications section of this group for the starter motor free running test maximum amperage draw specifications.

(7) If the ammeter reading exceeds the maximum amperage draw specification, replace the faulty starter motor assembly.

STARTER SOLENOID

This test can only be performed with the starter motor removed from the vehicle.

(1) Remove the starter motor from the vehicle. Refer to **Starter Motor** in the Removal and Installation section of this group for the procedures.

(2) Disconnect the wire from the solenoid field coil terminal.

(3) Check for continuity between the solenoid terminal and the solenoid field coil terminal with a continuity tester (Fig. 7) or (Fig. 8). There should be continuity. If OK, go to Step 4. If not OK, replace the faulty starter motor assembly.

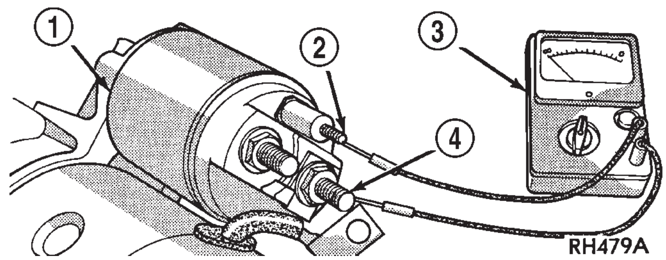


Fig. 7 Continuity Test Between Solenoid Terminal and Field Coil Terminal - 2.5L Engine - Typical

1 – SOLENOID
2 – SOLENOID TERMINAL
3 – OHMMETER
4 – FIELD COIL TERMINAL

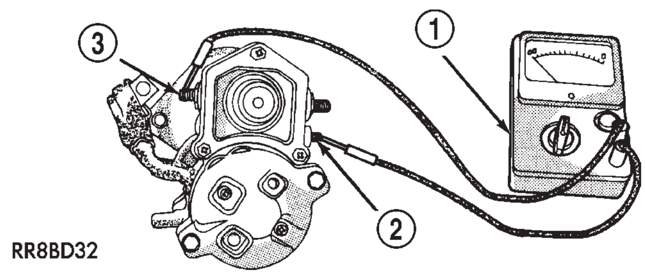


Fig. 8 Continuity Test Between Solenoid Terminal and Field Coil Terminal - 3.9L, 4.7L, 5.9L Engine - Typical

1 – OHMMETER
2 – SOLENOID TERMINAL
3 – FIELD COIL TERMINAL

(4) Check for continuity between the solenoid terminal and the solenoid case (Fig. 9) or (Fig. 10). There should be continuity. If not OK, replace the faulty starter motor assembly.

STARTER RELAY

The starter relay (Fig. 11) is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for starter relay identification and location. Refer to **Starting System** in the index of this service manual for the location of complete starting system wiring diagrams.

DIAGNOSIS AND TESTING (Continued)

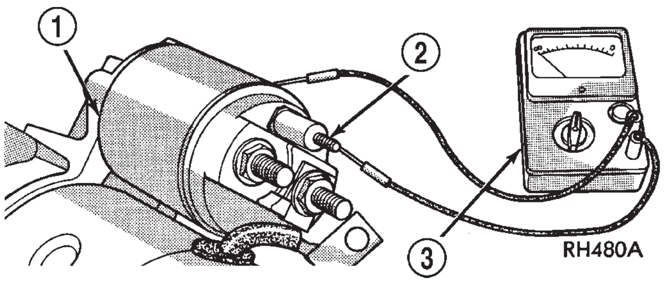


Fig. 9 Continuity Test Between Solenoid Terminal and Solenoid Case - 2.5L Engine - Typical

1 – SOLENOID
2 – SOLENOID TERMINAL
3 – OHMMETER

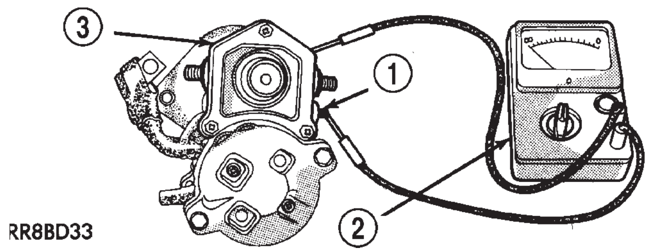


Fig. 10 Continuity Test Between Solenoid Terminal and Solenoid Case - 3.9L, 4.7L, 5.9L Engine - Typical

1 – SOLENOID TERMINAL
2 – OHMMETER
3 – SOLENOID

RELAY TEST

(1) Remove the starter relay from the PDC. Refer to **Starter Relay** in the index of this service manual for the location of the proper starter relay removal and installation procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

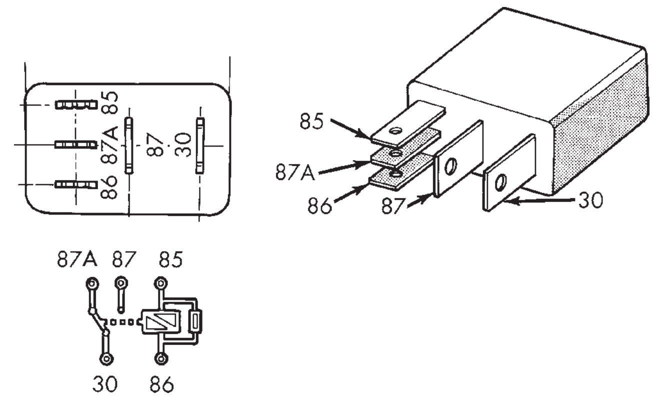
(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fused B(+) fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.



TERMINAL LEGEND	
NUMBER	**IDENTIFICATION**
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 11 Starter Relay

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the starter solenoid field coil. There should be continuity between the cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair the open engine starter motor relay output circuit to the starter solenoid as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is held in the Start position. On vehicles with a manual transmission, the clutch pedal must be blocked in the fully depressed position for this test. Check for battery voltage at the cavity for relay terminal 86 with the ignition switch in the Start position, and no voltage when the ignition switch is released to the On position. If OK, go to Step 5. If not OK with a manual transmission, disconnect the clutch pedal position switch wire harness connector and install a jumper wire between the two cavities in the body half of the connector and check for battery voltage again at the cavity for relay terminal 86. If now OK, replace the faulty clutch pedal position switch. If still not OK with a manual transmission or if not OK with an automatic transmission, check for an open or shorted fused ignition switch output (start) circuit to the ignition switch and repair, as required. If the fused ignition switch output (start) circuit is OK, refer to **Ignition Switch and Key Lock Cylinder** in the index of this service manual for the location of the proper ignition switch diagnosis and testing procedures.

DIAGNOSIS AND TESTING (Continued)

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. On vehicles with a manual transmission, it is grounded at all times. On vehicles with an automatic transmission, it is grounded through the park/neutral position switch only when the gearshift selector lever is in the Park or Neutral positions. Check for continuity to ground at the cavity for relay terminal 85. If not OK with a manual transmission, repair the open park/neutral position switch sense circuit to ground as required. If not OK with an automatic transmission, check for an open or shorted park/neutral position switch sense circuit to the park/neutral position switch and repair, as required. If the park/neutral position switch sense circuit checks OK, refer to **Park/Neutral Position Switch** in the index of this service manual for the location of the proper park/neutral position switch diagnosis and testing procedures.

REMOVAL AND INSTALLATION

STARTER MOTOR

REMOVAL

2.5L ENGINE

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the screw and washer (forward facing) that secures the lower mounting flange of the starter motor to the manual transmission clutch housing (Fig. 12).

(4) While supporting the starter motor with one hand, use the other hand to remove the screw and washer (rearward facing) that secures the upper mounting flange of the starter motor to the manual transmission clutch housing.

(5) Lower the starter motor from the front of the manual transmission clutch housing far enough to access and remove the nut that secures the battery positive cable eyelet terminal to the starter solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(6) Remove the battery positive cable eyelet terminal from the solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(7) Disconnect the battery positive cable solenoid terminal wire harness connector from the connector receptacle on the starter solenoid. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(8) Remove the starter motor from the manual transmission clutch housing.

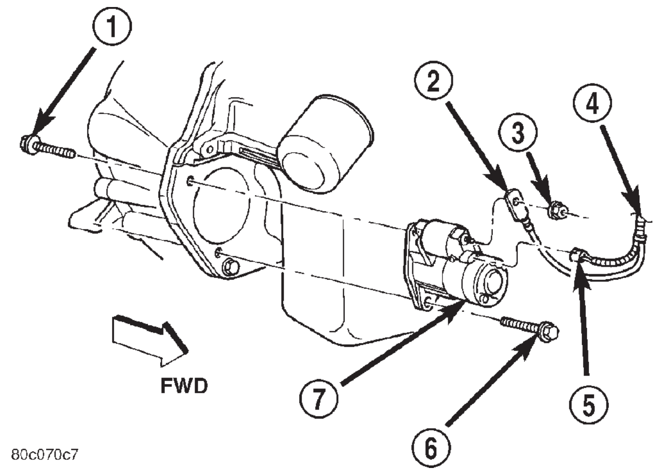


Fig. 12 Starter Motor Remove/Install - 2.5L Engine

1 – SCREW AND WASHER
2 – EYELET TERMINAL
3 – NUT
4 – BATTERY POSITIVE CABLE WIRE HARNESS
5 – WIRE HARNESS CONNECTOR
6 – SCREW AND WASHER
7 – STARTER MOTOR

ALL 3.9L AND 5.9L ENGINE, OR 4.7L ENGINE WITH MANUAL TRANSMISSION ONLY

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the nut and the lock washer that secures the lower mounting flange of the starter motor to the stud on the manual transmission clutch housing or the automatic transmission torque converter housing (Fig. 13).

(4) While supporting the starter motor with one hand, use the other hand to remove the screw and washer that secures the upper mounting flange of the starter motor to the manual transmission clutch housing or the automatic transmission torque converter housing.

(5) If the vehicle is equipped with an automatic transmission, slide the automatic transmission cooler tube bracket forward on the tubes far enough for the starter motor mounting flange to be removed from the lower mounting stud.

(6) Lower the starter motor from the front of the manual transmission clutch housing or the automatic transmission torque converter housing far enough to access and remove the nut that secures the battery positive cable eyelet terminal to the starter solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(7) Remove the battery positive cable eyelet terminal from the solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

REMOVAL AND INSTALLATION (Continued)

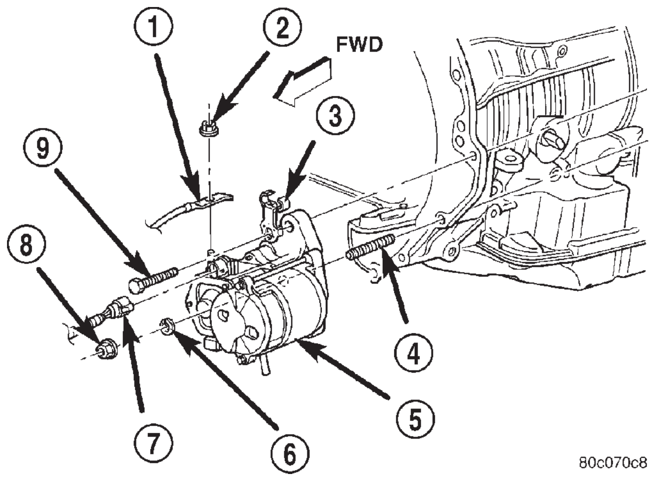


Fig. 13 Starter Motor Remove/Install - All 3.9L and 5.9L Engine, or 4.7L Engine with Manual Transmission Only

1 – EYELET TERMINAL
2 – NUT
3 – BRACKET
4 – STUD
5 – STARTER MOTOR
6 – LOCK WASHER
7 – WIRE HARNESS CONNECTOR
8 – NUT
9 – SCREW AND WASHER

(8) Disconnect the battery positive cable solenoid terminal wire harness connector from the connector receptacle on the starter solenoid. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(9) Remove the starter motor from the manual transmission clutch housing or automatic transmission torque converter housing.

4.7L ENGINE WITH AUTOMATIC TRANSMISSION

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the screw and washer (rearward facing) that secures the lower mounting flange of the starter motor to the automatic transmission torque converter housing (Fig. 14).

(4) While supporting the starter motor with one hand, use the other hand to remove the screw and washer (rearward facing) that secures the upper mounting flange of the starter motor to the automatic transmission torque converter housing.

(5) Lower the starter motor from the front of the automatic transmission torque converter housing far enough to access and remove the nut that secures the battery positive cable eyelet terminal to the starter solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

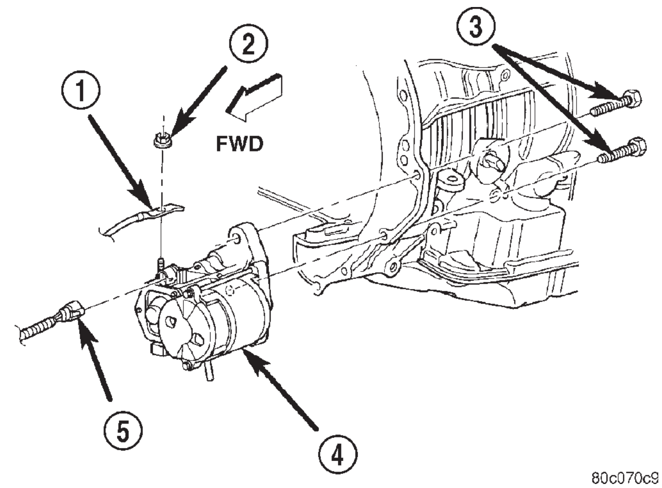


Fig. 14 Starter Motor Remove/Install - 4.7L Engine with Automatic Transmission

1 – EYELET TERMINAL
2 – NUT
3 – SCREW AND WASHER (2)
4 – STARTER MOTOR
5 – WIRE HARNESS CONNECTOR

(6) Remove the battery positive cable eyelet terminal from the solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(7) Disconnect the battery positive cable solenoid terminal wire harness connector from the connector receptacle on the starter solenoid. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(8) Remove the starter motor from the automatic transmission torque converter housing.

INSTALLATION

2.5L ENGINE

(1) Position the starter motor to the manual transmission clutch housing.

(2) Reconnect the battery positive cable solenoid terminal wire harness connector to the connector receptacle on the starter solenoid. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(3) Install the battery positive cable eyelet terminal onto the solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(4) Install and tighten the nut that secures the battery positive cable eyelet terminal to the starter solenoid B(+) terminal stud. Tighten the nut to 13.6 N·m (120 in. lbs.). Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(5) Position the starter motor mounting flange on the manual transmission clutch housing and loosely install the two screw and washer units to secure it.

(6) Tighten the two screw and washer units that secure the starter motor mounting flange to the manual transmission clutch housing. Tighten the screws to 54.2 N·m (40 ft. lbs.).

(7) Lower the vehicle.

(8) Reconnect the battery negative cable.

ALL 3.9L AND 5.9L ENGINE, OR 4.7L ENGINE WITH MANUAL TRANSMISSION ONLY

(1) Position the starter motor to the manual transmission clutch housing or automatic transmission torque converter housing.

(2) Reconnect the battery positive cable solenoid terminal wire harness connector to the connector receptacle on the starter solenoid. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(3) Install the battery positive cable eyelet terminal onto the solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(4) Install and tighten the nut that secures the battery positive cable eyelet terminal to the starter solenoid B(+) terminal stud. Tighten the nut to 13.6 N·m (120 in. lbs.). Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(5) Position the hole in the starter motor lower mounting flange over the stud on the manual transmission clutch housing or automatic transmission torque converter housing.

(6) If the vehicle is equipped with an automatic transmission, slide the automatic transmission cooler tube bracket rearward on the tubes and into position over the starter motor upper mounting flange.

(7) Loosely install the screw and washer unit that secures the starter motor upper mounting flange to the manual transmission clutch housing or automatic transmission torque converter housing.

(8) Loosely install the lock washer and nut that secures the starter motor lower mounting flange to the stud on the manual transmission clutch housing or automatic transmission torque converter housing.

(9) Tighten the screw and washer unit and the nut that secure the starter motor mounting flange to the manual transmission clutch housing or automatic transmission torque converter housing. Tighten the screw and the nut to 67.8 N·m (50 ft. lbs.).

(10) Lower the vehicle.

(11) Reconnect the battery negative cable.

4.7L ENGINE WITH AUTOMATIC TRANSMISSION

(1) Position the starter motor to the automatic transmission torque converter housing.

(2) Reconnect the battery positive cable solenoid terminal wire harness connector to the connector receptacle on the starter solenoid. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(3) Install the battery positive cable eyelet terminal onto the solenoid B(+) terminal stud. Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(4) Install and tighten the nut that secures the battery positive cable eyelet terminal to the starter solenoid B(+) terminal stud. Tighten the nut to 13.6 N·m (120 in. lbs.). Always support the starter motor during this process. Do not let the starter motor hang from the wire harness.

(5) Position the starter motor mounting flange on the automatic transmission torque converter housing and loosely install the two screw and washer units to secure it.

(6) Tighten the two screw and washer units that secure the starter motor mounting flange to the automatic transmission torque converter housing. Tighten the screws to 67.8 N·m (50 ft. lbs.).

(7) Lower the vehicle.

(8) Reconnect the battery negative cable.

STARTER RELAY

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 15).

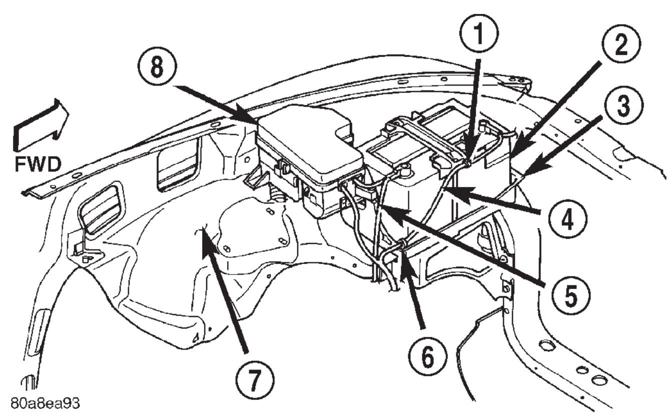


Fig. 15 Power Distribution Center

1 – CLIP
2 – BATTERY
3 – TRAY
4 – NEGATIVE CABLE
5 – POSITIVE CABLE
6 – CLIP
7 – FENDER INNER SHIELD
8 – POWER DISTRIBUTION CENTER

REMOVAL AND INSTALLATION (Continued)

(3) See the fuse and relay layout label affixed to the underside of the PDC cover for starter relay identification and location.

(4) Remove the starter relay from the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for the proper starter relay location.

(2) Position the starter relay in the proper receptacle in the PDC.

(3) Align the starter relay terminals with the terminal cavities in the PDC receptacle.

(4) Push down firmly on the starter relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Install the cover onto the PDC.

(6) Reconnect the battery negative cable.

SPECIFICATIONS

STARTING SYSTEM

Starter Motor and Solenoid			
Manufacturer	Mitsubishi	Denso	Denso
Part Number	56041013AC	56027702AC	56028715
Engine Application	2.5L	3.9L, 4.7L (Manual), 5.9L	4.7L (Auto)
Power Rating	1.2 Kilowatt (1.6 Horsepower)	1.4 Kilowatt (1.9 Horsepower	1.4 Kilowatt (1.9 Horsepower
Voltage	12 Volts	12 Volts	12 Volts
Pinion Teeth	9	10	10
Number of Fields	4	4	4
Number of Poles	4	4	4
Number of Brushes	4	4	4
Drive Type	Planetary Gear Reduction	Reduction Gear Train	Reduction Gear Train
Free Running Test Voltage	11.2 Volts	11 Volts	11 Volts
Free Running Test Maximum Amperage Draw	90 Amperes	73 Amperes	73 Amperes
Free Running Test Minimum Speed	2600 rpm	3601 rpm	3601 rpm
Solenoid Closing Maximum Voltage Required	7.8 Volts	7.5 Volts	7.5 Volts
*Cranking Amperage Draw Test	130 Amperes	125 - 250 Amperes	125 - 250 Amperes
*Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.			

CHARGING SYSTEM

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
CHARGING SYSTEM 1
GENERATOR 1
BATTERY TEMPERATURE SENSOR 2
ELECTRONIC VOLTAGE REGULATOR 2
DIAGNOSIS AND TESTING
CHARGING SYSTEM 2
ON-BOARD DIAGNOSTIC TEST FOR CHARGING SYSTEM 3

page

REMOVAL AND INSTALLATION
GENERATOR 3
BATTERY TEMPERATURE SENSOR 5
SPECIFICATIONS
GENERATOR RATINGS 6
TORQUE CHART 6

DESCRIPTION AND OPERATION

CHARGING SYSTEM

DESCRIPTION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to Ignition System for information)
- Battery (refer to Battery for information)
- Battery temperature sensor
- Check Gauges Lamp (if equipped)
- Voltmeter (refer to Instrument Panel and Gauges for information)
- Wiring harness and connections (refer to Wiring for information)

OPERATION

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. When the ASD relay is on, voltage is supplied to the ASD relay sense circuit at the PCM. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The amount of direct current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor, located in the battery tray housing, is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects. Refer to On-Board Diagnostics in Emission Control System for more DTC information.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage,** engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as a reminder to check the three gauges. The signal to activate the lamp is sent via the multiplexed bus circuits. The lamp is located on the instrument panel. Refer to Instrument Panel and Gauges for additional information.

GENERATOR

DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

DESCRIPTION AND OPERATION (Continued)

The Y type stator winding connections deliver the induced alternating current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified direct current is delivered to the vehicle electrical system through the generator battery terminal.

Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Generator Ratings in the Specifications section at the back of this group for amperage ratings and part numbers.

Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

BATTERY TEMPERATURE SENSOR

DESCRIPTION

The Battery Temperature Sensor (BTS) is attached to the battery tray located under the battery.

OPERATION

The BTS is used to determine the battery temperature and control battery charging rate. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

The PCM sends 5 volts to the sensor and is grounded through the sensor return line. As temperature increases, resistance in the sensor decreases and the detection voltage at the PCM increases.

The BTS is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled, depending upon BTS input (for example, disable purge and enable Leak Detection Pump (LDP) and O2 sensor heater tests). Most OBD II monitors are disabled below 20°F.

ELECTRONIC VOLTAGE REGULATOR

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of direct current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output. Also refer to Charging System Operation for additional information.

DIAGNOSIS AND TESTING

CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

- the check gauges indicator lamp (if equipped) is illuminated with the engine running
- the voltmeter (if equipped) does not register properly
- an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- accessories being left on with the engine not running
- a faulty or improperly adjusted switch that allows a lamp to stay on. See Ignition-Off Draw Test in Group 8A, Battery for more information.

INSPECTION

To perform a complete test of the charging system, refer to the appropriate Powertrain Diagnostic Procedures service manual and the DRB scan tool. Perform the following inspections before attaching the scan tool.

(1) Inspect the battery condition. Refer to Group 8A, Battery for procedures.

(2) Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.

DIAGNOSIS AND TESTING (Continued)

(3) Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(5) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in Group 7, Cooling System.

(6) Inspect automatic belt tensioner (if equipped). Refer to Group 7, Cooling System for information.

(7) Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

ON-BOARD DIAGNOSTIC TEST FOR CHARGING SYSTEM

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (OBD) system. Some circuits are checked continuously and some are checked only under certain conditions.

For DTC information, refer to Diagnostic Trouble Codes in Group 25, Emission Control System. This will include a complete list of DTC's including DTC's for the charging system.

REMOVAL AND INSTALLATION

GENERATOR

REMOVAL

WARNING: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE (B+ WIRE) FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY OR DAMAGE TO ELECTRICAL SYSTEM.

(1) Disconnect negative battery cable at battery.

(2) Remove generator drive belt. Refer to Group 7, Cooling System for procedures.

(3) Unsnap plastic cable protector cover from B+ mounting stud (4.7L V-8 engine only).

(4) 2.5L/3.9L/5.9L Engines: Remove generator pivot and mounting bolts/nut (Fig. 1) or (Fig. 2). Position generator for access to wire connectors.

(5) 4.7L Engine: Remove 3 generator mounting bolts (Fig. 3). Position generator for access to wire connectors.

(6) Remove B+ terminal mounting nut at rear of generator (Fig. 4) or (Fig. 5). Disconnect terminal from generator.

(7) Disconnect field wire connector at rear of generator by pushing on connector tab and pulling connector from generator.

(8) Remove generator from vehicle.

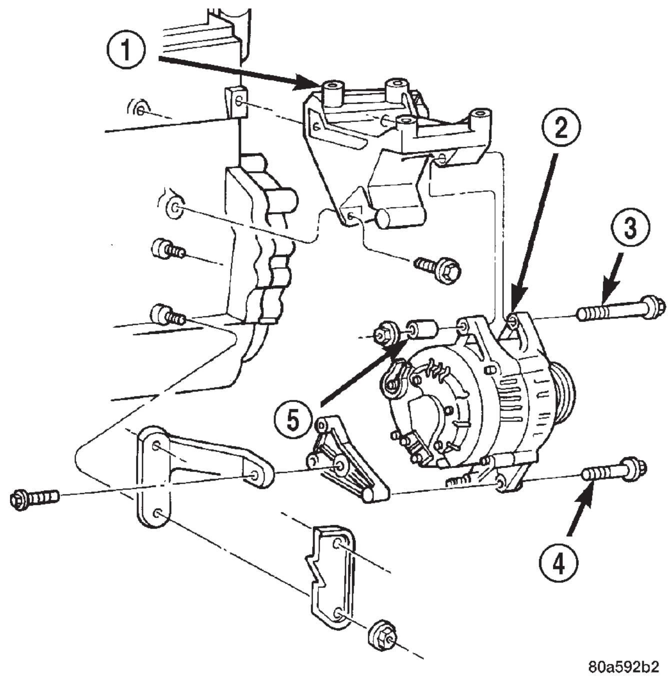


Fig. 1 Remove/Install Generator—2.5L Engine

1 – UPPER MOUNTING BRACKET
2 – GENERATOR
3 – UPPER BOLT
4 – LOWER BOLT
5 – SPACER

REMOVAL AND INSTALLATION (Continued)

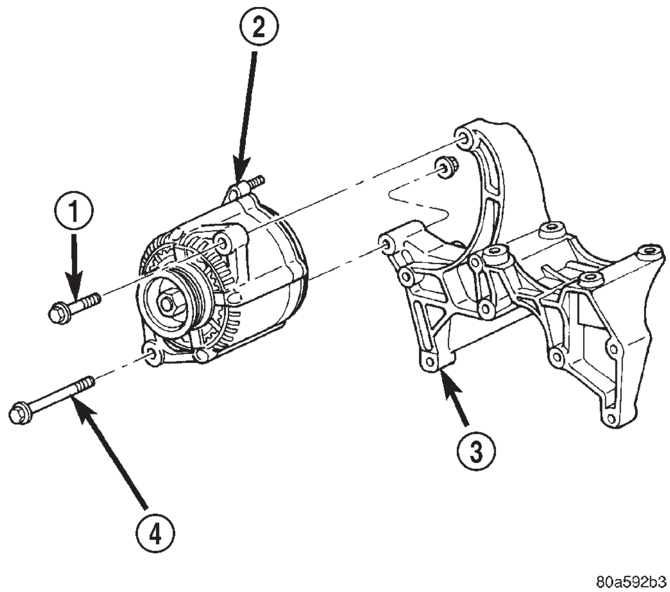


Fig. 2 Remove/Install Generator—3.9L/5.9L Engines

1 – MOUNTING BOLT
2 – GENERATOR
3 – MOUNTING BRACKET
4 – MOUNTING BOLT/NUT

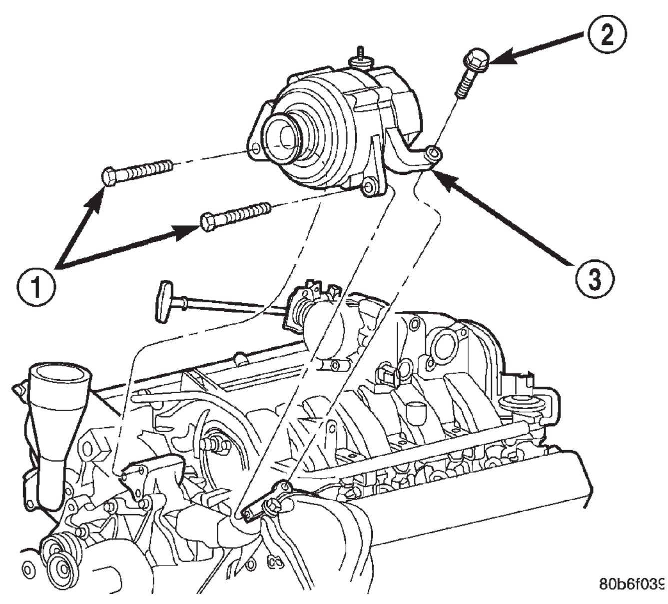


Fig. 3 Remove/Install Generator—4.7L V-8 Engine

1 – LOWER BOLTS
2 – REAR BOLT
3 – GENERATOR

INSTALLATION

(1) Position generator to engine and snap field wire connector into rear of generator.

(2) Install B+ terminal to generator mounting stud. Tighten mounting nut to 8.5 N·m (75 in. lbs.) torque.

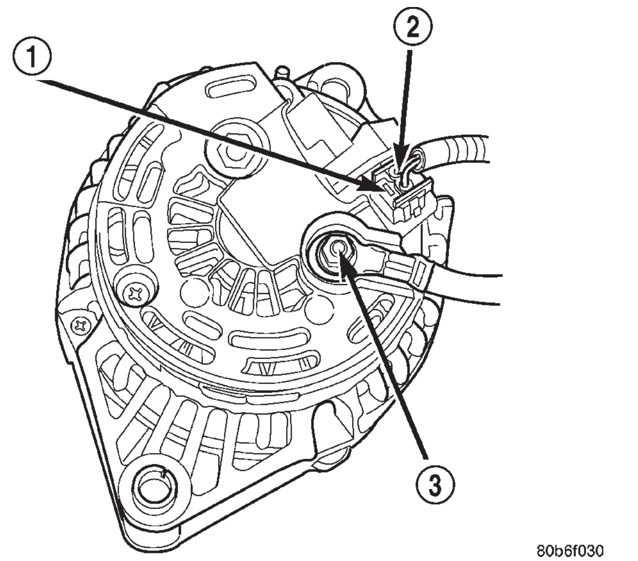


Fig. 4 Generator Connectors—Typical Bosch

1 – FIELD WIRE CONNECTOR
2 – FIELD WIRES
3 – B+ (OUTPUT TERMINAL)

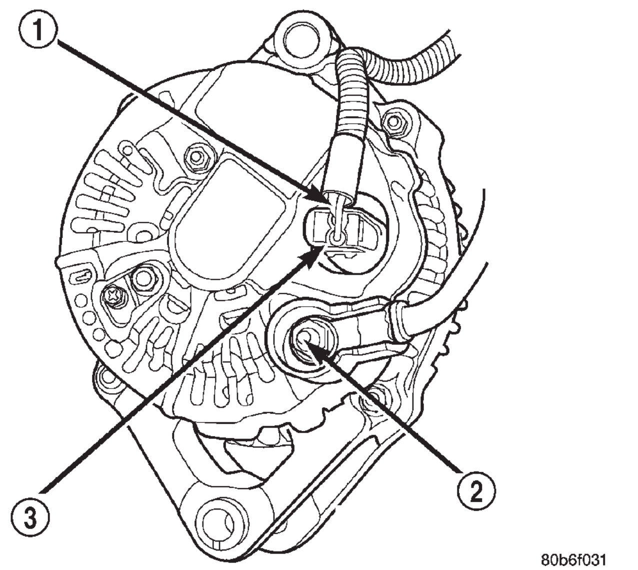


Fig. 5 Generator Connectors—Typical Denso

1 – FIELD WIRES
2 – B+ (OUTPUT TERMINAL)
3 – FIELD WIRE CONNECTOR

(3) Install generator mounting fasteners and tighten as follows:

• Generator mounting bolt 3.9L/5.9L engines—41 N·m (30 ft. lbs.) torque.

• Generator pivot bolt/nut 3.9L/5.9L engines—41 N·m (30 ft. lbs.) torque.

• Generator mounting bolt 2.5L engine—55 N·m (41 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

- Generator pivot bolt 2.5L engine—55 N·m (41 ft. lbs.) torque.
- Vertical mounting bolt 4.7L engine—55 N·m (40 ft. lbs.)
- Long horizontal mounting bolt 4.7L engine—55 N·m (40 ft. lbs.)
- Short horizontal mounting bolt 4.7L engine—74 N·m (55 ft. lbs.)

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in Group 7, Cooling System.

(4) Install generator drive belt. Refer to Group 7, Cooling System for procedure.

(5) Snap cable protector cover to B+ mounting stud (if equipped).

(6) Install negative battery cable to battery.

BATTERY TEMPERATURE SENSOR

The battery temperature sensor is located under vehicle battery (Fig. 6) and is attached to a mounting hole on battery tray.

REMOVAL

(1) Remove battery. Refer to Group 8A, Battery for procedures.

(2) Disconnect sensor pigtail harness from engine wire harness. Sensor pigtail harness is clipped to vehicle near its electrical connector.

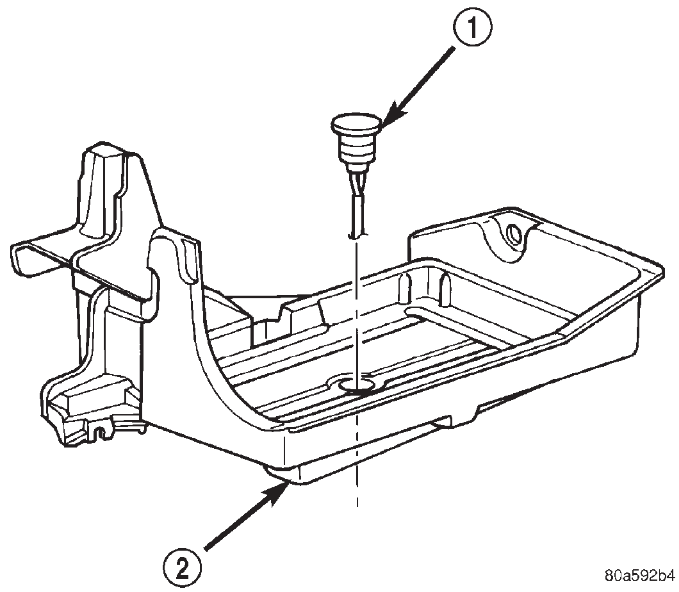


Fig. 6 Battery Temperature Sensor Location

1 – BATTERY TEMPERATURE SENSOR
2 – BATTERY TRAY

(3) Pry sensor straight up from battery tray mounting hole.

INSTALLATION

(1) Feed pigtail harness through hole in top of battery tray and press sensor into top of battery tray.

(2) Connect pigtail harness.

(3) Install battery. Refer to Group 8A, Battery for procedures.

SPECIFICATIONS

GENERATOR RATINGS

TYPE	PART NUMBER	RATED SAE AMPS	ENGINES	MINIMUM TEST AMPS
DENSO	56005685AC	117	2.5L	88
DENSO	56005686AB	136	2.5L	95
DENSO	56027912AB	117	3.9L/5.9L	90
DENSO	56027913AB	136	3.9L/5.9L	100
DENSO	56041324AC	136	4.7L	100

TORQUE CHART

DESCRIPTION	TORQUE
Generator Mounting Bolt—3.9L/5.9L Engines	41 N·m (30 ft. lbs.)
Generator Pivot Bolt—3.9L/5.9L Engines	41 N·m (30 ft. lbs.)
Generator Mounting Bolt—2.5L Engine	55 N·m (41 ft. lbs.)
Generator Pivot Bolt—2.5L Engine	55 N·m (41 ft. lbs.)
Generator Vertical Mounting Bolt—4.7L V–8 Engine	55 N·m (40 ft. lbs.)
Generator (long) Horizontal Mounting Bolt—4.7L V–8 Engine	55 N·m (40 ft. lbs.)
Generator (short) Horizontal Mounting Bolt—4.7L V–8 Engine	74 N·m (55 ft. lbs.)
Generator B+ Output Cable Terminal Nut	8.5 N·m (75 in. lbs.)

IGNITION SYSTEM

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
IGNITION SYSTEM 1
DISTRIBUTOR. 2
SPARK PLUGS 2
SPARK PLUG CABLES 2
IGNITION COIL (EXCEPT 4.7L ENGINE). 2
IGNITION COIL—4.7L ENGINE. 3
CRANKSHAFT POSITION SENSOR—2.5L ENGINE 3
CRANKSHAFT POSITION SENSOR—3.9L V-6 ENGINE 4
CRANKSHAFT POSITION SENSOR—5.2/5.9L V-8 ENGINE 4
CRANKSHAFT POSITION SENSOR—4.7L ENGINE 5
CAMSHAFT POSITION SENSOR. 5
CAMSHAFT POSITION SENSOR—4.7L ENGINE 6
IGNITION SWITCH AND KEY LOCK CYLINDER 6
DIAGNOSIS AND TESTING
DISTRIBUTOR CAP. 7
DISTRIBUTOR ROTOR 7
SPARK PLUG CABLES 8
SPARK PLUG CONDITIONS 9
IGNITION SWITCH AND KEY LOCK CYLINDER 11
REMOVAL AND INSTALLATION
SPARK PLUG CABLES 12
SPARK PLUGS 13
IGNITION COIL—2.5L ENGINE. 14

page

IGNITION COIL—3.9/5.2/5.9L ENGINES 14
IGNITION COIL—4.7L ENGINE. 15
CRANKSHAFT POSITION SENSOR—2.5L ENGINE 16
CRANKSHAFT POSITION SENSOR—3.9/5.2/5.9L ENGINES 16
CRANKSHAFT POSITION SENSOR—4.7L V-8 ENGINE 17
CAMSHAFT POSITION SENSOR. 17
CAMSHAFT POSITION SENSOR—4.7L ENGINE 18
DISTRIBUTOR—2.5L ENGINE 18
DISTRIBUTORS—3.9/5.2/5.9L ENGINES 21
IGNITION SWITCH AND KEY CYLINDER 23
COLUMN SHIFT INTERLOCK 26
SPECIFICATIONS
IGNITION TIMING. 27
ENGINE FIRING ORDER—2.5L 4-CYLINDER ENGINE 27
ENGINE FIRING ORDER—3.9L V-6 ENGINE . . . 27
ENGINE FIRING ORDER—4.7L V-8 ENGINE . . . 27
ENGINE FIRING ORDER—5.2L/5.9L V-8 ENGINES 27
SPARK PLUGS 28
SPARK PLUG CABLE RESISTANCE 28
IGNITION COIL RESISTANCE—EXCEPT 4.7L ENGINE 28
IGNITION COIL RESISTANCE—4.7L V-8 ENGINE 28
TORQUE CHART 28

DESCRIPTION AND OPERATION

IGNITION SYSTEM

DESCRIPTION

Two different ignition systems are used. One type of system is for the 2.5L 4–cylinder, the 3.9L V-6 engine and the 5.9L V-8 engine. The other is for the 4.7L V-8 engine.

The ignition systems used on 2.5L 4–cylinder, 3.9L V-6 and 5.9L V-8 engines are basically identical using a conventional distributor and remotely mounted coil. The 4.7L V-8 engine does not use a distributor and has 8 separate coils.

OPERATION

The ignition system is controlled by the Powertrain Control Module (PCM) on all engines.

The ignition system consists of:

- Spark Plugs
- Ignition Coil(s)
- Secondary Ignition Cables (2.5L/3.9L/5.9L engines)

DESCRIPTION AND OPERATION (Continued)

- Distributor (contains rotor and camshaft position sensor) (2.5L/3.9L/5.9L engines)
- Powertrain Control Module (PCM)
- Crankshaft Position and Camshaft Position Sensors
- The MAP, TPS, IAC and ECT also have an effect on the control of the ignition system.

DISTRIBUTOR

DESCRIPTION

All 2.5L/3.9L/5.9L engines are equipped with a camshaft driven mechanical distributor (Fig. 1) containing a shaft driven distributor rotor. All distributors are equipped with an internal camshaft position (fuel sync) sensor (Fig. 1).

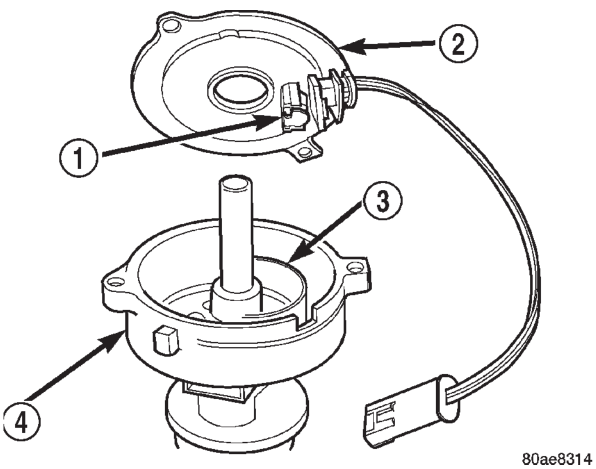


Fig. 1 Distributor and Camshaft Position Sensor-Typical (3.9L/5.9L Shown)

1 – SYNC SIGNAL GENERATOR
2 – CAMSHAFT POSITION SENSOR
3 – PULSE RING
4 – DISTRIBUTOR ASSEMBLY

OPERATION

The camshaft position sensor provides fuel injection synchronization and cylinder identification.

The distributor does not have built in centrifugal or vacuum assisted advance. Base ignition timing and all timing advance is controlled by the Powertrain Control Module (PCM). Because ignition timing is controlled by the PCM, **base ignition timing is not adjustable on any of these engines.**

All 2.5L/3.9L/5.9L distributors contain an internal oil seal that prevents oil from entering the distributor housing. The seal is not serviceable.

SPARK PLUGS

DESCRIPTION

All engines use resistor type spark plugs. 4.7L V-8 engines are equipped with “fired in suppressor seal” type spark plugs using a copper core ground electrode.

Because of the use of an aluminum cylinder head on the 4.7L engine, spark plug torque is very critical.

To prevent possible pre-ignition and/or mechanical engine damage, the correct type/heat range/number spark plug must be used.

OPERATION

Remove the spark plugs and examine them for burned electrodes and fouled, cracked or broken porcelain insulators. Keep plugs arranged in the order in which they were removed from the engine. A single plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in Group O, Lubrication and Maintenance.

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective, carbon or oil fouled. Also refer to Spark Plug Conditions.

CAUTION: Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.

SPARK PLUG CABLES

DESCRIPTION

Spark plug cables are sometimes referred to as secondary ignition wires.

OPERATION

The spark plug cables transfer electrical current from the ignition coil(s) and/or distributor, to individual spark plugs at each cylinder. The resistive spark plug cables are of nonmetallic construction. The cables provide suppression of radio frequency emissions from the ignition system.

IGNITION COIL (EXCEPT 4.7L ENGINE)

DESCRIPTION

A single ignition coil is used. The coil is not oil filled. The coil windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the coil to be mounted on the engine.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The Powertrain Control Module (PCM) opens and closes the ignition coil ground circuit for ignition coil operation.

Battery voltage is supplied to the ignition coil positive terminal from the ASD relay. If the PCM does not see a signal from the crankshaft and camshaft sensors (indicating the ignition key is ON but the engine is not running), it will shut down the ASD circuit.

Base ignition timing is not adjustable on any engine. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

IGNITION COIL—4.7L ENGINE

DESCRIPTION

The 4.7L V–8 engine uses 8 dedicated, and individually fired coil (Fig. 2) for each spark plug. Each coil is mounted directly to the top of each spark plug (Fig. 3).

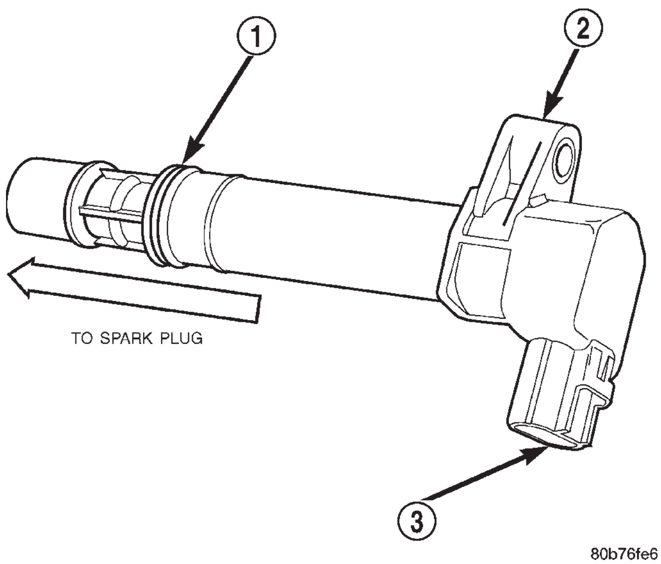


Fig. 2 Ignition Coil—4.7L Engine

1 – O-RING
2 – IGNITION COIL
3 – ELECTRICAL CONNECTOR

OPERATION

Battery voltage is supplied to the 8 ignition coils from the ASD relay. The Powertrain Control Module (PCM) opens and closes each ignition coil ground circuit at a determined time for ignition coil operation.

Base ignition timing is not adjustable. By controlling the coil ground circuit, the PCM is able to set the base timing and adjust the ignition timing advance. This is done to meet changing engine operating conditions.

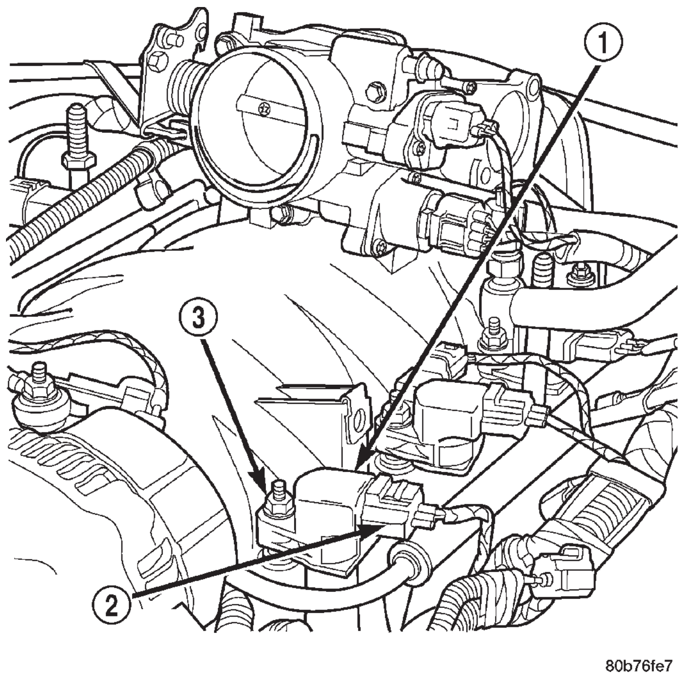


Fig. 3 Ignition Coil Location—4.7L Engine

1 – IGNITION COIL
2 – COIL ELECTRICAL CONNECTOR
3 – COIL MOUNTING STUD/NUT

The ignition coil is not oil filled. The windings are embedded in an epoxy compound. This provides heat and vibration resistance that allows the ignition coil to be mounted on the engine.

Because of coil design, spark plug cables (secondary cables) are not used.

CRANKSHAFT POSITION SENSOR—2.5L ENGINE

DESCRIPTION

The Crankshaft Position (CKP) sensor is located near the outer edge of the flywheel (or starter ringear).

OPERATION

Engine speed and crankshaft position are provided through the CKP sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

DESCRIPTION AND OPERATION (Continued)

The flywheel/drive plate has groups of four notches at its outer edge. On 2.5L 4-cylinder engines there are two sets of notches (Fig. 4).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution there are two groups of four pulses generated on 2.5L 4-cylinder engines.

The trailing edge of the fourth notch, which causes the pulse, is four degrees before top dead center (TDC) of the corresponding piston.

The engine will not operate if the PCM does not receive a CKP sensor input.

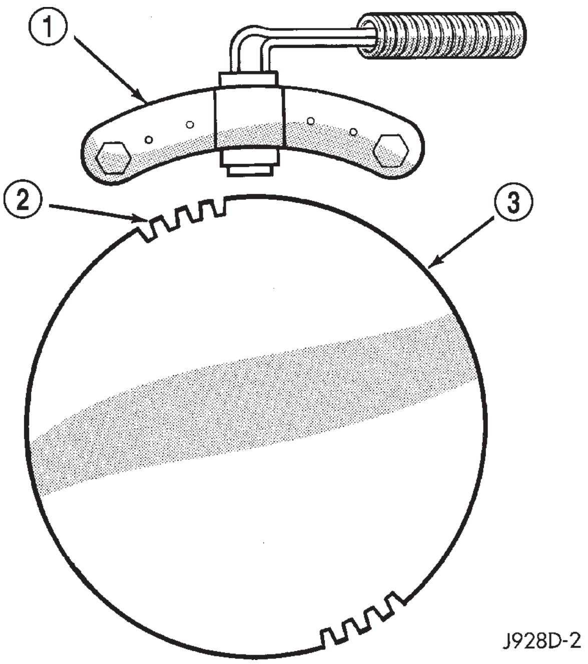


Fig. 4 CKP Sensor Operation—2.5L 4-Cyl. Engine

1 – CRANKSHAFT POSITION SENSOR
2 – NOTCHES
3 – FLYWHEEL

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

The flywheel/drive plate has groups of notches at its outer edge. On 3.9L V-6 engines, there are three sets of double notches and three sets of single notches (Fig. 5).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.

The engine will not operate if the PCM does not receive a CKP sensor input.

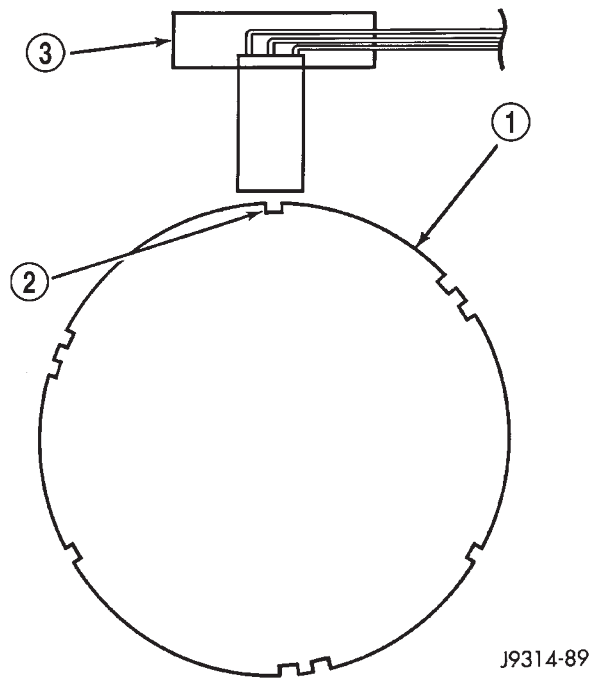


Fig. 5 CKP Sensor Operation—3.9L Engine

1 – FLYWHEEL
2 – NOTCHES
3 – CRANKSHAFT POSITION SENSOR

CRANKSHAFT POSITION SENSOR—3.9L V-6 ENGINE

DESCRIPTION

The Crankshaft Position (CKP) sensor is located near the outer edge of the flywheel (starter ringear).

OPERATION

Engine speed and crankshaft position are provided through the CKP sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

CRANKSHAFT POSITION SENSOR—5.2/5.9L V-8 ENGINE

DESCRIPTION

The Crankshaft Position (CKP) sensor is located near the outer edge of the flywheel (starter ringear).

OPERATION

Engine speed and crankshaft position are provided through the CKP sensor. The sensor generates pulses that are the input sent to the Powertrain Control Module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

DESCRIPTION AND OPERATION (Continued)

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

On 5.2/5.9L V-8 engines, the flywheel/drive plate has 8 single notches, spaced every 45 degrees, at its outer edge (Fig. 6).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM. For each engine revolution, there are 8 pulses generated on V-8 engines.

The engine will not operate if the PCM does not receive a CKP sensor input.

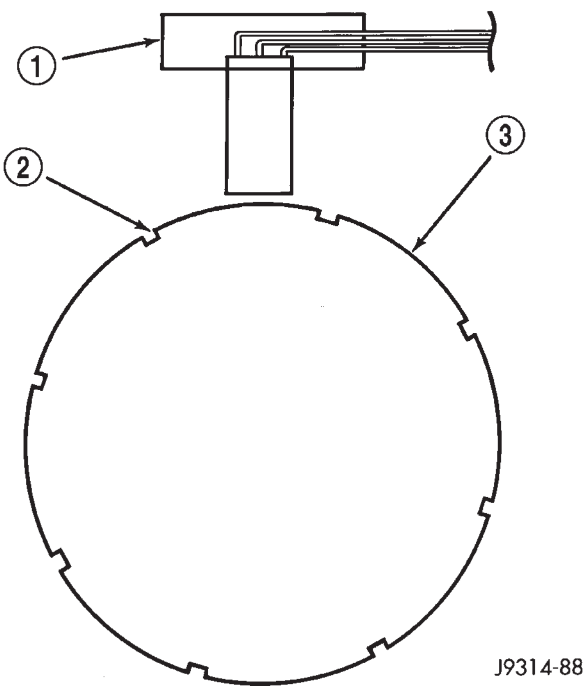


Fig. 6 CKP Sensor Operation—5.2L/5.9L Engine

1 – CRANKSHAFT POSITION SENSOR
2 – NOTCHES
3 – FLYWHEEL

CRANKSHAFT POSITION SENSOR—4.7L ENGINE

DESCRIPTION

The Crankshaft Position Sensor (CKP) is mounted into the right-rear side of the engine block (Fig. 7).

OPERATION

Engine speed and crankshaft position are provided through the crankshaft position sensor. The sensor generates pulses that are the input sent to the powertrain control module (PCM). The PCM interprets the sensor input to determine the crankshaft position. The PCM then uses this position, along with other inputs, to determine injector sequence and ignition timing.

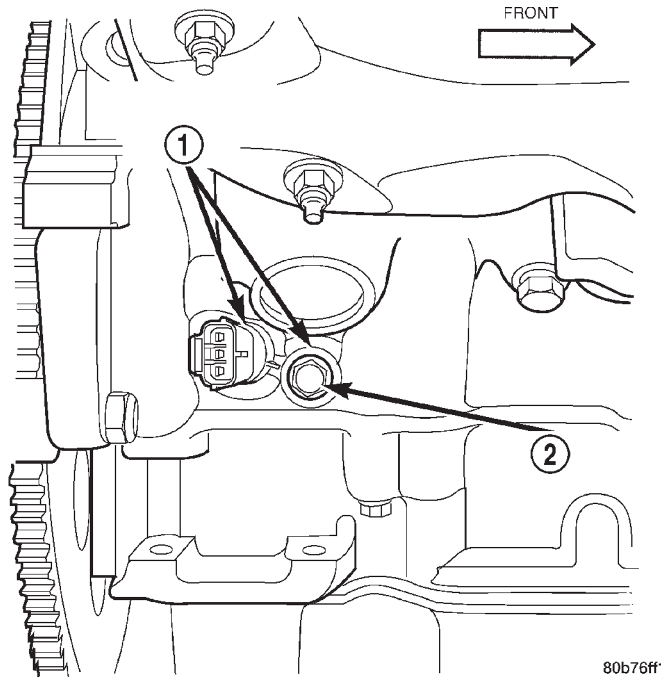


Fig. 7 CKP Sensor Location—4.7L V–8 Engine

1 – CRANKSHAFT POSITION SENSOR
2 – MOUNTING BOLT

The sensor is a hall effect device combined with an internal magnet. It is also sensitive to steel within a certain distance from it.

On the 4.7L V–8 engine, a tonewheel is bolted to the engine crankshaft (Fig. 8). This tonewheel has sets of notches at its outer edge (Fig. 8).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.

CAMSHAFT POSITION SENSOR

DESCRIPTION

The Camshaft Position (CMP) sensor is located in the distributor.

OPERATION

The sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects a rotating pulse ring (shutter) on the distributor shaft. The pulse ring rotates 180 degrees through the sync signal generator. Its signal is used in conjunction with the Crankshaft Position (CKP) sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

When the leading edge of the pulse ring (shutter) enters the sync signal generator, the following occurs: The interruption of magnetic field causes the voltage

DESCRIPTION AND OPERATION (Continued)

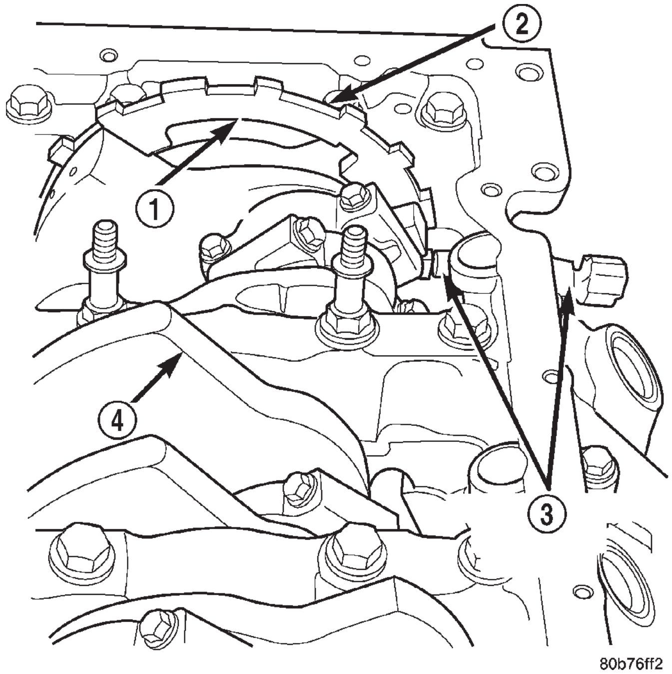


Fig. 8 CKP Sensor Operation and Tonewheel—4.7L V–8 Engine

1 – TONEWHEEL
2 – NOTCHES
3 – CRANKSHAFT POSITION SENSOR
4 – CRANKSHAFT

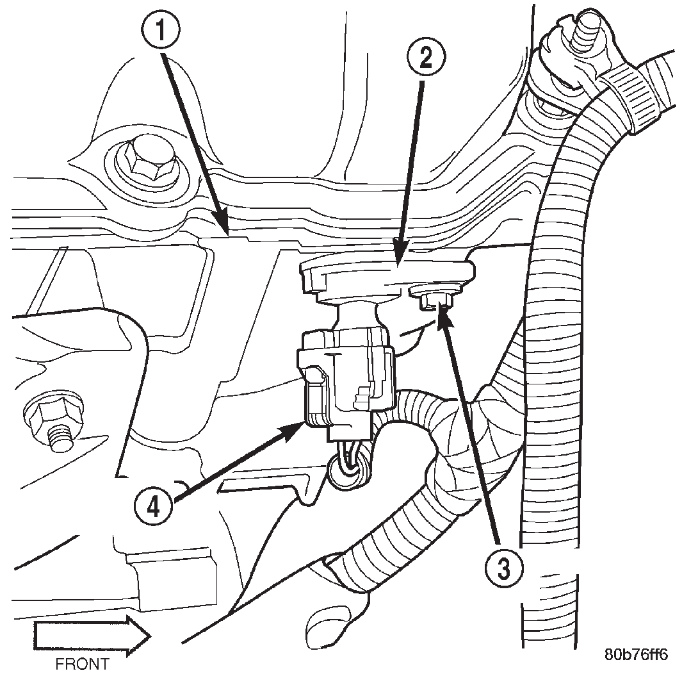


Fig. 9 CMP Location—4.7L Engine

1 – RIGHT CYLINDER HEAD
2 – CAMSHAFT POSITION SENSOR
3 – MOUNTING BOLT
4 – ELEC. CONNECTOR

to switch high resulting in a sync signal of approximately 5 volts.

When the trailing edge of the pulse ring (shutter) leaves the sync signal generator, the following occurs: The change of the magnetic field causes the sync signal voltage to switch low to 0 volts.

CAMSHAFT POSITION SENSOR—4.7L ENGINE

DESCRIPTION

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine is bolted to the front/top of the right cylinder head (Fig. 9).

OPERATION

The CMP sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects notches located on a tonewheel. The tonewheel is located at the front of the camshaft for the right cylinder head (Fig. 10). As the tonewheel rotates, the notches pass through the sync signal generator. The pattern of the notches (viewed counter-clockwise from front of engine) is: 1 notch, 2 notches, 3 notches, 3 notches, 2 notches 1 notch, 3 notches and 1 notch. The signal from the CMP sensor is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

IGNITION SWITCH AND KEY LOCK CYLINDER

DESCRIPTION

The electrical ignition switch is located on the steering column. It is used as the main on/off switching device for most electrical components. The mechanical key lock cylinder is used to engage/disengage the electrical ignition switch.

OPERATION

Vehicles equipped with an automatic transmission and a floor mounted shifter: a cable is used to connect the interlock device in the steering column assembly, to the transmission floor shift lever. This interlock device is used to lock the transmission shifter in the PARK position when the key lock cylinder is rotated to the LOCKED or ACCESSORY position. The interlock device within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

If the ignition key is difficult to rotate to or from the LOCK or ACCESSORY position, it may not be the fault of the key cylinder or the steering column

DESCRIPTION AND OPERATION (Continued)

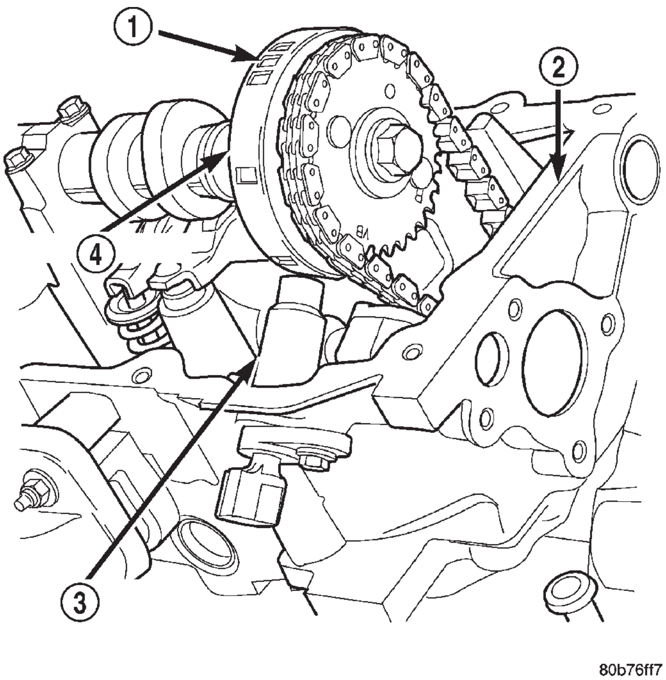


Fig. 10 CMP Sensor and Tonewheel—4.7L Engine

1 – NOTCHES
2 – RIGHT CYLINDER HEAD
3 – CAMSHAFT POSITION SENSOR
4 – TONEWHEEL

components. The brake transmission shift interlock cable may be out of adjustment. Refer to Brake Transmission Shift Interlock Cable Adjustment in Group 21, Transmissions for adjustment procedures.

Vehicles equipped with an automatic transmission and a steering column mounted shifter: an interlock device is located within the steering column. This interlock device is used to lock the transmission shifter in the PARK position when the key lock cylinder is in the LOCKED or ACCESSORY position. If it is difficult to rotate the key to or from the LOCK or ACCESSORY position, the interlock device within the steering column may be defective. This device is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

Vehicles equipped with a manual transmission, a floor mounted shifter, and a LEVER below the ignition key: A lever is located on the steering column behind the ignition key lock cylinder. The lever must be manually operated to allow rotation of the ignition key lock cylinder to the LOCK or ACCESSORY position. If it is difficult to rotate the key to the LOCK or ACCESSORY position, the lever mechanism may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

Vehicles equipped with a manual transmission, a floor mounted shifter, and NO LEVER below the ignition key: The ignition key cylinder must be depressed to allow it to be rotated into the LOCK or ACCESSORY position. If it is difficult to rotate the key to the LOCK or ACCESSORY position, the lock mechanism within the steering column may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

DIAGNOSIS AND TESTING

DISTRIBUTOR CAP

Remove the distributor cap and wipe it clean with a dry lint free cloth. Visually inspect the cap for cracks, carbon paths, broken towers or damaged rotor button (Fig. 11) or (Fig. 12). Also check for white deposits on the inside (caused by condensation entering the cap through cracks). Replace any cap that displays charred or eroded terminals. The machined surface of a terminal end (faces toward rotor) will indicate some evidence of erosion from normal operation. Examine the terminal ends for evidence of mechanical interference with the rotor tip.

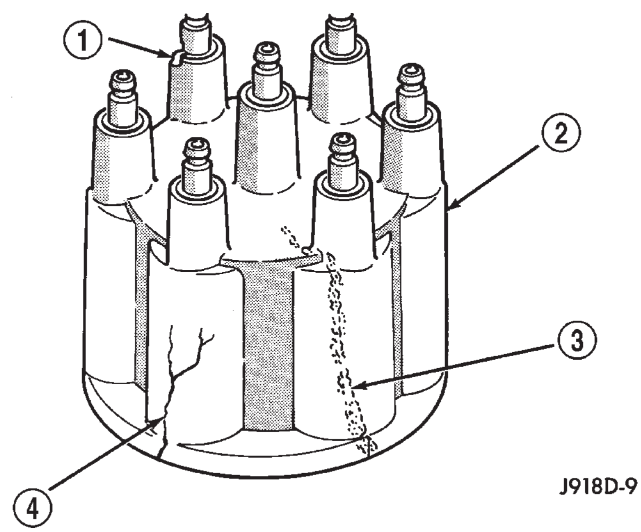


Fig. 11 Cap Inspection—External—Typical

1 – BROKEN TOWER
2 – DISTRIBUTOR CAP
3 – CARBON PATH
4 – CRACK

DISTRIBUTOR ROTOR

Visually inspect the rotor (Fig. 13) for cracks, evidence of corrosion or the effects of arcing on the metal tip. Also check for evidence of mechanical interference with the cap. Some charring is normal on the end of the metal tip. The silicone-dielectric-

DIAGNOSIS AND TESTING (Continued)

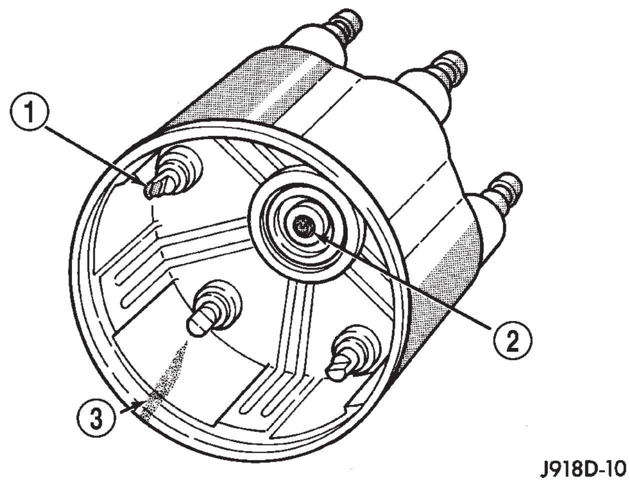


Fig. 12 Cap Inspection—Internal—Typical

1 – CHARRED OR ERODED TERMINALS
2 – WORN OR DAMAGED ROTOR BUTTON
3 – CARBON PATH

varnish-compound applied to the rotor tip for radio interference noise suppression, will appear charred. This is normal. **Do not remove the charred compound.** Test the spring for insufficient tension. Replace a rotor that displays any of these adverse conditions.

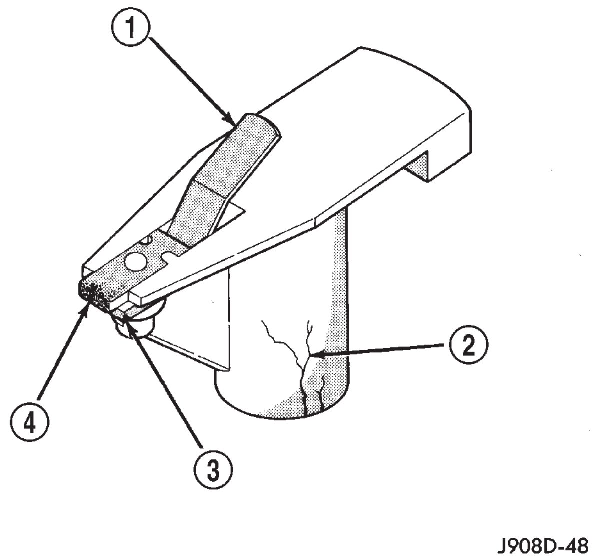


Fig. 13 Rotor Inspection—Typical

1 – INSUFFICIENT SPRING TENSION
2 – CRACKS
3 – EVIDENCE OF PHYSICAL CONTACT WITH CAP
4 – ROTOR TIP CORRODED

SPARK PLUG CABLES

Check the spark plug cable connections for good contact at the coil(s), distributor cap towers, and spark plugs. Terminals should be fully seated. The insulators should be in good condition and should fit tightly on the coil, distributor and spark plugs. Spark plug cables with insulators that are cracked or torn must be replaced.

Clean high voltage ignition cables with a cloth moistened with a non-flammable solvent. Wipe the cables dry. Check for brittle or cracked insulation.

On 3.9L V-6 and 5.2/5.9L V-8 engines, spark plug cable heat shields are pressed into the cylinder head to surround each spark plug cable boot and spark plug (Fig. 14). These shields protect the spark plug boots from damage (due to intense engine heat generated by the exhaust manifolds) and should not be removed. After the spark plug cable has been installed, the lip of the cable boot should have a small air gap to the top of the heat shield (Fig. 14).

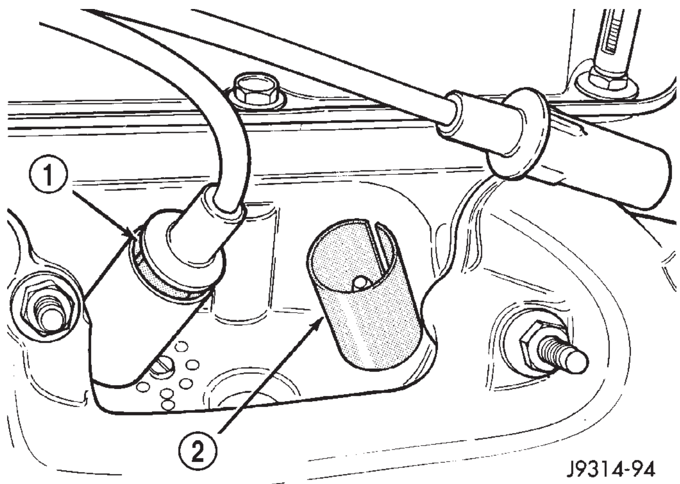


Fig. 14 Heat Shields—3.9/5.2/5.9L Engines

1 – AIR GAP
2 – SPARK PLUG BOOT HEAT SHIELD

TESTING

When testing secondary cables for damage with an oscilloscope, follow the instructions of the equipment manufacturer.

If an oscilloscope is not available, spark plug cables may be tested as follows:

CAUTION: Do not leave any one spark plug cable disconnected for longer than necessary during testing. This may cause possible heat damage to the catalytic converter. Total test time must not exceed ten minutes.

With the engine running, remove spark plug cable from spark plug (one at a time) and hold next to a good engine ground. If the cable and spark plug are in good condition, the engine rpm should drop and the engine will run poorly. If engine rpm does not drop, the cable and/or spark plug may not be operat-

DIAGNOSIS AND TESTING (Continued)

ing properly and should be replaced. Also check engine cylinder compression.

With the engine not running, connect one end of a test probe to a good ground. Start the engine and run the other end of the test probe along the entire length of all spark plug cables. If cables are cracked or punctured, there will be a noticeable spark jump from the damaged area to the test probe. The cable running from the ignition coil to the distributor cap can be checked in the same manner. Cracked, damaged or faulty cables should be replaced with resistance type cable. This can be identified by the words ELECTRONIC SUPPRESSION printed on the cable jacket.

Use an ohmmeter to test for open circuits, excessive resistance or loose terminals. If equipped, remove the distributor cap from the distributor. **Do not remove cables from cap.** Remove cable from spark plug. Connect ohmmeter to spark plug terminal end of cable and to corresponding electrode in distributor cap. Resistance should be 250 to 1000 Ohms per inch of cable. If not, remove cable from distributor cap tower and connect ohmmeter to the terminal ends of cable. If resistance is not within specifications as found in the SPARK PLUG CABLE RESISTANCE chart, replace the cable. Test all spark plug cables in this manner.

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

To test ignition coil-to-distributor cap cable, do not remove the cable from the cap. Connect ohmmeter to rotor button (center contact) of distributor cap and terminal at ignition coil end of cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, remove the cable from the distributor cap. Connect the ohmmeter to the terminal ends of the cable. If resistance is not within specifications as found in the Spark Plug Cable Resistance chart, replace the cable. Inspect the ignition coil tower for cracks, burns or corrosion.

SPARK PLUG CONDITIONS

NORMAL OPERATING

The few deposits present on the spark plug will probably be light tan or slightly gray in color. This is evident with most grades of commercial gasoline (Fig. 15). There will not be evidence of electrode burning. On all engines except the 4.7L V-8, gap growth will not average more than approximately 0.025 mm (.001 in) per 3200 km (2000 miles) of operation. On the 4.7L V-8, gap growth will not average more than approximately.0015 in per 3200 km (2000 miles) of operation. Spark plugs that have normal wear can usually be cleaned, have the electrodes filed, have the gap set and then be installed.

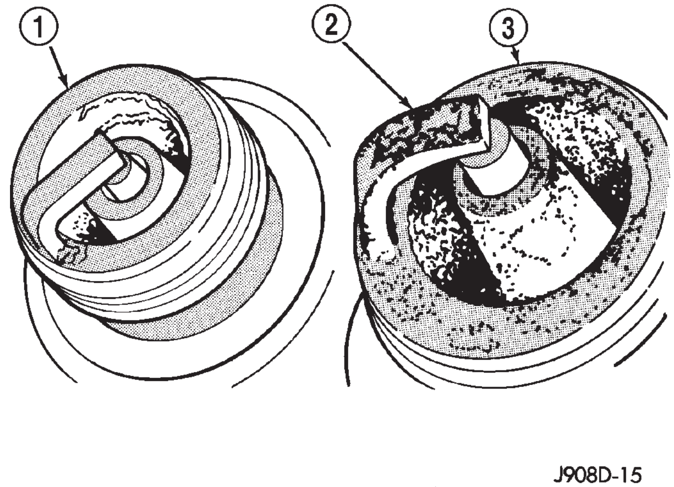


Fig. 15 Normal Operation and Cold (Carbon) Fouling

1 – NORMAL
2 – DRY BLACK DEPOSITS
3 – COLD (CARBON) FOULING

Some fuel refiners in several areas of the United States have introduced a manganese additive (MMT) for unleaded fuel. During combustion, fuel with MMT causes the entire tip of the spark plug to be coated with a rust colored deposit. This rust color can be misdiagnosed as being caused by coolant in the combustion chamber. Spark plug performance may be affected by MMT deposits.

COLD FOULING/CARBON FOULING

Cold fouling is sometimes referred to as carbon fouling. The deposits that cause cold fouling are basically carbon (Fig. 15). A dry, black deposit on one or two plugs in a set may be caused by sticking valves or defective spark plug cables. Cold (carbon) fouling of the entire set of spark plugs may be caused by a clogged air cleaner element or repeated short operating times (short trips).

WET FOULING OR GAS FOULING

A spark plug coated with excessive wet fuel or oil is wet fouled. In older engines, worn piston rings, leaking valve guide seals or excessive cylinder wear can cause wet fouling. In new or recently overhauled engines, wet fouling may occur before break-in (normal oil control) is achieved. This condition can usually be resolved by cleaning and reinstalling the fouled plugs.

DIAGNOSIS AND TESTING (Continued)

OIL OR ASH ENCRUSTED

If one or more spark plugs are oil or oil ash encrusted (Fig. 16), evaluate engine condition for the cause of oil entry into that particular combustion chamber.

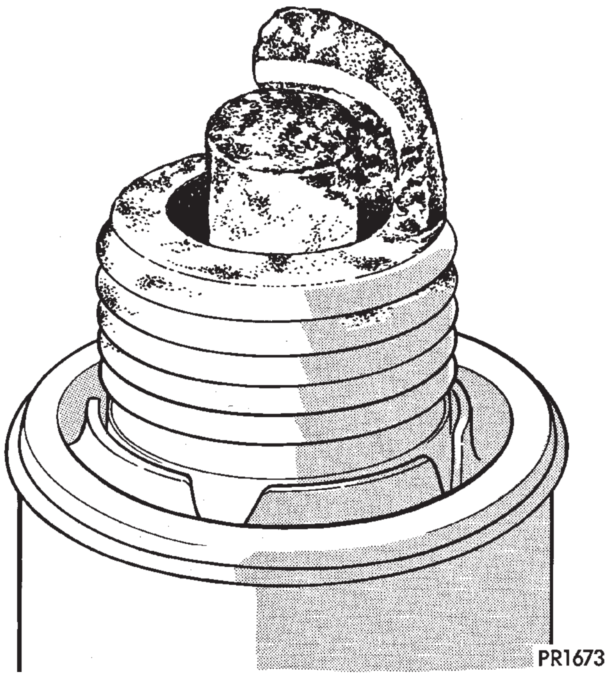


Fig. 16 Oil or Ash Encrusted

ELECTRODE GAP BRIDGING

Electrode gap bridging may be traced to loose deposits in the combustion chamber. These deposits accumulate on the spark plugs during continuous stop-and-go driving. When the engine is suddenly subjected to a high torque load, deposits partially liquefy and bridge the gap between electrodes (Fig. 17). This short circuits the electrodes. Spark plugs with electrode gap bridging can be cleaned using standard procedures.

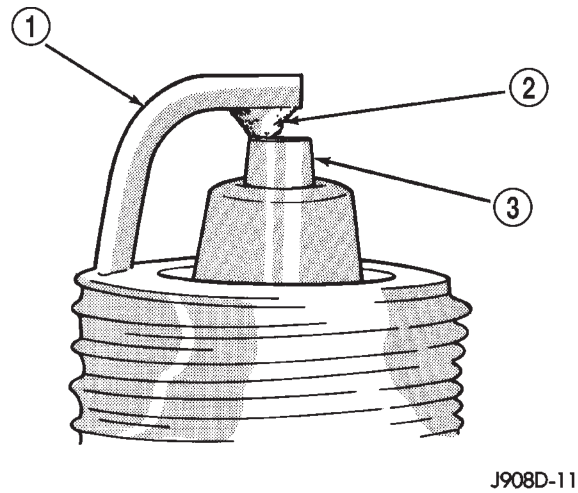


Fig. 17 Electrode Gap Bridging

1 – GROUND ELECTRODE
2 – DEPOSITS
3 – CENTER ELECTRODE

SCAVENGER DEPOSITS

Fuel scavenger deposits may be either white or yellow (Fig. 18). They may appear to be harmful, but this is a normal condition caused by chemical additives in certain fuels. These additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground electrode and shell area may be heavy, but the deposits are easily removed. Spark plugs with scavenger deposits can be considered normal in condition and can be cleaned using standard procedures.

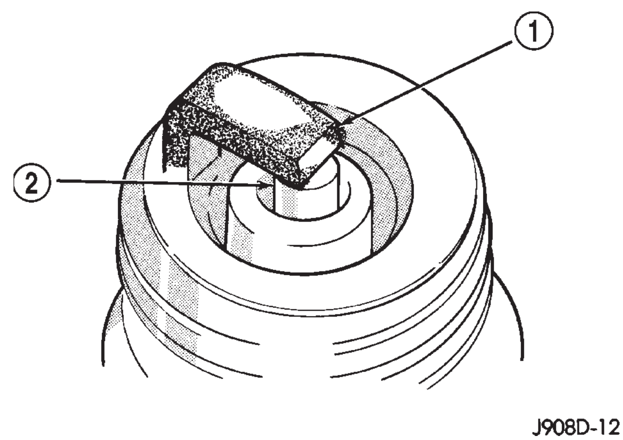


Fig. 18 Scavenger Deposits

1 – GROUND ELECTRODE COVERED WITH WHITE OR YELLOW DEPOSITS
2 – CENTER ELECTRODE

CHIPPED ELECTRODE INSULATOR

A chipped electrode insulator usually results from bending the center electrode while adjusting the spark plug electrode gap. Under certain conditions, severe detonation can also separate the insulator from the center electrode (Fig. 19). Spark plugs with this condition must be replaced.

PREIGNITION DAMAGE

Preignition damage is usually caused by excessive combustion chamber temperature. The center electrode dissolves first and the ground electrode dissolves somewhat latter (Fig. 20). Insulators appear relatively deposit free. Determine if the spark plug has the correct heat range rating for the engine. Determine if ignition timing is over advanced or if other operating conditions are causing engine overheating. (The heat range rating refers to the operating temperature of a particular type spark plug.

DIAGNOSIS AND TESTING (Continued)

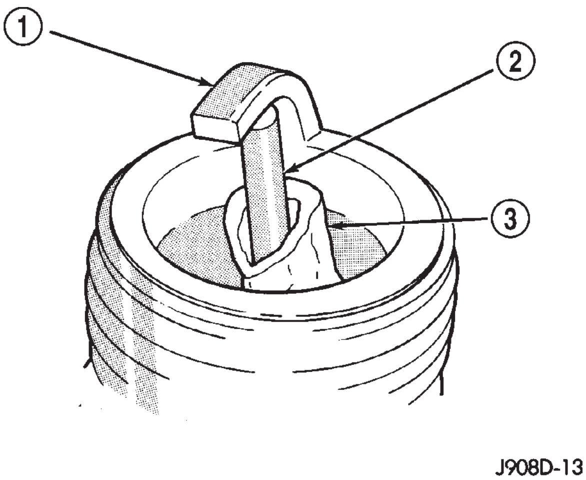


Fig. 19 Chipped Electrode Insulator

1 – GROUND ELECTRODE
2 – CENTER ELECTRODE
3 – CHIPPED INSULATOR

Spark plugs are designed to operate within specific temperature ranges. This depends upon the thickness and length of the center electrodes porcelain insulator.)

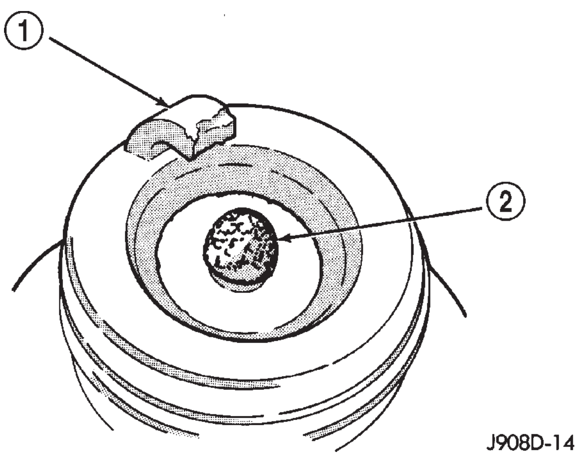


Fig. 20 Preignition Damage

1 – GROUND ELECTRODE STARTING TO DISSOLVE
2 – CENTER ELECTRODE DISSOLVED

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 21). The increase in electrode gap will be considerably in excess of 0.001 inch per 2000 miles of operation. This suggests that a plug with a cooler heat range rating should be used. Over advanced ignition timing, detonation and cooling system malfunctions can also cause spark plug overheating.

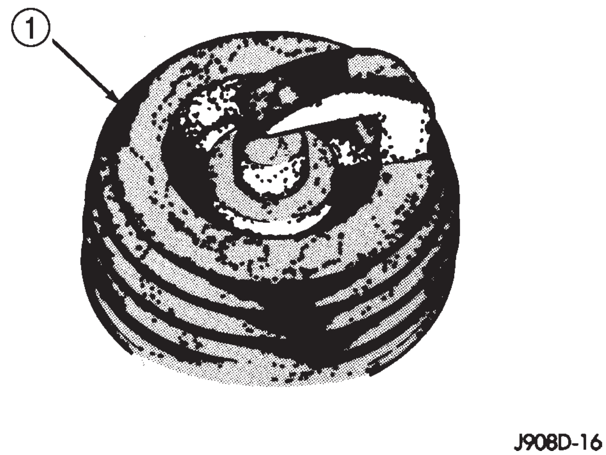


Fig. 21 Spark Plug Overheating

1 – BLISTERED WHITE OR GRAY COLORED INSULATOR

IGNITION SWITCH AND KEY LOCK CYLINDER

ELECTRICAL DIAGNOSIS

For ignition switch electrical schematics, refer to Ignition Switch in Group 8W, Wiring Diagrams.

MECHANICAL DIAGNOSIS (KEY DIFFICULT TO ROTATE)

Vehicles equipped with an automatic transmission and a floor mounted shifter: a cable is used to connect the interlock device in the steering column assembly, to the transmission floor shift lever. This interlock device is used to lock the transmission shifter in the PARK position when the key lock cylinder is rotated to the LOCKED or ACCESSORY position. The interlock device within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

If the ignition key is difficult to rotate to or from the LOCK or ACCESSORY position, it may not be the fault of the key cylinder or the steering column components. The brake transmission shift interlock cable may be out of adjustment. Refer to Brake Transmission Shift Interlock Cable Adjustment in Group 21, Transmissions for adjustment procedures.

Vehicles equipped with an automatic transmission and a steering column mounted shifter: an interlock device is located within the steering column. This interlock device is used to lock the transmission shifter in the PARK position when the key lock cylinder is in the LOCKED or ACCESSORY position. If it is difficult to rotate the key to or from the LOCK or ACCESSORY position, the interlock device within the steering column may be defective. This device is not serviceable. If repair is necessary,

DIAGNOSIS AND TESTING (Continued)

the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

Vehicles equipped with a manual transmission and a floor mounted shifter: on certain models, a lever is located on the steering column behind the ignition key lock cylinder. The lever must be manually operated to allow rotation of the ignition key lock cylinder to the LOCK or ACCESSORY position. If it is difficult to rotate the key to the LOCK or ACCESSORY position, the lever mechanism may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

On other models, the ignition key cylinder must be depressed to allow it to be rotated into the LOCK or ACCESSORY position. If it is difficult to rotate the key to the LOCK or ACCESSORY position, the lock mechanism within the steering column may be defective. This mechanism is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

REMOVAL AND INSTALLATION

SPARK PLUG CABLES

CAUTION: When disconnecting a high voltage cable from a spark plug or from the distributor cap, twist the rubber boot slightly (1/2 turn) to break it loose (Fig. 22). Grasp the boot (not the cable) and pull it off with a steady, even force.

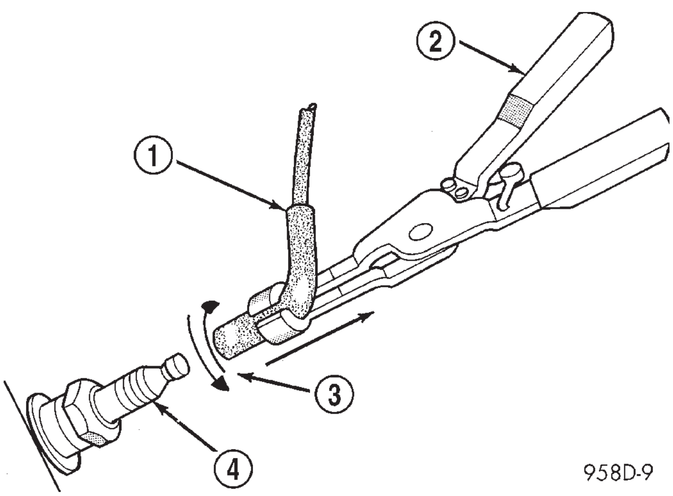


Fig. 22 Cable Removal

1 – SPARK PLUG CABLE AND BOOT
2 – SPARK PLUG BOOT PULLER
3 – TWIST AND PULL
4 – SPARK PLUG

Install cables into the proper engine cylinder firing order (Fig. 23), (Fig. 24) or (Fig. 25).

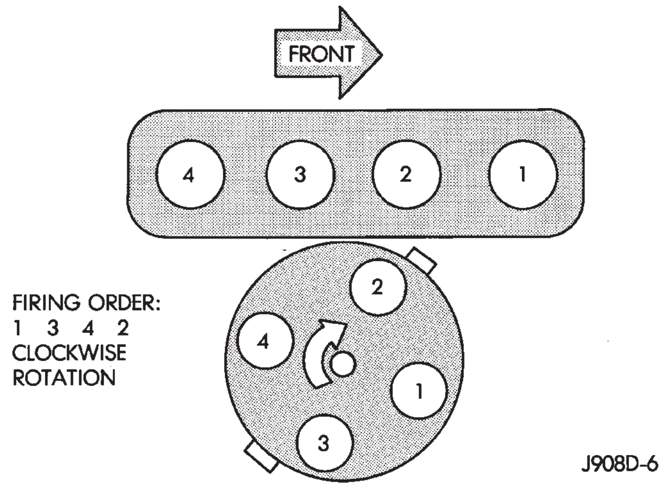


Fig. 23 Engine Firing Order—2.5L 4–Cyl. Engine

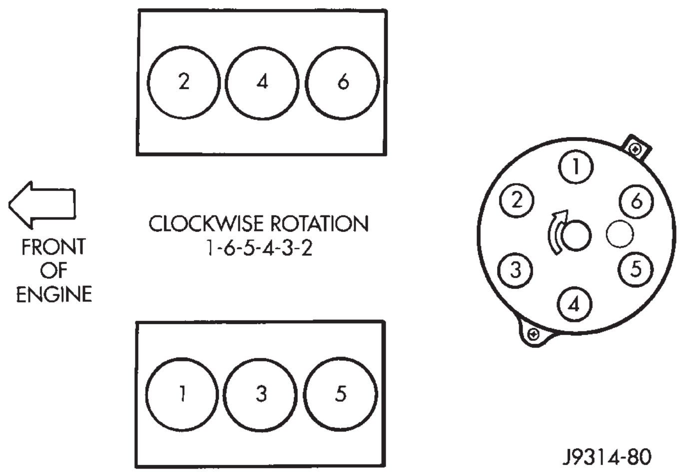


Fig. 24 Engine Firing Order—3.9L V-6 Engine

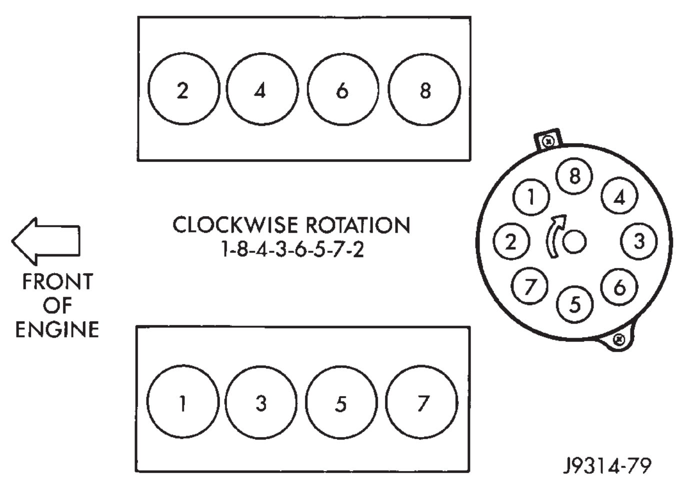


Fig. 25 Engine Firing Order—5.2/5.9L V-8 Engine

When replacing the spark plug and coil cables, route the cables correctly and secure in the proper

REMOVAL AND INSTALLATION (Continued)

retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise. It could also cause cross ignition of the plugs or short circuit the cables to ground.

When installing new cables, make sure a positive connection is made. A snap should be felt when a good connection is made between the plug cable and the distributor cap tower.

SPARK PLUGS

REMOVAL

On 3.9L V-6 and 5.2/5.9L V-8 engines, spark plug cable heat shields are pressed into the cylinder head to surround each cable boot and spark plug (Fig. 26).

If removal of the heat shield(s) is necessary,

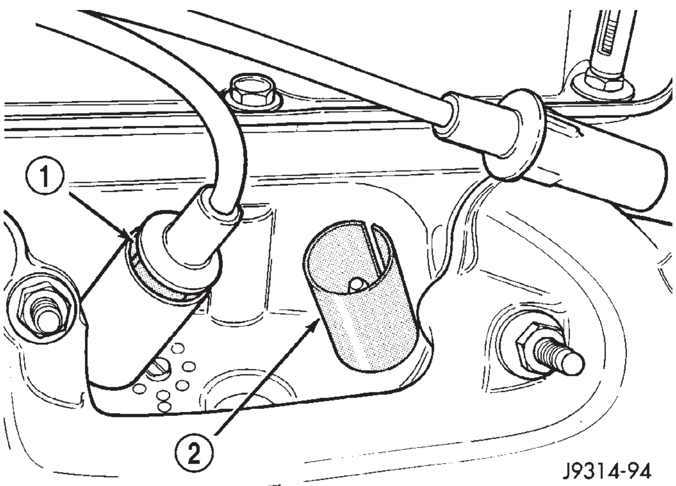


Fig. 26 Heat Shields—3.9/5.2/5.9L Engines

1 – AIR GAP
2 – SPARK PLUG BOOT HEAT SHIELD

remove the spark plug cable and compress the sides of shield for removal. Each shield is slotted to allow for compression and removal. To install the shields, align shield to machined opening in cylinder head and tap into place with a block of wood.

4.7L V–8 Engine: Each individual spark plug is located under each ignition coil. Each individual ignition coil must be removed to gain access to each spark plug. Refer to Ignition Coil Removal/Installation.

(1) Except 4.7L Engine: Prior to removing spark plug, spray compressed air around spark plug hole and area around spark plug. This will help prevent foreign material from entering combustion chamber.

(2) 4.7L V–8 Engine: Prior to removing spark plug, spray compressed air around base of ignition coil at cylinder head. This will help prevent foreign material from entering combustion chamber.

(3) Remove spark plug from cylinder head using a quality socket with a rubber or foam insert. If equipped with a 4.7L V-8 engine, also check condition of coil o-ring and replace as necessary.

(4) Except 4.7L: Always remove spark plug or ignition coil cables by grasping at the cable boot (Fig. 22). Turn the cable boot 1/2 turn and pull straight back in a steady motion. Never pull directly on the cable. Internal damage to cable will result.

(5) Inspect spark plug condition. Refer to Spark Plug Conditions.

CLEANING

The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file the center electrode flat with a small point file or jewelers file before adjusting gap.

CAUTION: Never use a motorized wire wheel brush to clean the spark plugs. Metallic deposits will remain on the spark plug insulator and will cause plug misfire.

GAP ADJUSTMENT

Check the spark plug gap with a gap gauge tool. If the gap is not correct, adjust it by bending the ground electrode (Fig. 27). **Never attempt to adjust the gap by bending the center electrode.**

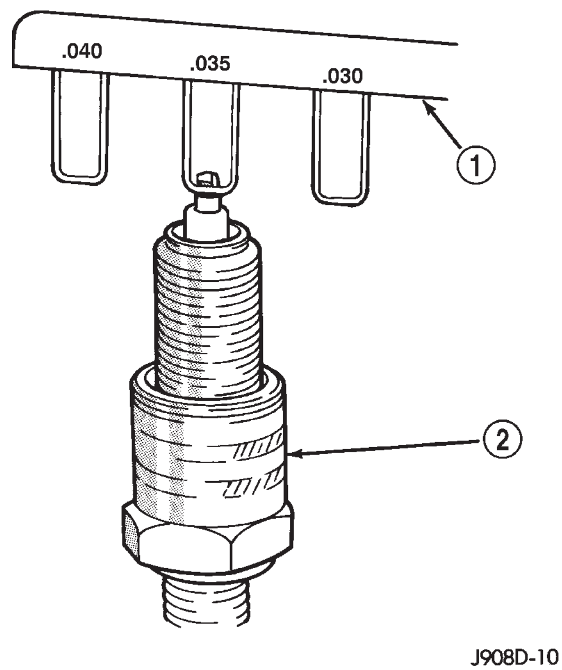


Fig. 27 Setting Spark Plug Gap—Typical

1 – GAUGE
2 – SPARK PLUG

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: The 4.7L V–8 engine is equipped with copper core ground electrode spark plugs. They must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

Special care should be taken when installing spark plugs into the cylinder head spark plug wells. Be sure the plugs do not drop into the plug wells as electrodes can be damaged.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap or a cracked porcelain insulator.

Except 4.7L Engine: When replacing the spark plug and ignition coil cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise. It could cause cross ignition of the spark plugs or short circuit the cables to ground.

(1) Start the spark plug into the cylinder head by hand to avoid cross threading.

(2) Except 4.7L Engine: Tighten spark plugs to 35-41 N·m (26-30 ft. lbs.) torque.

(3) Except 4.7L Engine: Install spark plug cables over spark plugs.

(4) 4.7L V–8 Engine: Tighten spark plugs to 27 N·m (20 ft. lbs.) torque.

(5) 4.7L V–8 Engine: Before installing coil(s), check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.

(6) 4.7L V–8 Engine: Install ignition coil(s). Refer to Ignition Coil Removal/Installation.

IGNITION COIL—2.5L ENGINE

The ignition coil is an epoxy filled type. If the coil is replaced, it must be replaced with the same type.

REMOVAL

The ignition coil is mounted to a bracket on the side of the engine to the rear of the distributor (Fig. 28).

(1) Disconnect the ignition coil secondary cable from ignition coil (Fig. 28).

(2) Disconnect engine harness connector from ignition coil.

(3) Remove ignition coil mounting bolts (nuts may also be used on back side of bracket).

(4) Remove coil.

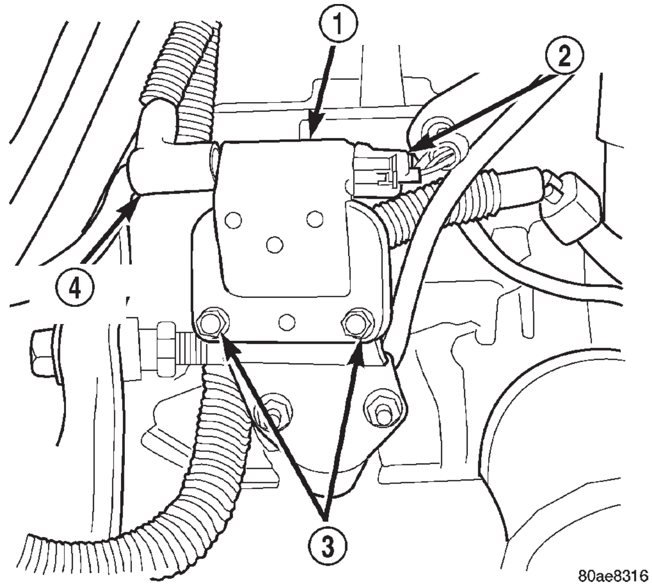


Fig. 28 Ignition Coil—2.5L Engine

1 – IGNITION COIL
2 – ELECTRICAL CONNECTOR
3 – MOUNTING BOLTS (2)
4 – SECONDARY CABLE

INSTALLATION

(1) Install ignition coil to bracket. If nut and bolts are used to secure coil to coil bracket, tighten to 11 N·m (100 in. lbs.) torque. If bolts are used, tighten bolts to 5 N·m (50 in. lbs.) torque.

(2) Connect engine harness connector to coil.

(3) Connect ignition coil cable to ignition coil.

IGNITION COIL—3.9/5.2/5.9L ENGINES

The ignition coil is an epoxy filled type. If the coil is replaced, it must be replaced with the same type.

REMOVAL

The coil is mounted to a bracket that is bolted to the front of the right engine cylinder head (Fig. 29). This bracket is mounted on top of the automatic belt tensioner bracket using common bolts.

(1) Disconnect the primary wiring from the ignition coil.

(2) Disconnect the secondary spark plug cable from the ignition coil.

WARNING: DO NOT REMOVE THE COIL MOUNTING BRACKET-TO-CYLINDER HEAD MOUNTING BOLTS. THE COIL MOUNTING BRACKET IS UNDER ACCESSORY DRIVE BELT TENSION. IF THIS BRACKET IS TO BE REMOVED FOR ANY REASON, ALL BELT TENSION MUST FIRST BE RELIEVED. REFER TO THE BELT SECTION OF GROUP 7, COOLING SYSTEM.

REMOVAL AND INSTALLATION (Continued)

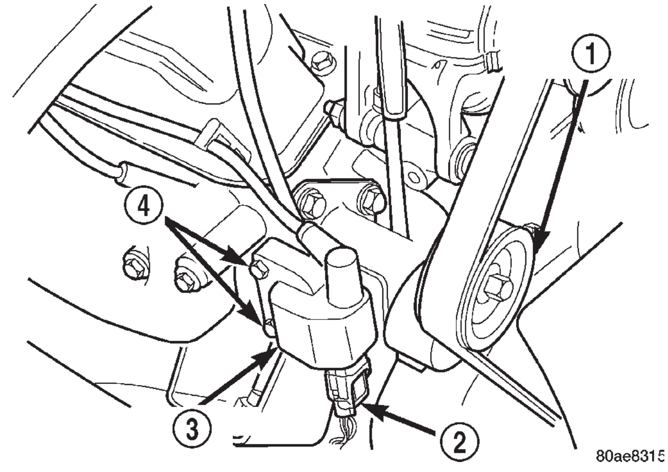


Fig. 29 Ignition Coil—3.9L V-6 or 5.2/5.9L V-8 Engines

1 – ACCESSORY DRIVE BELT TENSIONER
2 – COIL CONNECTOR
3 – IGNITION COIL
4 – COIL MOUNTING BOLTS

(3) Remove ignition coil from coil mounting bracket (two bolts).

INSTALLATION

(1) Install the ignition coil to coil bracket. If nuts and bolts are used to secure coil to coil bracket, tighten to 11 N·m (100 in. lbs.) torque. If the coil mounting bracket has been tapped for coil mounting bolts, tighten bolts to 5 N·m (50 in. lbs.) torque.

(2) Connect all wiring to ignition coil.

IGNITION COIL—4.7L ENGINE

REMOVAL

An individual ignition coil is used for each spark plug (Fig. 30). The coil fits into machined holes in the cylinder head. A mounting stud/nut secures each coil to the top of the intake manifold (Fig. 31). The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring (Fig. 30) is used to seal the coil at the opening into the cylinder head.

(1) Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.

(2) Disconnect electrical connector (Fig. 31) from coil by pushing downward on release lock on top of connector and pull connector from coil.

(3) Clean area at base of coil with compressed air before removal.

(4) Remove coil mounting nut from mounting stud (Fig. 31).

(5) Carefully pull up coil from cylinder head opening with a slight twisting action.

(6) Remove coil from vehicle.

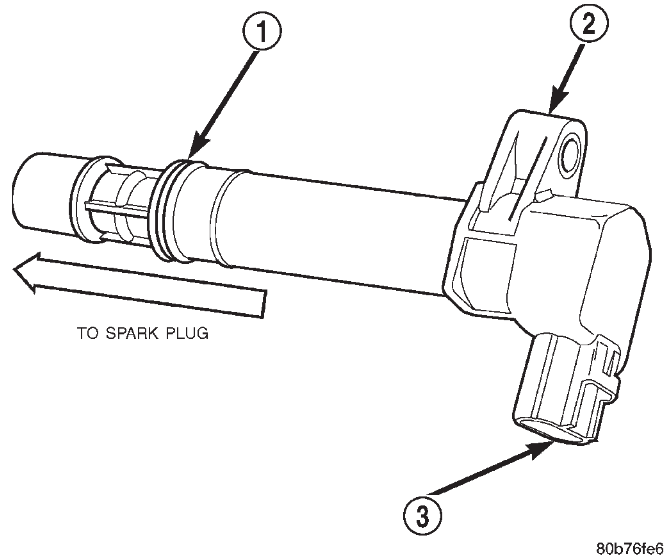


Fig. 30 Ignition Coil—4.7L V–8 Engine

1 – O-RING
2 – IGNITION COIL
3 – ELECTRICAL CONNECTOR

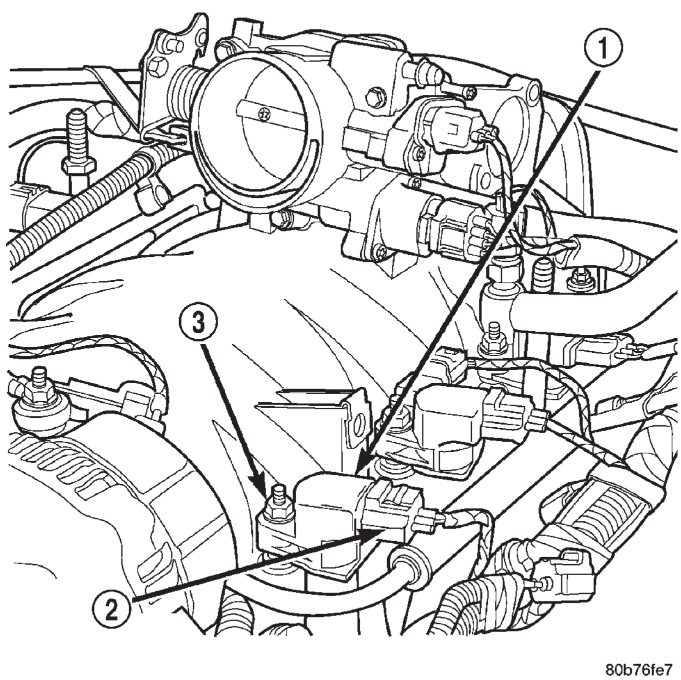


Fig. 31 Ignition Coil Location—4.7L V–8 Engine

1 – IGNITION COIL
2 – COIL ELECTRICAL CONNECTOR
3 – COIL MOUNTING STUD/NUT

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Using compressed air, blow out any dirt or contaminants from around top of spark plug.

(2) Check condition of coil o-ring and replace as necessary. To aid in coil installation, apply silicone to coil o-ring.

(3) Position ignition coil into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.

(4) Install mounting stud nut and tighten to 8 N·m (70 in. lbs.) torque.

(5) Connect electrical connector to coil by snapping into position.

(6) If necessary, install throttle body air tube or box.

CRANKSHAFT POSITION SENSOR—2.5L ENGINE

The crankshaft position sensor is mounted in the transmission bellhousing at left/rear side of engine block (Fig. 32).

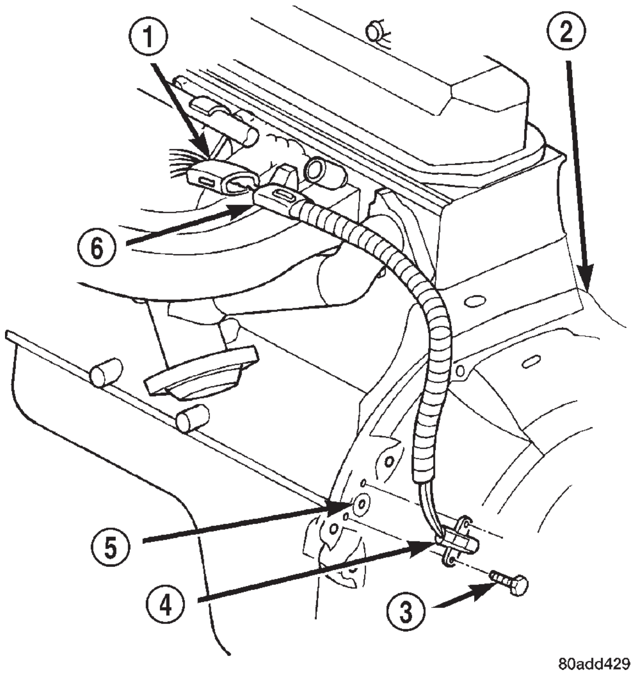


Fig. 32 Crankshaft Position Sensor—2.5L 4-Cylinder Engine

1 – ELECTRICAL CONNECTOR
2 – TRANSMISSION BELLHOUSING
3 – MOUNTING BOLTS (2)
4 – CRANKSHAFT POSITION SENSOR
5 – RUBBER GROMMET
6 – PIGTAIL HARNESS

REMOVAL

(1) Remove air tube between throttle body and air cleaner housing.

(2) Near rear of intake manifold, disconnect pigtail harness (on the sensor) from main electrical harness.

(3) Remove 2 sensor mounting bolts.

(4) Remove sensor.

(5) Remove clip from sensor wire harness.

INSTALLATION

(1) Install sensor flush against opening in transmission housing.

(2) Install and tighten two sensor mounting bolts to 19 N·m (14 ft. lbs.) torque.

CAUTION: Two bolts are used to secure the sensor to transmission. These bolts are specially machined to correctly space the unit to flywheel. Do not attempt to install any other bolts.

(3) Connect electrical connector to sensor.

(4) Install clip on sensor wire harness.

(5) Install air tube between throttle body and air cleaner housing.

CRANKSHAFT POSITION SENSOR—3.9/5.2/5.9L ENGINES

REMOVAL

The sensor is bolted to the top of the cylinder block near the rear of right cylinder head (Fig. 33). The sensor is accessed by removing the right front fender liner.

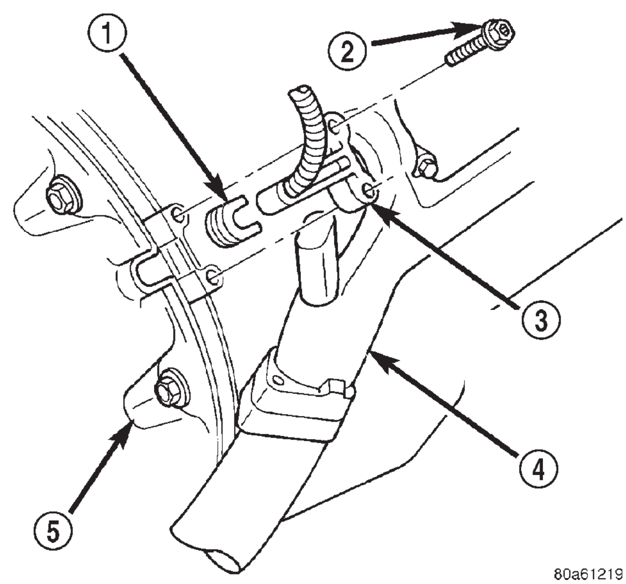


Fig. 33 Crankshaft Position Sensor—3.9/5.2/5.9L Engines

1 – GROMMET
2 – MOUNTING BOLTS (2)
3 – CRANKSHAFT POSITION SENSOR
4 – RIGHT EXHAUST MANIFOLD
5 – TRANSMISSION BELL HOUSING

REMOVAL AND INSTALLATION (Continued)

(1) Remove right front tire and right front wheelhouse liner. Refer to Front Wheelhouse Liner in Group 23, Body.

(2) Disconnect crankshaft position sensor pigtail harness from main wiring harness.

(3) Remove two sensor (recessed hex head) mounting bolts (Fig. 33).

(4) Remove sensor from engine.

INSTALLATION

(1) Position crankshaft position sensor to engine.

(2) Install mounting bolts and tighten to 8 N·m (70 in. lbs.) torque.

(3) Connect main harness electrical connector to sensor.

(4) Install right front tire and right front wheelhouse liner. Refer to Front Wheelhouse Liner in Group 23, Body.

CRANKSHAFT POSITION SENSOR—4.7L V-8 ENGINE

REMOVAL

The Crankshaft Position (CKP) sensor is located at the right-rear side of the engine cylinder block (Fig. 34). It is positioned and bolted into a machined hole in the engine block.

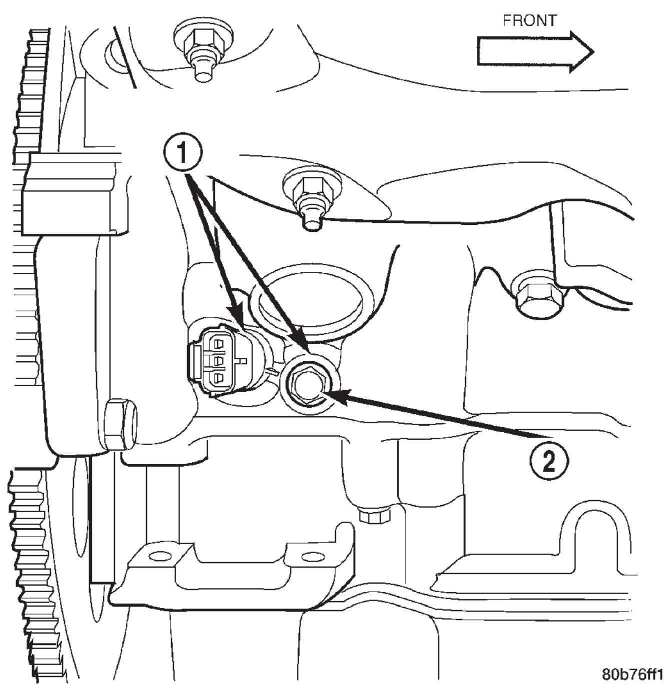


Fig. 34 CKP Sensor Location/Removal/Installation—4.7L V–8 Engine

1 – CRANKSHAFT POSITION SENSOR
2 – MOUNTING BOLT

(1) Disconnect CKP electrical connector at sensor.

(2) Remove CKP mounting bolt (Fig. 34).

(3) Carefully pry sensor from cylinder block in a rocking action with two small screwdrivers.

(4) Remove sensor from vehicle.

(5) Check condition of sensor o-ring.

INSTALLATION

(1) Clean out machined hole in engine block.

(2) Apply a small amount of engine oil to sensor o-ring.

(3) Install sensor into engine block with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.

(4) Install mounting bolt and tighten to 28 N·m (21 ft. lbs.) torque.

(5) Connect electrical connector to sensor.

CAMSHAFT POSITION SENSOR

The camshaft position sensor is located in the distributor on all 2.5/3.9/5.2/5.9L engines (Fig. 35).

REMOVAL

Distributor removal is not necessary to remove camshaft position sensor.

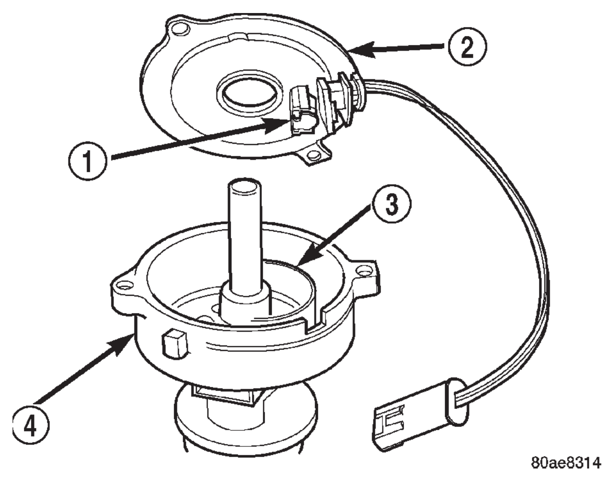


Fig. 35 Camshaft Position Sensor—Typical (3.9/5.2/5.9L Shown)

1 – SYNC SIGNAL GENERATOR
2 – CAMSHAFT POSITION SENSOR
3 – PULSE RING
4 – DISTRIBUTOR ASSEMBLY

(1) Remove air cleaner assembly.

(2) Disconnect negative cable from battery.

(3) Remove distributor cap from distributor (two screws).

REMOVAL AND INSTALLATION (Continued)

(4) Disconnect camshaft position sensor wiring harness from main engine wiring harness.

(5) Remove distributor rotor from distributor shaft.

(6) Lift the camshaft position sensor assembly from the distributor housing (Fig. 35).

INSTALLATION

(1) Install camshaft position sensor to distributor. Align sensor into notch on distributor housing.

(2) Connect wiring harness.

(3) Install rotor.

(4) Install distributor cap. Tighten mounting screws.

(5) Install air cleaner assembly.

CAMSHAFT POSITION SENSOR—4.7L ENGINE

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine is bolted to the front/top of the right cylinder head (Fig. 36).

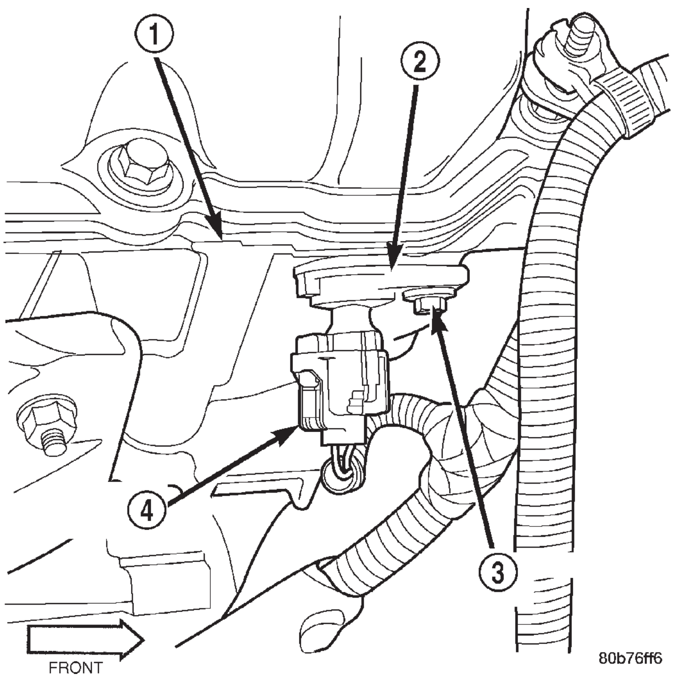


Fig. 36 CMP Location—4.7L Engine

1 – RIGHT CYLINDER HEAD
2 – CAMSHAFT POSITION SENSOR
3 – MOUNTING BOLT
4 – ELEC. CONNECTOR

REMOVAL

It is easier to remove/install sensor from under vehicle.

(1) Raise and support vehicle.

(2) Disconnect electrical connector at CMP sensor (Fig. 36).

(3) Remove sensor mounting bolt (Fig. 36).

(4) Carefully pry sensor from cylinder head in a rocking action with two small screwdrivers.

(5) Check condition of sensor o-ring.

INSTALLATION

(1) Clean out machined hole in cylinder head.

(2) Apply a small amount of engine oil to sensor o-ring.

(3) Install sensor into cylinder head with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

(4) Install mounting bolt and tighten to 12 N·m (106 in. lbs.) torque.

(5) Connect electrical connector to sensor.

(6) Lower vehicle.

DISTRIBUTOR—2.5L ENGINE

The distributor contains an internal oil seal that prevents oil from entering the distributor housing. The seal is not serviceable.

Factory replacement distributors are equipped with a plastic alignment pin already installed. The pin is located in an access hole on the bottom of the distributor housing (Fig. 37). It is used to temporarily lock the rotor to the cylinder number 1 position during installation. The pin must be removed after installing distributor.

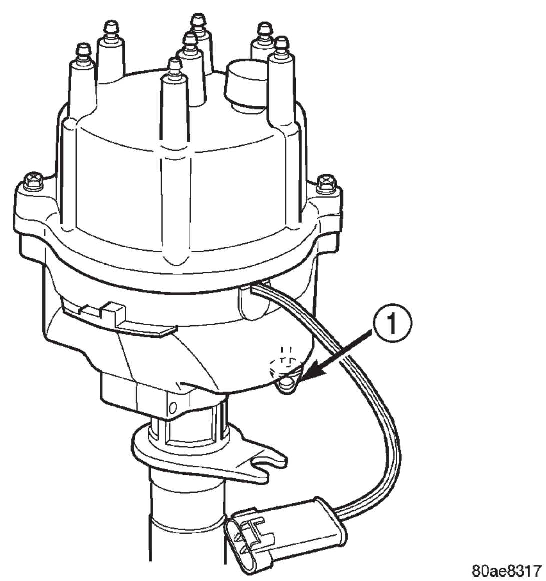


Fig. 37 Plastic Alignment Pin

1 – PLASTIC ALIGNMENT PIN

The camshaft position sensor is located in the distributor on all engines (Fig. 38). For removal/installation procedures, refer to Camshaft Position Sensor.

REMOVAL AND INSTALLATION (Continued)

Distributor removal is not necessary for sensor removal.

Refer to (Fig. 38) for an exploded view of the distributor.

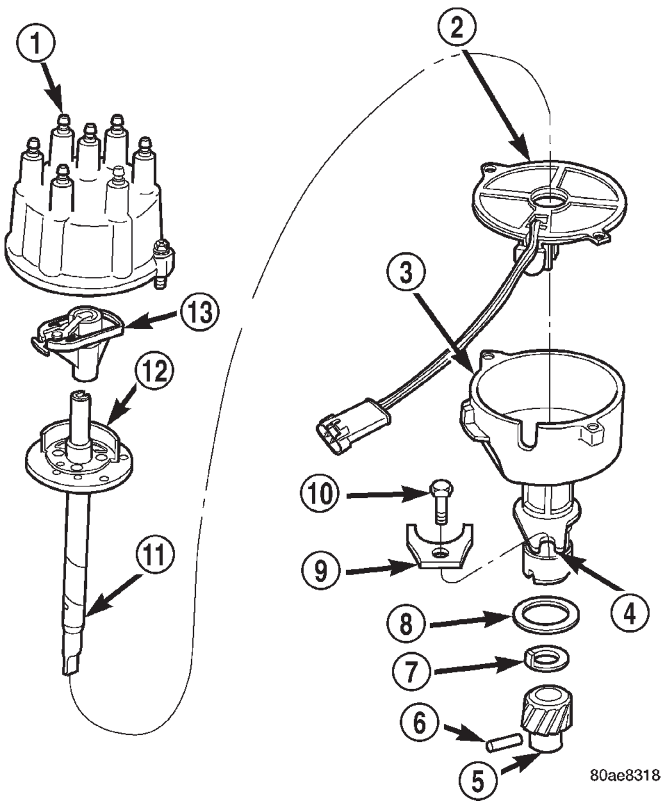


Fig. 38 Distributor—2.5L Engine—Typical

1 – CAP
2 – CAMSHAFT POSITION SENSOR
3 – HOUSING
4 – FORK WITH SLOT
5 – DRIVE GEAR
6 – ROLL PIN
7 – WASHER
8 – GASKET
9 – HOLDDOWN CLAMP
10 – HOLDDOWN BOLT
11 – SHAFT
12 – PULSE RING
13 – ROTOR

A fork with a slot is supplied on the bottom of the distributor housing where the housing base seats against the engine block (Fig. 38). The centerline of the slot aligns with the distributor holddown bolt hole in the engine block. Because of the fork, the distributor cannot be rotated. Distributor rotation is not necessary as all ignition timing requirements are handled by the powertrain control module (PCM).

The position of the distributor determines fuel synchronization only. It does not determine ignition timing.

NOTE: Do not attempt to modify this fork to attain ignition timing.

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Remove air tube between throttle body and air cleaner housing.

(3) Disconnect coil secondary cable at coil.

(4) Remove distributor cap from distributor (2 screws). Do not remove cables from cap. Do not remove rotor.

(5) Disconnect distributor wiring harness from main engine harness.

(6) Remove cylinder number 1 spark plug.

(7) Hold a finger over open spark plug hole. Rotate engine at vibration dampener bolt until compression (pressure) is felt.

(8) Slowly continue to rotate engine. Do this until timing index mark on vibration damper pulley aligns with top dead center (TDC) mark (0 degree) on timing degree scale (Fig. 39). Always rotate engine in direction of normal rotation. Do not rotate engine backward to align timing marks.

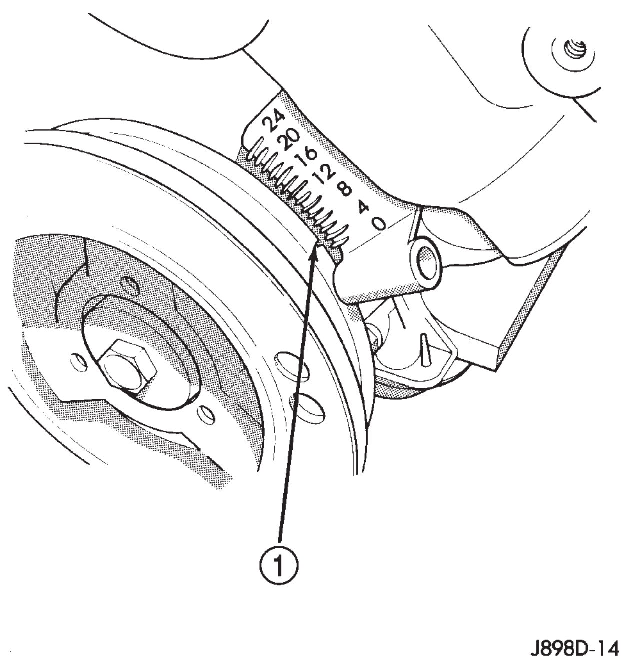


Fig. 39 Align Timing Marks

1 – CRANKSHAFT VIBRATION DAMPER TIMING MARK

(9) Remove distributor holddown bolt and clamp.

(10) Remove distributor from engine by slowly lifting straight up.

(11) Note that rotor will rotate slightly in a counterclockwise direction while lifting up distributor. The oil pump gear will also rotate slightly in a counterclockwise direction while lifting up distributor.

REMOVAL AND INSTALLATION (Continued)

This is due to the helical cut gears on distributor and camshaft.

(12) Note removed position of rotor during distributor removal. During installation, this will be referred to as the Pre-position.

(13) Observe slot in oil pump gear through hole on side of engine. It should be slightly before (counterclockwise of) 10 o'clock position (Fig. 40).

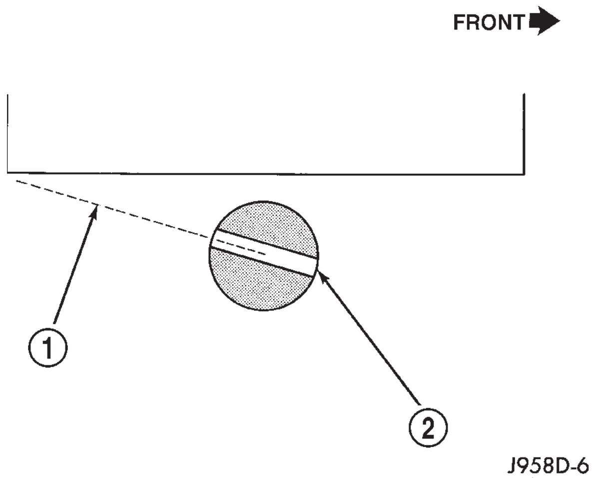


Fig. 40 Slot At 10 O'clock Position—2.5L Engine

1 – 10 0'CLOCK POSITION
2 – OIL PUMP SLOT

(14) Remove and discard the old distributor-to-engine block gasket.

INSTALLATION

(1) If engine crankshaft has been rotated after distributor removal, cylinder number 1 must be returned to its proper firing stroke. Refer to previous REMOVAL Step 6 and Step 7. These steps must be done before installing distributor.

(2) Check position of slot on oil pump gear. It should be just slightly before (counterclockwise of) 10 o'clock position (Fig. 40). If not, place a flat blade screwdriver into oil pump gear and rotate it into proper position.

(3) Factory replacement distributors are equipped with a plastic alignment pin already installed (Fig. 37). This pin is used to temporarily hold rotor to cylinder number 1 firing position during distributor installation. If this pin is in place, proceed to Step 8. If not, proceed to next step.

(4) If original distributor is to be reinstalled, such as during engine overhaul, the plastic pin will not be available. A 3/16 inch drift pin punch tool may be substituted for plastic pin.

(5) Remove camshaft position sensor from distributor housing. Lift straight up.

(6) Four different alignment holes are provided on the plastic ring (Fig. 41). **Note that 2.5L 4–cylinder and 4.0L 6–cylinder engines have different alignment holes (Fig. 41).**

(7) Rotate distributor shaft and install pin punch tool through proper alignment hole in plastic ring (Fig. 41) and into mating access hole in distributor housing. This will prevent distributor shaft and rotor from rotating.

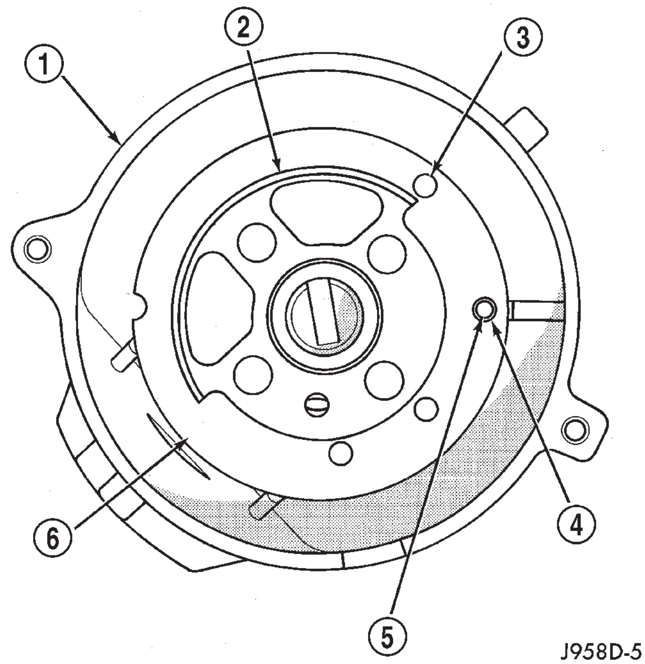


Fig. 41 Pin Alignment Holes

1 – DISTRIBUTOR HOUSING (TOP VIEW)
2 – PULSE RING
3 – 4.0L 6–CYLINDER ENGINE ALIGN. HOLE
4 – 2.5L 4–CYLINDER ENGINE ALIGN. HOLE
5 – MATING ACCESS HOLE IN DISTRIBUTOR HOUSING
6 – PLASTIC RING

(8) Clean distributor mounting hole area of engine block.

(9) Install new distributor-to-engine block gasket (Fig. 38).

(10) Install rotor to distributor shaft.

(11) Pre-position distributor into engine while holding centerline of base slot in 1 o'clock position (Fig. 42). Continue to engage distributor into engine. The rotor and distributor will rotate clockwise during installation. This is due to helical cut gears on distributor and camshaft. When distributor is fully seated to engine block, the centerline of base slot should be aligned to clamp bolt mounting hole on engine (Fig. 43). The rotor should also be pointed slightly past (clockwise of) 3 o'clock position.

It may be necessary to rotate rotor and distributor shaft (very slightly) to engage distributor shaft with slot in oil pump gear. The same may have to be done to engage distributor gear with camshaft gear.

REMOVAL AND INSTALLATION (Continued)

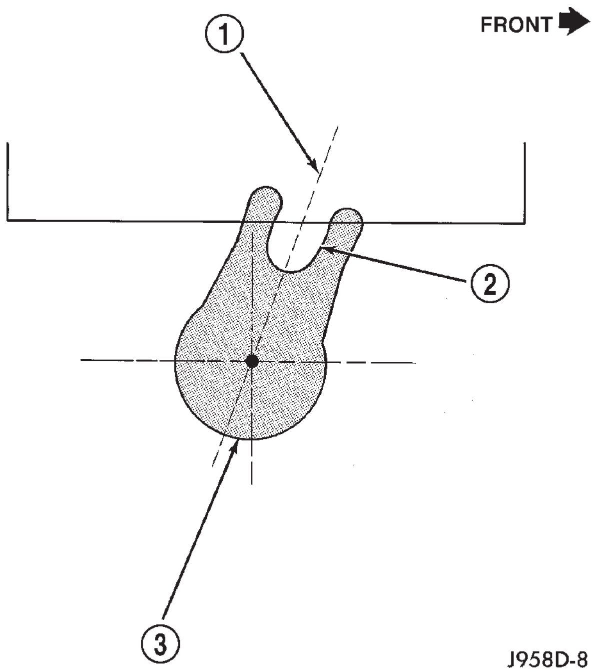


Fig. 42 Distributor Pre-position

1 – 1 O'CLOCK POSITION
2 – BASE SLOT
3 – DISTRIBUTOR BASE

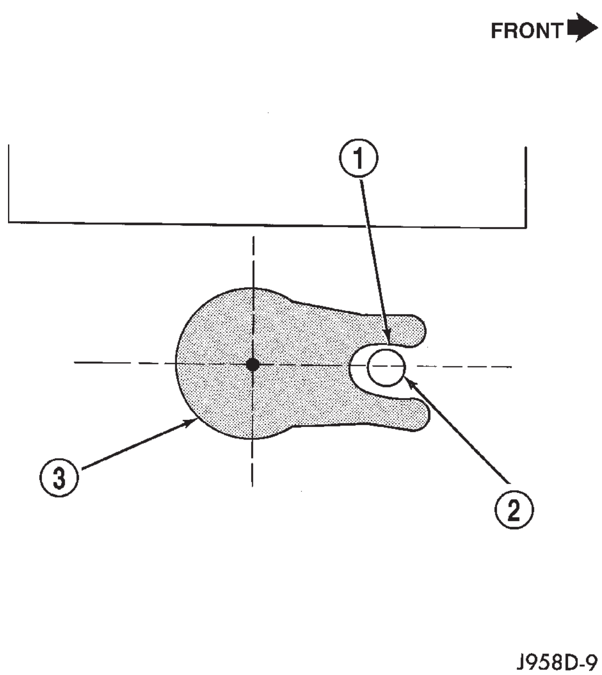


Fig. 43 Distributor Engaged Position—2.5L 4-Cylinder Engine

1 – DISTRIBUTOR BASE SLOT
2 – CLAMP BOLT MOUNTING HOLE (ON ENGINE)
3 – DISTRIBUTOR BASE

The distributor is correctly installed when:

- rotor is pointed at the 3 o'clock position
- plastic alignment pin (or pin punch tool) is still installed to distributor.
- number 1 cylinder piston is set at top dead center (TDC) (compression stroke).
- centerline of slot at base of distributor is aligned to centerline of distributor holddown bolt hole on engine. In this position, holddown bolt should easily pass through slot and into engine.

No adjustments are necessary. Proceed to next step.

(12) Install distributor holddown clamp and bolt. Tighten bolt to 23 N·m (17 ft. lbs.) torque.

(13) Remove pin punch tool from distributor. Or, if plastic alignment pin was used, remove it straight down from bottom of distributor. Discard plastic pin.

(14) If removed, install camshaft position sensor to distributor. Align wiring harness grommet to notch in distributor housing.

(15) Install rotor.

CAUTION: If the distributor cap is incorrectly positioned on distributor housing, the cap or rotor may be damaged when engine is started.

(16) Install distributor cap. Tighten distributor cap holddown screws to 3 N·m (26 in. lbs.) torque.

(17) If removed, install spark plug cables to distributor cap. For proper firing order, refer to Specifications section at end of this group. See Engine Firing Order.

(18) Connect distributor wiring harness to main engine harness.

(19) Connect air tube between throttle body and air cleaner housing.

(20) Connect battery cable to battery.

DISTRIBUTORS—3.9/5.2/5.9L ENGINES

REMOVAL

CAUTION: Base ignition timing is not adjustable on any engine. Distributors do not have built in centrifugal or vacuum assisted advance. Base ignition timing and timing advance are controlled by the Powertrain Control Module (PCM). Because a conventional timing light can not be used to adjust distributor position after installation, note position of distributor before removal.

(1) Remove air cleaner assembly.

(2) Disconnect negative cable from battery.

(3) Remove distributor cap from distributor (two screws).

(4) Mark the position of distributor housing in relationship to engine or dash panel. This is done to aid in installation.

REMOVAL AND INSTALLATION (Continued)

(5) Before distributor is removed, the number one cylinder must be brought to the Top Dead Center (TDC) firing position.

(6) Attach a socket to the Crankshaft Vibration Damper mounting bolt.

(7) Slowly rotate engine clockwise, as viewed from front, until indicating mark on crankshaft vibration damper is aligned to 0 degree (TDC) mark on timing chain cover (Fig. 44).

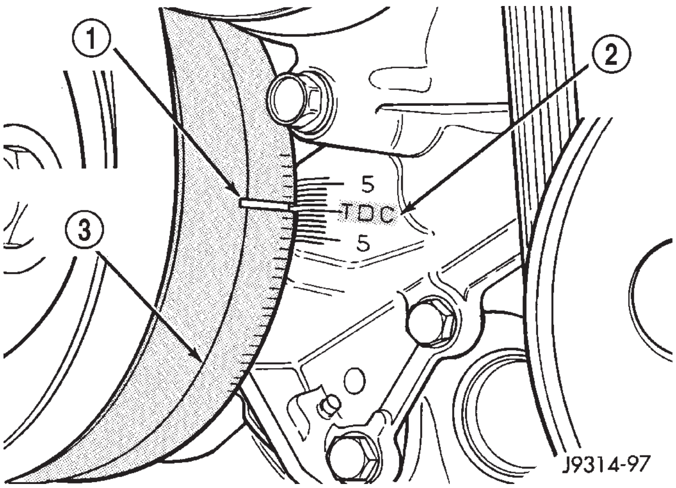


Fig. 44 Damper-To-Cover Alignment Marks—Typical

1 – ALIGNMENT MARK
2 – TIMING CHAIN COVER MARKS
3 – CRANKSHAFT VIBRATION DAMPER

(8) The distributor rotor should now be aligned to the CYL. NO. 1 alignment mark (stamped) into the camshaft position sensor (Fig. 45). If not, rotate the crankshaft through another complete 360 degree turn. Note the position of the number one cylinder spark plug cable (on the cap) in relation to rotor. Rotor should now be aligned to this position.

(9) Disconnect camshaft position sensor wiring harness from main engine wiring harness.

(10) Remove distributor rotor from distributor shaft.

(11) Remove distributor holddown clamp bolt and clamp (Fig. 46). Remove distributor from vehicle.

CAUTION: Do not crank engine with distributor removed. Distributor/crankshaft relationship will be lost.

INSTALLATION

If engine has been cranked while distributor is removed, establish the relationship between distributor shaft and number one piston position as follows:

Rotate crankshaft in a clockwise direction, as viewed from front, until number one cylinder piston is at top of compression stroke (compression should be felt on finger with number one spark plug removed). Then continue to slowly rotate engine clockwise until indicating mark (Fig. 44) is aligned to 0 degree (TDC) mark on timing chain cover.

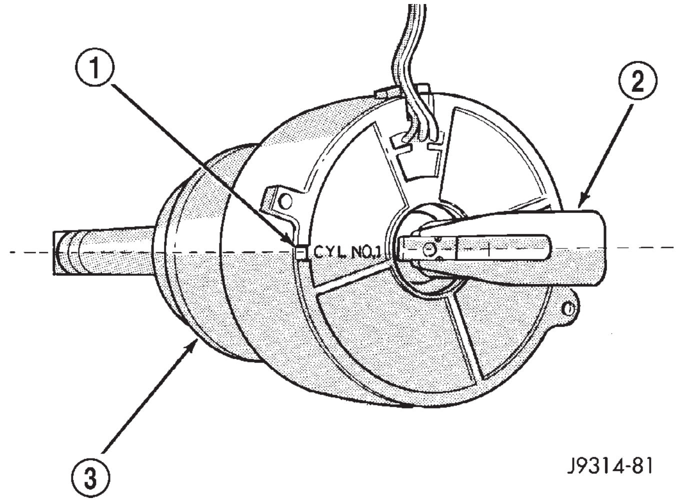


Fig. 45 Rotor Alignment Mark—3.9/5.2/5.9L Engines

1 – CAMSHAFT POSITION SENSOR ALIGNMENT MARK
2 – ROTOR
3 – DISTRIBUTOR

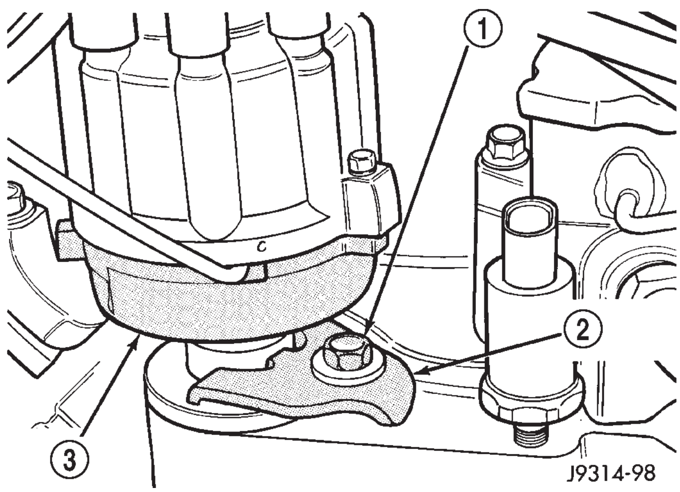


Fig. 46 Distributor Holddown Clamp—3.9/5.2/5.9L Engines

1 – CLAMP BOLT
2 – HOLDDOWN CLAMP
3 – DISTRIBUTOR HOUSING

(1) Clean top of cylinder block for a good seal between distributor base and block.

(2) Lightly oil the rubber o-ring seal on the distributor housing.

(3) Install rotor to distributor shaft.

(4) Position distributor into engine to its original position. Engage tongue of distributor shaft with slot

REMOVAL AND INSTALLATION (Continued)

in distributor oil pump drive gear. Position rotor to the number one spark plug cable position.

(5) Install distributor holddown clamp and clamp bolt. Do not tighten bolt at this time.

(6) Rotate the distributor housing until rotor is aligned to CYL. NO. 1 alignment mark on the camshaft position sensor (Fig. 45).

(7) Tighten clamp holddown bolt (Fig. 46) to 22.5 N·m (200 in. lbs.) torque.

(8) Connect camshaft position sensor wiring harness to main engine harness.

(9) Install distributor cap. Tighten mounting screws.

(10) Refer to the following, Checking Distributor Position.

CHECKING DISTRIBUTOR POSITION

To verify correct distributor rotational position, the DRB scan tool must be used.

WARNING: WHEN PERFORMING THE FOLLOWING TEST, THE ENGINE WILL BE RUNNING. BE CAREFUL NOT TO STAND IN LINE WITH THE FAN BLADES OR FAN BELT. DO NOT WEAR LOOSE CLOTHING.

(1) Connect DRB scan tool to data link connector. The data link connector is located in passenger compartment, below and to left of steering column.

(2) Gain access to SET SYNC screen on DRB.

(3) Follow directions on DRB screen and start engine. Bring to operating temperature (engine must be in “closed loop” mode).

(4) With engine running at **idle speed**, the words IN RANGE should appear on screen along with 0°. This indicates correct distributor position.

(5) If a plus (+) or a minus (-) is displayed next to degree number, and/or the degree displayed is not zero, loosen but do not remove distributor holddown clamp bolt. Rotate distributor until IN RANGE appears on screen. Continue to rotate distributor until achieving as close to 0° as possible. After adjustment, tighten clamp bolt to 22.5 N·m (200 in. lbs.) torque.

The degree scale on SET SYNC screen of DRB is referring to fuel synchronization only. **It is not referring to ignition timing.** Because of this, do not attempt to adjust ignition timing using this method. Rotating distributor will have no effect on ignition timing. All ignition timing values are controlled by powertrain control module (PCM).

After testing, install air cleaner assembly.

IGNITION SWITCH AND KEY CYLINDER

The ignition key must be in the key cylinder for cylinder removal.

KEY CYLINDER REMOVAL

(1) Disconnect negative cable from battery.

(2) If equipped with tilt column, remove tilt lever by turning it counterclockwise.

(3) Remove upper and lower covers (shrouds) from steering column (Fig. 47).

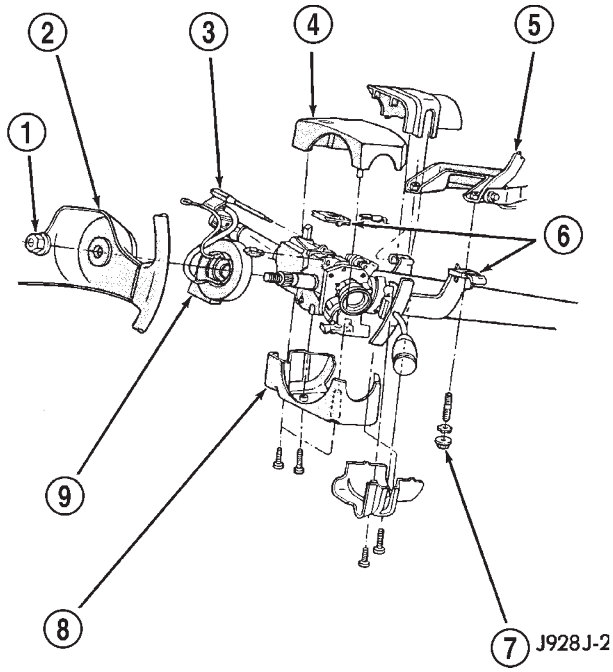


Fig. 47 Shroud Removal/Installation—Typical

1 – NUT
2 – STEERING WHEEL
3 – TILT LEVER
4 – UPPER SHROUD
5 – PANEL BRACKET
6 – SPACER
7 – NUT
8 – LOWER SHROUD
9 – CLOCK SPRING

(4) If equipped with automatic transmission, place shifter in PARK position.

(5) A retaining pin (Fig. 48) is located at side of key cylinder assembly.

(a) Rotate key to RUN position.

(b) Press in on retaining pin while pulling key cylinder from ignition switch.

IGNITION SWITCH REMOVAL

(1) Remove key lock cylinder. Refer to previous steps.

(2) Remove 3 ignition switch mounting screws (Fig. 49). Use tamper proof torx bit (Snap-On® SDMTR10 or equivalent) to remove screws.

(3) Gently pull switch away from column. Release connector locks on 7-terminal wiring connector at ignition switch and remove connector (Fig. 50).

REMOVAL AND INSTALLATION (Continued)

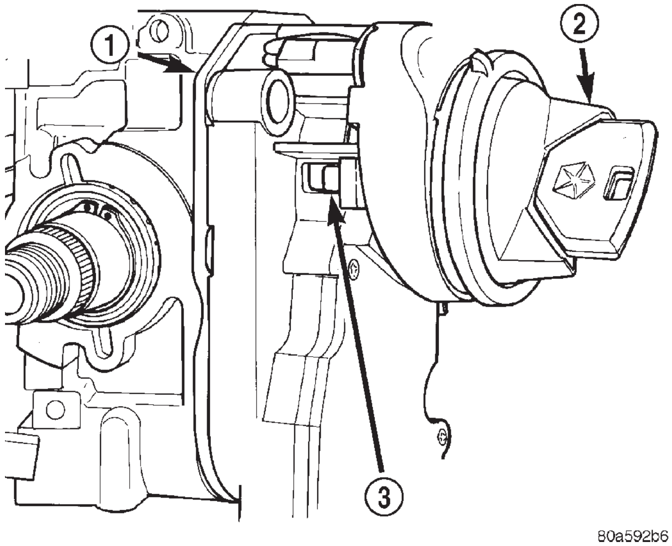


Fig. 48 Retaining Pin

1 – IGNITION SWITCH
2 – KEY/KEY CYLINDER (RUN POSITION)
3 – RETAINING PIN

(4) Release connector lock on 4-terminal halo lamp wiring connector and remove connector (Fig. 50).

(5) Disconnect electronic "PRNDL" from switch (if equipped).

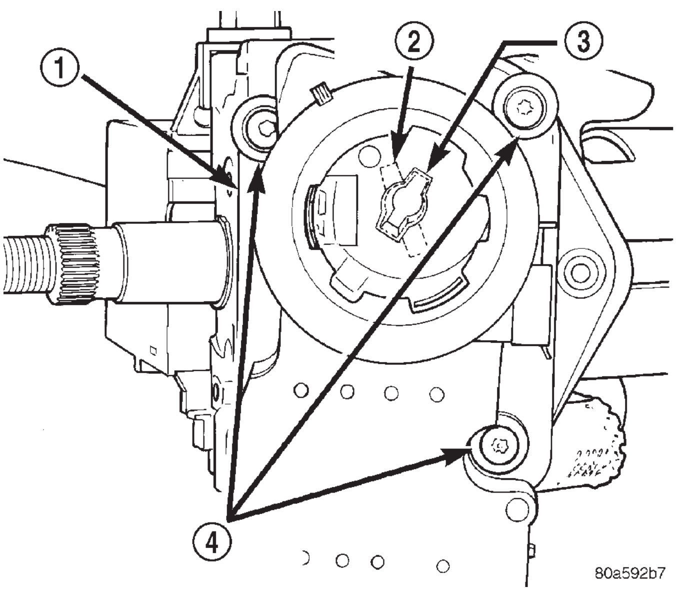


Fig. 49 Switch Mounting Screws

1 – IGNITION SWITCH
2 – SLOTS NOT ALIGNED
3 – SLOTS ALIGNED
4 – IGNITION SWITCH MOUNTING SCREWS (3)

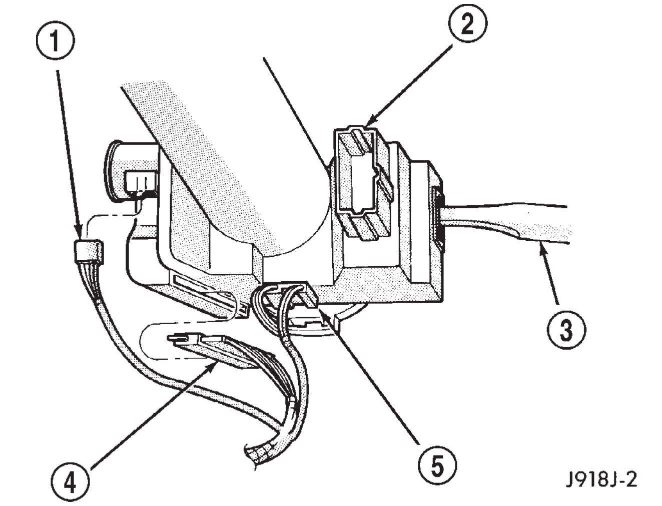


Fig. 50 Ignition Switch and Halo Lamp Connectors

1 – KEY-IN SWITCH & HALO LIGHT
2 – MULTI-FUNCTION SWITCH
3 – TURN SIGNAL SWITCH & LEVER
4 – IGNITION SWITCH
5 – SPEED CONTROL

IGNITION SWITCH AND KEY CYLINDER INSTALLATION

If installing **ignition key lock cylinder only,** proceed to following steps 2, 3 and 4. Also refer to following steps 12 through 18. If installing both switch and key cylinder, refer to steps 1 through 18.

(1) Rotate flag (Fig. 51) on rear of ignition switch until in RUN position. This step must be done to allow tang (Fig. 52) on key cylinder to fit into slots (Fig. 49) within ignition switch.

(2) With key into ignition key cylinder, rotate key clockwise until retaining pin can be depressed (Fig. 52) or (Fig. 53).

(3) Install key cylinder into ignition switch by aligning retaining pin into retaining pin slot (Fig. 53). Push key cylinder into switch until retaining pin engages. After pin engages, rotate key to OFF or LOCK position.

(4) Check for proper retention of key cylinder by attempting to pull cylinder from switch.

(5) Automatic Transmission Only: Before attaching ignition switch to steering column, the transmission shifter must be in PARK position. The park lock dowel pin on rear of ignition switch (Fig. 54) must also be properly indexed into the park lock linkage (Fig. 55) before installing switch.

(6) The flag at rear of ignition switch (Fig. 54) must be properly indexed into steering column before installing switch. This flag is used to operate the steering wheel lock lever in steering column (Fig. 56). This lever allows steering wheel position to be locked when key switch is in LOCK position.

REMOVAL AND INSTALLATION (Continued)

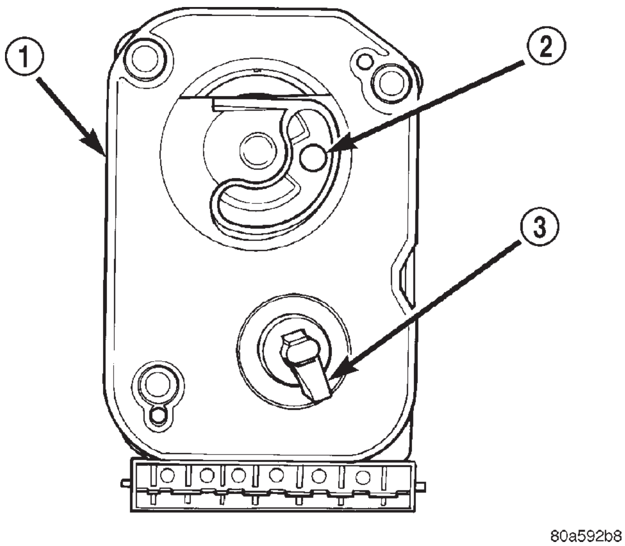


Fig. 51 Flag in RUN Position

1 – REAR OF IGNITION SWITCH
2 – PARK LOCK DOWEL PIN (RUN POSITION)
3 – FLAG (RUN POSITION)

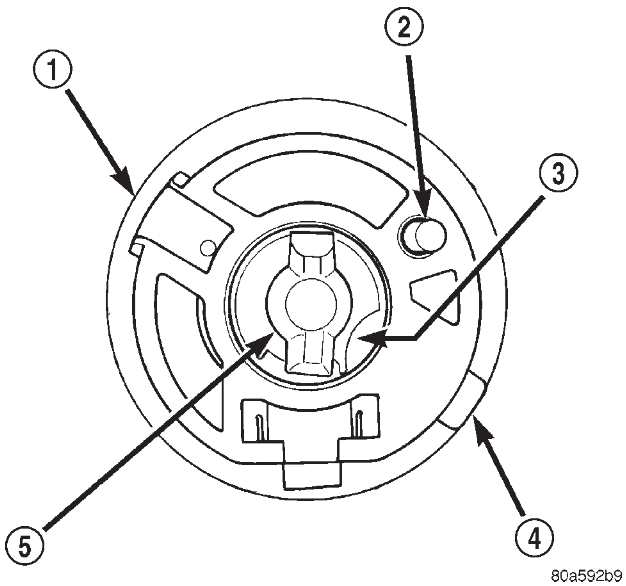


Fig. 52 Key Cylinder—Rear View

1 – IGNITION KEY LOCK CYLINDER
2 – PUSH PIN
3 – RETAINING PIN SLOT
4 – RETAINING PIN
5 – DRIVER

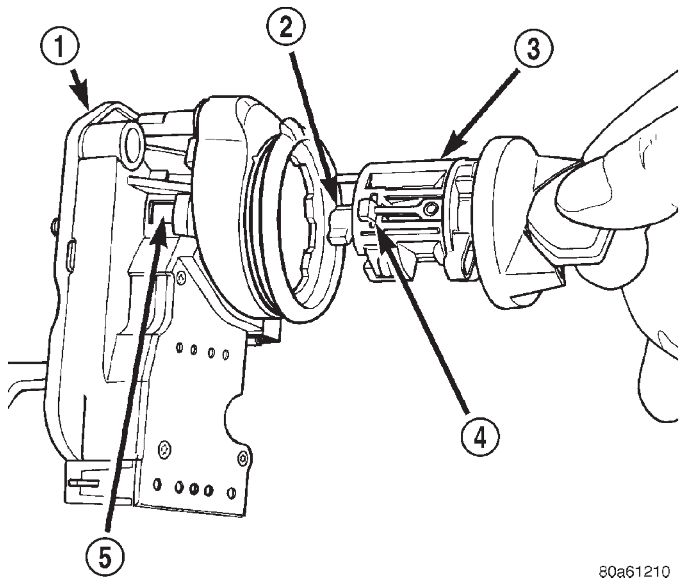


Fig. 53 Installing Key Cylinder Into Switch

1 – IGNITION SWITCH
2 – DRIVER
3 – IGNITION KEY LOCK CYLINDER
4 – RETAINING PIN
5 – RETAINING PIN SLOT

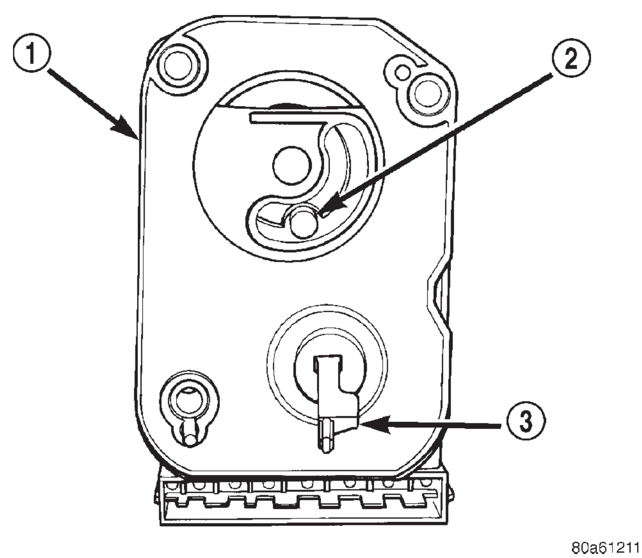


Fig. 54 Ignition Switch View From Column

1 – REAR OF IGNITION SWITCH
2 – PARK LOCK DOWEL PIN (LOCK POSITION)
3 – FLAG (LOCK POSITION)

(7) Place ignition switch in LOCK position. The switch is in the LOCK position when column lock flag is parallel to ignition switch terminals (Fig. 54).

(8) Automatic Transmission Only: Apply a light coating of grease to park lock dowel pin and park lock slider linkage. Before installing switch, push the park lock slider linkage (Fig. 55) forward until it bottoms. Do a final positioning by pulling it rearward about one-quarter inch.

(9) Apply a light coating of grease to both column lock flag and shaft at end of flag.

REMOVAL AND INSTALLATION (Continued)

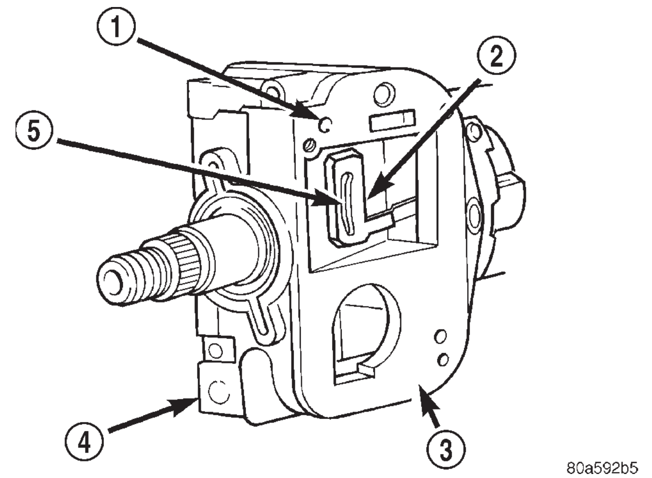


Fig. 55 Park Lock Linkage—Automatic Transmission—Typical

1 – DOWEL LOCATING HOLES (2)
2 – PARK LOCK SLIDER LINKAGE
3 – IGNITION SWITCH MOUNTING PAD
4 – STEERING COLUMN
5 – SLOT

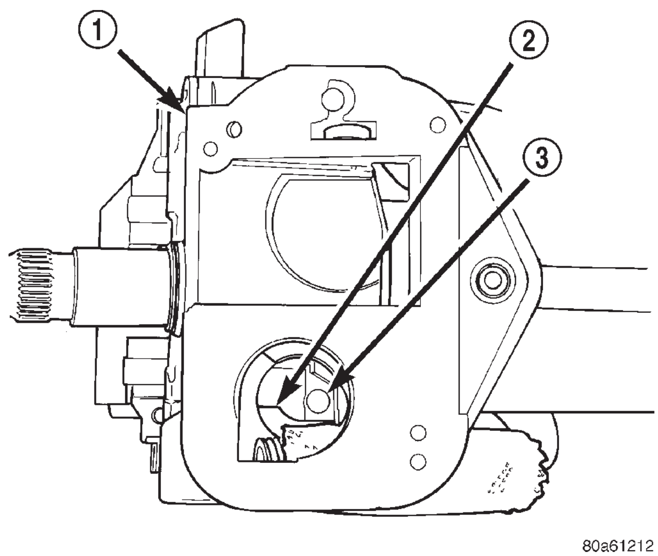


Fig. 56 Steering Wheel Lock Lever

1 – STEERING COLUMN
2 – STEERING WHEEL LOCK LEVER
3 – LOCATOR
(SHAFT AT END OF FLAG)

(10) Place ignition switch into openings on steering column.

(a) Automatic Transmission Only: Be sure park lock dowel pin on rear of ignition switch enters slot in park lock slider linkage (Fig. 55).

(b) Be sure flag on rear of switch is positioned above steering wheel lock lever (Fig. 56).

(c) Align dowel pins on rear of switch into holes on side of steering column.

(d) Install 3 ignition switch mounting screws. Tighten screws to 2 N·m ±.5 N·m (17 in. lbs. ± 5 in. lbs.) torque.

(e) After installing ignition switch, rotate ignition key from LOCK to ON position. Verify that park lock slider moves in slider slot, allowing gearshift lever to be moved out of PARK (auto. trans. only). If slider does not move, and gearshift lever is locked in PARK, the ignition switch park lock dowel pin, on rear of ignition switch, is not properly installed in slot of park lock slider linkage. Remove ignition switch and reinstall.

(11) Connect electrical connectors to ignition switch, halo lamp and (if equipped), to “PRNDL”. Make sure that switch locking tabs are fully seated in wiring connectors.

(12) Install steering column covers (shrouds). Tighten screws to 2 N·m (17 in. lbs.) torque.

(13) Install tilt column lever (if equipped).

(14) Connect negative cable to battery.

(15) Check for proper operation of halo light.

(16) Automatic Transmission Only: Shifter should lock in PARK position when key is in LOCK position (if equipped with shift lock device). Shifter should unlock when key rotated to ON position.

(17) Check for proper operation of ignition switch in ACCESSORY, LOCK, OFF, ON, RUN, and START positions.

(18) Steering wheel should lock when key is in LOCK position. Rotate steering wheel at least 180° to verify. Steering wheel should unlock when key is rotated to ON position.

COLUMN SHIFT INTERLOCK

REMOVAL/INSTALLATION

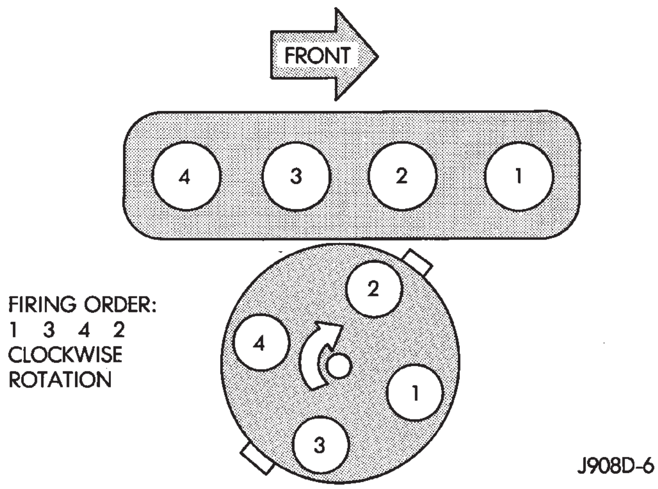
The column shift interlock is used to lock the transmission shifter in the Park position when the key is in the Off position. The interlock device is located within the steering column assembly and is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

SPECIFICATIONS

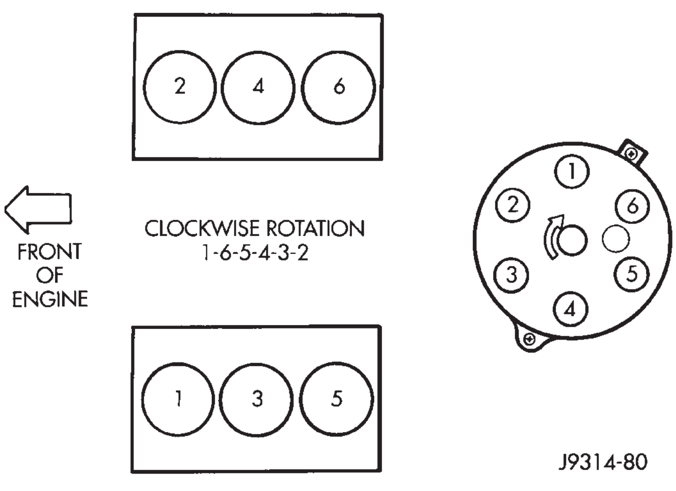
IGNITION TIMING

Ignition timing is not adjustable on any engine.

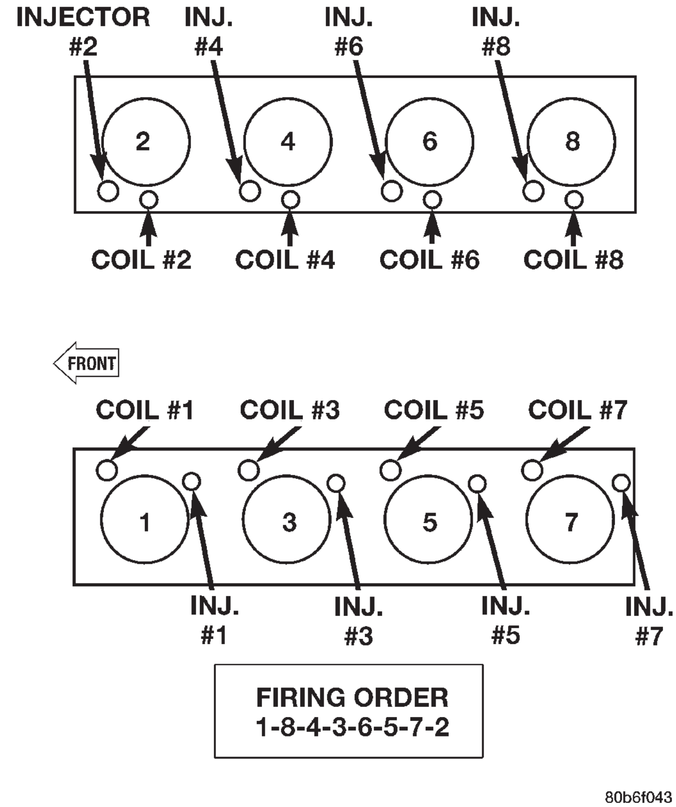
ENGINE FIRING ORDER—2.5L 4-CYLINDER ENGINE



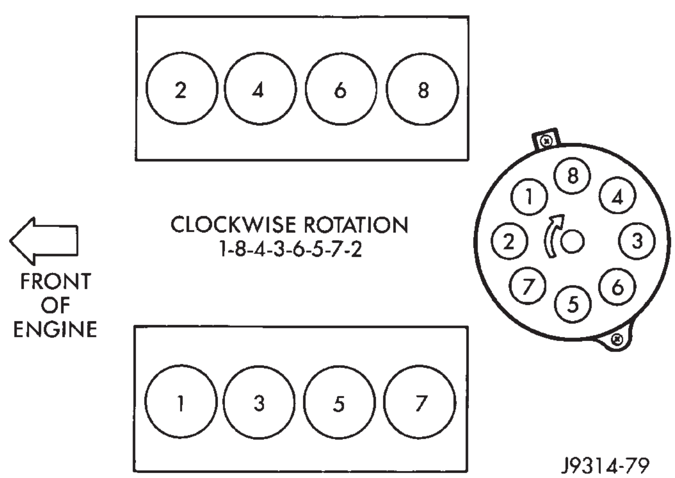
ENGINE FIRING ORDER—3.9L V-6 ENGINE



ENGINE FIRING ORDER—4.7L V-8 ENGINE



ENGINE FIRING ORDER—5.2L/5.9L V-8 ENGINES



SPECIFICATIONS (Continued)

SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
2.5L 4-CYL.	RC12ECC	0.89 mm (.035 in.)
3.9L V-6	RC12LC4	1.01 mm (.040 in.)
4.7L V-8	RC12MCC4	1.01 mm (.040 in.)
5.2L V-8	RC12LC4	1.01 mm (.040 in.)
5.9L V-8	RC12LC4	1.01 mm (.040 in.)

SPARK PLUG CABLE RESISTANCE

MINIMUM	MAXIMUM
250 Ohms Per Inch	1000 Ohms Per Inch
3000 Ohms Per Foot	12,000 Ohms Per Foot

IGNITION COIL RESISTANCE—EXCEPT 4.7L ENGINE

COIL MANUFACTURER	PRIMARY RESISTANCE @ 21-27°C (70-80°F)	SECONDARY RESISTANCE @ 21-27°C (70-80°F)
Diamond	0.97 - 1.18 Ohms	11,300 - 15,300 Ohms
Toyodenso	0.95 - 1.20 Ohms	11,300 - 13,300 Ohms

IGNITION COIL RESISTANCE—4.7L V-8 ENGINE

PRIMARY RESISTANCE 21-27°C (70-80°F)	SECONDARY RESISTANCE 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

TORQUE CHART

DESCRIPTION	TORQUE
Camshaft Position Sensor Bolt—4.7L V-8 Engine	12 N·m (106 in. lbs.)
Crankshaft Position Sensor—2.5L Engine	19 N·m (15 ft. lbs.)
Crankshaft Position Sensor—3.9L/5.2L/5.9L Engines	8 N·m (70 in. lbs.)
Crankshaft Position Sensor Bolt—4.7L V-8 Engine	28 N·m (21 ft. lbs.)
Distributor Hold Down Bolt	23 N·m (17 ft. lbs.)
Ignition Coil Mounting (except 4.7L) (if tapped bolts are used)	5 N·m (50 in. lbs.)
Ignition Coil Mounting (except 4.7L) (if nuts/bolts are used)	11 N·m (100 in. lbs.)
Ignition Coil Mounting Nut—4.7L V-8 Engine	8 N·m (70 in. lbs.)
Spark Plugs—Except 4.7L	35–41 N·m (26–30 ft. lbs.)
Spark Plugs—4.7L V-8 Engine	27 N·m (20 ft. lbs.)

INSTRUMENT PANEL SYSTEMS

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
INSTRUMENT PANEL SYSTEM	1
INSTRUMENT PANEL	1
INSTRUMENT CLUSTER	2
CENTRAL TIMER MODULE	4
CIGAR LIGHTER	4
GEAR SELECTOR INDICATOR	5
POWER OUTLET	5
DIAGNOSIS AND TESTING	
INSTRUMENT CLUSTER	6
CIGAR LIGHTER	11
POWER OUTLET	12
REMOVAL AND INSTALLATION	
CLUSTER BEZEL	12
HEADLAMP SWITCH	13
INSTRUMENT CLUSTER	13
INSTRUMENT CLUSTER COMPONENTS	14
STEERING COLUMN OPENING COVER	16
GEAR SELECTOR INDICATOR	17
PARK BRAKE RELEASE HANDLE	18
INSTRUMENT PANEL LOWER REINFORCEMENT	19
INSTRUMENT PANEL CENTER SUPPORT BRACKET	19
INSTRUMENT PANEL ASH RECEIVER	20
INSTRUMENT PANEL LOWER BEZEL	21
CIGAR LIGHTER AND POWER OUTLET	22
GLOVE BOX LAMP AND SWITCH	23
GLOVE BOX LATCH STRIKER	23
GLOVE BOX	24
GLOVE BOX COMPONENTS	25
CENTRAL TIMER MODULE	25
INSTRUMENT PANEL ASSEMBLY	27
INSTRUMENT PANEL TOP COVER	30

DESCRIPTION AND OPERATION

INSTRUMENT PANEL SYSTEM

DESCRIPTION

The instrument panel serves as the command center of the vehicle, which necessarily makes it a very complex unit. The instrument panel is designed to house the controls and monitors for standard and optional powertrains, climate control systems, audio systems, lighting systems, safety systems and many other comfort or convenience items. The instrument panel is also designed so that all of the various controls can be safely reached and the monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access to each of these items for service. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the instrument panel components and systems.

This group is responsible for covering service information for the vehicle instrument panel systems. However, complete service information coverage for all of the systems and components housed in the instrument panel in a single section of the service manual would not be practical. Therefore, the service information for any component will be found in the group designated to cover the vehicle system that the component belongs to, even though the component is mounted on or in the instrument panel. If you cannot locate a listing for the component or system you are servicing in the table of contents for this group, or if you are uncertain as to which vehicle system a component belongs to, it is suggested that you refer to the alphabetical **Component and System Index** found at the back of this service manual.

INSTRUMENT PANEL

DESCRIPTION

This instrument panel uses a full-width structural plastic foundation as its primary support. When the three primary molded plastic components of this structure are vibration welded together they provide superior instrument panel stiffness and integrity to help reduce buzzes, squeaks, and rattles even on the bumpiest roads.

This type of construction also provides improved energy absorption which, in conjunction with the dual airbag modules and seat belts, helps to improve occupant protection. This foundation structure also serves as the ducting for the heating and air conditioning system panel and defroster outlets, which greatly reduces the number of components used over conventional instrument panel construction.

DESCRIPTION AND OPERATION (Continued)

Modular instrument panel construction allows all of the gauges and controls to be serviced from the front of the panel. In addition, most of the instrument panel electrical components can be accessed without complete instrument panel removal. If necessary, the instrument panel can be removed from the vehicle as an assembly.

Removal of the steering column opening cover provides access to the steering column mounts, the steering column wiring, the gearshift interlock mechanism, the junction block, the relay and fuse block and much of the instrument panel wiring. Removal of the glove box provides access to the Central Timer Module (CTM), the radio antenna coaxial cable, and additional instrument panel wiring.

Removal of the instrument cluster bezel allows access to the cluster assembly, the radio, the exterior lighting system switches, and the heating and air conditioning controls. Removal of the cluster assembly allows access to the cluster illumination and indicator lamp bulbs, and more of the instrument panel wiring. The instrument panel lower bezel contains an ash receiver and has provisions for a cigar lighter and an accessory power outlet. Depending upon the body style, the lower bezel may also contain a passenger airbag on/off switch (except quad cab) or an optional rear window defogger switch (quad cab only).

Removal of the complete instrument panel is required for service of the passenger side airbag module and most passenger compartment components of the heating and air conditioning systems.

INSTRUMENT CLUSTER

DESCRIPTION

A single instrument cluster is offered on this model. The cluster is an electromechanical unit that utilizes integrated circuitry and information carried on the Chrysler Collision Detection (CCD) data bus network for control of all gauges and many of the indicator lamps. This cluster also incorporates a digital Vacuum Fluorescent Display (VFD) for the odometer/trip odometer display functions. Some variations of this cluster exist due to optional equipment and regulatory requirements.

This instrument cluster includes the following analog gauges:

- Coolant temperature gauge
- Fuel gauge
- Oil pressure gauge
- Speedometer
- Tachometer
- Voltmeter.

This instrument cluster also includes provisions for the following indicator lamps:

- Airbag indicator lamp
- Anti-lock Brake System (ABS) lamp
- Brake warning lamp
- Check gauges lamp
- Cruise-on indicator lamp (programmable)
- Door ajar lamp
- Four-wheel drive lock indicator lamp
- Headlamp high beam indicator lamp
- Low fuel warning lamp
- Low washer fluid warning lamp
- Malfunction Indicator Lamp (MIL)
- Overdrive-off indicator lamp (automatic transmission - programmable)
- Seat belt reminder lamp
- Security lamp
- Transmission oil temperature warning lamp (automatic transmission - programmable)
- Turn signal indicator lamps
- Upshift indicator lamp (manual transmission - programmable).

The instrument cluster includes a provision for mounting an automatic transmission gear selector indicator in the lower right corner of the cluster. A mechanical gear selector indicator is used with all automatic transmissions except the optional 45RFE to indicate the gear selector position. If the vehicle is equipped with the optional 45RFE automatic transmission, the instrument cluster contains an integral electronic gear selector indicator using a second digital Vacuum Fluorescent Display (VFD) to indicate the gear selector position. The electronic gear selector indicator is controlled by messages received by the instrument cluster from the electronic Transmission Control Module (TCM) over the CCD data bus network. Models equipped with a manual transmission have a block-out plate installed in place of the gear selector indicator.

The instrument cluster circuitry has a self-diagnostic actuator test capability, which will test each of the CCD bus message-controlled functions of the cluster by lighting the appropriate indicator lamps and positioning the gauge needles at several predetermined locations on the gauge faces in a prescribed sequence. For more information on this function, refer to **Instrument Cluster** in the Diagnosis and Testing section of this group.

The instrument cluster circuitry also sends chime tone requests over a hard wired circuit to the Central Timer Module (CTM) when it monitors certain conditions or inputs. The CTM replaces the chime or buzzer module. Refer to **Chime Warning System** in the Description and Operation section of Group 8U - Chime/Buzzer Warning Systems for more information on this feature.

The instrument cluster for this model is serviced only as a complete unit. If a cluster gauge or the

DESCRIPTION AND OPERATION (Continued)

cluster circuit board are faulty, the entire cluster must be replaced. The cluster lens, the cluster hood, the rear cluster housing cover, and the incandescent lamp bulbs and holders are available for service replacement.

OPERATION

GAUGE

With the ignition switch in the On or Start positions, voltage is supplied to all gauges through the instrument cluster electronic circuit board. With the ignition switch in the Off position, voltage is not supplied to the gauges. The gauges do not accurately indicate any vehicle condition unless the ignition switch is in the On or Start positions.

All of the instrument cluster gauges, except the odometer, are air core magnetic units. Two fixed electromagnetic coils are located within the gauge. These coils are wrapped at right angles to each other around a movable permanent magnet. The movable magnet is suspended within the coils on one end of a shaft. The gauge needle is attached to the other end of the shaft.

One of the coils has a fixed current flowing through it to maintain a constant magnetic field strength. Current flow through the second coil changes, which causes changes in its magnetic field strength. The current flowing through the second coil is changed by the instrument cluster electronic circuitry in response to messages received on the Chrysler Collision Detection (CCD) data bus network.

The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets. The instrument cluster circuitry is programmed to move all of the gauge needles back to the low end of their respective scales after the ignition switch is turned to the Off position.

INDICATOR LAMP

Indicator lamps are located in the instrument cluster and are served by the cluster circuit board and connectors. Many of the indicator lamps in the instrument cluster are controlled by the instrument cluster circuitry in response to messages received over the Chrysler Collision Detection (CCD) data bus network.

The four-wheel drive lock indicator lamp, headlamp high beam indicator lamp, low washer fluid warning lamp, security lamp and turn signal indicator lamps are hard wired. The seat belt reminder lamp is controlled by the instrument cluster programming and by CCD data bus messages from the Airbag Control Module (ACM). The brake warning lamp is controlled by a hard wired input from the park brake switch and by CCD data bus messages from the Controller Anti-lock Brake (CAB). The instrument cluster circuitry uses CCD data bus messages from the Powertrain Control Module (PCM), ACM, and CAB to control all of the remaining indicator lamps.

In addition, certain indicator lamps in this instrument cluster are programmable. This feature allows those indicator lamps to be activated or deactivated with a DRBIII® scan tool through the instrument cluster electronic circuitry for compatibility with certain optional equipment. The programmable indicator lamps for this model include the cruise-on indicator lamp, the overdrive-off indicator lamp, the transmission oil temperature warning lamp and the upshift indicator lamp.

Except for the cruise-on indicator lamp, the headlamp high beam indicator lamp and the turn signal indicator lamps, each of the indicator lamps in the instrument cluster is illuminated by a dedicated Light-Emitting Diode (LED). If an LED should fail, the entire instrument cluster must be replaced. The cruise-on indicator lamp is part of the odometer VFD display. The headlamp high beam indicator lamp and the turn signal indicator lamps use incandescent bulbs and holders. Each incandescent indicator lamp has a replaceable bulb and bulb holder.

CLUSTER ILLUMINATION LAMP

The cluster illumination lamps are hard wired in the instrument cluster. When the park or head lamps are turned on, the cluster illumination lamps light. Illumination brightness is adjusted by rotating the headlamp switch panel lamps dimmer thumbwheel (down to dim, up to brighten). The instrument cluster illumination lamps receive battery feed from the panel dimmer circuitry in the headlamp switch through a fuse in the junction block.

The instrument cluster electronic circuitry also monitors the cluster illumination lamp dimming level whenever the park or head lamps are turned on. The instrument cluster electronic circuitry responds by adjusting the dimming level of the instrument cluster Vacuum Fluorescent Display(s) (VFD), and sending dimming level messages over the Chrysler Collision Detection (CCD) data bus network. All VFDs are illuminated at full brightness for improved daylight visibility whenever the park lamps or headlamps are turned off.

Each of the cluster illumination lamps is located on the instrument cluster circuit board. Each cluster illumination lamp has a replaceable bulb and bulb holder.

DESCRIPTION AND OPERATION (Continued)

CENTRAL TIMER MODULE

DESCRIPTION

Two versions of the Central Timer Module (CTM) are available on this vehicle, a base version and a high-line version. The base version of the CTM is used on base models of the vehicle. The base version of the CTM combines the functions of a chime/buzzer module, an intermittent wipe module, and an ignition lamp time delay relay in a single unit. The base CTM also uses inputs from the door ajar switches, the headlamp switch and the key-in ignition switch to control the output to the dome lamp circuits, which allows the base CTM to provide load shedding to help protect the battery from becoming discharged.

The high-line version of the CTM is used on high-line vehicles. The high-line CTM provides all of the functions of the base version CTM, but also is used to control and integrate many of the additional electronic functions and features included on the high-line models. The high-line version of the CTM contains a central processing unit and interfaces with other modules in the vehicle on the Chrysler Collision Detection (CCD) data bus network.

The CCD data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

Both versions of the CTM are mounted under the passenger side end of the instrument panel, outboard of the instrument panel glove box opening. For diagnosis of the base version of the CTM, refer to **Central Timer Module** in the Diagnosis and Testing section of Group 8U - Chime/Buzzer Warning Systems. For diagnosis of the high-line version of the CTM or the CCD data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended. The CTM cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

Some of the functions and features that the CTM supports or controls include:

- Chimes for the following conditions:
- Headlamps on with ignition off and driver door open warning
- Key in ignition with ignition off and driver door open warning
- ABS lamp warning (if the vehicle is so equipped)
- Airbag lamp warning
- Check gauges lamp warning
- Door ajar lamp warning
- Low fuel lamp warning
- Low washer fluid lamp warning
- Seat belt reminder lamp warning
- Transmission oil temperature lamp warning (automatic transmission)
- Central locking
- Courtesy lamp defeat
- Courtesy lamp time-out (high-line only)
- Intermittent wipe control
- Enhanced accident response (high-line only)
- Horn chirp upon door lock with RKE (customer programmable) (high-line only)
- Illuminated entry (high-line only)
- Power door lock control (high-line only)
- Power lock inhibit (high-line only)
- Remote Keyless Entry (RKE) (high-line only)
- Remote radio switches (high-line only)
- Rolling door locks (customer programmable) (high-line only)
- Speed sensitive intermittent wipe (high-line only)
- Vehicle Theft Security System (VTSS) (high-line only) (if the vehicle is so equipped)
- Wipe after wash (high-line only).

More information on the operation of these CTM features and functions can be found in the group that covers the system to which that feature or function applies.

CIGAR LIGHTER

DESCRIPTION

A cigar lighter is standard equipment on this model. The cigar lighter is installed in the instrument panel lower bezel, which is located near the center of the instrument panel, below the radio. The cigar lighter base is secured by a snap fit within the instrument panel lower bezel.

The cigar lighter knob and heating element unit, and the cigar lighter receptacle unit are available for service. These components cannot be repaired and, if faulty or damaged, they must be replaced.

OPERATION

The cigar lighter consists of two major components: a knob and heating element unit, and the cigar lighter base or receptacle shell. The receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The cigar lighter receives battery voltage from a fuse in the junction block only when the ignition switch is in the Accessory or On positions.

The knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the knob and heating element are inserted in the receptacle shell, the heating element resistor coil is grounded through its

DESCRIPTION AND OPERATION (Continued)

housing to the receptacle shell. If the cigar lighter knob is pushed inward, the heat shield slides up toward the knob exposing the heating element, and the heating element extends from the housing toward the insulated contact in the bottom of the receptacle shell.

Two small spring-clip retainers are located on either side of the insulated contact inside the bottom of the receptacle shell. These clips engage and hold the heating element against the insulated contact long enough for the resistor coil to heat up. When the heating element is engaged with the contact, battery current can flow through the resistor coil to ground, causing the resistor coil to heat.

When the resistor coil becomes sufficiently heated, excess heat radiates from the heating element causing the spring-clips to expand. Once the spring-clips expand far enough to release the heating element, the spring-loaded housing forces the knob and heating element to pop back outward to their relaxed position. When the cigar lighter knob and element are pulled out of the receptacle shell, the protective heat shield slides downward on the housing so that the heating element is recessed and shielded around its circumference for safety.

GEAR SELECTOR INDICATOR

DESCRIPTION

An automatic transmission gear selector indicator is standard factory-installed equipment in this model, when it is also equipped with an optional automatic transmission. Two types of gear selector indicators are used, mechanical or electronic. Either gear selector indicator gives an indication of the transmission gear that has been selected with the automatic transmission gear selector lever. If the vehicle is equipped with the optional 45RFE automatic transmission, the instrument cluster contains an integral electronic gear selector indicator. All other automatic transmission types use the mechanical gear selector indicator.

Diagnosis of the electronic gear selector indicator should be performed using a DRBIII® scan tool and the proper Diagnostic Procedures manual. The electronic gear selector indicator cannot be adjusted or repaired. If faulty or damaged, the instrument cluster unit must be replaced.

The mechanical gear selector indicator housing is mounted to the rear of the instrument cluster housing. The mechanical gear selector indicator pointer is easily visible through an opening provided in the front of the instrument cluster mask, and is also lighted by the cluster illumination lamps for visibility at night. This group covers only the removal and installation of the mechanical gear selector indicator from the instrument cluster. Refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for the mechanical gear selector indicator cable adjustment procedures.

OPERATION

The electronic gear selector indicator uses a digital Vacuum Fluorescent Display (VFD) to indicate the gear selector position. The electronic gear selector indicator is controlled by messages received by the instrument cluster circuitry from the electronic Transmission Control Module (TCM) over the CCD data bus network.

The mechanical gear selector indicator has a spring-loaded pointer that is mechanically actuated by a cable connected to the gear selector indicator driver lever of the gear selector lever mechanism on the steering column. When the gear selector lever is moved the indicator driver lever moves, which actuates the spring-loaded pointer through the mechanical actuator cable. An adjuster mounted on the steering column housing provides a mechanical means of calibrating the gear selector indicator mechanism.

POWER OUTLET

DESCRIPTION

An accessory power outlet is optional equipment on this model. The power outlet is installed in the instrument panel lower bezel, which is located near the center of the instrument panel, below the radio. The power outlet base is secured by a snap fit within the instrument panel lower bezel. A plastic protective cap snaps into the power outlet base when the power outlet is not being used, and hangs from the power outlet base mount by an integral bail strap while the power outlet is in use.

The power outlet receptacle unit and the accessory power outlet protective cap are available for service. The power outlet receptacle cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the Power Distribution Center (PDC) at all times.

While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

DIAGNOSIS AND TESTING

INSTRUMENT CLUSTER

If all of the gauges and/or indicator lamps are inoperative, perform the Preliminary Diagnosis. If an individual gauge or Chrysler Collision Detection (CCD) data bus message-controlled indicator lamp is inoperative, go directly to the Self-Diagnostic Test. If an individual hard wired indicator lamp is inoperative, refer to **Instrument Cluster - Hard Wired Lamp Diagnosis** in the Diagnosis and Testing section of this group for the procedures to diagnosis that lamp. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

NOTE: Certain indicator lamps in this instrument cluster are programmable. This feature allows those indicator lamps to be activated or deactivated with a DRBIII® scan tool through the instrument cluster electronic circuitry for compatibility with certain optional equipment. If the problem being diagnosed involves improper illumination of the cruise-on indicator lamp, the overdrive-off indicator lamp, the transmission oil temperature warning lamp, or the upshift indicator lamp, use a DRBIII® scan tool to be certain that the instrument cluster has been programmed with the proper vehicle equipment option settings.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

PRELIMINARY DIAGNOSIS

(1) If the indicator lamps operate, but none of the gauges operate, go to Step 2. If all of the gauges and the CCD data bus message-controlled indicator lamps are inoperative, go to Step 5.

(2) Check the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(3) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the battery as required.

(4) Disconnect and isolate the battery negative cable. Remove the instrument cluster. Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument cluster wire harness connector A. If OK, refer to **Instrument Cluster - Self-Diagnostic Test** in the Diagnosis and Testing section of this group. If not OK, repair the open fused B(+) circuit to the fuse in the junction block as required.

(5) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 6. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(6) Turn the ignition switch to the On position and check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(7) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Install the instrument cluster. Connect the battery negative cable. Turn the ignition switch to the On position. Set the park brake. The red brake warning lamp should light. If OK, go to Step 8. If not OK, go to Step 9.

(8) Turn the ignition switch to the Off position. Turn on the park lamps and adjust the panel lamps dimmer thumbwheel on the headlamp switch to the full bright position. The cluster illumination lamps should light. If OK, go to Step 10. If not OK, repair the open power ground circuit from the instrument cluster wire harness connector A to ground as required.

(9) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument cluster. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the instrument cluster wire harness connector A. If OK, refer to **Instrument Cluster - Self-Diagnostic Test** in the Diagnosis and Testing section of this group. If not OK, repair the open fused ignition switch output (run/start) circuit to the fuse in the junction block as required.

(10) Disconnect and isolate the battery negative cable. Remove the instrument cluster. Check for continuity between the logic ground circuit cavity of the instrument cluster wire harness connector A and a good ground. There should be continuity. If OK, refer to **Instrument Cluster - Self-Diagnostic Test** in the Diagnosis and Testing section of this group. If not OK, repair the open logic ground circuit to ground as required.

DIAGNOSIS AND TESTING (Continued)

SELF-DIAGNOSTIC TEST

The instrument cluster self-diagnostic test will put the instrument cluster into its self-diagnostic mode. In this mode the instrument cluster can perform a self-diagnostic test that will confirm that the instrument cluster circuitry, the gauges, and the CCD data bus message-controlled indicator lamps are capable of operating as designed.

However, there may still be a problem with the CCD data bus, the Powertrain Control Module (PCM), the Transmission Control Module (TCM), the Airbag Control Module (ACM), the Controller Antilock Brake (CAB), or the inputs to one of these electronic control modules. Use a DRBIII® scan tool and the proper Diagnostic Procedures manual for testing of these components.

(1) Begin the test with the ignition switch in the Off position.

(2) Depress the trip odometer reset button.

(3) While holding the trip odometer reset button depressed, turn the ignition switch to the On position, but do not start the engine.

(4) Keep the trip odometer reset button depressed for about ten seconds, until **CHEC** appears in the odometer display, then release the odometer reset button.

(5) A series of three-digit numeric failure messages may appear in the odometer display, depending upon the failure mode. If a failure message appears, see the Instrument Cluster Failure Message chart for the description and proper correction. If no failure message appears, the self-diagnostic test will proceed as described in Step 6.

INSTRUMENT CLUSTER FAILURE MESSAGE		
Message	Description	Correction
110	A failure has been identified in the cluster CPU, RAM, or EEPROM.	1. Replace the faulty cluster.
900	The CCD data bus is not operational.	1. Check the CCD data bus connections at the cluster. 2. Check the cluster fuses. 3. Check the CCD data bus bias. 4. Check the CCD data bus voltage. 5. Check the CCD data bus terminations.
920	The cluster is not receiving a vehicle speed message from the PCM.	1. Check the PCM software level and reflash if required. 2. Use a DRBIII® scan tool to verify that the vehicle speed message is being sent by the PCM.
921	The cluster is not receiving a distance pulse message from the PCM.	1. Check the PCM software level and reflash if required. 2. Use a DRBIII® scan tool to verify that the distance pulse message is being sent by the PCM.
940	The cluster is not receiving an airbag lamp-on message from the ACM.	1. Check the CCD data bus connections at the ACM. 2. Check the ACM fuse.
950	The cluster is not receiving an ABS lamp-on message from the CAB.	1. Check the CCD data bus connections at the CAB. 2. Check the CAB fuse.
960	The cluster is not receiving a PRND21 message from the TCM.	1. Check the CCD data bus connections at the TCM. 2. Check the TCM fuse.
999	An error has been discovered.	1. Record the failure message. 2. Depress the trip odometer reset button to continue the Self-Diagnostic Test.

DIAGNOSIS AND TESTING (Continued)

(6) The instrument cluster will begin the odometer walking segment test. This test will require the operator to visually inspect each odometer segment as it is displayed to determine a pass or fail condition. First, all of the segments will be illuminated at once; then, each individual segment of the odometer display will be illuminated in sequence. If any segment in the display fails to illuminate, repeat the test to confirm the failure. If the failure is confirmed, replace the faulty instrument cluster. Following the odometer walking segment test, the self-diagnostic test will automatically proceed as described in Step 7.

(7) The instrument cluster will perform a bulb check of each indicator lamp that the instrument cluster circuitry controls. If an individual amber indicator lamp does not illuminate during this test, the instrument cluster should be removed. However, check that the incandescent lamp bulb is not faulty and that the bulb holder is properly installed on the instrument cluster electronic circuit board before considering instrument cluster replacement. If the bulb and bulb holder check OK, replace the faulty instrument cluster. Each of the red indicators are illuminated by a Light Emitting Diode (LED). If an LED fails to illuminate during this test, the instrument cluster must be replaced. Following the bulb check test, the self-diagnostic test will automatically proceed as described in Step 8.

(8) The instrument cluster will perform a gauge actuator test. In this test the instrument cluster circuitry positions each of the gauge needles at three different calibration points, then returns the gauge needles to their relaxed positions. If an individual gauge does not respond properly, or does not respond at all during the gauge actuator test, the instrument cluster should be removed. However, check that the gauge terminal pins are properly inserted through the spring-clip terminal pin receptacles on the instrument cluster electronic circuit board before considering instrument cluster replacement. If the gauge terminal connections are OK, replace the faulty instrument cluster.

(9) The self-diagnostic test is now completed. The instrument cluster will automatically exit the self-diagnostic mode and return to normal operation at the completion of the test, if the ignition switch is turned to the Off position during the test, or if a vehicle speed message indicating that the vehicle is moving is received from the PCM on the CCD data bus during the test.

(10) Go back to Step 1 to repeat the test, if required.

HARD WIRED LAMP DIAGNOSIS

Each of the lamps found in this section depends upon a hard wired circuit input to the instrument cluster for proper operation. The following procedures will help to diagnose conditions that may cause an inoperative hard wired lamp circuit condition.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

BRAKE WARNING LAMP

The diagnosis found here addresses an inoperative brake warning lamp condition. If the brake warning lamp stays on with the ignition switch in the On position and the park brake released, or comes on while driving, refer to **Rear Wheel Antilock** for vehicles equipped with a rear wheel anti-lock brake system, or refer to **Antilock Brakes** for vehicles equipped with a four wheel anti-lock brake system in the Diagnosis and Testing section of Group 5 - Brakes for further diagnosis. If no brake system problem is found, the following procedure will help locate a faulty park brake switch or park brake switch sense circuit. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the wire harness connector at the park brake switch. With the park brake released, check for continuity between the park brake switch terminal and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, adjust or replace the faulty park brake switch.

(4) Remove the instrument cluster. With the park brake switch wire harness connector still disconnected, check for continuity between the park brake switch sense circuit cavity of the park brake switch wire harness connector and a good ground. There

DIAGNOSIS AND TESTING (Continued)

should be no continuity. If OK, go to Step 5. If not OK, repair the shorted park brake switch sense circuit as required.

(5) Check for continuity between the park brake switch sense circuit cavities of the instrument cluster wire harness connector A and the park brake switch wire harness connector. There should be continuity. If OK, refer to **Instrument Cluster - Preliminary Diagnosis** in the Diagnosis and Testing section of this group for further testing of the brake warning lamp and the instrument cluster circuitry. If not OK, repair the open park brake switch sense circuit as required.

CLUSTER ILLUMINATION LAMP

The diagnosis found here addresses an inoperative instrument cluster illumination lamp condition. If the problem being diagnosed includes inoperative exterior lighting controlled by the headlamp switch, that system needs to be repaired first. If the exterior lamps controlled by the headlamp switch are inoperative, refer to **Headlamp Diagnosis** in the Diagnosis and Testing section of Group 8L - Lamps for diagnosis. If no exterior lighting system problems are found, the following procedure will help locate a short or open in the cluster illumination lamp circuit. If the problem being diagnosed involves a lack of dimming control for the odometer/trip odometer Vacuum Fluorescent Display (VFD), but all of the other cluster illumination lamps can be dimmed, repair the open headlamp switch output circuit input to the instrument cluster. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the panel lamps dimmer fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the park lamps on with the headlamp switch. Rotate the panel lamps dimmer thumbwheel on the headlamp switch upward to just before the interior lamps detent. Check for battery voltage at the panel lamps dimmer fuse in the junction block. Rotate the panel lamps dimmer thumbwheel downward while observing the test voltmeter. The reading should go from battery voltage to zero volts. If OK, go to Step 3. If not OK, repair the open panel lamps dimmer switch signal circuit to the headlamp switch as required. If the circuit tests OK, refer to **Headlamp Diagnosis** in the Diagnosis and Testing section of Group 8L - Lamps to diagnose the headlamp switch.

(3) Disconnect and isolate the battery negative cable. Remove the instrument cluster. Turn the headlamp switch off. Remove the panel lamps dimmer fuse from the junction block. Probe the fused panel lamps dimmer switch signal circuit cavity of the instrument cluster wire harness connector B. Check for continuity to a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted fused panel lamps dimmer switch signal circuit as required.

(4) Install the panel lamps dimmer fuse in the junction block. Connect the battery negative cable. Turn the park lamps on with the headlamp switch. Rotate the panel lamps dimmer thumbwheel on the headlamp switch upward to just before the interior lamps detent. Check for battery voltage at the fused panel lamps dimmer switch signal circuit cavity of the instrument cluster wire harness connector B. If OK, replace the faulty cluster illumination lamp bulb(s) and bulb holder(s). If not OK, repair the open fused panel lamps dimmer switch signal circuit as required.

FOUR-WHEEL DRIVE LOCK INDICATOR LAMP

The diagnosis found here addresses an inoperative four-wheel drive indicator lamp condition. If the problem being diagnosed is related to lamp accuracy, be certain to confirm that the problem is with the lamp or switch and not with a damaged or inoperative transfer case or transfer case linkage. Refer to **NV231 Diagnosis** or **NV242 Diagnosis** in the Diagnosis and Testing section of Group 21 - Transmission for more information. If no transfer case problem is found, the following procedure will help locate a short or open in the indicator lamp circuit. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the transfer case switch wire harness connector. Check for continuity between the ground circuit cavity of the transfer case switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Turn the ignition switch to the On position. Install a jumper wire between the four wheel drive lock indicator lamp driver circuit cavity of the transfer case switch wire harness connector and a good ground. The four-

DIAGNOSIS AND TESTING (Continued)

wheel drive lock indicator lamp should light. If OK, replace the faulty transfer case switch. If not OK, go to Step 5.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the wire harness connector at the Controller Anti-Lock Brake (CAB). Remove the instrument cluster. With the transfer case switch wire harness connector still disconnected, check for continuity between the four wheel drive lock indicator lamp driver circuit cavity of the instrument cluster wire harness connector B and a good ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted four wheel drive lock indicator lamp driver circuit as required.

(6) Check for continuity between the four wheel drive lock indicator lamp driver circuit cavities of the instrument cluster wire harness connector B and the transfer case switch wire harness connector. There should be continuity. If OK, replace the faulty bulb. If not OK, repair the open four wheel drive lock indicator lamp driver circuit as required.

HEADLAMP HIGH BEAM INDICATOR LAMP

The diagnosis found here addresses an inoperative headlamp high beam indicator lamp condition. If the problem being diagnosed is related to inoperative headlamp high beams, refer to **Headlamp Diagnosis** in the Diagnosis and Testing section of Group 8L - Lamps for diagnosis of the headlamp system. If no headlamp system problems are found, the following procedure will help locate an open in the high beam indicator lamp circuit. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster.

(2) Connect the battery negative cable. Turn the headlamps on and select the high beams with the multi-function switch stalk. Check for battery voltage at the high beam indicator driver circuit cavity of the instrument cluster wire harness connector B. If OK, replace the faulty bulb. If not OK, repair the open high beam indicator driver circuit to the headlamp dimmer (multi-function) switch as required.

LOW WASHER FLUID WARNING LAMP

The diagnosis found here addresses an inoperative low washer fluid warning lamp condition. If the problem being diagnosed is related to lamp accuracy, be certain to confirm that the problem is with the lamp or washer fluid level sensor and not with a damaged or empty washer fluid reservoir. Inspect the reservoir for proper fluid level and signs of damage or distortion that could affect sensor performance before you proceed with lamp diagnosis. Refer to **Washer System** in the Diagnosis and Testing section of Group 8K - Wiper and Washer Systems for more information. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect the wire harness connector from the washer fluid level sensor. Install a jumper wire between the two cavities of the washer fluid level sensor wire harness connector. Turn the ignition switch to the On position. About thirty seconds after the ignition switch is turned to the On position, the low washer fluid warning lamp should light. Turn the ignition switch to the Off position. Remove the jumper wire from the washer fluid level sensor connector. Turn the ignition switch to the On position and, following the cluster bulb check sequence, the lamp should go off. If OK, replace the faulty washer fluid level sensor. If not OK, go to Step 4.

NOTE: If the ignition switch is in the On position when the washer fluid level sensor circuit is grounded, the instrument cluster programming will double the low washer fluid warning lamp illumination delay time from thirty seconds to about sixty seconds. This feature is intended to compensate for the effects of washer fluid sloshing within the washer fluid reservoir while the vehicle is being driven.

(4) Turn the ignition switch to the Off position. Check for continuity between the ground circuit cavity of the washer fluid level sensor wire harness connector and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Disconnect and isolate the battery negative cable. Remove the instrument cluster. With the washer fluid level sensor wire harness connector still disconnected, check for continuity between the low washer fluid level sense circuit cavity of the instrument cluster wire harness connector B and a good ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted low washer fluid level sense circuit as required.

(6) Check for continuity between the low washer fluid level sense circuit cavities of the instrument

DIAGNOSIS AND TESTING (Continued)

cluster wire harness connector B and the washer fluid level sensor wire harness connector. There should be continuity. If OK, replace the faulty bulb. If not OK, repair the open low washer fluid level sense circuit as required.

SECURITY LAMP

The diagnosis found here addresses an inoperative security lamp condition. If the problem being diagnosed is an inaccurate security lamp, refer to **Vehicle Theft Security System** in the Diagnosis and Testing section of Group 8Q - Vehicle Theft/Security Systems for diagnosis. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the battery as required.

(3) Disconnect and isolate the battery negative cable. Remove the Central Timer Module (CTM). Disconnect the CTM wire harness connectors. Connect the battery negative cable. Install a jumper wire between the VTSS indicator driver circuit cavity of the 18-way CTM wire harness connector and a good ground. The security lamp should light. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the Vehicle Theft Security System (VTSS) and the CTM. If not OK, go to Step 4.

(4) Disconnect and isolate the battery negative cable. Remove the instrument cluster. Check for continuity between the fused B(+) circuit cavity of the instrument cluster wire harness connector A and the fused B(+) fuse in the junction block. There should be continuity. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the fuse in the junction block as required.

(5) Check for continuity between the VTSS indicator driver circuit cavities of the instrument cluster wire harness connector A and the 18-way CTM wire harness connector. There should be continuity. If OK, refer to **Instrument Cluster - Self-Diagnostic Test** in the Diagnosis and Testing section of this group for further diagnosis of the security lamp and the instrument cluster circuitry. If not OK, repair the open VTSS indicator driver circuit as required.

TURN SIGNAL INDICATOR LAMP

The diagnosis found here addresses an inoperative turn signal indicator lamp condition. For any other turn signal problem, refer to **Turn Signal and Hazard Warning Systems** in the Diagnosis and Testing section of Group 8J - Turn Signal and Hazard Warning Systems for further diagnosis. If no turn signal or hazard warning system problem is found, the following procedure will help locate a short or open in the indicator lamp circuit. For complete circuit descriptions, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster.

(2) Connect the battery negative cable. Activate the hazard warning system by moving the hazard warning switch button to the On position. Check for battery voltage at the inoperative (right or left) turn signal circuit cavity of the instrument cluster wire harness connector B. There should be a switching (on and off) battery voltage signal. If OK, replace the faulty (right or left) turn signal indicator lamp bulb. If not OK, repair the open (right or left) turn signal circuit to the turn signal/hazard warning (multi-function) switch as required.

CIGAR LIGHTER

For complete circuit diagrams, refer to **Cigar Lighter** in the Component Index of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused ignition switch output (run/accessory) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/accessory) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/accessory) circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Remove the cigar lighter knob and element from the cigar lighter receptacle. Check for continuity between the inside circumference of the cigar lighter receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Turn the ignition switch to the On position. Check for battery voltage at the insulated contact located at the back of the cigar lighter receptacle. If OK, replace the faulty cigar lighter knob and element. If not OK, go to Step 5.

DIAGNOSIS AND TESTING (Continued)

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument panel lower bezel. Check for continuity between the ground circuit cavity of the cigar lighter wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/accessory) circuit cavity of the cigar lighter wire harness connector. If OK, replace the faulty cigar lighter receptacle. If not OK, repair the open fused ignition switch output (run/accessory) circuit to the junction block fuse as required.

POWER OUTLET

For complete circuit diagrams, refer to **Power Outlet** in the Component Index of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the PDC. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the battery as required.

(3) Remove the plastic protective cap from the power outlet receptacle. Check for continuity between the inside circumference of the power outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 5.

(5) Disconnect and isolate the battery negative cable. Remove the instrument panel lower bezel. Check for continuity between the ground circuit cavity of the power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the power outlet wire harness connector. If OK, replace the faulty power outlet receptacle. If not OK, repair the open fused B(+) circuit to the PDC fuse as required.

REMOVAL AND INSTALLATION

CLUSTER BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is equipped with an automatic transmission, turn the ignition switch to the Unlock position, set the parking brake, and place the automatic transmission gear selector lever in the Low position.

(3) If the vehicle is so equipped, set the tilt steering column in its lowest position.

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry around the perimeter of the cluster bezel to disengage the snap clips from their receptacles in the instrument panel (Fig. 1).

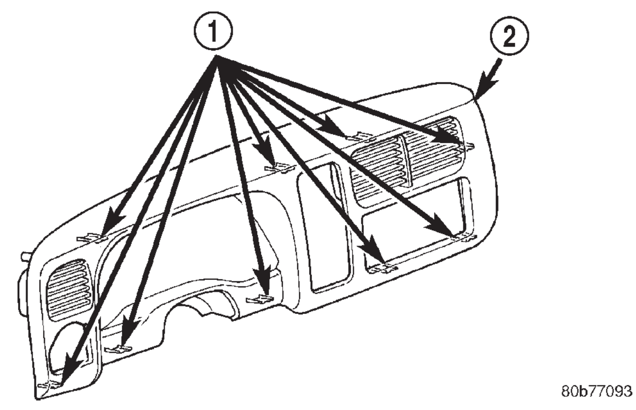


Fig. 1 Cluster Bezel Remove/Install

1 – SNAP CLIP RETAINERS
2 – CLUSTER BEZEL

(5) Remove the cluster bezel from the instrument panel.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position the cluster bezel to the instrument panel.

(2) Align the snap clips on the cluster bezel with the receptacles in the instrument panel.

(3) Press firmly on the cluster bezel over each of the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Reconnect the battery negative cable.

HEADLAMP SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(3) Remove the three screws that secure the headlamp switch to the instrument panel (Fig. 2).

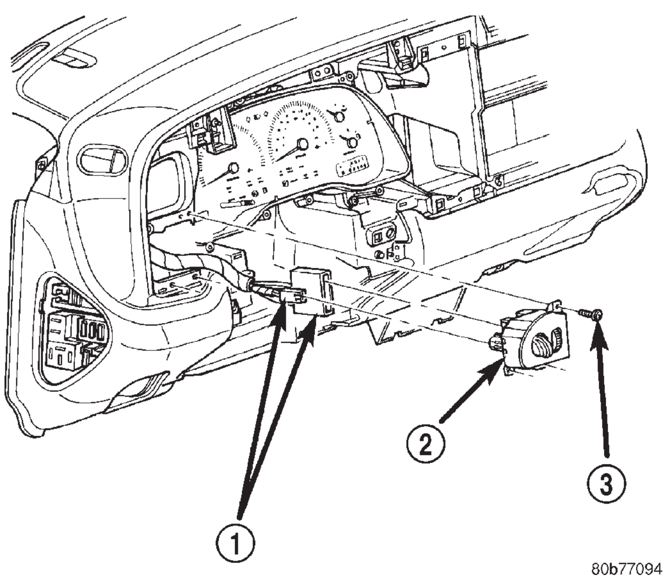


Fig. 2 Headlamp Switch Remove/Install

1 – INSTRUMENT PANEL WIRE HARNESS CONNECTORS
2 – HEADLAMP SWITCH
3 – SCREW (3)

(4) Pull the headlamp switch away from the instrument panel far enough to access the instrument panel wire harness connectors.

(5) Disconnect the two instrument panel wire harness connectors from the headlamp switch connector receptacles.

(6) Remove the headlamp switch from the instrument panel.

INSTALLATION

(1) Position the headlamp switch to the instrument panel.

(2) Reconnect the two instrument panel wire harness connectors to the headlamp switch connector receptacles.

(3) Install the headlamp switch into the instrument panel.

(4) Install and tighten the three screws that secure the headlamp switch to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

INSTRUMENT CLUSTER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the index of this service manual for the location of the proper cluster bezel removal procedures.

(3) Remove the four screws that secure the instrument cluster to the instrument panel (Fig. 3).

(4) If the vehicle is equipped with an automatic transmission, place the automatic transmission gear selector lever in the Park position.

(5) Pull the instrument cluster rearward far enough to disengage the two self-docking instrument panel wire harness connectors from the connector receptacles on the back of the cluster housing.

(6) If the vehicle is equipped with a mechanical automatic transmission gear selector indicator, remove the gear selector indicator from the back of

REMOVAL AND INSTALLATION (Continued)

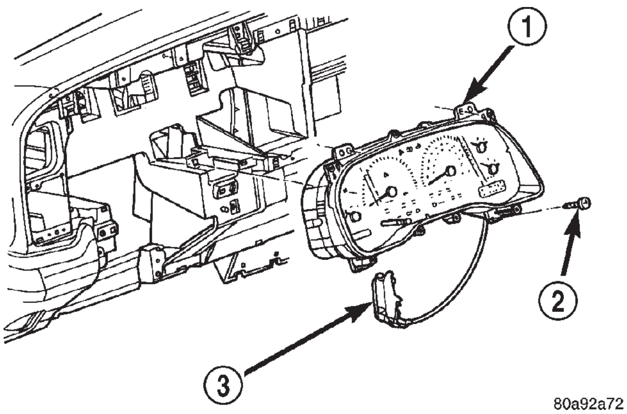


Fig. 3 Instrument Cluster Remove/Install

1 – CLUSTER
2 – SCREW
3 – PRNDL ADJUSTER AND CABLE

the cluster housing. Refer to **Gear Selector Indicator** in the index of this service manual for the location of the proper gear selector indicator removal procedures.

(7) Remove the instrument cluster from the instrument panel.

INSTALLATION

(1) Position the instrument cluster to the instrument panel.

(2) If the vehicle is equipped with amechanical automatic transmission gear selector indicator, install the gear selector indicator onto the back of the cluster housing. Refer to **Gear Selector Indicator** in the index of this service manual for the location of the proper gear selector indicator installation procedures.

(3) Align the instrument cluster with the cluster opening in the instrument panel and push the cluster firmly and evenly into place. The instrument panel has two self-docking wire harness connectors that will be automatically aligned with, and connected to the cluster connector receptacles when the cluster is installed in the instrument panel.

(4) Install and tighten the four screws that secure the instrument cluster to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the index of this service manual for the location of the proper cluster bezel installation procedures.

(6) Reconnect the battery negative cable.

NOTE: Certain indicator lamps in this instrument cluster are programmable. This feature allows those indicator lamps to be activated or deactivated with a DRBIII® scan tool through the instrument cluster electronic circuitry for compatibility with certain optional equipment. If a new instrument cluster is being installed, use a DRBIII® scan tool to program the instrument cluster with the proper vehicle equipment option settings to activate and/or deactivate the cruise-on indicator lamp, the overdrive-off indicator lamp, the transmission oil temperature warning lamp, and the upshift indicator lamp.

INSTRUMENT CLUSTER COMPONENTS

Some of the components for the instrument cluster used in this vehicle are serviced individually. The serviced components include: the incandescent instrument cluster indicator lamp and illumination lamp bulbs (including the integral bulb holders), the cluster lens and hood unit, the instrument cluster housing rear cover, and the instrument cluster housing (including the trip odometer reset knob, the cluster mask, the gauges and the instrument cluster electronic circuit board). Following are the service procedures for the instrument cluster components.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

CLUSTER BULB

This procedure applies to each of the incandescent cluster illumination lamp or indicator lamp bulb and bulb holder units. However, the illumination lamps and the indicator lamps use different bulb and bulb holder unit sizes. They must never be interchanged. Be certain that any bulb and bulb holder unit removed from the cluster electronic circuit board is reinstalled in the correct position. Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the instrument cluster, the electronic circuit board and/or the gauges.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Turn the bulb holder counterclockwise about sixty degrees on the cluster electronic circuit board.

REMOVAL AND INSTALLATION (Continued)

(4) Pull the bulb and bulb holder unit straight back to remove it from the bulb mounting hole in the cluster electronic circuit board (Fig. 4).

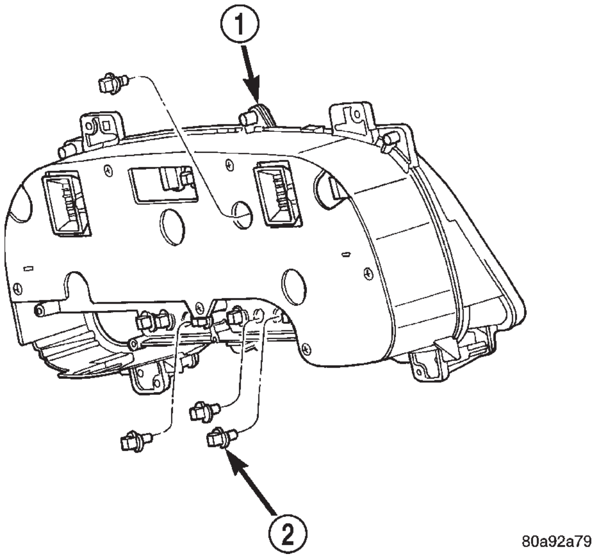


Fig. 4 Cluster Bulb Remove/Install

1 – INSTRUMENT CLUSTER
2 – BULB AND HOLDER

CLUSTER LENS AND HOOD

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Remove the seven screws that secure the lens and hood unit to the cluster housing (Fig. 5).

(4) Gently pull the lens and hood unit away from the cluster housing.

CAUTION: Do not touch the face of the gauge mask or the back of the cluster lens with your finger. It will leave a permanent finger print.

CLUSTER HOUSING REAR COVER

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Remove the six screws that secure the rear cover to the back of the cluster housing (Fig. 6).

(4) Remove the rear cover from the back of the cluster housing.

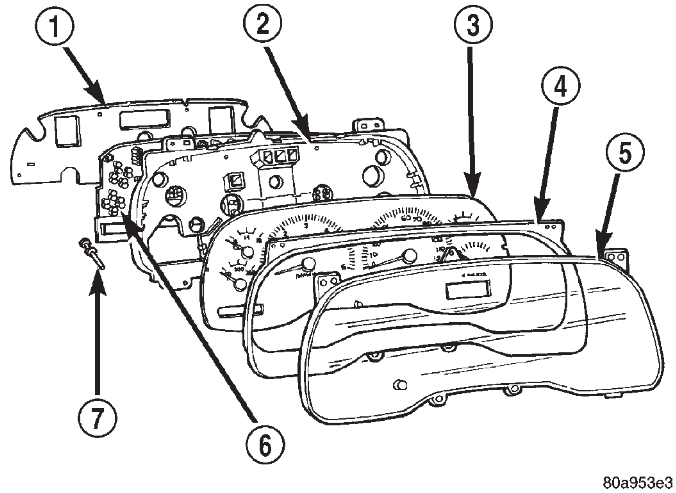


Fig. 5 Instrument Cluster Components

1 – COVER
2 – HOUSING
3 – MASK AND GAUGES
4 – HOOD
5 – LENS
6 – CIRCUIT BOARD
7 – ODOMETER RESET BUTTON

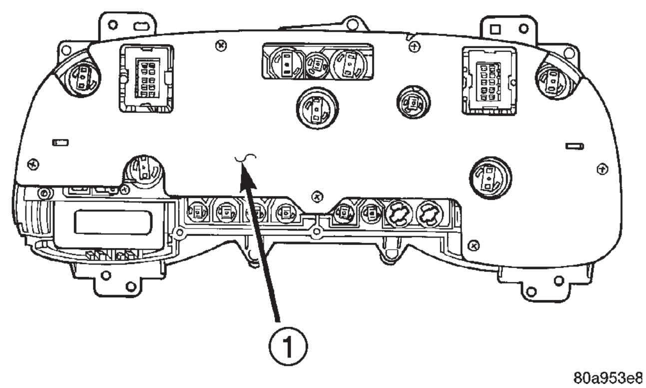


Fig. 6 Cluster Housing Rear Cover Remove/Install

1 – REAR CLUSTER HOUSING COVER

CLUSTER HOUSING

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Remove all of the incandescent illumination lamp and indicator lamp bulb and bulb holder units from the cluster electronic circuit board. Refer to **Instrument Cluster Components - Cluster Bulbs** in the Removal and Installation section of this group for the procedures.

(4) Remove the lens and hood unit from the cluster housing. Refer to **Instrument Cluster Compo-**

REMOVAL AND INSTALLATION (Continued)

nents - Cluster Lens and Hood in the Removal and Installation section of this group for the procedures.

(5) Remove the rear cover from the cluster housing. Refer to **Instrument Cluster Components - Cluster Housing Rear Cover** in the Removal and Installation section of this group for the procedures.

INSTALLATION

CLUSTER BULB

This procedure applies to each of the incandescent cluster illumination lamp or indicator lamp bulb and bulb holder units. However, the illumination lamps and the indicator lamps use different bulb and bulb holder unit sizes. They must never be interchanged. Be certain that any bulb and bulb holder unit removed from the cluster electronic circuit board is reinstalled in the correct position.

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the instrument cluster, the electronic circuit board and/or the gauges.

(1) Insert the bulb and bulb holder unit straight into the correct bulb mounting hole in the cluster electronic circuit board.

(2) With the bulb holder fully seated against the cluster electronic circuit board, turn the bulb holder clockwise about sixty degrees to lock it into place.

(3) Install the instrument cluster onto the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(4) Reconnect the battery negative cable.

CLUSTER LENS AND HOOD

(1) Align the lens and hood unit with the cluster housing.

(2) Press firmly and evenly on the lens and hood unit to install it onto the cluster housing.

(3) Install and tighten the seven screws that secure the lens and hood unit to the cluster housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Install the instrument cluster onto the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(5) Reconnect the battery negative cable.

CLUSTER HOUSING REAR COVER

(1) Position the rear cover to the back of the cluster housing.

(2) Install and tighten the six screws that secure the rear cover to the back of the cluster housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install the instrument cluster onto the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(4) Reconnect the battery negative cable.

CLUSTER HOUSING

(1) Install the rear cover onto the cluster housing. Refer to **Instrument Cluster Components - Cluster Housing Rear Cover** in the Removal and Installation section of this group for the procedures.

(2) Install the lens and hood unit onto the cluster housing. Refer to **Instrument Cluster Components - Cluster Lens and Hood** in the Removal and Installation section of this group for the procedures.

(3) Install all of the incandescent illumination lamp and indicator lamp bulb and bulb holder units onto the cluster electronic circuit board. Refer to **Instrument Cluster Components - Cluster Bulbs** in the Removal and Installation section of this group for the procedures.

(4) Install the instrument cluster onto the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(5) Reconnect the battery negative cable.

STEERING COLUMN OPENING COVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the three screws that secure the lower edge of the steering column opening cover to the lower instrument panel reinforcement (Fig. 7).

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the upper edge of the steering column opening cover just below the cluster bezel on each side of the steering column away from the instrument panel far enough to disengage the snap clip retainers from the receptacles in the instrument panel.

REMOVAL AND INSTALLATION (Continued)

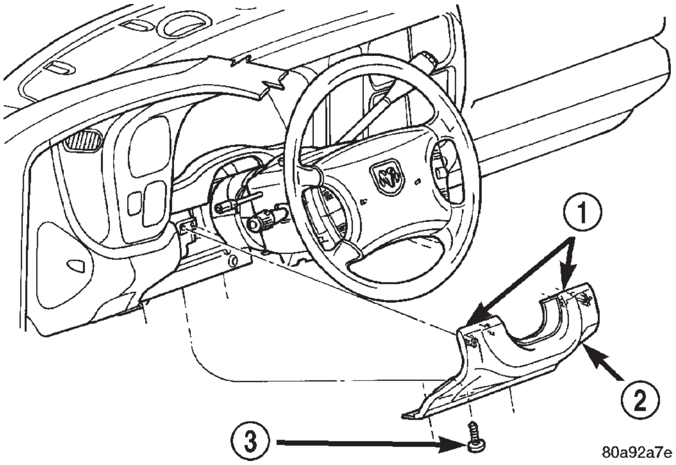


Fig. 7 Steering Column Opening Cover Remove/ Install

1 – SNAP CLIPS
2 – COVER
3 – SCREW

(4) Remove the steering column opening cover from the instrument panel.

INSTALLATION

(1) Position the steering column opening cover to the instrument panel.

(2) Align the snap clip retainers on the steering column opening cover with the receptacles in the instrument panel.

(3) Press firmly on the steering column opening cover over the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Install and tighten the three screws that secure the lower edge of the steering column opening cover to the lower instrument panel reinforcement. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Reconnect the battery negative cable.

GEAR SELECTOR INDICATOR

The following service procedures apply only to the mechanical gear selector indicator. The electronic gear selector indicator is integral to the instrument cluster and can only be serviced by replacement of the instrument cluster unit.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Remove the two screws that secure the gear selector indicator mechanism to the back of the instrument cluster housing (Fig. 8).

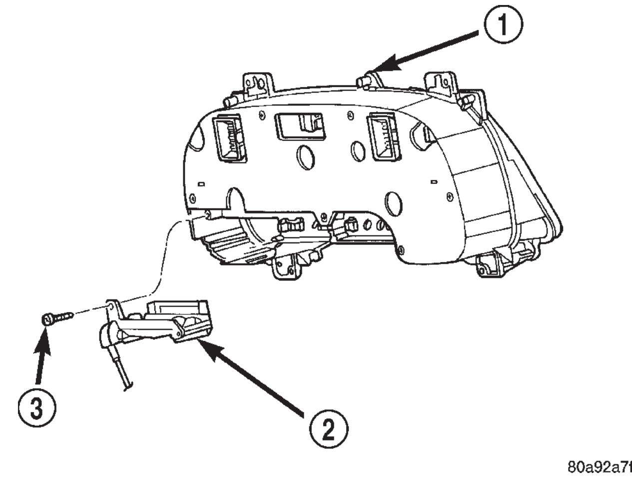


Fig. 8 Gear Selector Indicator Remove/Install

1 – INSTRUMENT CLUSTER
2 – GEAR SELECTOR INDICATOR
3 – SCREW

(4) Remove the gear selector indicator mechanism from the back of the instrument cluster housing.

(5) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(6) Disengage the loop end of the gear selector indicator cable from the lever on the left side of the steering column (Fig. 9).

(7) Squeeze the sides of the plastic adjuster and bracket unit to disengage the tabs that secure it to the sides of the steering column window.

(8) Remove the gear selector indicator mechanism and cable unit from the instrument panel.

INSTALLATION

(1) Position the gear selector indicator mechanism and cable unit to the instrument panel.

(2) Squeeze the sides of the plastic adjuster and bracket unit and engage the tabs that secure it with the sides of the steering column window.

(3) Engage the loop end of the gear selector indicator cable onto the lever on the left side of the steering column (Fig. 9).

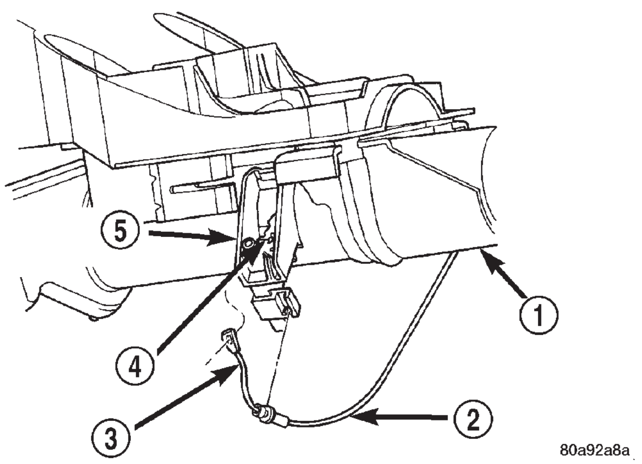


Fig. 9 Gear Selector Indicator Cable Remove/Install

1 – STEERING COLUMN
2 – CABLE
3 – LOOP END
4 – LEVER
5 – ADJUSTER AND BRACKET

(4) Position the gear selector indicator mechanism onto the back of the instrument cluster housing.

(5) Install and tighten the two screws that secure the gear selector indicator mechanism to the back of the instrument cluster housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Install the instrument cluster onto the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(7) Check the gear selector indicator for proper calibration. If adjustment is needed, refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for the gear selector indicator cable (PRNDL) adjustment procedure.

(8) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(9) Reconnect the battery negative cable.

PARK BRAKE RELEASE HANDLE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Reach under the driver side outboard end of the instrument panel to access and unsnap the plastic retainer clip that secures the park brake release linkage rod to the lever on the back side of the park brake release handle.

(3) Disengage the park brake release linkage rod end from the lever on the back of the park brake release handle.

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry one of the park brake handle hinge tabs away from its pivot pin on the instrument panel (Fig. 10).

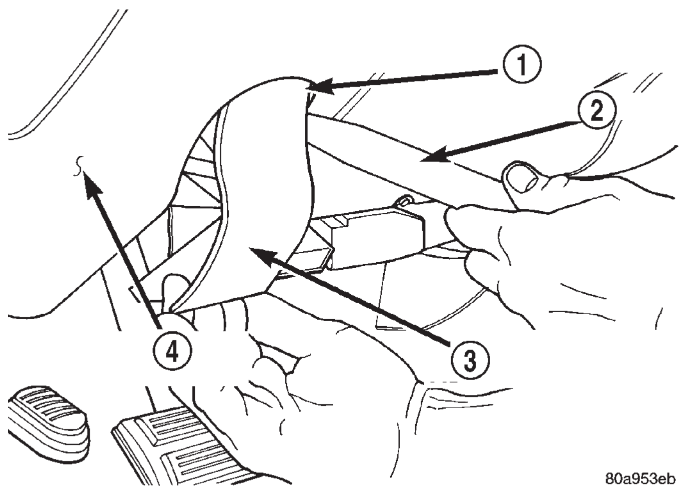


Fig. 10 Park Brake Release Handle Remove/Install

1 – INSERT BETWEEN HINGE TAB AND PIVOT PIN
2 – TRIM STICK
3 – PARK BRAKE RELEASE HANDLE
4 – INSTRUMENT PANEL

(5) While prying the park brake release handle hinge tab with one hand, use the other hand to pull the handle firmly down and away from the pivot pin.

(6) Remove the park brake release handle from the instrument panel.

INSTALLATION

(1) Position the park brake release handle to the instrument panel.

(2) Engage one of the park brake release handle hinge tabs with one of the pivot pins on the instrument panel.

(3) Align the second park brake release handle hinge tab hinge over the second pivot pin on the instrument panel.

(4) Press firmly on the park brake release handle over the second hinge tab until it snaps over the second pivot pin on the instrument panel.

REMOVAL AND INSTALLATION (Continued)

(5) Reach under the driver side outboard end of the instrument panel to access and engage the park brake release linkage rod end from the lever on the back of the park brake release handle.

(6) Snap the plastic retainer clip that secures the park brake release linkage rod to the lever on the back side of the park brake release handle over the linkage rod.

(7) Reconnect the battery negative cable.

INSTRUMENT PANEL LOWER REINFORCEMENT

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(3) Remove the two screws that secure the inside hood latch release handle to the instrument panel lower reinforcement and lower the release handle to the floor.

(4) Depress the latch tabs that secure the 16-way data link wire harness connector to the instrument panel lower reinforcement, and push the connector out of its mounting hole.

(5) Remove the four screws that secure the lower reinforcement to the instrument panel (Fig. 11).

(6) Remove the lower reinforcement from the instrument panel.

INSTALLATION

(1) Position the lower reinforcement onto the instrument panel.

(2) Install and tighten the four screws that secure the lower reinforcement to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install the 16-way data link wire harness connector into the mounting hole on the instrument panel lower reinforcement.

(4) Position the inside hood latch release handle to the instrument panel lower reinforcement.

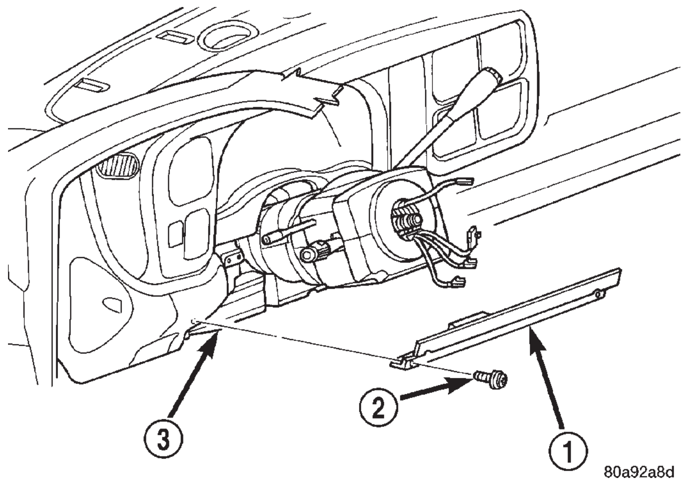


Fig. 11 Instrument Panel Lower Reinforcement Remove/Install

1 – REINFORCEMENT
2 – SCREW
3 – INSTRUMENT PANEL

(5) Install and tighten the two screws that secure the inside hood latch release handle to the instrument panel lower reinforcement. Tighten the screws to 2.8 N·m (25 in. lbs.).

(6) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(7) Reconnect the battery negative cable.

INSTRUMENT PANEL CENTER SUPPORT BRACKET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull the floor carpet back from the front of the floor panel transmission tunnel far enough to access the center support bracket mounting screws.

(3) Remove the two screws that secure the center support bracket to the instrument panel.

(4) Remove the two screws on the left, and one screw on the right that secure the instrument panel

center support bracket to the Airbag Control Module (ACM) bracket on the floor panel transmission tunnel (Fig. 12).

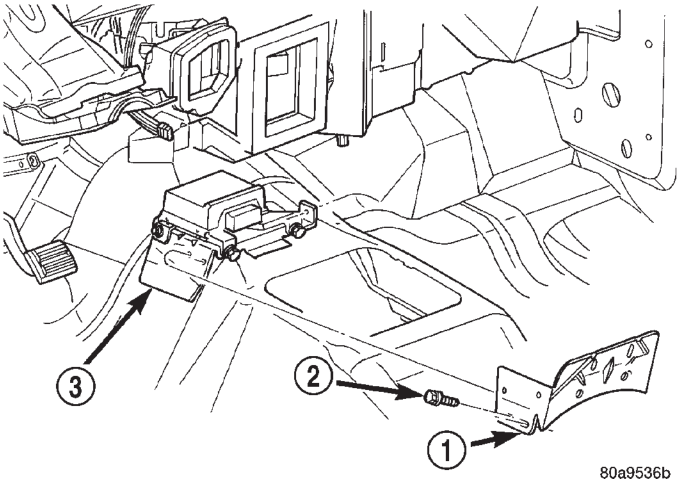


Fig. 12 Instrument Panel Center Support Bracket Remove/Install

1 – CENTER SUPPORT BRACKET
2 – SCREW
3 – AIRBAG CONTROL MODULE BRACKET

(5) Remove the center support bracket from the instrument panel.

INSTALLATION

(1) Position the center support bracket to the ACM bracket on the floor panel transmission tunnel.

(2) Install and tighten the two screws on the left, and one screw on the right that secure the instrument panel center support bracket to the Airbag Control Module (ACM) bracket on the floor panel transmission tunnel. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Align the screw holes in the instrument panel to the mounting holes in the center support bracket.

(4) Install and tighten the two screws that secure the center support bracket to the instrument panel. Tighten the screws to 11.8 N·m (105 in. lbs.).

(5) Reposition the floor carpet on the front of the floor panel transmission tunnel to conceal the instrument panel center support bracket.

(6) Reconnect the battery negative cable.

INSTRUMENT PANEL ASH RECEIVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Open the instrument panel ash receiver.

(3) Depress the spring retainer in the center of the open ash receiver to release it, then lift the ash receiver slightly and pull it straight out from the pivot pins in the instrument panel lower bezel.

(4) Remove the two screws that secure the ash receiver flame shield to the instrument panel lower bezel (Fig. 13).

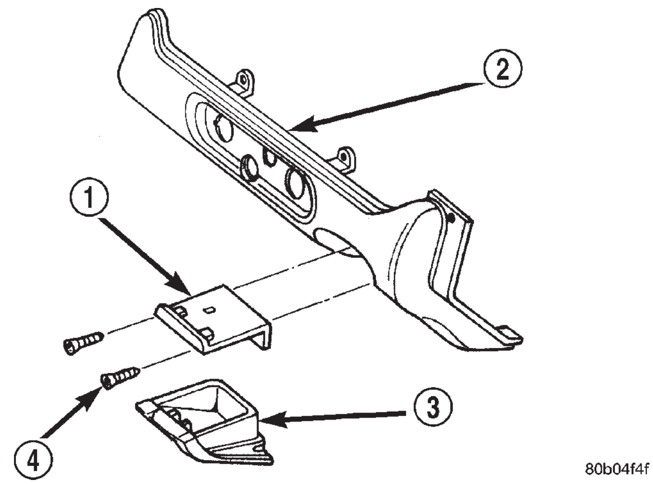


Fig. 13 Instrument Panel Ash Receiver Remove/Install

1 – FLAME SHIELD
2 – INSTRUMENT PANEL LOWER BEZEL
3 – ASH RECEIVER
4 – SCREW

(5) Pull the ash receiver flame shield out from the instrument panel far enough to disengage the two retaining tabs on the top of the shield from the mounting holes in the instrument panel lower bezel.

(6) Lower the flame shield from the instrument panel lower bezel far enough to access the ash receiver lamp and hood.

(7) Squeeze the ash receiver lamp and hood bracket to disengage the unit from the mounting hole in the flame shield.

(8) Remove the ash receiver flame shield from the instrument panel lower bezel.

INSTALLATION

(1) Position the ash receiver flame shield to the instrument panel lower bezel.

REMOVAL AND INSTALLATION (Continued)

(2) Squeeze the ash receiver lamp and hood bracket and engage the unit to the mounting hole in the flame shield.

(3) Insert the two retaining tabs on the top of the ash receiver flame shield into the mounting holes in the instrument panel lower bezel, then push the shield forward to engage the tabs with the bezel.

(4) Install and tighten the two screws that secure the ash receiver flame shield to the instrument panel lower bezel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Align the pivot receptacles on each side of the ash receiver with the pivot pins in the instrument panel lower bezel.

(6) Push the ash receiver forward onto the pivot pins in the instrument panel lower bezel until the spring retainer in the center of the open ash receiver snaps into place.

(7) Reconnect the battery negative cable.

INSTRUMENT PANEL LOWER BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(3) Open the glove box.

(4) Remove the two screws that secure the lower edge of the lower bezel to the instrument panel (Fig. 14).

(5) Remove the four screws that secure the upper edge of the lower bezel to the instrument panel.

(6) Pull the lower bezel away from the instrument panel far enough to access the instrument panel wire harness connectors.

(7) Disconnect the instrument panel wire harness connectors from the ash receiver lamp, the cigar lighter, the power outlet and the passenger airbag on/off switch (except quad cab) or the rear window defogger switch (quad cab only) (Fig. 15).

(8) Remove the lower bezel from the instrument panel.

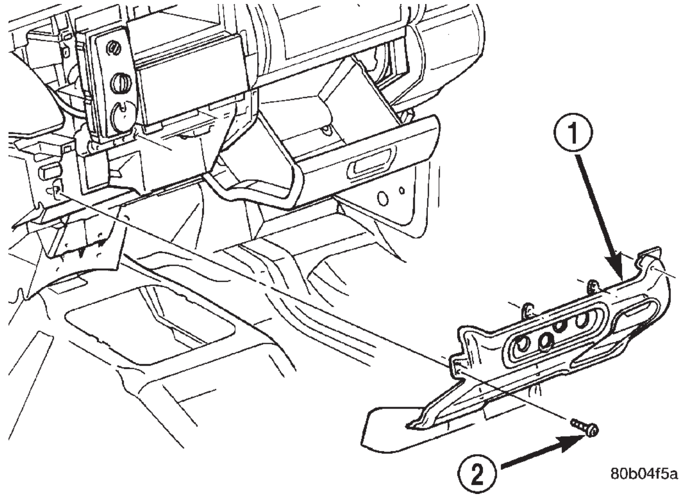


Fig. 14 Instrument Panel Lower Bezel Remove/Install - Typical

1 – INSTRUMENT PANEL LOWER BEZEL
2 – SCREW

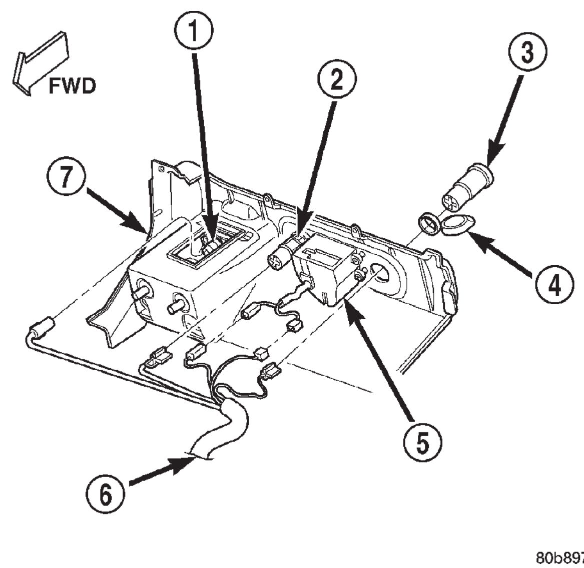


Fig. 15 Instrument Panel Lower Bezel Connections

1 – ASH RECEIVER LAMP
2 – CIGAR LIGHTER
3 – POWER OUTLET
4 – CAP
5 – PASSENGER AIRBAG ON/OFF SWITCH
6 – INSTRUMENT PANEL WIRE HARNESS
7 – INSTRUMENT PANEL LOWER BEZEL

INSTALLATION

(1) Position the lower bezel to the instrument panel.

(2) Reconnect the instrument panel wire harness connectors to the ash receiver lamp, the cigar lighter, the power outlet and the passenger airbag on/off

REMOVAL AND INSTALLATION (Continued)

switch (except quad cab) or the rear window defogger switch (quad cab only).

(3) Align the mounting holes in the lower bezel with the screw holes in the instrument panel.

(4) Install and tighten the four screws that secure the upper edge of the lower bezel to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install and tighten the two screws that secure the lower edge of the lower bezel to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Close the glove box.

(7) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(8) Reconnect the battery negative cable.

CIGAR LIGHTER AND POWER OUTLET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the lower bezel from the instrument panel. Refer to **Instrument Panel Lower Bezel** in the Removal and Installation section of this group for the procedures.

(3) Pull the cigar lighter knob and element out of the cigar lighter receptacle base, or unsnap the protective cap from the power outlet receptacle base (Fig. 16).

(4) Look inside the cigar lighter or power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the instrument panel lower bezel (Fig. 17).

(5) Insert a pair of external snap ring pliers into the cigar lighter or power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.

(6) Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.

(7) Remove the cigar lighter or power outlet mount from the instrument panel lower bezel.

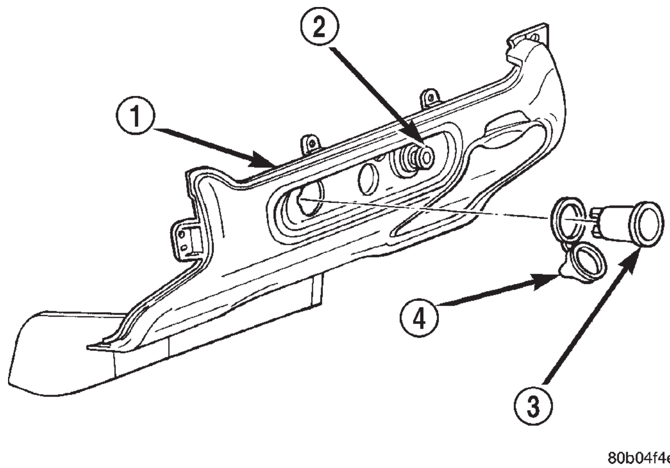


Fig. 16 Cigar Lighter and Power Outlet

1 – INSTRUMENT PANEL LOWER BEZEL
2 – CIGAR LIGHTER KNOB AND ELEMENT
3 – POWER OUTLET BASE AND MOUNT
4 – POWER OUTLET CAP

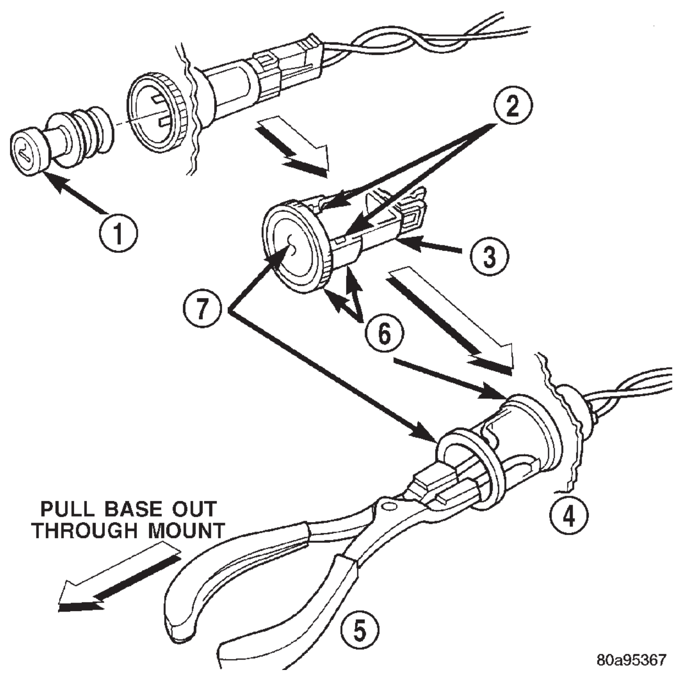


Fig. 17 Cigar Lighter and Power Outlet Remove/ Install - Typical

1 – KNOB AND ELEMENT
2 – RETAINING BOSSES-ENGAGE PLIERS HERE
3 – BASE
4 – PARTIALLY REMOVED
5 – EXTERNAL SNAP-RING PLIERS
6 – MOUNT
7 – BASE

INSTALLATION

(1) Install the cigar lighter or power outlet mount into the instrument panel lower bezel.

REMOVAL AND INSTALLATION (Continued)

(2) Align the splines on the outside of the cigar lighter or power outlet receptacle base connector receptacle with the grooves on the inside of the mount.

(3) Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

(4) Install the cigar lighter knob and element into the cigar lighter receptacle base, or the protective cap into the power outlet receptacle base.

(5) Install the lower bezel onto the instrument panel. Refer to **Instrument Panel Lower Bezel** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

GLOVE BOX LAMP AND SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box.

(3) Reach through the glove box opening and behind the glove box opening upper reinforcement in the instrument panel to access and depress the retaining latches on the top and bottom of the glove box lamp and switch housing.

(4) While holding the retaining latches depressed, push the glove box lamp and switch out through the mounting hole in the instrument panel glove box opening upper reinforcement (Fig. 18).

(5) Pull the glove box lamp and switch out from the mounting hole far enough to access the wire harness connector.

(6) Disconnect the instrument panel wire harness connector from the glove box lamp and switch connector receptacle.

(7) Remove the glove box lamp and switch from the instrument panel.

INSTALLATION

(1) Position the glove box lamp and switch to the instrument panel.

(2) Reconnect the instrument panel wire harness connector to the glove box lamp and switch connector receptacle.

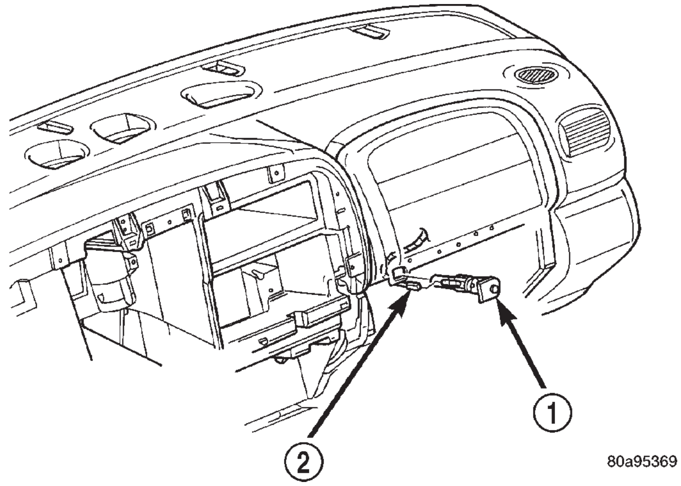


Fig. 18 Glove Box Lamp and Switch Remove/Install

1 – GLOVE BOX LAMP AND SWITCH
2 – CONNECTOR

(3) Feed the instrument panel wire harness back into the glove box lamp and switch mounting hole in the glove box opening upper reinforcement.

(4) Align the glove box lamp and switch housing with the mounting hole in the instrument panel glove box opening upper reinforcement.

(5) Push the glove box lamp and switch into the mounting hole in the instrument panel glove box opening upper reinforcement until the retaining latches are fully engaged.

(6) Close the glove box.

(7) Reconnect the battery negative cable.

GLOVE BOX LATCH STRIKER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box.

(3) Remove the two screws that secure the latch striker to the instrument panel glove box opening upper reinforcement (Fig. 19).

(4) Remove the latch striker from the instrument panel glove box opening upper reinforcement.

REMOVAL AND INSTALLATION (Continued)

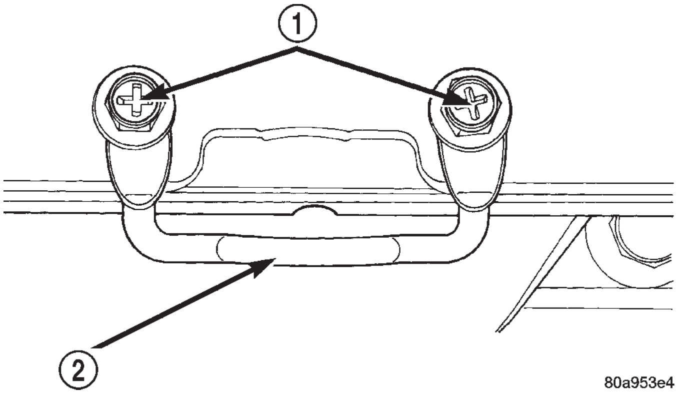


Fig. 19 Glove Box Latch Striker Remove/Install

1 – SCREWS
2 – STRIKER

INSTALLATION

(1) Position the latch striker onto the instrument panel glove box opening upper reinforcement.

(2) Install and tighten the two screws that secure the latch striker to the instrument panel glove box opening upper reinforcement. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Close the glove box.

(4) Reconnect the battery negative cable.

GLOVE BOX

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ROLL DOWN

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box.

(3) Depress the two sides of the glove box bin far enough so that the rubber stop bumpers located on each side of the bin will clear the metal stops located on the bracket on each side of the glove box opening.

(4) While holding the sides of the glove box bin depressed, roll the glove box downward until the stop bumpers are beyond the stops, then release the sides of the bin.

(5) Reverse the roll down procedure to roll the glove box back up into the instrument panel.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box.

(3) Locate three screws in the bottom of the glove box bin. Remove only the center screw.

(4) Roll down the glove box from the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

(5) Grasp the upper outboard corner of the glove box door securely with both hands.

(6) Pull the door firmly and quickly away from the instrument panel to unsnap the three glove box hinge hooks (Fig. 20) from the three hinge pins on the instrument panel (Fig. 21).

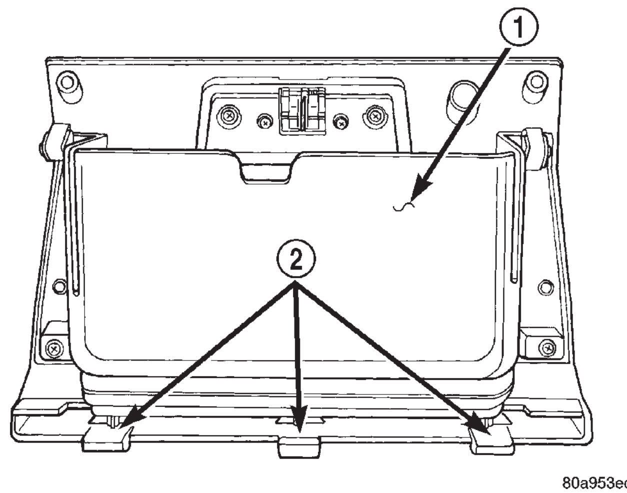


Fig. 20 Glove Box Hinge Hooks

1 – GLOVE BOX
2 – HINGE HOOKS

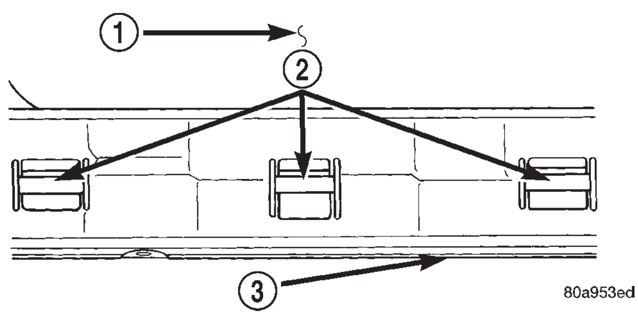


Fig. 21 Glove Box Hinge Pins

1 – GLOVE BOX OPENING
2 – HINGE PINS
3 – INSTRUMENT PANEL

(7) Remove the glove box from the instrument panel.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position the glove box to the instrument panel with the bin inserted in the glove box opening far enough so that the rubber stop bumpers located on each side of the bin are behind the metal stops located on the bracket on each side of the glove box opening.

(2) Starting on the outboard side of the glove box, insert the first glove box hinge hook over the first hinge pin on the instrument panel.

(3) Use a slight twisting action on the glove box door to insert the second hinge hook under the second hinge pin.

(4) Finally, again using a slight twisting action on the glove box door, insert the last hinge hook over the last hinge pin.

(5) Install and tighten the center screw in the bottom of the glove box bin. Tighten the screw to 2.2 N·m (20 in. lbs.).

(6) Close the glove box, then reopen it to check for proper hinge operation.

(7) Reconnect the battery negative cable.

GLOVE BOX COMPONENTS

The only serviced component of the glove box is the glove box bin. If any other component of the glove box is faulty or damaged, the entire glove box assembly must be replaced.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

GLOVE BOX BIN

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel. Refer to **Glove Box - Removal** in the Removal and Installation section of this group for the procedures.

(3) Remove the two screws that secure each outboard flange of the glove box bin to the glove box door (Fig. 22).

(4) Remove the two remaining screws in the bottom of the glove box bin (the center screw was removed during glove box removal) that secure the bin to the bottom of the glove box door.

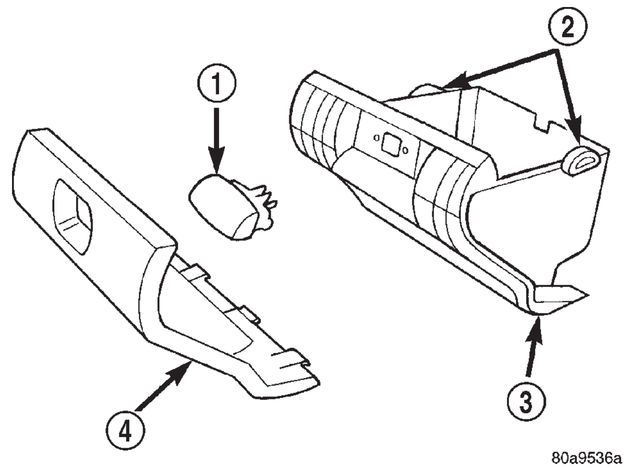


Fig. 22 Glove Box Components Remove/Install

1 – LATCH
2 – STOP BUMPERS
3 – BIN
4 – DOOR

(5) Remove the four screws that secure the top of the glove box bin and the glove box latch to the glove box door.

(6) Remove the glove box bin and the glove box latch from the glove box door.

INSTALLATION

GLOVE BOX BIN

(1) Position the glove box latch and the glove box bin to the glove box door.

(2) Install and tighten the four screws that secure the top of the glove box bin and the glove box latch to the glove box door. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install and tighten the two outboard screws in the bottom of the glove box bin (the center screw will be installed following glove box installation) that secure the bin to the bottom of the glove box door. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Install and tighten the two screws that secure each outboard flange of the glove box bin to the glove box door. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the glove box onto the instrument panel. Refer to **Glove Box - Installation** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

CENTRAL TIMER MODULE

Before replacing a high-line Central Timer Module (CTM), use a DRB scan tool to determine the current settings for the CTM programmable features. These settings should be duplicated in the replacement

REMOVAL AND INSTALLATION (Continued)

CTM using the DRB scan tool, before returning the vehicle to service.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box from the instrument panel. Refer to **Glove Box - Removal** in the Removal and Installation section of this group for the procedures.

(3) Remove the three screws that secure the bracket on the outboard side of the glove box opening to the instrument panel (Fig. 23).

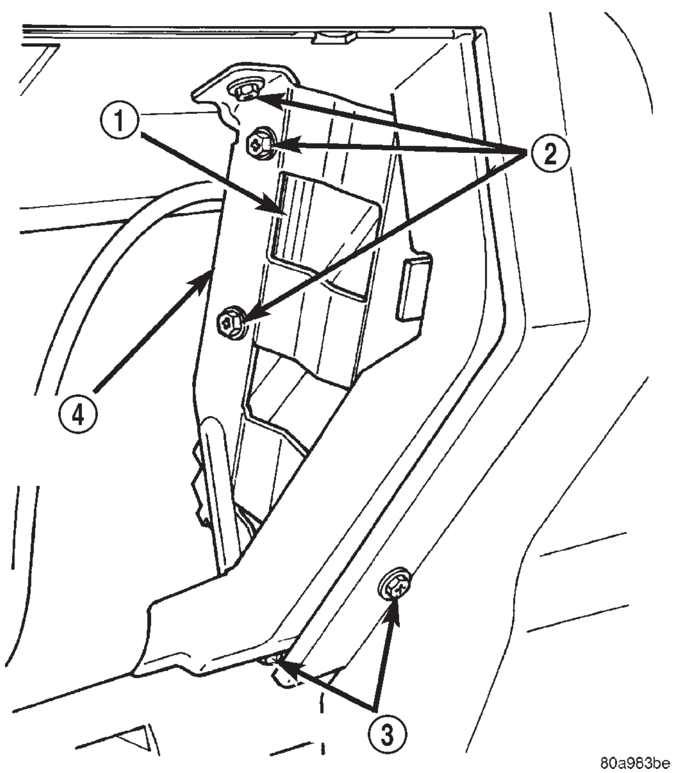


Fig. 23 Outboard Glove Box Opening Bracket Remove/Install

1 – CTM BRACKET
2 – SCREWS
3 – SCREWS
4 – GLOVE BOX OPENING BRACKET

(4) Remove the two screws that secure the Central Timer Module (CTM) mounting bracket to the bracket on the outboard side of instrument panel glove box opening (Fig. 24).

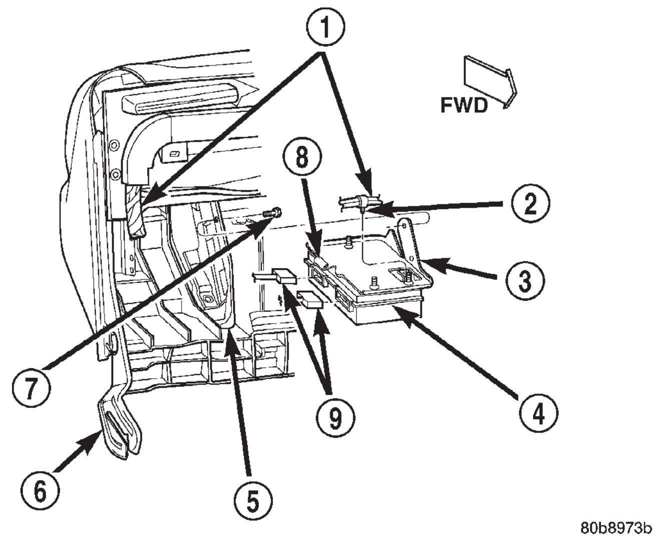


Fig. 24 Central Timer Module Remove/Install

1 – INSTRUMENT PANEL WIRE HARNESS
2 – RETAINER
3 – MOUNTING BRACKET
4 – CENTRAL TIMER MODULE
5 – OUTBOARD GLOVE BOX OPENING BRACKET
6 – END BRACKET
7 – SCREW (2)
8 – TAB
9 – WIRE HARNESS CONNECTORS

(5) Remove the bracket on the outboard side of the glove box opening from the instrument panel through the glove box opening.

(6) Move the CTM and its mounting bracket into the glove box opening far enough to access and disengage the instrument panel wire harness retainer from the CTM mounting bracket.

(7) Disconnect the instrument panel wire harness connector(s) (one connector for the base CTM, two connectors for high-line CTM) from the CTM connector receptacle(s).

(8) Remove the CTM and mounting bracket unit from the instrument panel through the glove box opening.

INSTALLATION

(1) Position the CTM and mounting bracket unit in the instrument panel glove box opening.

(2) Reconnect the instrument panel wire harness connector(s) (one connector for the base CTM, two connectors for high-line CTM) to the CTM connector receptacle(s).

(3) Engage the instrument panel wire harness retainer with the hole in the CTM mounting bracket.

REMOVAL AND INSTALLATION (Continued)

(4) Engage the tab on the outboard end of the CTM mounting bracket in the slot in the right instrument panel end bracket.

(5) Working through the instrument panel glove box opening, position the outboard glove box opening bracket to the CTM mounting bracket.

(6) Install and tighten the two screws that secure the Central Timer Module (CTM) mounting bracket to the bracket on the outboard side of instrument panel glove box opening. Tighten the screws to 2.2 N·m (20 in. lbs.).

(7) Install and tighten the three screws that secure the bracket on the outboard side of the glove box opening to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(8) Install the glove box onto the instrument panel. Refer to **Glove Box - Installation** in the Removal and Installation section of this group for the procedures.

(9) Reconnect the battery negative cable.

NOTE: If a new high-line Central Timer Module is installed, the programmable features must be enabled and/or disabled to the customer's preferred settings. Use a DRB scan tool and the proper Diagnostic Procedures manual to perform these operations.

INSTRUMENT PANEL ASSEMBLY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim from the right and left door sills. Refer to **Door Sill Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the trim from the left and right cowl side inner panels. Refer to **Cowl Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(5) Remove the two screws that secure the inside hood latch release handle to the instrument panel lower reinforcement and lower the release handle to the floor.

(6) Disconnect the driver side airbag module wire harness connector from the instrument panel wire harness at the instrument panel lower reinforcement.

(7) If the vehicle is so equipped, disconnect the overdrive lockout switch wire harness connector from the instrument panel wire harness near the instrument panel lower reinforcement.

(8) Remove the steering column from the vehicle, but do not remove the driver side airbag module, the steering wheel, or the switches from the steering column. Be certain that the steering wheel is locked and secured from rotation to prevent the loss of clockspring centering. Refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for the procedures.

(9) From under the driver side of the instrument panel, perform the following:

- (a) Remove the screw from the center of the headlamp and dash to instrument panel bulkhead wire harness connector and disconnect the connector.
- (b) Disconnect the two body wire harness connectors from the two instrument panel wire harness connectors that are secured to the outboard side of the instrument panel bulkhead connector.
- (c) Disconnect the three wire harness connectors (one from the body wire harness, and two from the headlamp and dash wire harness) from the three junction block connector receptacles located closest to the dash panel.
- (d) Unsnap the plastic retainer clip that secures the park brake release linkage rod to the lever on the back side of the park brake release handle and disengage the linkage rod end from the lever on the handle.
- (e) Disconnect the instrument panel wire harness connector from the stop lamp switch connector receptacle.
- (f) Disconnect the vacuum harness connector located near the left end of the heater-A/C housing.

(10) Remove the center support bracket from the instrument panel. Refer to **Instrument Panel Center Support Bracket** in the Removal and Installation section of this group for the procedures.

(11) Remove the screw that secures the instrument panel wire harness ground eyelets to the left side of

REMOVAL AND INSTALLATION (Continued)

the Airbag Control Module (ACM) mount on the floor panel transmission tunnel.

(12) Disconnect the instrument panel wire harness connector from the ACM connector receptacle.

(13) Remove the glove box from the instrument panel. Refer to **Glove Box** in the Removal and Installation section of this group for the procedures.

(14) Reaching through the instrument panel glove box opening, perform the following:

(a) Disconnect the two halves of the radio antenna coaxial cable connector near the center of the lower instrument panel glove box opening.

(b) Disengage the antenna half of the radio antenna coaxial cable from the retainer clip near the outboard side of the lower instrument panel glove box opening.

(c) Disconnect the blower motor wire harness connector located near the heater-A/C housing support brace on the inboard side of the instrument panel glove box opening.

(15) From under the passenger side of the instrument panel, perform the following:

(a) If the vehicle is so equipped, disconnect the two instrument panel wire harness connectors from the Infinity speaker amplifier connector receptacles on the right cowl side inner panel.

(b) Remove the nut that secures the instrument panel wire harness radio ground eyelet to the stud on the right cowl side inner panel.

(16) Loosen the right and left instrument panel cowl side roll-down bracket screws about 6 mm (0.25 inch) (Fig. 25).

(17) Remove the five screws that secure the top of the instrument panel to the top of the dash panel, removing the center screw last.

(18) Pull the lower instrument panel rearward until the right and left cowl side roll-down bracket screws are in the roll-down slot position of both brackets (Fig. 26).

(19) Roll down the instrument panel and install a temporary hook in the center hole on top of the instrument panel. Secure the other end of the hook to the center hole in the top of the dash panel. The hook should support the instrument panel in its rolled down position about 46 cm (18 inches) from the dash panel.

(20) With the instrument panel supported in the roll-down position:

(a) Disconnect the two instrument panel wire harness connectors from the door jumper wire harness connectors located on a bracket near the right end of the instrument panel.

(b) Disconnect the instrument panel wire harness connector from the blower motor resistor connector receptacle on the dash panel.

(c) Disconnect the temperature control cable flag retainer from the top of the heater-A/C housing and pull the cable core adjuster clip off of the blend-air door lever.

(d) Disconnect the demister duct flexible hose from the adapter on the top of the heater-A/C housing.

(21) With the aid of an assistant, remove the temporary hook and lift the instrument panel assembly off of the roll-down bracket screws and remove it from the vehicle.

INSTALLATION

(1) With the aid of an assistant, install the instrument panel assembly onto the roll-down bracket screws in the vehicle. Install a temporary hook in the center hole on top of the instrument panel. Secure the other end of the hook to the center hole in the top of the dash panel. The hook should support the instrument panel in its rolled down position about 46 cm (18 inches) from the dash panel.

(2) With the instrument panel supported in the roll-down position:

(a) Reconnect the two instrument panel wire harness connectors to the door jumper wire harness connectors located on a bracket near the right end of the instrument panel.

(b) Reconnect the instrument panel wire harness connector to the blower motor resistor connector receptacle on the dash panel.

(c) Reconnect the temperature control cable flag retainer onto the top of the heater-A/C housing and push the cable core adjuster clip onto the blend-air door lever.

(d) Reconnect the demister duct flexible hose to the adapter on the top of the heater-A/C housing.

(3) Push the lower instrument panel forward until the right and left cowl side roll-down bracket screws are in the installed slot position of both brackets (Fig. 26).

(4) Remove the temporary hook from the instrument panel and roll the instrument panel up to the installed position against the dash panel.

(5) Install and tighten the five screws that secure the top of the instrument panel to the top of the dash panel. Tighten the screws to 3.2 N·m (28 in. lbs.).

(6) Tighten the right and left instrument panel cowl side roll-down bracket screws. Tighten the screws to 11.9 N·m (105 in. lbs.).

(7) From under the passenger side of the instrument panel, perform the following:

(a) If the vehicle is so equipped, reconnect the two instrument panel wire harness connectors to the Infinity speaker amplifier connector receptacles on the right cowl side inner panel.

REMOVAL AND INSTALLATION (Continued)

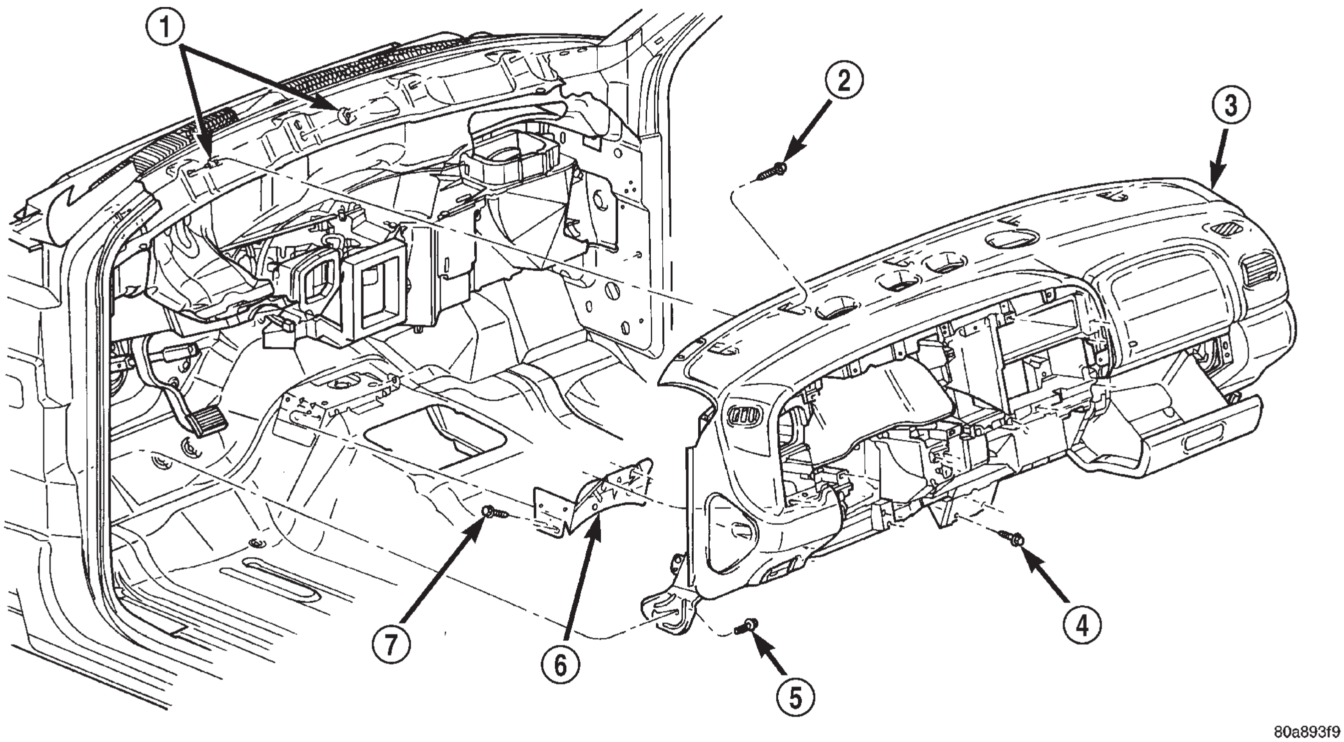


Fig. 25 Instrument Panel Assembly Remove/Install

1 – CLIPS
2 – SCREW
3 – INSTRUMENT PANEL
4 – SCREW
5 – SCREW
6 – CENTER SUPPORT BRACKET
7 – SCREW

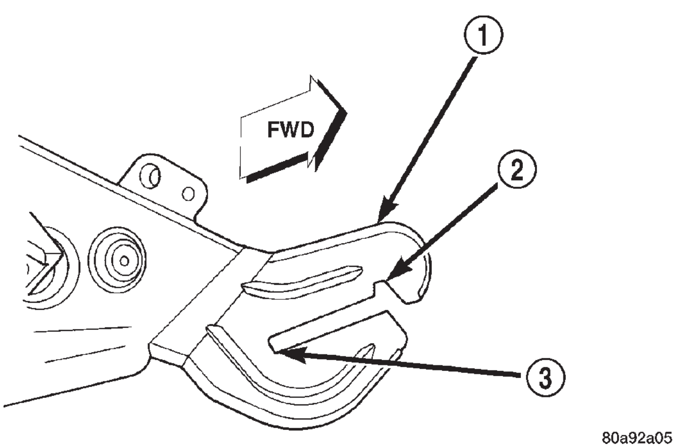


Fig. 26 Roll-Down Bracket

1 – ROLL — DOWN BRACKET
2 – ROLL — DOWN SLOT
3 – INSTALLED SLOT

(b) Install and tighten the nut that secures the instrument panel wire harness radio ground eyelet to the stud on the right cowl side inner panel. Tighten the nut to 3.9 N·m (35 in. lbs.).

(8) Reaching through the instrument panel glove box opening, perform the following:

(a) Reconnect the two halves of the radio antenna coaxial cable connector near the center of the lower instrument panel glove box opening.

(b) Engage the antenna half of the radio antenna coaxial cable into the retainer clip near the outboard side of the lower instrument panel glove box opening.

(c) Reconnect the blower motor wire harness connector located near the heater-A/C housing support brace on the inboard side of the instrument panel glove box opening.

(9) Install the glove box onto the instrument panel. Refer to **Glove Box** in the Removal and Installation section of this group for the procedures.

(10) Install and tighten the screw that secures the instrument panel wire harness ground eyelets to the left side of the Airbag Control Module (ACM) mount on the floor panel transmission tunnel. Tighten the screw to 3.4 N·m (30 in. lbs.).

(11) Reconnect the instrument panel wire harness connector to the ACM connector receptacle.

(12) Install the center support bracket onto the instrument panel. Refer to **Instrument Panel Center Support Bracket** in the Removal and Installation section of this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

(13) From under the driver side of the instrument panel, perform the following:

(a) Reconnect the headlamp and dash to instrument panel bulkhead wire harness connector and tighten the screw in the center of the connector. Tighten the screw to 3.5 N·m (31 in. lbs.).

(b) Reconnect the two body wire harness connectors to the two instrument panel wire harness connectors that are secured to the outboard side of the instrument panel bulkhead connector.

(c) Reconnect the three wire harness connectors (one from the body wire harness, and two from the headlamp and dash wire harness) to the three junction block connector receptacles located closest to the dash panel.

(d) Engage the linkage rod end into the lever on the back side of the park brake release handle and snap the plastic retainer clip over the linkage rod that secures it to the lever.

(e) Reconnect the instrument panel wire harness connector to the stop lamp switch connector receptacle.

(f) Reconnect the vacuum harness connector located near the left end of the heater-A/C housing.

(14) Install the steering column into the vehicle. Be certain that the steering wheel was locked and secured from rotation to prevent the loss of clockspring centering. Refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for the procedures.

(15) If the vehicle is so equipped, reconnect the overdrive lockout switch wire harness connector to the instrument panel wire harness near the instrument panel lower reinforcement.

(16) Reconnect the driver side airbag module wire harness connector to the instrument panel wire harness at the instrument panel lower reinforcement.

(17) Position the inside hood latch release handle to the instrument panel lower reinforcement.

(18) Install and tighten the two screws that secure the inside hood latch release handle to the instrument panel lower reinforcement. Tighten the screws to 2.8 N·m (25 in. lbs.).

(19) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(20) Install the trim onto the left and right cowl side inner panels. Refer to **Cowl Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(21) Install the trim onto the right and left door sills. Refer to **Door Sill Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(22) Reconnect the battery negative cable.

INSTRUMENT PANEL TOP COVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(3) Remove the park brake release handle from the instrument panel. Refer to **Park Brake Release Handle** in the Removal and Installation section of this group for the procedures.

(4) Remove the glove box from the instrument panel. Refer to **Glove Box** in the Removal and Installation section of this group for the procedures.

(5) Remove the glove box lamp and switch from the instrument panel. Refer to **Glove Box Lamp and Switch** in the Removal and Installation section of this group for the procedures.

(6) Reach through and above the instrument panel glove box opening to remove the two screws that secure the passenger side airbag module lower bracket to the instrument panel (Fig. 27).

(7) Reach through and above the instrument panel glove box opening to access and disconnect the passenger side airbag module wire harness connector from the instrument panel wire harness.

(8) Disengage the passenger side airbag module wire harness connector retainer from the back of the instrument panel inboard glove box opening bracket.

(9) Remove the heater and air conditioner control from the instrument panel. Refer to **Heater-A/C Control** in the Removal and Installation section of Group 24 - Heating and Air Conditioning for the procedures.

(10) Reach through the instrument panel heater-A/C control opening to remove the screw that secures the flexible demister tube to the demister duct tee, and remove the tube from the tee.

(11) Reach through the instrument panel heater-A/C control opening to remove the screw that secures the demister duct tee to the instrument panel.

(12) Remove the instrument panel from the vehicle. Refer to **Instrument Panel Assembly** in the

REMOVAL AND INSTALLATION (Continued)

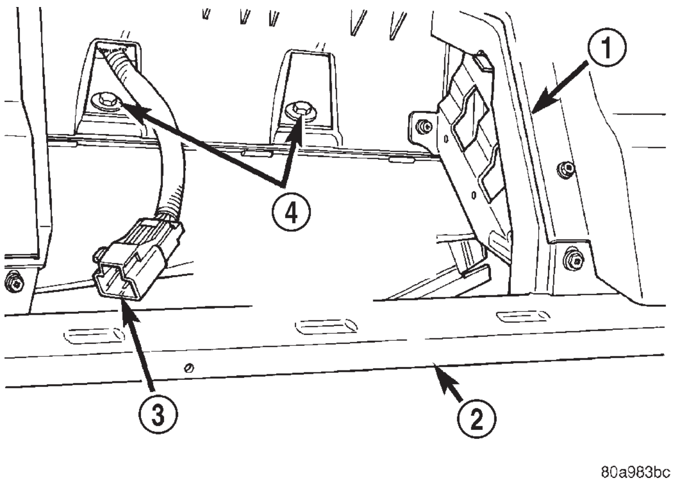


Fig. 27 Passenger Side Airbag Module Lower Bracket Screws

1 – GLOVE BOX OPENING
2 – LOWER INSTRUMENT PANEL REINFORCEMENT
3 – AIRBAG MODULE WIRE HARNESS CONNECTOR
4 – PASSENGER SIDE AIRBAG MODULE LOWER BRACKET SCREWS

Removal and Installation section of this group for the procedures.

(13) Place the instrument panel on a suitable work surface. Be certain to take the proper precautions to protect the instrument panel from any possible cosmetic damage.

(14) Use a drill motor with a large drill bit, a high-speed grinder, or a soldering iron with a cutting tip to remove the collapsed heat stakes from the underside of the five instrument panel to dash panel mounting screw holes at or below the illustrated cut line (Fig. 28). If the instrument panel top cover is to be reused, use care not to drill through or to enlarge the screw holes in the top cover. To prevent the removal of too much material, use a trim stick or another suitable wide flat-bladed tool to gently pry between the top cover and the instrument panel base bracket near the heat stake during the removal process. This will cause the panels to separate noticeably when the collapsed heat stake has been sufficiently removed. After removal, the heat stakes should be flush with, or protruding no more than 4 millimeters (0.1875 inches) from the lower surface of the top cover.

(15) Remove the screws around the perimeter of the top cover that secure it to the instrument panel base.

(16) Lift the top cover off of the instrument panel.

INSTALLATION

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE INSTRUMENT PANEL TOP COVER AND THE PASSENGER SIDE AIRBAG MODULE. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

NOTE: New instrument panel top covers are supplied with heat stakes that have not been collapsed. These non-collapsed heat stakes must also be removed in order to install the new top cover. Use a hack saw or razor knife to remove the non-collapsed heat stakes from a new top cover. See Step 14 in the Removal procedure for the heat stake removal details.

(1) Position the top cover onto the instrument panel.

(2) Install and tighten the screws around the perimeter of the top cover that secure it to the instrument panel base. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install the instrument panel into the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(4) Reach through the instrument panel heater-A/C control opening to install and tighten the screw that secures the demister duct tee to the instrument panel. Tighten the screw to 2.2 N·m (20 in. lbs.).

(5) Reach through the instrument panel heater-A/C control opening to install and tighten the screw that secures the flexible demister tube to the demister duct tee, and remove the tube from the tee. Tighten the screw to 2.2 N·m (20 in. lbs.).

(6) Install the heater and air conditioner control onto the instrument panel. Refer to **Heater-A/C Control** in the Removal and Installation section of Group 24 - Heating and Air Conditioning for the procedures.

(7) Engage the passenger side airbag module wire harness connector retainer onto the back of the instrument panel inboard glove box opening bracket.

(8) Reach through and above the instrument panel glove box opening to access and reconnect the passenger side airbag module wire harness connector to the instrument panel wire harness.

(9) Reach through and above the instrument panel glove box opening to install and tighten the two screws that secure the passenger side airbag module lower bracket to the instrument panel. Tighten the screws to 11.8 N·m (105 in. lbs.).

(10) Install the glove box lamp and switch onto the instrument panel. Refer to **Glove Box Lamp and Switch** in the Removal and Installation section of this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

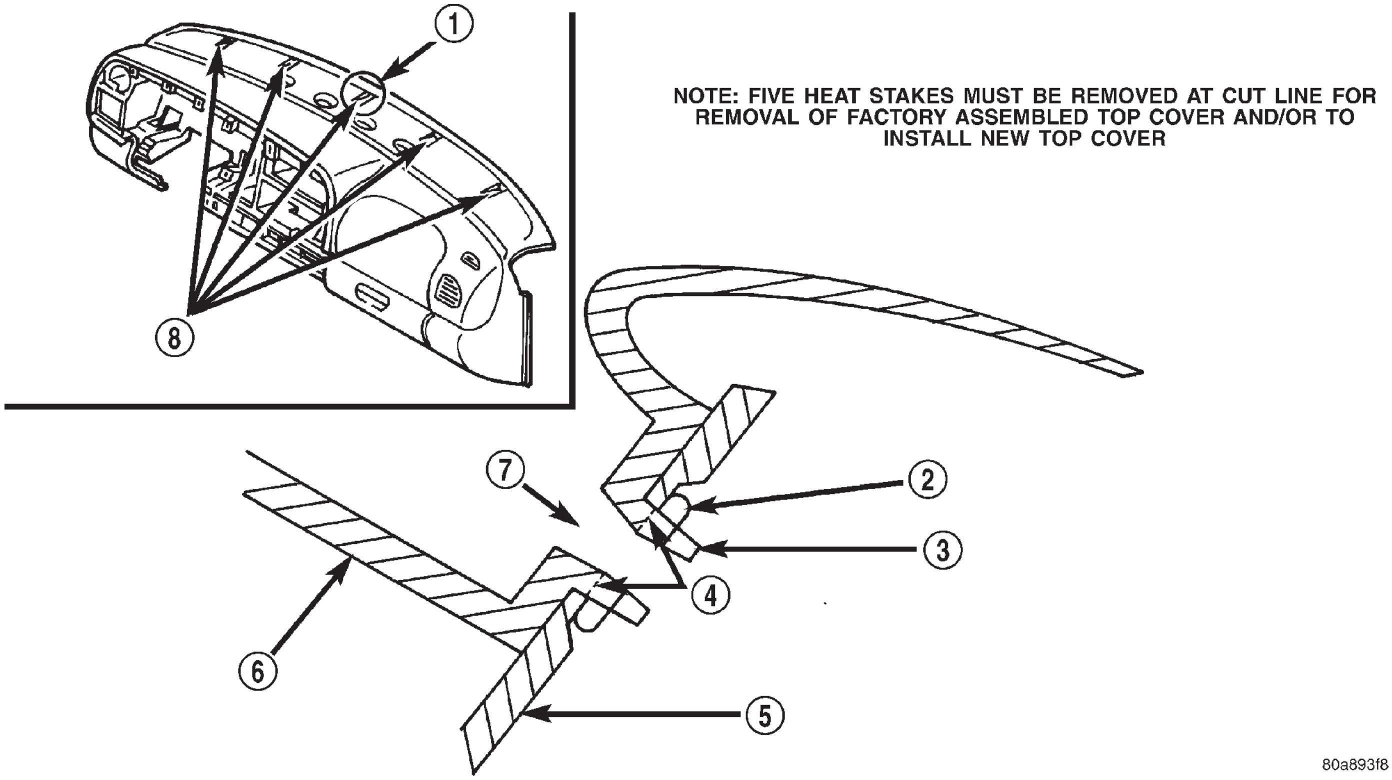


Fig. 28 Instrument Panel Top Cover Remove/Install

1 – AREA OF DETAIL
2 – COMPRESSED HEAT STAKE (FACTORY ASSEMBLED TOP COVER)
3 – HEAT STAKE (NEW TOP COVER)
4 – CUT LINE (REMOVE UNSHADED MATERIAL)
5 – INSTRUMENT PANEL BASE
6 – INSTRUMENT PANEL TOP COVER
7 – MOUNTING SCREW HOLE
8 – FIVE HEAT STAKE LOCATIONS

(11) Install the glove box onto the instrument panel. Refer to **Glove Box** in the Removal and Installation section of this group for the procedures.

(12) Install the park brake release handle onto the instrument panel. Refer to **Park Brake Release Handle** in the Removal and Installation section of this group for the procedures.

(13) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(14) Reconnect the battery negative cable.

AUDIO SYSTEMS

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
AUDIO SYSTEM 1
RADIO RECEIVER 2
REMOTE RADIO SWITCH 2
SPEAKER SYSTEM 3
POWER AMPLIFIER 3
ANTENNA 4
RADIO NOISE SUPPRESSION 4
DIAGNOSIS AND TESTING
AUDIO SYSTEM 4
RADIO RECEIVER 5
REMOTE RADIO SWITCH 6
SPEAKER 7
POWER AMPLIFIER 8
ANTENNA 8
RADIO FREQUENCY INTERFERENCE 9
REMOVAL AND INSTALLATION
RADIO RECEIVER 10
REMOTE RADIO SWITCH 11
SPEAKER 11
POWER AMPLIFIER 14
ANTENNA 15
RADIO NOISE SUPPRESSION COMPONENTS . . 18
SPECIAL TOOLS
AUDIO SYSTEMS 21

DESCRIPTION AND OPERATION

AUDIO SYSTEM

DESCRIPTION

An audio system is standard factory-installed equipment on this model, unless the vehicle is ordered with an available radio delete option. The standard equipment audio system includes an AM/FM/cassette (RAS sales code) receiver, and speakers in four locations. Several combinations of radio receivers and speaker systems are offered as optional equipment on this model. The audio system uses an ignition switched source of battery current so that the system will only operate when the ignition switch is in the On or Accessory positions. The audio system includes the following components:

- Antenna
- Clockspring (with remote radio switches only)
- High-line Central Timer Module (CTM) (with remote radio switches)
- Power amplifier (with premium speaker system only)
- Radio noise suppression components
- Radio receiver
- Remote radio switches (optional with RAZ radio receiver only)
- Speakers

Refer to **Clockspring** in the Description and Operation section of Group 8M - Passive Restraint Systems for more information on this component. Refer to **Central Timer Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component. Refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the remaining major components in the standard and optional factory-installed audio systems.

OPERATION

See the owner's manual in the vehicle glove box for more information on the features, use and operation of each of the available audio systems.

CENTRAL TIMER MODULE

The high-line Central Timer Module (CTM) can also control some features of the audio system when the vehicle is equipped with the optional RAZ radio receiver and remote radio switches. A high-line CTM is used on high-line versions of this vehicle. The CTM combines the functions of a chime/buzzer module, an intermittent wipe module, an illuminated entry module, a remote keyless entry module, and a vehicle theft security system module in a single unit.

The high-line CTM also controls and integrates many of the additional electronic functions and features included on models with this option. The RAZ radio receiver with a remote radio switch option is one of the features that the CTM controls. The CTM is programmed to send switch status messages over the Chrysler Collision Detection (CCD) data bus to control the volume, seek, and pre-set station advance functions of the RAZ radio receiver. The CTM monitors the status of the remote radio switches located

DESCRIPTION AND OPERATION (Continued)

on the steering wheel through a hard wired circuit. The CTM then sends the proper switch status messages to the radio receiver. The electronic circuitry within the radio receiver responds to the switch status messages it receives by adjusting the radio settings as requested.

Refer to **Central Timer Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on the high-line CTM. Refer to **Remote Radio Switch** in the Description and Operation section of this group for more information on this component. In addition, radio receivers connected to the CCD data bus have several audio system functions that can be diagnosed using a DRB scan tool. Refer to the proper Diagnostic Procedures manual for more information on DRB testing of the audio systems.

RADIO RECEIVER

DESCRIPTION

Available factory-installed radio receivers for this model include an AM/FM/cassette (RAS sales code), an AM/FM/cassette/5-band graphic equalizer with CD changer control feature (RBN sales code), an AM/FM/CD/3-band graphic equalizer (RBR sales code), or an AM/FM/CD/cassette/3-band graphic equalizer (RAZ sales code). The factory-installed RAZ sales code radio receivers can also communicate on the Chrysler Collision Detection (CCD) data bus network through a separate two-way wire harness connector. All factory-installed receivers are stereo Electronically Tuned Radios (ETR) and include an electronic digital clock function.

These radio receivers can only be serviced by an authorized radio repair station. See the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations.

IGNITION-OFF DRAW FUSE

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse that is removed when the vehicle is shipped from the factory. This fuse feeds various accessories that require battery current when the ignition switch is in the Off position, including the clock. The IOD fuse is removed to prevent battery discharge during vehicle storage.

When removing or installing the IOD fuse, it is important that the ignition switch be in the Off position. Failure to place the ignition switch in the Off position can cause the radio display to become scrambled when the IOD fuse is removed and replaced. Removing and replacing the IOD fuse again, with the ignition switch in the Off position, will correct the scrambled display condition.

The IOD fuse should be checked if the radio or clock displays are inoperative. The IOD fuse is located in the junction block. Refer to the fuse layout label on the back of the instrument panel fuse access panel for IOD fuse identification and location.

OPERATION

The radio receiver operates on fused battery current that is available only when the ignition switch is in the On or Accessory positions. The electronic digital clock function of the radio operates on fused battery current supplied through the IOD fuse, regardless of the ignition switch position.

For more information on the features, setting procedures, and control functions for each of the available factory-installed radio receivers, see the owner's manual in the vehicle glove box. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

REMOTE RADIO SWITCH

DESCRIPTION

A remote radio switch option is available on models equipped with the AM/FM/CD/cassette/3-band graphic equalizer (RAZ sales code) radio receiver and the high-line Central Timer Module (CTM). Refer to **Central Timer Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component.

Two rocker-type switches (Fig. 1) are mounted in the sides of the rear (instrument panel side) steering wheel trim cover. The switch on the left side is the seek switch and has seek up, seek down, and preset station advance functions. The switch on the right side is the volume control switch and has volume up, and volume down functions. The two switches are retained in mounting holes located on each side of the rear steering wheel trim cover by four latches that are integral to the switches.

The remote radio switches share a common steering wheel wire harness with the vehicle speed control switches. The steering wheel wire harness is connected to the instrument panel wire harness through the clockspring. Refer to **Clockspring** in the Description and Operation section of Group 8M - Passive Restraint Systems for more information on this component.

OPERATION

The remote radio switches are resistor multiplexed units that are hard wired to the high-line CTM through the clockspring. The CTM monitors the status of the remote radio switches and sends the proper switch status messages on the Chrysler Collision Detection (CCD) data bus network to the radio

DESCRIPTION AND OPERATION (Continued)

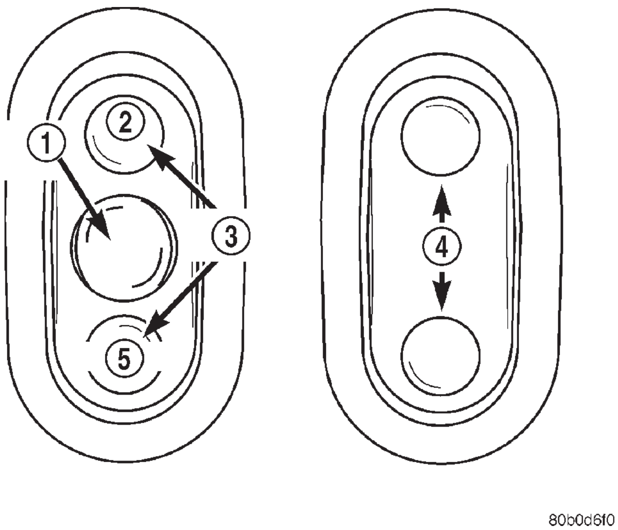


Fig. 1 Remote Radio Switches

1 – PRESET SEEK
2 – UP
3 – SEEK
4 – VOLUME
5 – DOWN

receiver. The electronic circuitry within the radio is programmed to respond to these remote radio switch status messages by adjusting the radio settings as requested.

For diagnosis of the CTM or the CCD data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended. For more information on the features and control functions for each of the remote radio switches, see the owner's manual in the vehicle glove box. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

SPEAKER SYSTEM

DESCRIPTION

STANDARD

The standard equipment speaker system includes speakers in four locations. One full-range 16.5 centimeter (6.50 inch) diameter speaker is located in each front door. There is also one full-range speaker located in each rear cab side panel, 13.3 centimeter (5.25 inch) diameter units for the standard cab models, and 16.5 centimeter (6.50 inch) diameter units for the club cab models. On quad cab models, the 16.5 centimeter (6.50 inch) diameter full-range speaker units are located in each rear door, instead of in the cab side panel.

PREMIUM

The optional premium speaker system features Infinity model speakers in six locations. Each of the standard speakers in the four speaker stereo system are replaced with Infinity model speakers, and an additional 6.9 centimeter (2.75 inch) diameter Infinity dome tweeter is mounted high in the front door trim panels. The premium speaker system also includes an additional Infinity power amplifier. The total available power of the premium speaker system is about 100 watts.

OPERATION

STANDARD

Each of the four full-range speakers used in the standard speaker system is driven by the amplifier that is integral to the factory-installed radio receiver. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

PREMIUM

The six Infinity speakers used in the premium speaker system are all driven by the radio receiver through an Infinity power amplifier. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

POWER AMPLIFIER

DESCRIPTION

Models equipped with the Infinity premium speaker package have a separate power amplifier unit. This power amplifier is rated at 100 watts output. The power amplifier unit is mounted to the right cowl side inner panel under the passenger side end of the instrument panel. The power amplifier unit can be accessed for service by removing the trim from the right cowl side inner panel.

The power amplifier unit should be checked if there is no sound output noted from the speakers. For diagnosis of the power amplifier, refer to **Speaker** in the Diagnosis and Testing section of this group. The power amplifier cannot be repaired or adjusted and, if faulty or damaged, the unit must be replaced.

OPERATION

The power amplifier receives fused battery current from a fuse in the Junction Block (JB) at all times. The internal circuitry of the power amplifier switches the amplifier on based upon a fused 12 volt output signal that is received from the radio receiver whenever the radio is turned on. The power amplifier receives the sound signal inputs for four speaker channels from the radio receiver, then sends the

DESCRIPTION AND OPERATION (Continued)

amplified speaker outputs for each of those channels to the six speakers. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

ANTENNA

DESCRIPTION

All models use a black painted fixed-length stainless steel rod-type antenna mast, installed on the right front fender of the vehicle. The antenna mast has a spiral groove cut down its length to reduce wind noise. The antenna mast is connected to the center wire of the coaxial antenna cable, and is not grounded to any part of the vehicle. To eliminate static, the antenna base must have a good ground. The coaxial antenna cable shield (the outer wire mesh of the cable) is grounded to the antenna base and the radio receiver chassis.

The antenna coaxial cable has an additional disconnect, located near the inboard side of the glove box opening on the back side of the lower instrument panel reinforcement. This additional disconnect allows the instrument panel assembly to be removed and installed without removing the radio receiver.

The factory-installed Electronically Tuned Radios (ETR) automatically compensate for radio antenna trim. Therefore, no antenna trimmer adjustment is required or possible when replacing the radio receiver or the antenna.

RADIO NOISE SUPPRESSION

DESCRIPTION

Radio Frequency Interference (RFI) and Electro-Magnetic Interference (EMI) noise suppression is accomplished primarily through circuitry internal to the radio receivers. These internal suppression devices are only serviced as part of the radio receiver.

External suppression devices that are used on this vehicle to control RFI or EMI noise include the following:

- Radio antenna base ground
- Radio receiver chassis ground wire or strap
- Engine-to-body ground strap(s)
- Exhaust system-to-body ground strap (4.7L engines only)
- Resistor-type spark plugs
- Radio suppression-type secondary ignition wiring.

For more information on the spark plugs and secondary ignition components, refer to **Ignition System** in the Description and Operation section of Group 8D - Ignition System.

DIAGNOSIS AND TESTING

AUDIO SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

Audio System Diagnosis

CONDITION	POSSIBLE CAUSE	CORRECTION
NO AUDIO	1. Fuse faulty. 2. Radio connector faulty. 3. Wiring faulty. 4. Ground faulty. 5. Radio faulty. 6. Speakers faulty. 7. Amplifier faulty (if equipped).	1. Check radio fuses in junction block. Replace faulty fuses, if required. 2. Check for loose or corroded radio connections. Repair, if required. 3. Check for battery voltage at radio connector. Repair wiring, if required. 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 5. Refer to Radio in the Diagnosis and Testing section of this group. 6. Refer to Speaker in the Diagnosis and Testing section of this group. 7. Refer to Speaker in the Diagnosis and Testing section of this group.

DIAGNOSIS AND TESTING (Continued)

Audio System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
NO DISPLAY	1. Fuse faulty. 2. Radio connector faulty. 3. Wiring faulty. 4. Ground faulty. 5. Radio faulty.	1. Check radio fuses in junction block. Replace faulty fuses, if required. 2. Check for loose or corroded radio connections. Repair, if required. 3. Check for battery voltage at radio connector. Repair wiring, if required. 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 5. Refer to Radio in the Diagnosis and Testing section of this group.
CLOCK WILL NOT KEEP SET TIME	1. Fuse faulty. 2. Radio connector faulty. 3. Wiring faulty. 4. Ground faulty. 5. Radio faulty.	1. Check ignition-off draw fuse. Replace faulty fuse, if required. 2. Check for loose or corroded radio connections. Repair, if required. 3. Check for battery voltage at radio connector. Repair wiring, if required. 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 5. Refer to Radio in the Diagnosis and Testing section of this group.
POOR RADIO RECEPTION	1. Antenna faulty. 2. Ground faulty. 3. Radio faulty. 4. Faulty EMI or RFI noise suppression.	1. Refer to Antenna in the Diagnosis and Testing section of this group. 2. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 3. Refer to Radio in the Diagnosis and Testing section of this group. 4. Refer to Radio Frequency Interference in the Diagnosis and Testing section of this group.
NO/POOR TAPE OPERATION	1. Faulty tape. 2. Foreign objects behind tape door. 3. Dirty cassette tape head. 4. Faulty tape deck.	1. Insert known good tape and test operation. 2. Remove foreign objects and test operation. 3. Clean head with Mopar Cassette Head Cleaner. 4. Exchange or replace radio, if required.
NO COMPACT DISC OPERATION	1. Faulty CD. 2. Foreign material on CD. 3. Condensation on CD or optics. 4. Faulty CD player.	1. Insert known good CD and test operation. 2. Clean CD and test operation. 3. Allow temperature of vehicle interior to stabilize and test operation. 4. Exchange or replace radio, if required.

RADIO RECEIVER

If the vehicle is equipped with the optional remote radio switches located on the steering wheel and the problem being diagnosed is related to one of the symptoms listed below, be certain to check the remote radio switches and circuits. Refer to **Remote Radio Switch** in the Diagnosis and Testing section of this group prior to attempting radio diagnosis or repair.

- Stations changing with no remote radio switch input
- Radio memory presets not working properly
- Volume changes with no remote radio switch input

DIAGNOSIS AND TESTING (Continued)

• Remote radio switch buttons taking on other functions
• CD player skipping tracks
• Remote radio switch inoperative.

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CAUTION: The speaker output of the radio receiver is a "floating ground" system. Do not allow any speaker lead to short to ground, as damage to the radio receiver may result.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) as required.

(3) Check the fused ignition switch output (acc/run) fuse in the junction block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (acc/run) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel, but do not disconnect the wire harness connectors. Check for continuity between the radio receiver chassis and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) circuit cavity of the left (gray) radio wire harness connector. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (acc/run) circuit to the junction block fuse as required.

(7) Turn the ignition switch to the Off position. Check for battery voltage at the fused B(+) circuit cavity of the left (gray) radio wire harness connector. If OK, replace the faulty radio receiver. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

REMOTE RADIO SWITCH

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the remote radio switch(es) (Fig. 2) from the steering wheel.

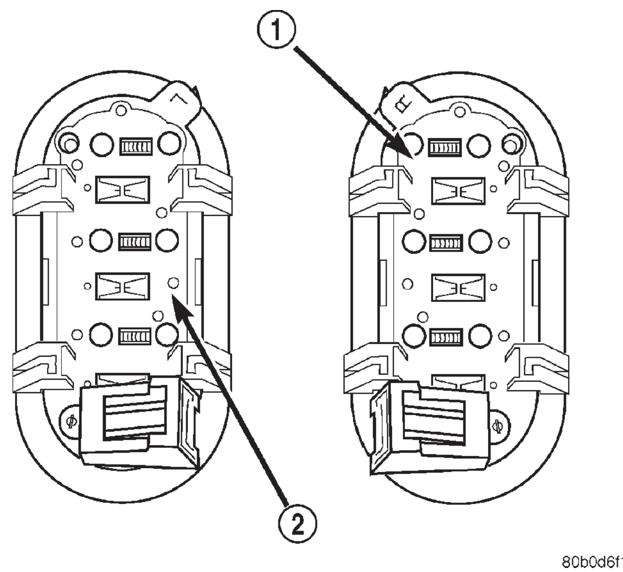


Fig. 2 Remote Radio Switches

1 – WHITE REAR SWITCH
2 – BLACK REAR SWITCH

(2) Use an ohmmeter to check the switch resistances as shown in the Remote Radio Switch Test chart. If the remote radio switch resistances check OK, go to Step 3. If not OK, replace the faulty switch.

(3) Check for continuity between the ground circuit cavity of the remote radio switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

DIAGNOSIS AND TESTING (Continued)

REMOTE RADIO SWITCH TEST		
SWITCH	SWITCH POSITION	RESISTANCE
Right (White)	Volume Up	7320 Ohms
Right (White)	Volume Down	1210 Ohms
Left (Black)	Seek Up	4530 Ohms
Left (Black)	Seek Down	2050 Ohms
Left (Black)	Pre-Set Station Advance	10 Ohms

(4) Disconnect the 18-way wire harness connector from the Central Timer Module (CTM). Check for continuity between the radio control mux circuit cavity of the remote radio switch wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted radio control mux circuit as required.

(5) Check for continuity between the radio control mux circuit cavities of the remote radio switch wire harness connector and the 18-way CTM wire harness connector. There should be continuity. If OK, refer to the proper Diagnostic Procedures manual to test the CTM and the Chrysler Collision Detection (CCD) data bus. If not OK, repair the open radio control mux circuit as required.

SPEAKER

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CAUTION: The speaker output of the radio is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio may result.

(1) Turn the ignition switch to the On position. Turn the radio receiver on. Adjust the balance and fader controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly. Go to Step 2.

(2) Turn the radio receiver off. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel. If the vehicle is equipped with the Infinity speaker package, also disconnect the wire harness connectors at the power amplifier. Check both the speaker feed (+) circuit and return (–) circuit cavities for the inoperative speaker location(s) at the radio receiver wire harness connectors for continuity to ground. In each case, there should be no continuity. If OK, go to Step 3. If not OK, repair the shorted speaker feed (+) and/or return (–) circuit(s) to the speaker as required.

(3) If the vehicle is equipped with the Infinity speaker package, go to Step 6. If the vehicle is equipped with the standard speaker system, check the resistance between the speaker feed (+) circuit and return (–) circuit cavities of the radio receiver wire harness connectors for the inoperative speaker location(s). The meter should read between 2 and 28 ohms (speaker resistance). If OK, go to Step 4. If not OK, go to Step 5.

(4) Install a known good radio receiver. Connect the battery negative cable. Turn the ignition switch to the On position. Turn on the radio receiver and test the speaker operation. If OK, replace the faulty radio receiver. If not OK, turn the radio receiver off, turn the ignition switch to the Off position, disconnect and isolate the battery negative cable, remove the test radio receiver, and go to Step 5.

(5) Disconnect the wire harness connector at the inoperative speaker. Check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. Repeat the check between the speaker return (–) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. In each case, there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open speaker feed (+) and/or return (–) circuit(s) as required.

(6) For each inoperative speaker location, check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connectors and the power amplifier wire harness connectors. Repeat the check for each inoperative speaker location between the speaker return (–) circuit cavities of the radio receiver wire harness connectors and the power amplifier wire harness connectors. In each case, there should be continuity. If OK, go to Step 7. If not OK, repair the open speaker feed (+) and/or return (–) circuit(s) as required.

(7) Check for continuity between the two ground circuit cavities of the power amplifier wire harness connector and a good ground. There should be conti-

DIAGNOSIS AND TESTING (Continued)

nuity. If OK, go to Step 8. If not OK, repair the open ground circuit(s) to ground as required.

(8) Check the power amplifier fuse in the junction block. If OK, go to Step 9. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(9) Install the radio receiver. Connect the battery negative cable. Check for battery voltage at the power amplifier fuse in the junction block. If OK, go to Step 10. If not OK, repair the open fused B(+) circuit to the PDC as required.

(10) Check for battery voltage at the two fused B(+) circuit cavities of the power amplifier wire harness connector. If OK, go to Step 11. If not OK, repair the open fused B(+) circuit(s) to the fuse in the junction block as required.

(11) Turn the ignition switch to the On position. Turn the radio receiver on. Check for battery voltage at the radio 12 volt output circuit cavity of the power amplifier wire harness connector. If OK, go to Step 12. If not OK, repair the open radio 12 volt output circuit to the radio receiver as required.

(12) Turn the radio receiver off. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. For each inoperative speaker location, check both the amplified feed (+) circuit and the amplified return (–) circuit cavities of the power amplifier wire harness connectors for continuity to ground. In each case there should be no continuity. If OK, go to Step 13. If not OK, repair the shorted amplified feed (+) and/or amplified return (–) circuit(s) to the speaker as required.

(13) For each inoperative speaker location, check the resistance between the amplified feed (+) circuit and the amplified return (–) circuit cavities of the power amplifier wire harness connectors. The meter should read between 2 and 28 ohms (speaker resistance). If OK, replace the faulty power amplifier. If not OK, go to Step 14.

(14) Disconnect the speaker wire harness connector at the inoperative speaker. Check for continuity between the amplified feed (+) circuit cavities of the speaker wire harness connector and the power amplifier wire harness connector. Repeat the check between the amplified return (–) circuit cavities of the speaker wire harness connector and the power amplifier wire harness connector. In each case there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open amplified feed (+) and/or amplified return (–) circuit(s) as required.

POWER AMPLIFIER

The power amplifier unit should be checked if there is no sound output noted from the speakers. For diagnosis of the power amplifier, refer to **Speaker** in the Diagnosis and Testing section of this group. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

ANTENNA

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The following four tests are used to diagnose the antenna with an ohmmeter:

- **Test 1 -** Mast to ground test
- **Test 2 -** Tip-of-mast to tip-of-conductor test
- **Test 3 -** Body ground to battery ground test
- **Test 4 -** Body ground to coaxial shield test.

The ohmmeter test lead connections for each test are shown in Antenna Tests (Fig. 3).

NOTE: This model has a special coating on the antenna mast which is not electrically conductive. Remove the antenna mast from the antenna base before attempting to perform Tests 1 and 2.

NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate a coaxial cable problem; from the coaxial cable connection under the right end of the instrument panel near the inboard side of the glove box opening to the antenna base, and then from the coaxial cable connection to the radio chassis connection.

TEST 1

Test 1 determines if the antenna mast is insulated from the base. Proceed as follows:

(1) Disconnect the antenna coaxial cable connector from the radio receiver chassis and isolate. Remove the antenna mast from the antenna base.

(2) Insert one ohmmeter test lead into the socket for the antenna mast in the center of the antenna base. Connect the other test lead to the perimeter of the antenna base. Check for continuity.

(3) There should be no continuity. If continuity is found, replace the faulty or damaged antenna base and cable assembly.

DIAGNOSIS AND TESTING (Continued)

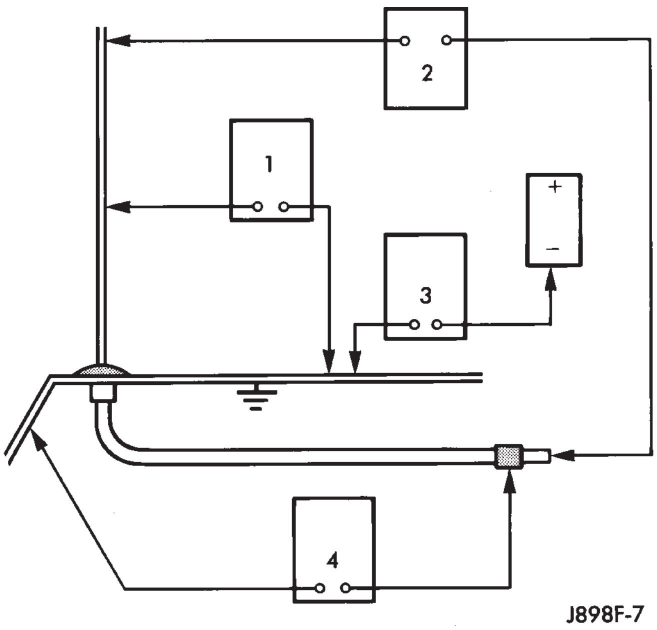


Fig. 3 Antenna Tests

TEST 2

Test 2 checks the antenna for an open circuit as follows:

(1) Disconnect the antenna coaxial cable connector from the radio receiver chassis. Remove the antenna mast from the antenna base.

(2) Insert one ohmmeter test lead into the socket for the antenna mast in the center of the antenna base. Connect the other test lead to the center pin of the antenna coaxial cable connector.

(3) Continuity should exist (the ohmmeter should only register a fraction of an ohm). High or infinite resistance indicates damage to the base and cable assembly. Replace the faulty base and cable, if required.

TEST 3

Test 3 checks the condition of the vehicle body ground connection. This test should be performed with the battery positive cable removed from the battery. Disconnect both battery cables, the negative cable first. Reconnect the battery negative cable and perform the test as follows:

(1) Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the battery negative terminal post.

(2) The resistance should be less than one ohm.

(3) If the resistance is more than one ohm, check the braided ground strap(s) connected to the engine and the vehicle body for being loose, corroded, or damaged. Repair the ground strap connections, if required.

TEST 4

Test 4 checks the condition of the ground between the antenna base and the vehicle body as follows:

(1) Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the outer crimp on the antenna coaxial cable connector.

(2) The resistance should be less then one ohm.

(3) If the resistance is more then one ohm, clean and/or tighten the antenna base to fender mounting hardware.

RADIO FREQUENCY INTERFERENCE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For complete circuit diagrams, see Group 8W - Wiring Diagrams. Inspect the ground paths and connections at the following locations:

- Blower motor
- Electric fuel pump
- Engine-to-body ground strap(s)
- Generator
- Ignition module
- Radio antenna base ground
- Radio receiver chassis ground wire or strap
- Wiper motor.

If the source of RFI or EMI noise is identified as a component on the vehicle (i.e., generator, blower motor, etc.), the ground path for that component should be checked. If excessive resistance is found in any ground circuit, clean, tighten, or repair the ground circuits or connections to ground as required before considering any component replacement.

For service and inspection of secondary ignition components, refer to the Diagnosis and Testing section of Group 8D - Ignition Systems. Inspect the following secondary ignition system components:

- Distributor cap and rotor
- Ignition coil
- Spark plugs
- Spark plug wire routing and condition.

Reroute the spark plug wires or replace the faulty components as required.

If the source of the RFI or EMI noise is identified as two-way mobile radio or telephone equipment, check the equipment installation for the following:

DIAGNOSIS AND TESTING (Continued)

- Power connections should be made directly to the battery, and fused as closely to the battery as possible.
- The antenna should be mounted on the roof or toward the rear of the vehicle. Remember that magnetic antenna mounts on the roof panel can adversely affect the operation of an overhead console compass, if the vehicle is so equipped.
- The antenna cable should be fully shielded coaxial cable, should be as short as is practical, and should be routed away from the factory-installed vehicle wire harnesses whenever possible.
- The antenna and cable must be carefully matched to ensure a low Standing Wave Ratio (SWR).

Fleet vehicles are available with an extra-cost RFI-suppressed Powertrain Control Module (PCM). This unit reduces interference generated by the PCM on some radio frequencies used in two-way radio communications. However, this unit will not resolve complaints of RFI in the commercial AM or FM radio frequency ranges.

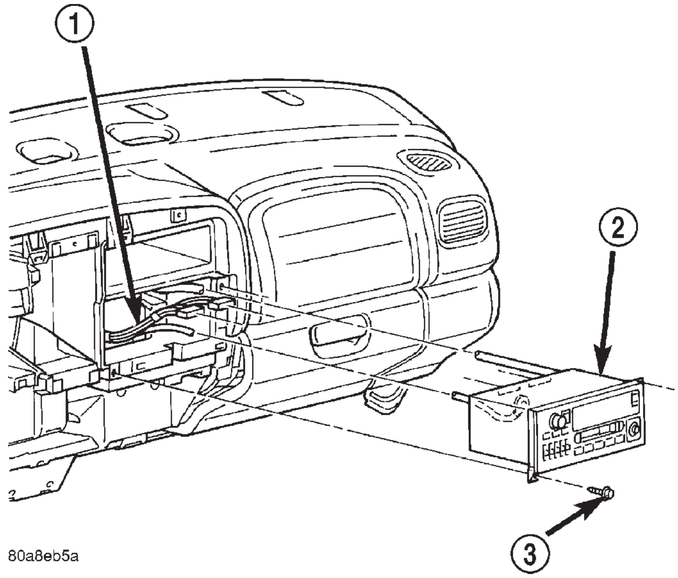


Fig. 4 Radio Receiver Remove/Install

1 – WIRE HARNESS
2 – RADIO
3 – SCREW

REMOVAL AND INSTALLATION

RADIO RECEIVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the two screws that secure the radio receiver to the instrument panel (Fig. 4).

(4) Pull the radio receiver out from the instrument panel far enough to access the instrument panel wire harness connectors and the antenna coaxial cable connector (Fig. 5).

(5) Disconnect the instrument panel wire harness connectors and the antenna coaxial cable connector from the receptacles on the rear of the radio receiver.

(6) Remove the radio receiver from the instrument panel.

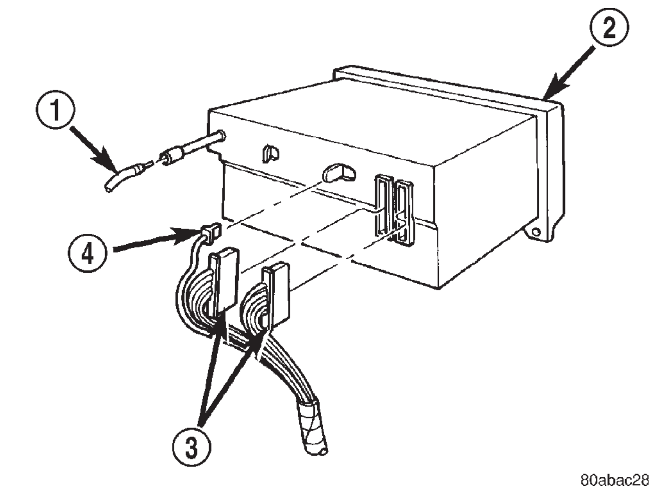


Fig. 5 Radio Receiver Connections - Typical

1 – ANTENNA CABLE
2 – RADIO
3 – INSTRUMENT PANEL WIRING
4 – GROUND WIRE

INSTALLATION

(1) Position the radio receiver to the instrument panel.

(2) Reconnect the instrument panel wire harness connectors and the antenna coaxial cable connector to the receptacles on the rear of the radio receiver.

(3) Position the radio receiver into the mounting hole in the instrument panel.

REMOVAL AND INSTALLATION (Continued)

(4) Install and tighten the two screws that secure the radio receiver to the instrument panel. Tighten the screws to 5 N·m (45 in. lbs.).

(5) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(6) Reconnect the battery negative cable.

REMOTE RADIO SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side airbag module from the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(3) Remove the speed control switch located on the same side of the steering wheel as the remote radio switch that is being serviced. Refer to **Speed Control Switches** in the Removal and Installation section of Group 8H - Speed Control System for the procedures.

(4) Disconnect the steering wheel wire harness connector from the connector receptacle of the remote radio switch (Fig. 6).

(5) Disengage the four remote radio switch latches that secure the switch to the inside of the mounting hole in the steering wheel rear trim cover.

(6) From the outside of the steering wheel rear trim cover, remove the remote radio switch from the trim cover mounting hole.

INSTALLATION

(1) Position the remote radio switch to the mounting hole on the outside of the steering wheel rear trim cover. Be certain that the connector receptacle is oriented toward the bottom of the switch and pointed toward the center of the steering wheel.

(2) Press firmly and evenly on the remote radio switch until each of the switch latches is fully engaged in the mounting hole of the steering wheel rear trim cover.

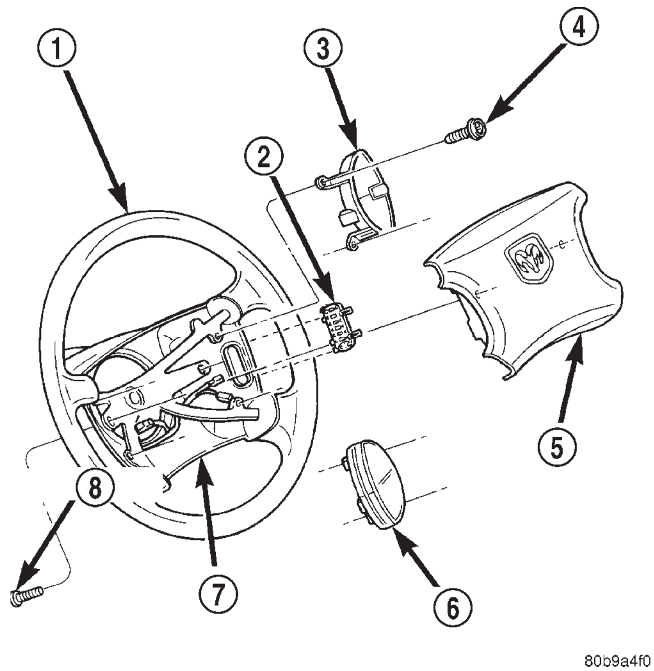


Fig. 6 Remote Radio Switches Remove/Install

1 – STEERING WHEEL
2 – REMOTE RADIO SWITCH
3 – SPEED CONTROL SWITCH
4 – SCREW (2)
5 – DRIVER SIDE AIRBAG MODULE
6 – SPEED CONTROL SWITCH
7 – REAR TRIM COVER
8 – SCREW (2)

(3) Reconnect the steering wheel wire harness connector to the connector receptacle of the remote radio switch.

(4) Install the speed control switch onto the steering wheel. Refer to **Speed Control Switches** in the Removal and Installation section of Group 8H - Speed Control System for the procedures.

(5) Install the driver side airbag module onto the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(6) Reconnect the battery negative cable.

SPEAKER

REMOVAL

FRONT DOOR UPPER SPEAKER

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

REMOVAL AND INSTALLATION (Continued)

(3) Disconnect the door wire harness connector from the front door upper speaker wire harness connector (Fig. 7).

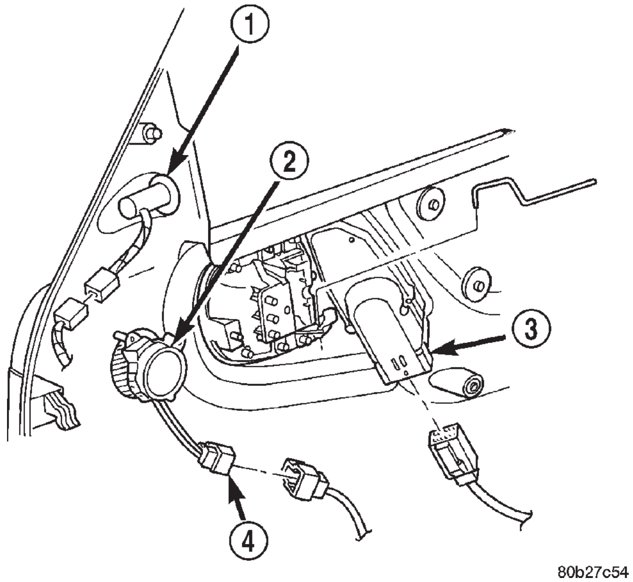


Fig. 7 Front Door Upper Speaker Remove/Install

1 – POWER MIRROR SWITCH
2 – TWEETER
3 – POWER WINDOW SWITCH
4 – WIRE HARNESS CONNECTOR

(4) Remove the two screws that secure the front door upper speaker to the back of the trim panel.

(5) Remove the front door upper speaker from the trim panel.

FRONT DOOR LOWER SPEAKER

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the three screws that secure the speaker to the front door inner panel (Fig. 8).

(4) Pull the speaker away from the mounting hole in the front door inner panel far enough to access the wire harness connector.

(5) Disconnect the front door wire harness connector from the speaker connector receptacle.

(6) Remove the speaker from the front door inner panel.

REAR CAB SIDE PANEL SPEAKER - STANDARD CAB

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the B-pillar. Refer to **B-Pillar Trim** in the Removal and Installation section of Group 23 - Body for the procedures.

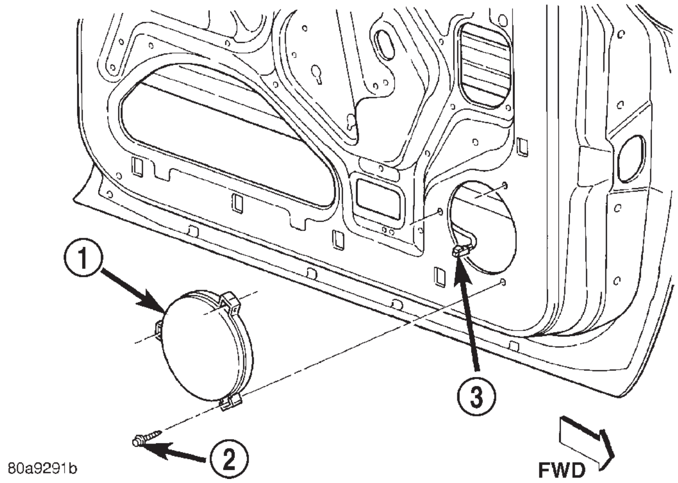


Fig. 8 Front Door Lower Speaker Remove/Install

1 – SPEAKER
2 – SCREW
3 – CONNECTOR

(3) Pull the B-pillar trim away from the cab side panel far enough to access the speaker wire harness connector (Fig. 9).

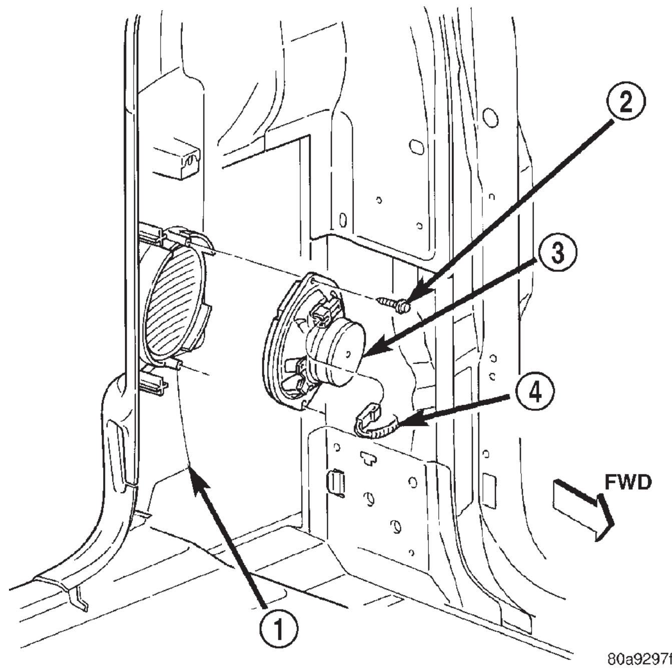


Fig. 9 Rear Cab Side Panel Speaker Remove/Install - Standard Cab

1 – B-PILLAR TRIM PANEL
2 – SCREW
3 – SPEAKER
4 – WIRE HARNESS CONNECTOR

(4) Disconnect the body wire harness connector from the speaker connector receptacle.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the two screws that secure the speaker to the back of the B-pillar trim.

(6) Remove the speaker from the back of the B-pillar trim.

REAR CAB SIDE PANEL SPEAKER - CLUB CAB

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the rear cab side inner panel. Refer to **Quarter Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the three screws that secure the speaker to the rear cab side inner panel (Fig. 10).

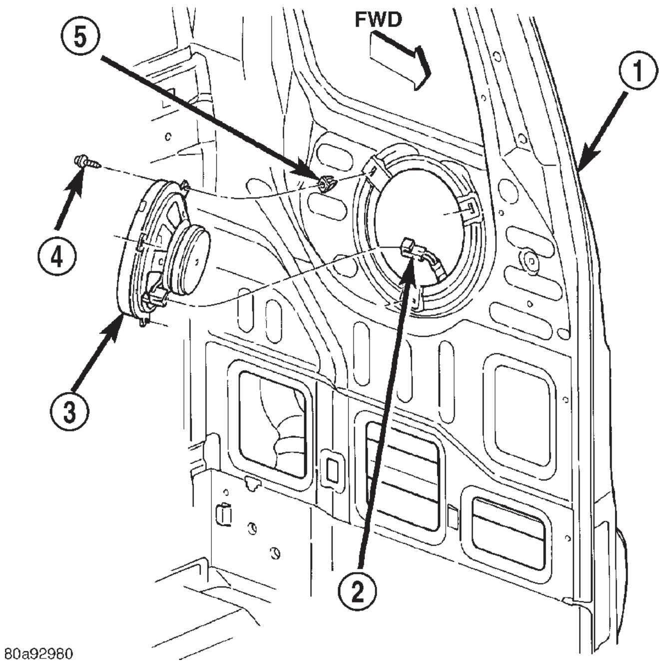


Fig. 10 Rear Cab Side Panel Speaker Remove/Install - Club Cab

1 – REAR CAB SIDE
2 – WIRE HARNESS CONNECTOR
3 – SPEAKER
4 – SCREW
5 – CLIP

(4) Pull the speaker away from the mounting hole in the rear cab side inner panel far enough to access the wire harness connector.

(5) Disconnect the body wire harness connector from the speaker connector receptacle.

(6) Remove the speaker from the rear cab side inner panel.

REAR DOOR SPEAKER - QUAD CAB

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the three screws that secure the speaker to the rear door inner panel (Fig. 11).

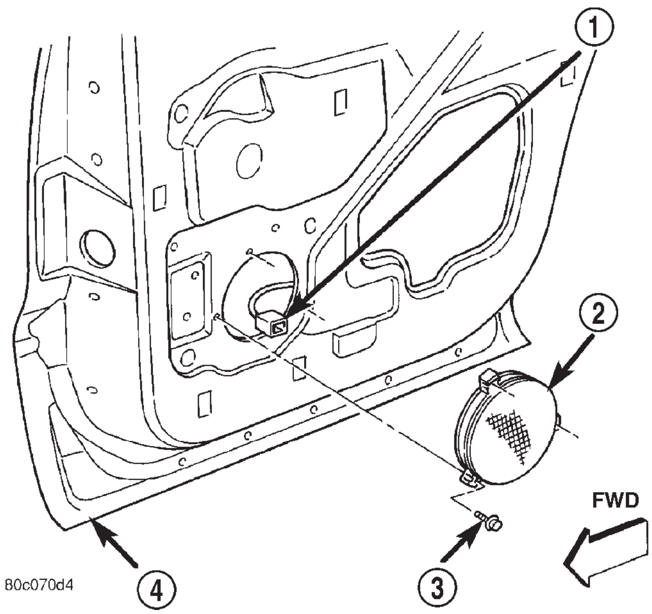


Fig. 11 Rear Door Speaker Remove/Install - Quad Cab

1 – CONNECTOR
2 – SPEAKER
3 – SCREW (3)
4 – REAR DOOR

(4) Pull the speaker away from the mounting hole in the rear door inner panel far enough to access the wire harness connector.

(5) Disconnect the rear door wire harness connector from the speaker connector receptacle.

(6) Remove the speaker from the rear door inner panel.

INSTALLATION

FRONT DOOR UPPER SPEAKER

(1) Position the front door upper speaker to the back of the trim panel.

(2) Install and tighten the two screws that secure the front door upper speaker to the trim panel. Tighten the screws to 2 N·m (17 in. lbs.).

(3) Reconnect the door wire harness connector to the front door upper speaker wire harness connector.

(4) Install the trim panel onto the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(5) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

FRONT DOOR LOWER SPEAKER

(1) Position the speaker to the front door inner panel.

(2) Reconnect the front door wire harness connector to the speaker connector receptacle.

(3) Position the speaker into the mounting hole in the front door inner panel.

(4) Install and tighten the three screws that secure the speaker to the front door inner panel. Tighten the screws to 2 N·m (17 in. lbs.).

(5) Install the trim panel onto the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

REAR CAB SIDE PANEL SPEAKER - STANDARD CAB

(1) Position the speaker onto the back of the B-pillar trim.

(2) Install and tighten the two screws that secure the speaker to the back of the B-pillar trim. Tighten the screws to 2 N·m (17 in. lbs.).

(3) Reconnect the body wire harness connector to the speaker connector receptacle.

(4) Install the trim panel onto the B-pillar. Refer to **B-Pillar Trim** in the Removal and Installation section of Group 23 - Body for the procedures.

(5) Reconnect the battery negative cable.

REAR CAB SIDE PANEL SPEAKER - CLUB CAB

(1) Position the speaker to the rear cab side inner panel.

(2) Reconnect the body wire harness connector to the speaker connector receptacle.

(3) Position the speaker into the mounting hole in the rear cab side inner panel.

(4) Install and tighten the three screws that secure the speaker to the rear cab side inner panel. Tighten the screws to 2 N·m (17 in. lbs.).

(5) Install the trim panel onto the rear cab side inner panel. Refer to **Quarter Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

REAR DOOR SPEAKER - QUAD CAB

(1) Position the speaker to the rear door inner panel.

(2) Reconnect the rear door wire harness connector to the speaker connector receptacle.

(3) Position the speaker into the mounting hole in the rear door inner panel.

(4) Install and tighten the three screws that secure the speaker to the rear door inner panel. Tighten the screws to 3.9 N·m (35 in. lbs.).

(5) Install the trim panel onto the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

POWER AMPLIFIER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim cover from the right cowl side inner panel. Refer to **Cowl Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Disconnect the two instrument panel wire harness connectors from the connector receptacles on the bottom of the power amplifier (Fig. 12).

(4) Remove the two screws that secure the power amplifier to the right cowl side inner panel (Fig. 13).

(5) To disengage the upper hook bracket of the power amplifier from the upper hinge access hole in the right cowl side inner panel:

(a) Lift the power amplifier upwards about 5 centimeters (2 inches).

(b) Tilt the top of the power amplifier toward the instrument panel.

(c) Keep the top of the power amplifier tilted toward the instrument panel while lowering the unit from between the right cowl side inner panel and the end of the heater-A/C housing.

(6) Remove the power amplifier from the right cowl side inner panel.

INSTALLATION

(1) Position the power amplifier to the right cowl side inner panel.

(2) To engage the upper hook bracket of the power amplifier in the upper hinge access hole in the right cowl side inner panel:

(a) Tilt the top of the power amplifier toward the instrument panel.

(b) Keep the top of the power amplifier tilted toward the instrument panel while lifting the unit up between the right cowl side inner panel and the end of the heater-A/C housing.

REMOVAL AND INSTALLATION (Continued)

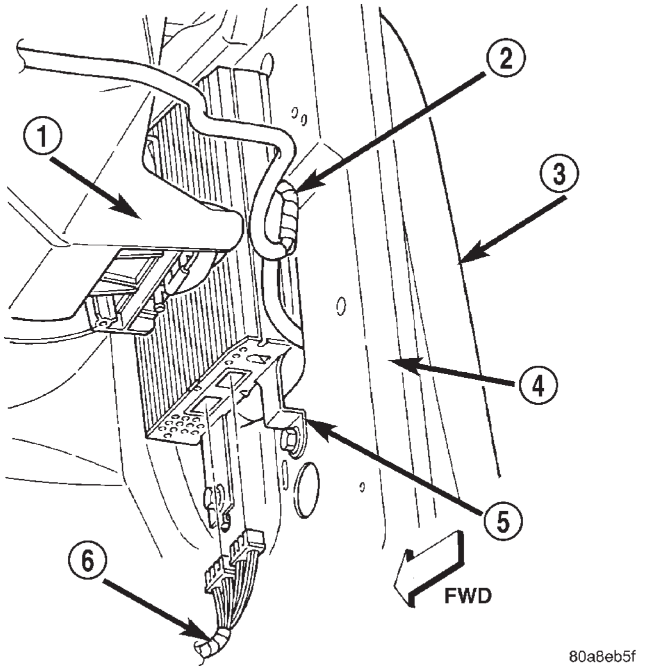


Fig. 12 Power Amplifier Connections Remove/Install

1 – HEATER-A/C HOUSING
2 – ANTENNA COAXIAL CABLE
3 – FENDER
4 – HINGE PILLAR
5 – AMPLIFIER
6 – WIRE HARNESS

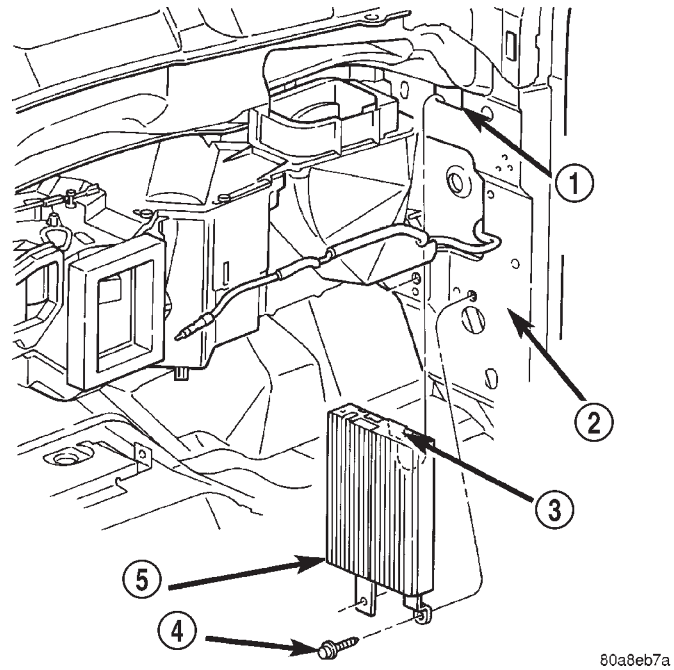


Fig. 13 Power Amplifier Remove/Install

1 – UPPER HINGE ACCESS HOLE
2 – COWL SIDE INNER PANEL
3 – HOOK
4 – SCREW
5 – AMPLIFIER

(c) When the lower power amplifier mounting brackets are about 5 centimeters (2 inches) above the mounting holes for the lower brackets in the right cowl side inner panel, tilt the top of the power amplifier toward the right cowl side inner panel.

(d) Lower the power amplifier until the upper hook bracket is engaged in the upper hinge access hole in the right cowl side inner panel. Tighten the screws to 2 N·m (17 in. lbs.).

(3) Install and tighten the two screws that secure the power amplifier to the right cowl side inner panel.

(4) Reconnect the two instrument panel wire harness connectors to the connector receptacles on the bottom of the power amplifier.

(5) Install the trim cover onto the right cowl side inner panel. Refer to **Cowl Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

ANTENNA

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

ANTENNA BODY AND CABLE

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim cover from the right cowl side inner panel. Refer to **Cowl Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Reach under the instrument panel below the glove box to access and disconnect the antenna coaxial cable connector (Fig. 14). Disconnect the connector by pulling it apart while twisting the metal connector halves. Do not pull on the cable.

(4) Disengage the antenna coaxial cable from the retainer clips on the lower instrument panel reinforcement and the heater-A/C housing.

(5) Disengage the antenna coaxial cable retainers at the right cowl side inner panel and inside the right front fender.

REMOVAL AND INSTALLATION (Continued)

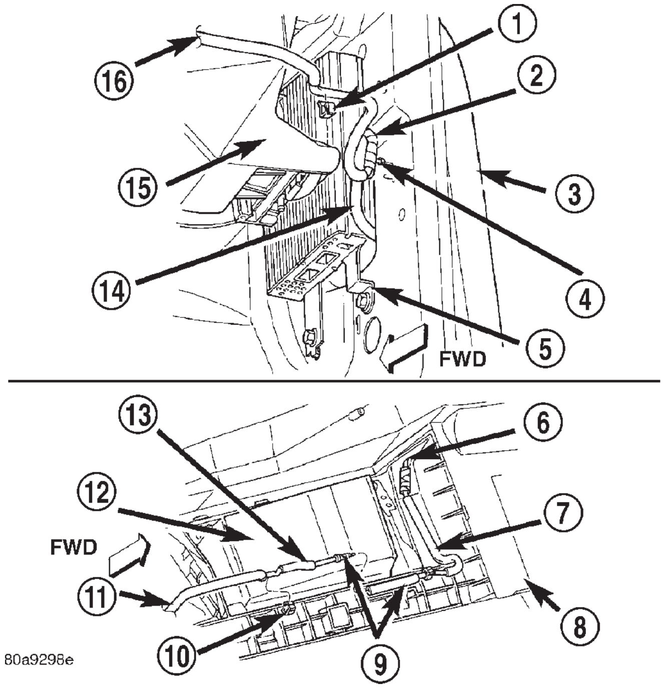


Fig. 14 Antenna Coaxial Cable Routing

1 – CLIP
2 – ANTENNA BODY AND CABLE
3 – RIGHT FRONT FENDER
4 – RETAINER
5 – AMPLIFIER
6 – TO RADIO
7 – COAXIAL CABLE
8 – INSTRUMENT PANEL
9 – CONNECTOR
10 – CLIP
11 – TO ANTENNA
12 – GLOVE BOX BIN
13 – ANTENNA BODY AND CABLE
14 – TO ANTENNA
15 – HEATER-A/C HOUSING
16 – TO RADIO

(6) Unscrew the antenna mast from the antenna body (Fig. 15).

(7) Remove the antenna cap nut using an antenna nut wrench (Special Tool C-4816) (Fig. 16).

(8) Remove the antenna adapter from the top of the fender.

(9) Lower the antenna body through the mounting hole in the top of the fender.

(10) Pull the antenna body and cable out through the opening between the right cowl side outer panel and the fender through the front door opening (Fig. 17).

(11) Disengage the antenna coaxial cable grommet from the hole in the right cowl side outer panel.

(12) Pull the antenna coaxial cable out of the passenger compartment through the hole in the right cowl side outer panel.

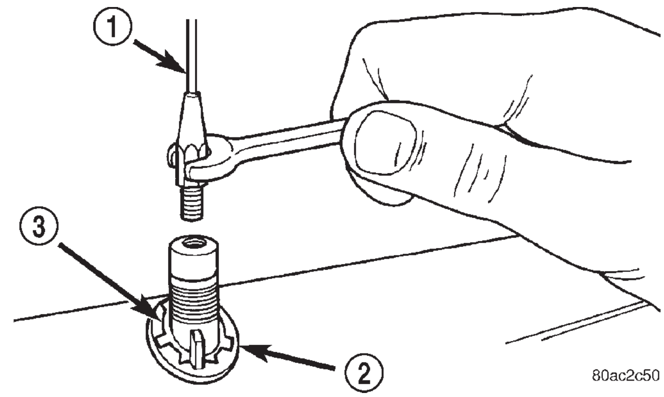


Fig. 15 Antenna Mast Remove/Install - Typical

1 – ANTENNA MAST
2 – ADAPTER
3 – CAP NUT

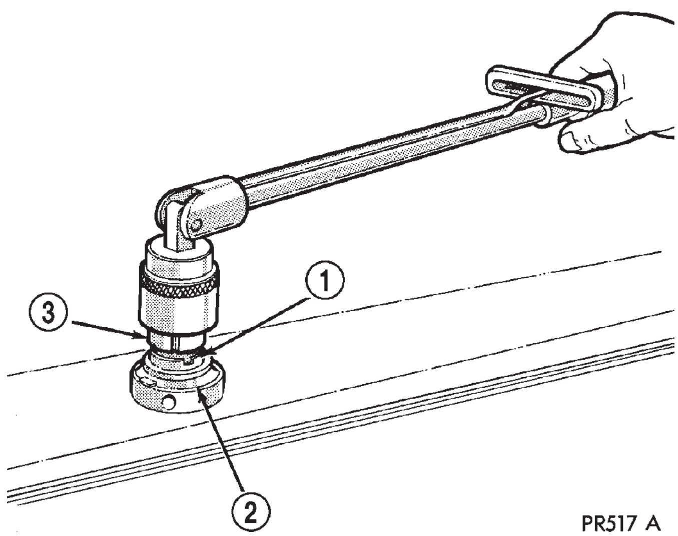


Fig. 16 Antenna Cap Nut and Adapter Remove/ Install - Typical

1 – CAP NUT
2 – ANTENNA ADAPTER
3 – TOOL

(13) Remove the antenna body and cable from the vehicle.

INSTRUMENT PANEL ANTENNA CABLE

(1) Disconnect and isolate the battery negative cable.

(2) Reach under the instrument panel below the glove box to access and disconnect the antenna coaxial cable connector (Fig. 14). Disconnect the connector by pulling it apart while twisting the metal connector halves. Do not pull on the cable.

(3) Securely tie a suitable length of cord or twine to the instrument panel half of the antenna coaxial cable connector. This cord will be used to pull or “fish” the cable back into position during installation.

REMOVAL AND INSTALLATION (Continued)

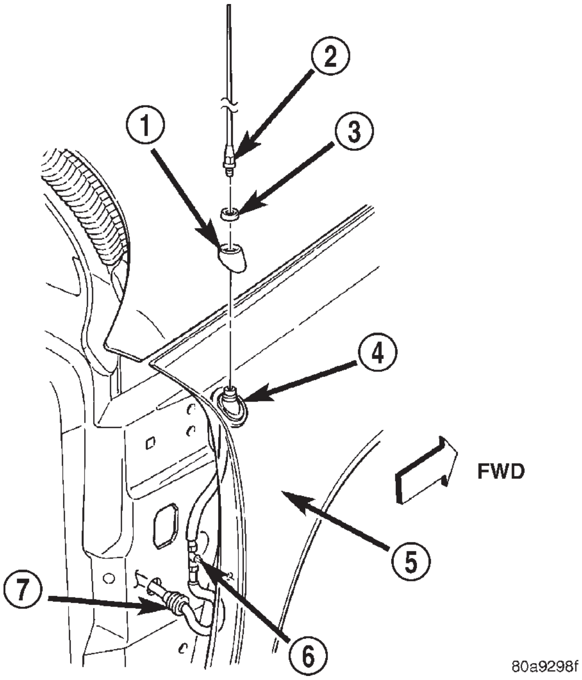


Fig. 17 Antenna Mounting

1 – ADAPTER
2 – MAST
3 – NUT
4 – ANTENNA BODY AND CABLE
5 – RIGHT FRONT FENDER
6 – RETAINER
7 – GROMMET

(4) Disengage the instrument panel antenna cable from the retainer clip on the lower instrument panel reinforcement inboard of the glove box opening.

(5) Roll down the glove box from the instrument panel. Refer to **Glove Box** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(6) Reach through the glove box opening to access and disengage the retainer that secures the antenna cable to the instrument panel structural support on the inboard side of the glove box opening.

(7) Remove the radio receiver from the instrument panel. Refer to **Radio Receiver** in the Removal and Installation section of this group for the procedures.

(8) Pull the antenna cable out through the radio receiver opening in the instrument panel.

(9) Untie the cord or twine from the instrument panel antenna cable connector, leaving the cord or twine in place of the cable in the instrument panel.

(10) Remove the antenna cable from the instrument panel.

INSTALLATION

ANTENNA BODY AND CABLE

(1) Position the antenna body and cable in the opening between the right cowl side outer panel and the fender through the front door opening.

(2) Push the antenna coaxial cable into the passenger compartment through the hole in the right cowl side outer panel.

(3) Engage the antenna coaxial cable grommet in the hole in the right cowl side outer panel.

(4) Position the antenna body through the mounting hole in the top of the fender.

(5) Install the adapter over the antenna body from the top of the fender.

(6) Install and tighten the antenna cap nut using an antenna nut wrench (Special Tool C-4816). Tighten the antenna cap nut to 8 N·m (70 in. lbs.).

(7) Install and tighten the antenna mast onto the antenna body. Tighten the mast to 3.3 N·m (30 in. lbs.).

(8) Engage the antenna coaxial cable retainers at the right cowl side inner panel and inside the right front fender.

(9) Engage the antenna coaxial cable in the retainer clips on the lower instrument panel reinforcement and the heater-A/C housing.

(10) Reach under the instrument panel below the glove box to reconnect the antenna coaxial cable connector.

(11) Install the trim cover onto the right cowl side inner panel. Refer to **Cowl Trim Cover** in the Removal and Installation section of Group 23 - Body for the procedures.

(12) Reconnect the battery negative cable.

INSTRUMENT PANEL ANTENNA CABLE

(1) Tie the end of the cord or twine that was used during instrument panel antenna cable removal securely to the connector on the end of the antenna coaxial cable being installed into the instrument panel. This cord will be used to pull or “fish” the cable back into position.

(2) Using the cord or twine, pull the antenna cable through the radio receiver opening from under the instrument panel.

(3) Install the radio receiver onto the instrument panel. Refer to **Radio Receiver** in the Removal and Installation section of this group for the procedures.

(4) Reach through the glove box opening to access and engage the retainer that secures the antenna cable to the instrument panel structural support on the inboard side of the glove box opening.

(5) Install the glove box onto the instrument panel. Refer to **Glove Box** in the Removal and Installation

REMOVAL AND INSTALLATION (Continued)

section of Group 8E - Instrument Panel Systems for the procedures.

(6) Engage the instrument panel antenna cable to the retainer clip on the lower instrument panel reinforcement inboard of the glove box opening.

(7) Untie the cord or twine from the instrument panel half of the antenna coaxial cable connector.

(8) Reach under the instrument panel below the glove box to access and reconnect the antenna coaxial cable connector.

(9) Reconnect the battery negative cable.

RADIO NOISE SUPPRESSION COMPONENTS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

ENGINE-TO-BODY GROUND STRAPS

(1) Remove the nut and washer that secures the left engine-to-body ground strap eyelet terminal to the weld stud on the left side of the lower plenum panel (Fig. 18).

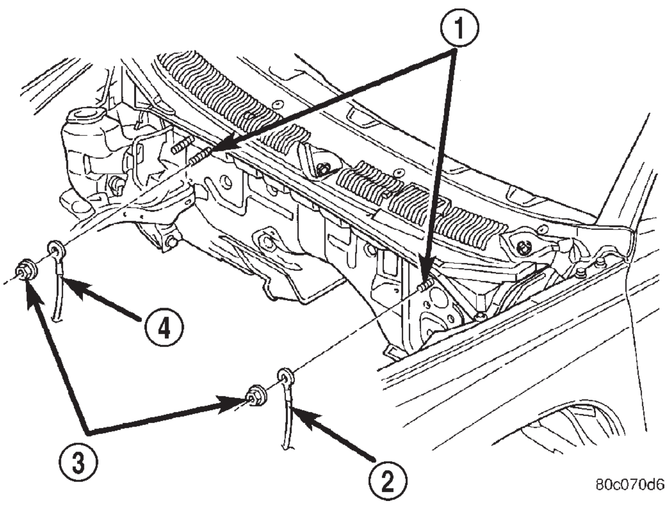


Fig. 18 Engine-To-Body Ground Strap Remove/Install - Typical

1 – WELD STUDS
2 – LEFT GROUND STRAP
3 – NUT AND WASHER (2)
4 – RIGHT GROUND STRAP

(2) On 6 and 8 cylinder engines only, remove the nut and washer that secures the right engine-to-body ground strap eyelet terminal to the inboard weld stud on the right side of the lower plenum panel (Fig. 18).

(3) On 4 cylinder engines only, remove the nut and washer that secures the left engine-to-body ground strap eyelet terminal to the stud on the left rear corner of the engine cylinder head (Fig. 19).

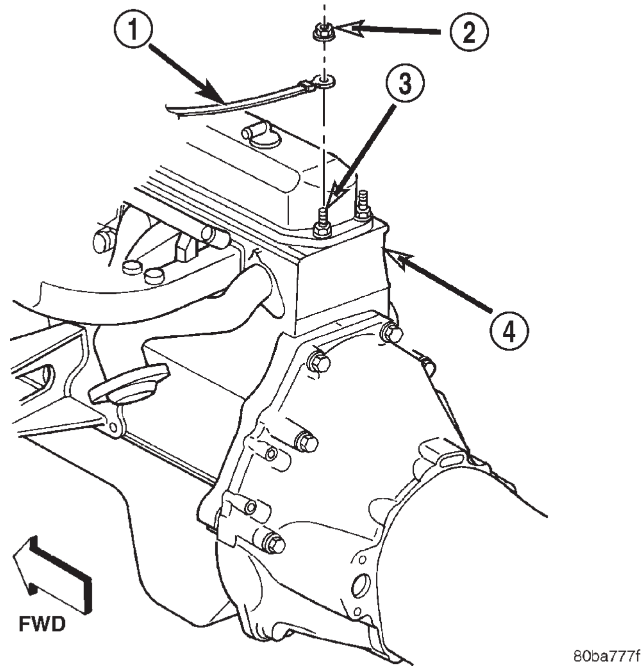


Fig. 19 Left Engine-To-Body Ground Strap Remove/Install - 4 Cylinder Engine Only

1 – LEFT GROUND STRAP
2 – NUT
3 – STUD
4 – ENGINE CYLINDER HEAD

(4) On 6 and 8 cylinder engines only, remove the screw that secures the left engine-to-body ground strap eyelet terminal to the rear of the left cylinder head (Fig. 20) or (Fig. 21).

(5) On 6 and 8 cylinder engines only, remove the screw that secures the right engine-to-body ground strap eyelet terminal to the rear of the right cylinder head (Fig. 20) or (Fig. 21).

(6) On 4.7L engines only, remove the nut and washer that secures the right engine-to-body ground strap eyelet terminal and the wire harness grounds to the weld stud on the right front fender wheelhouse inner panel (Fig. 22).

(7) On 4.7L engines only, remove the screw and washer that secures the right engine-to-body ground strap eyelet terminal to the transmission at the right rear corner of the engine block (Fig. 23).

REMOVAL AND INSTALLATION (Continued)

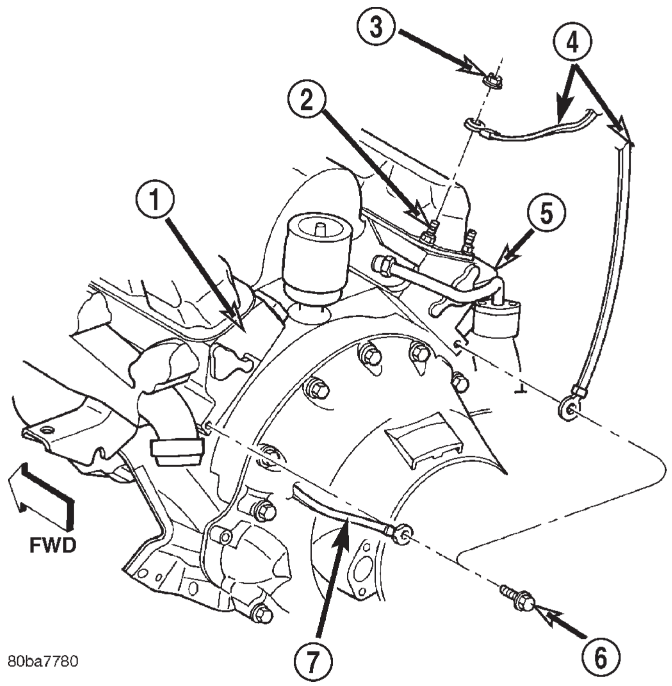


Fig. 20 Engine-To-Body Ground Strap Remove/ Install - 3.9L & 5.9L Engine Only

1 – LEFT CYLINDER HEAD
2 – STUD
3 – NUT
4 – RIGHT GROUND STRAP
5 – RIGHT CYLINDER HEAD
6 – SCREW (2)
7 – LEFT GROUND STRAP

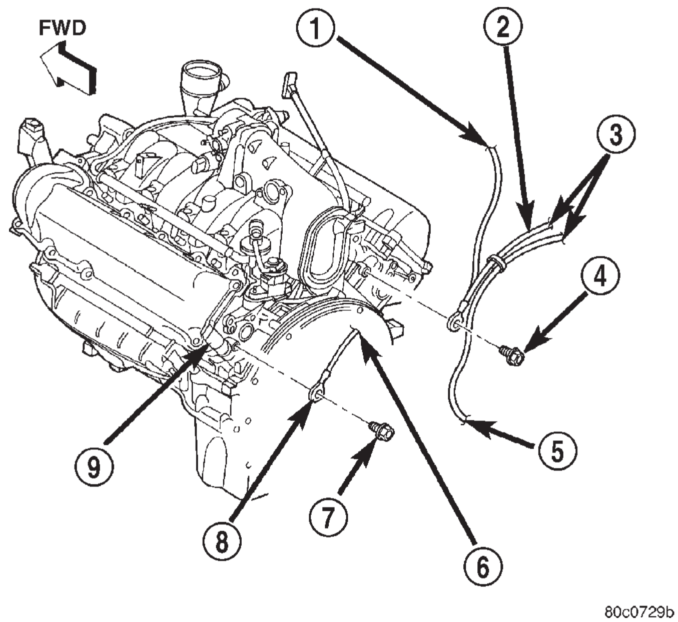


Fig. 21 Engine-To-Body Ground Strap Remove/ Install - 4.7L Engine Only

1 – TO RIGHT COWL STUD
2 – RIGHT GROUND STRAP
3 – TO RIGHT FENDER STUD
4 – SCREW
5 – TO TRANSMISSION
6 – TO LEFT COWL STUD
7 – SCREW
8 – LEFT GROUND STRAP
9 – LEFT CYLINDER HEAD

(8) On 3.9L and 5.9L engines only, remove the nut and washer that secures the right engine-to-body ground strap eyelet terminal to the inboard rear valve cover stud of the right cylinder head (Fig. 20).

(9) Remove the engine-to-body ground strap(s) from the engine compartment.

EXHAUST SYSTEM-TO-BODY GROUND STRAP - 4.7L ENGINE ONLY

(1) Raise and support the vehicle.

(2) Remove the nut and washer that secures the exhaust system-to-body ground strap eyelet terminal to the exhaust pipe clamp (Fig. 24).

(3) Remove the screw that secures the exhaust system-to-body ground strap eyelet terminal to the right body sill panel.

(4) Disengage the clip that secures the exhaust system-to-body ground strap from the hole on the top of the right frame rail.

(5) Remove the exhaust system-to-body ground strap from over the top of the right frame rail.

INSTALLATION

ENGINE-TO-BODY GROUND STRAPS

(1) Position the engine-to-body ground strap(s) in the engine compartment.

(2) On 3.9L and 5.9L engines only, position the right engine-to-body ground strap eyelet terminal over the inboard rear valve cover stud of the right cylinder head.

(3) On 3.9L and 5.9L engines only, install and tighten the nut and washer that secures the right engine-to-body ground strap eyelet terminal to the inboard rear valve cover stud of the right cylinder head. Tighten the nut to 2.8 N·m (25 in. lbs.).

(4) On 4.7L engines only, install and tighten the screw and washer that secures the right engine-to-body ground strap eyelet terminal to the transmission at the right rear corner of the engine block. Tighten the screw to 67.8 N·m (50 ft. lbs.).

(5) On 4.7L engines only, position the right engine-to-body ground strap eyelet terminal and the wire harness grounds over the weld stud on the right front fender wheelhouse inner panel.

REMOVAL AND INSTALLATION (Continued)

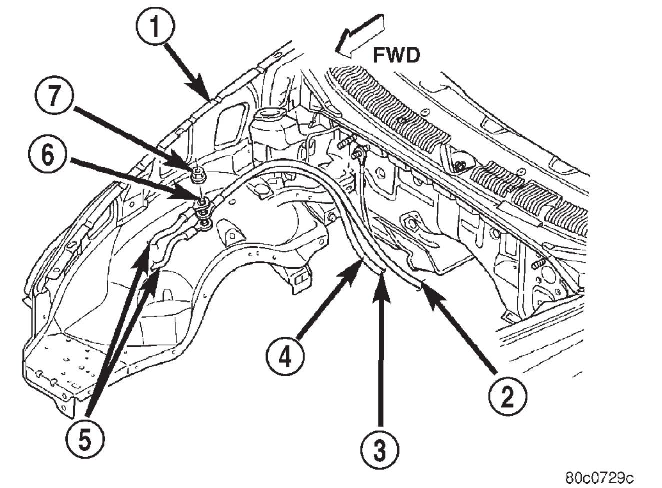


Fig. 22 Engine-To-Body Ground Strap Remove/ Install - 4.7L Engine Only

1 – RIGHT FRONT FENDER
2 – TO RIGHT CYLINDER HEAD
3 – TO TRANSMISSION
4 – RIGHT GROUND STRAP
5 – WIRE HARNESS GROUNDS
6 – WELD STUD
7 – NUT AND WASHER

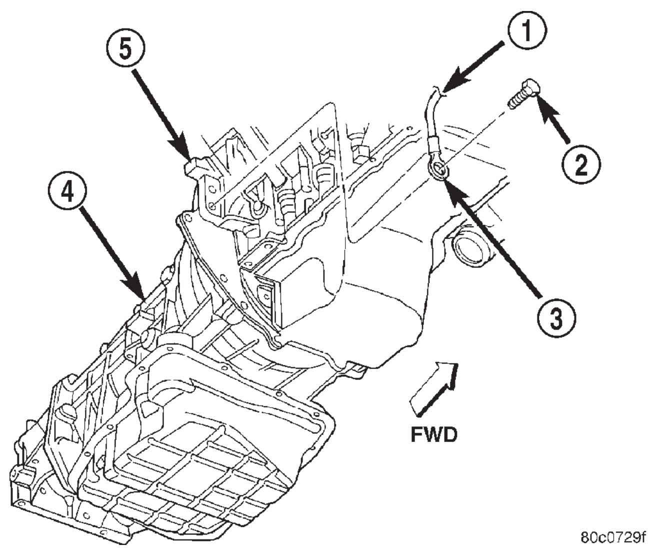


Fig. 23 Engine-To-Body Ground Strap Remove/ Install - 4.7L Engine Only

1 – TO RIGHT FENDER STUD
2 – SCREW AND WASHER
3 – RIGHT GROUND STRAP
4 – TRANSMISSION
5 – ENGINE BLOCK

(6) On 4.7L engines only, install and tighten the nut and washer that secures the right engine-to-body ground strap eyelet terminal and the wire harness grounds to the weld stud on the right front fender

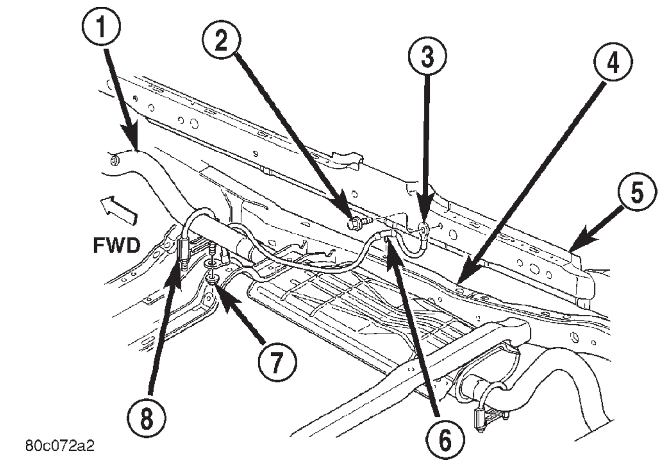


Fig. 24 Exhaust System-To-Body Ground Strap Remove/Install - Typical

1 – EXHAUST PIPE
2 – SCREW
3 – EXHAUST SYSTEM-TO-BODY GROUND STRAP
4 – RIGHT FRAME RAIL
5 – RIGHT BODY SILL PANEL
6 – CLIP
7 – NUT AND WASHER
8 – CLAMP

wheelhouse inner panel. Tighten the nut to 11.8 N·m (105 in. lbs.).

(7) On 6 and 8 cylinder engines only, install and tighten the screw that secures the right engine-to-body ground strap eyelet terminal to the rear of the right cylinder head. On 3.9L and 5.9L engines, tighten the screw to 10.2 N·m (90 in. lbs.). On 4.7L engines, tighten the screw to 10.7 N·m (95 in. lbs.).

(8) On 6 and 8 cylinder engines only, install and tighten the screw that secures the left engine-to-body ground strap eyelet terminal to the rear of the left cylinder head. On 3.9L and 5.9L engines, tighten the screw to 10.2 N·m (90 in. lbs.). On 4.7L engines, tighten the screw to 10.7 N·m (95 in. lbs.).

(9) On 4 cylinder engines only, position the left engine-to-body ground strap eyelet terminal over the stud on the left rear corner of the engine cylinder head.

(10) On 4 cylinder engines only, install and tighten the nut and washer that secures the left engine-to-body ground strap eyelet terminal to the stud on the left rear corner of the engine cylinder head. Tighten the nut to 2.8 N·m (25 in. lbs.).

(11) On 6 and 8 cylinder engines only, position the right engine-to-body ground strap eyelet over the inboard weld stud on the right side of the lower plenum panel.

(12) On 6 and 8 cylinder engines only, install and tighten the nut and washer that secures the right engine-to-body ground strap eyelet to the inboard

REMOVAL AND INSTALLATION (Continued)

weld stud on the right side of the lower plenum panel. Tighten the nut to 9 N·m (80 in. lbs.).

(13) Install and tighten the nut and washer that secures the left engine-to-body ground strap eyelet to the weld stud on the left side of the lower plenum panel. Tighten the nut to 9 N·m (80 in. lbs.).

EXHAUST SYSTEM-TO-BODY GROUND STRAP - 4.7L ENGINE ONLY

(1) Position the exhaust system-to-body ground strap over the top of the right frame rail.

(2) Engage the clip that secures the exhaust system-to-body ground strap in the hole on the top of the right frame rail.

(3) Install and tighten the screw that secures the exhaust system-to-body ground strap eyelet terminal to the right body sill panel. Tighten the screw to 5.0 N·m (45 in. lbs.).

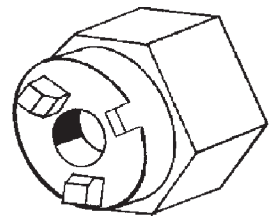
(4) Position the exhaust system-to-body ground strap eyelet terminal over the exhaust pipe clamp U-bolt.

(5) Install and tighten the nut and washer that secures the exhaust system-to-body ground strap eyelet terminal to the exhaust pipe clamp. Tighten the nut to 27.1 N·m (20 ft. lbs.).

(6) Lower the vehicle.

SPECIAL TOOLS

AUDIO SYSTEMS



Antenna Nut Wrench C-4816

HORN SYSTEMS

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
HORN SYSTEM 1
HORN 1
HORN RELAY 2
HORN SWITCH 2
DIAGNOSIS AND TESTING
HORN RELAY 3
HORN SWITCH 4
HORN 4
REMOVAL AND INSTALLATION
HORN RELAY 4
HORN 5

DESCRIPTION AND OPERATION

HORN SYSTEM

DESCRIPTION

A dual-note electric horn system is standard factory-installed equipment on this model. The standard equipment horn system features one low-note horn unit and one high-note horn unit. The horn system uses a non-switched source of battery current so that the system will remain functional, regardless of the ignition switch position. The horn system includes the following components:

- Clockspring
- High-line Central Timer Module (CTM)
- Horns
- Horn relay
- Horn switch

Refer to **Clockspring** in the Description and Operation section of Group 8M - Passive Restraint Systems for more information on this component. Refer to **Central Timer Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component. Refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the remaining major components in the horn system.

OPERATION

The horn system is activated by a horn switch concealed beneath the driver side airbag module trim cover in the center of the steering wheel. Depressing the center of the driver side airbag module trim cover closes the horn switch. Closing the horn switch activates the horn relay. The activated horn relay then switches the battery current needed to energize the horns.

Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the horn system.

CENTRAL TIMER MODULE

The high-line Central Timer Module (CTM) can also operate the horn system. A high-line CTM is used on high-line versions of this vehicle. The CTM combines the functions of a chime/buzzer module, an intermittent wipe module, an illuminated entry module, a remote keyless entry module, and a vehicle theft security system module in a single unit.

The high-line CTM also controls and integrates many of the additional electronic functions and features included on models with this option. The horn relay is one of the hard wired outputs of the CTM. The high-line CTM is programmed to energize or de-energize the horn relay in response to certain inputs from the Remote Keyless Entry (RKE) system and/or the Vehicle Theft Security System (VTSS).

Refer to **Central Timer Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on the high-line CTM. Refer to **Remote Keyless Entry System** in the Description and Operation section of Group 8P - Power Lock Systems for more information on the RKE system. Refer to **Vehicle Theft Security System** in the Description and Operation section of Group 8Q - Vehicle Theft/Security Systems for more information on the VTSS.

HORN

DESCRIPTION

The dual electromagnetic diaphragm-type horns are standard equipment on this model. Both horns are mounted on a single bracket that is secured to the front of the left vertical member of the radiator support, just behind the radiator grille and forward

DESCRIPTION AND OPERATION (Continued)

of the radiator. The high-note horn is connected in parallel with the low-note horn. The horns are connected to the vehicle electrical system through the headlamp and dash wire harness. Each horn is grounded through its wire harness connector and a ground circuit to an eyelet terminal secured by a ground screw located on the right front inner fender behind the right headlamp, and receives battery current through the closed contacts of the horn relay.

Both horns and the mounting bracket are serviced as a single unit. The horns cannot be repaired or adjusted and, if faulty or damaged, the entire horn and bracket unit must be replaced.

OPERATION

Within the two halves of the molded plastic horn housing are a flexible diaphragm, a plunger, an electromagnetic coil and a set of contact points. The diaphragm is secured in suspension around its perimeter by the mating surfaces of the horn housing. The plunger is secured to the center of the diaphragm and extends into the center of the electromagnetic coil. The contact points control the current flow through the electromagnet.

When the horn is energized, electrical current flows through the closed contact points to the electromagnet. The resulting electromagnetic field draws the plunger and diaphragm toward it until that movement mechanically opens the contact points. When the contact points open, the electromagnetic field collapses allowing the plunger and diaphragm to return to their relaxed positions and closing the contact points again. This cycle continues repeating at a very rapid rate producing the vibration and movement of air that creates the sound that is directed through the horn outlet.

HORN RELAY

DESCRIPTION

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch grounds the relay coil. The horn relay is located in the Junction Block (JB), on the left end of the instrument panel in the passenger compartment. If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the JB until further diagnosis is completed. See the fuse and relay layout label affixed to the inside surface of the fuse access panel for horn relay identification and location.

The horn relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The horn relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

HORN SWITCH

DESCRIPTION

A center-blow, normally open, resistive membrane-type horn switch is secured with heat stakes to the back side of the driver side airbag module trim cover in the center of the steering wheel (Fig. 1). The switch consists of two plastic membranes, one that is flat and one that is slightly convex. These two membranes are secured to each other around the perimeter. Inside the switch, the centers of the facing surfaces of these membranes each has a grid made with an electrically conductive material applied to it. One of the grids is connected to a circuit that provides it with continuity to ground at all times. The grid of the other membrane is connected to the horn relay control circuit.

The steering wheel and steering column must be properly grounded in order for the horn switch to function properly. The horn switch is only serviced as a part of the driver side airbag module trim cover. If the horn switch is damaged or faulty, or if the driver side airbag is deployed, the driver side airbag module trim cover and horn switch must be replaced as a unit.

OPERATION

When the center area of the driver side airbag trim cover is depressed, the electrically conductive grids on the facing surfaces of the horn switch membranes contact each other, closing the switch circuit. The

DESCRIPTION AND OPERATION (Continued)

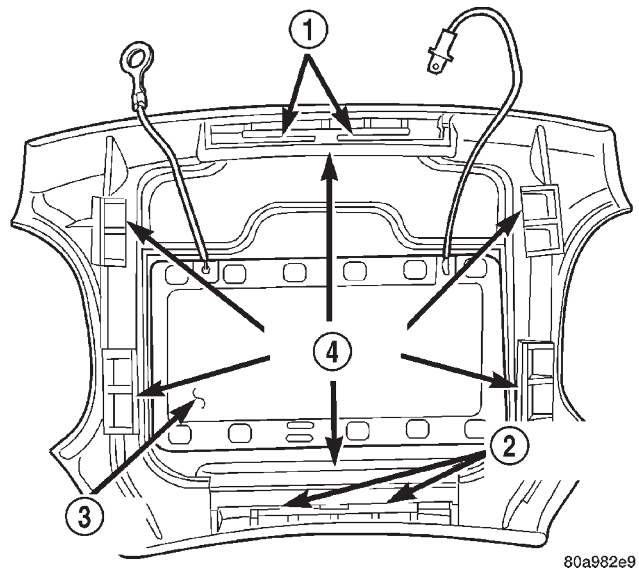


Fig. 1 Driver Side Airbag Module Trim Cover and Horn Switch

1 – RETAINER SLOTS
2 – RETAINER SLOTS
3 – HORN SWITCH
4 – LOCKING BLOCKS

completed horn switch circuit provides a ground for the control coil side of the horn relay, which activates the relay. When the horn switch is released, the resistive tension of the convex membrane separates the two electrically conductive grids and opens the switch circuit.

DIAGNOSIS AND TESTING

HORN RELAY

The horn relay (Fig. 2) is located in the Junction Block (JB) on the left end of the instrument panel in the passenger compartment of the vehicle. If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the JB until further diagnosis is completed. See the fuse and relay layout label affixed to the inside surface of the fuse access panel for horn relay identification and location. For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

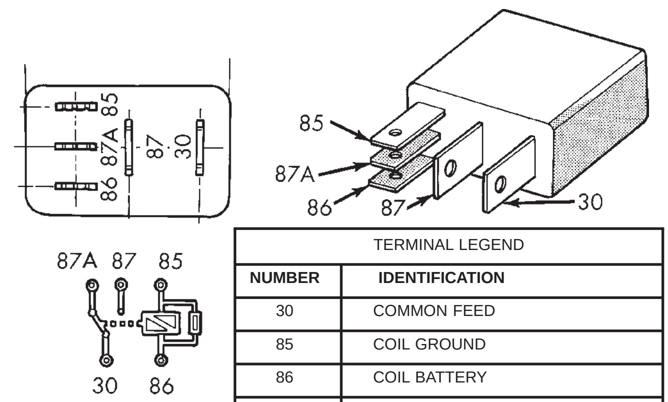
WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the horn relay from the JB. Refer to **Horn Relay** in the Removal and Installation section of this group for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 2 Horn Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the horn(s). There should be continuity between the cavity for relay terminal 87 and the horn relay output circuit cavity of each horn wire harness connector at all times. If OK, go to Step 4. If not OK, repair the open circuit to the horn(s) as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is connected to battery voltage and should be hot at all times. Check for battery voltage at the cavity for relay terminal 86. If OK, go to Step 5. If not OK, repair the open circuit to the fuse in the PDC as required.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. It is grounded

DIAGNOSIS AND TESTING (Continued)

through the horn switch when the horn switch is depressed. On vehicles equipped with the Remote Keyless Entry (RKE) system, the horn relay coil ground terminal can also be grounded by the Central Timer Module (CTM) in response to certain inputs related to the RKE system or the Vehicle Theft Security System. Check for continuity to ground at the cavity for relay terminal 85. There should be continuity with the horn switch depressed, and no continuity with the horn switch released. If not OK, refer to **Horn Switch** in the Diagnosis and Testing section of this group.

HORN SWITCH

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the steering column opening cover from the instrument panel.

(2) Check for continuity between the metal steering column jacket and a good ground. There should be continuity. If OK, go to Step 3. If not OK, refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for proper installation of the steering column.

(3) Remove the driver side airbag module from the steering wheel. Disconnect the horn switch wire harness connectors from the driver side airbag module.

(4) Remove the horn relay from the Junction Block (JB). Check for continuity between the steering column half of the horn switch feed wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted horn relay control circuit to the horn relay in the JB as required.

(5) Check for continuity between the steering column half of the horn switch feed wire harness connector and the horn relay control circuit cavity for the horn relay in the JB. There should be continuity. If OK, go to Step 6. If not OK, repair the open horn relay control circuit to the horn relay in the JB as required.

(6) Check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should be no continuity. If OK, go to Step 7. If not OK, replace the faulty horn switch.

(7) Depress the center of the driver side airbag module trim cover and check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should now be continuity. If not OK, replace the faulty horn switch.

HORN

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect the wire harness connector(s) from the horn connector receptacle(s). Measure the resistance between the ground circuit cavity of the horn(s) wire harness connector(s) and a good ground. There should be no measurable resistance. If OK, go to Step 2. If not OK, repair the open ground circuit to ground as required.

(2) Check for battery voltage at the horn relay output circuit cavity of the horn(s) wire harness connector(s). There should be zero volts. If OK, go to Step 3. If not OK, repair the shorted horn relay output circuit or replace the faulty horn relay as required.

(3) Depress the horn switch. There should now be battery voltage at the horn relay output circuit cavity of the horn(s) wire harness connector(s). If OK, replace the faulty horn(s). If not OK, repair the open horn relay output circuit to the horn relay as required.

REMOVAL AND INSTALLATION

HORN RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

(2) Remove the fuse access panel by inserting a finger in the finger recess molded into the panel and then pulling the panel sharply away from the left outboard end of the instrument panel (Fig. 3).

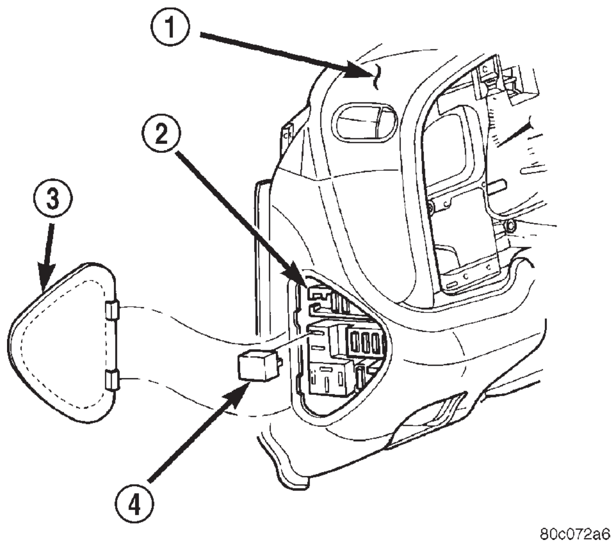


Fig. 3 Horn Relay Remove/Install

1 – INSTRUMENT PANEL
2 – JUNCTION BLOCK
3 – FUSE ACCESS PANEL
4 – HORN RELAY

(3) See the fuse and relay layout label affixed to the inside of the fuse access panel for horn relay identification and location.

(4) Grasp the horn relay firmly and pull it straight out from the JB.

INSTALLATION

(1) See the fuse and relay layout label affixed to the inside of the fuse access panel for the proper horn relay location.

(2) Position the horn relay in the proper receptacle in the JB.

(3) Align the horn relay terminals with the terminal cavities in the JB receptacle.

(4) Push in firmly on the horn relay until the terminals are fully seated in the terminal cavities in the JB receptacle.

(5) Insert the tabs on the forward edge of the fuse access panel in the notches on the forward edge of the instrument panel fuse access panel opening.

(6) Press the rear edge of the fuse access panel in toward the instrument panel until the panel snaps back into place.

(7) Reconnect the battery negative cable.

HORN

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the headlamp and dash wire harness connectors from the horn connector receptacles (Fig. 4).

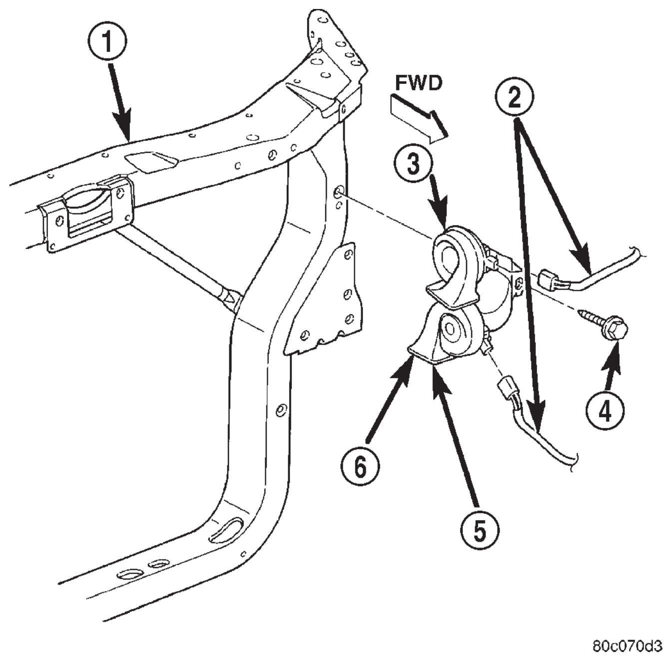


Fig. 4 Horns Remove/Install

1 – RADIATOR SUPPORT
2 – HEADLAMP AND DASH WIRE HARNESS
3 – LOW NOTE
4 – SCREW
5 – HORN AND BRACKET
6 – HIGH NOTE

(3) Remove the screw that secures the horn and mounting bracket unit to the front of the left vertical member of the radiator support.

(4) Remove the horn and mounting bracket unit from the radiator support.

INSTALLATION

(1) Position the horn and mounting bracket unit onto the front of the left vertical member of the radiator support.

(2) Install and tighten the screw that secures the horn and mounting bracket unit to the radiator support. Tighten the screw to 10.7 N·m (95 in. lbs.).

(3) Reconnect the headlamp and dash wire harness connectors to the horn connector receptacles.

(4) Reconnect the battery negative cable.

SPEED CONTROL SYSTEM

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
SPEED CONTROL SYSTEM	1
SPEED CONTROL SERVO	2
SPEED CONTROL SOLENOID CIRCUITS	2
SPEED CONTROL SWITCHES	2
BRAKE LAMP SWITCH	3
SERVO CABLE	3
VACUUM RESERVOIR	3
VEHICLE SPEED INPUT	3
DIAGNOSIS AND TESTING	
ROAD TEST	4
VACUUM SUPPLY TEST	4
REMOVAL AND INSTALLATION	
SPEED CONTROL SERVO	4
SPEED CONTROL SWITCHES	5
SERVO CABLE (EXCEPT 4.7L ENGINE)	6
SERVO CABLE—4.7L V-8 ENGINE	6
VACUUM RESERVOIR	8
SPECIFICATIONS	
TORQUE CHART	9

DESCRIPTION AND OPERATION

SPEED CONTROL SYSTEM

DESCRIPTION

The speed control system is electronically controlled and vacuum operated. Electronic control of the speed control system is integrated into the Powertrain Control Module (PCM). The controls consist of two steering wheel mounted switches. The switches are labeled: ON/OFF, RES/ACCEL, SET, COAST, and CANCEL.

The system is designed to operate at speeds above 30 mph (50 km/h).

WARNING: THE USE OF SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

OPERATION

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in PCM RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.
- Depressing the clutch pedal (if equipped).

NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM.

For added safety, the speed control system is programmed to disengage for any of the following conditions:

- An indication of Park or Neutral
- A rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The speed signal increases at a rate of 10 mph per second (indicates that the coefficient of friction between the road surface and tires is extremely low)
- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RES/ACCEL switch (when speed is greater than 30 mph) restores the vehicle to the target speed that was stored in the PCM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the RES/ACCEL switch. The new target speed is stored in the PCM when the RES/ACCEL is released. The PCM also has a “tap-up” feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the RES/ACCEL switch.

A “tap down” feature is used to decelerate without disengaging the speed control system. To decelerate

from an existing recorded target speed, momentarily depress the COAST switch. For each switch activation, speed will be lowered approximately 1 mph.

SPEED CONTROL SERVO

DESCRIPTION

The servo unit consists of a solenoid valve body, and a vacuum chamber. The solenoid valve body contains three solenoids:

- Vacuum
- Vent
- Dump

The vacuum chamber contains a diaphragm with a cable attached to control the throttle linkage.

OPERATION

The Powertrain Control Module (PCM) controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

Power is supplied to the servo's by the PCM through the brake switch. The PCM controls the ground path for the vacuum and vent solenoids.

The dump solenoid is energized anytime it receives power. If power to the dump solenoid is interrupted, the solenoid dumps vacuum in the servo. This provides a safety backup to the vent and vacuum solenoids.

The vacuum and vent solenoids must be grounded at the PCM to operate. When the PCM grounds the vacuum servo solenoid, the solenoid allows vacuum to enter the servo and pull open the throttle plate using the cable. When the PCM breaks the ground, the solenoid closes and no more vacuum is allowed to enter the servo. The PCM also operates the vent solenoid via ground. The vent solenoid opens and closes a passage to bleed or hold vacuum in the servo as required.

The PCM duty cycles the vacuum and vent solenoids to maintain the set speed, or to accelerate and decelerate the vehicle. To increase throttle opening, the PCM grounds the vacuum and vent solenoids. To decrease throttle opening, the PCM removes the grounds from the vacuum and vent solenoids. When the brake is released, if vehicle speed exceeds 30 mph to resume, 35 mph to set, and the RES/ACCEL switch has been depressed, ground for the vent and vacuum circuits is restored.

SPEED CONTROL SOLENOID CIRCUITS

OPERATION

When all of the speed control parameters are met, and the SET button is pressed, the PCM actuates the vent solenoid and “duty-cycles” the vacuum solenoid to open the throttle and bring the vehicle up to target speed. When the vehicle is at target speed, it will actuate the vent solenoid with the vacuum solenoid de-activated to maintain the vehicle at target speed. When the vehicle is above target speed, the PCM will “duty-cycle” the vent solenoid with the vacuum solenoid still de-activated to close the throttle to return to target speed.

SPEED CONTROL SWITCHES

DESCRIPTION

There are two separate switch pods that operate the speed control system. The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME, ACCELERATE, SET, DECEL and CANCEL modes. Refer to the owner's manual for more information on speed control switch functions and setting procedures.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

OPERATION

When speed control is selected by depressing the ON, OFF switch, the PCM allows a set speed to be stored in its RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between approximately 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.

The speed control can be disengaged also by any of the following conditions:

- An indication of Park or Neutral
- The VSS signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- Depressing the clutch pedal.
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The VSS signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)
- If the actual speed is not within 20 mph of the set speed

DESCRIPTION AND OPERATION (Continued)

The previous disengagement conditions are programmed for added safety.

Once the speed control has been disengaged, depressing the ACCEL switch restores the vehicle to the target speed that was stored in the PCM's RAM.

NOTE: Depressing the OFF switch will erase the set speed stored in the PCM's RAM.

If, while the speed control is engaged, the driver wishes to increase vehicle speed, the PCM is programmed for an acceleration feature. With the ACCEL switch held closed, the vehicle accelerates slowly to the desired speed. The new target speed is stored in the PCM's RAM when the ACCEL switch is released. The PCM also has a "tap-up" feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the ACCEL switch.

The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an existing recorded target speed, depress and hold the COAST switch until the desired speed is reached. Then release the switch. The ON, OFF switch operates two components: the PCM's ON, OFF input, and the battery voltage to the brake switch, which powers the speed control servo.

BRAKE LAMP SWITCH

DESCRIPTION

The switch is mounted on the brake pedal mounting bracket under the instrument panel.

OPERATION

Vehicles equipped with the speed control option use a dual function brake lamp switch. The PCM monitors the state of the dual function brake lamp switch. Refer to the Brake section for more information on brake lamp switch service and adjustment procedures.

The brake switch is equipped with three sets of contacts, one normally open and the other two normally closed (brakes disengaged). The PCM sends a 12 volt signal to one of the normally closed contacts in the brake switch, which is returned to the PCM as a brake switch state signal. With the contacts closed, the 12 volt signal is pulled to ground causing the signal to go low. The low voltage signal, monitored by the PCM, indicates that the brakes are not applied. When the brakes are applied, the contacts open, causing the PCM's output brake signal to go high, disengaging the speed control, cutting off PCM power to the speed control solenoids.

The second set of normally closed contacts supplies 12 volts from the PCM any time speed control is turned on. Through the brake switch, current is routed to the speed control servo solenoids. The speed control solenoids (vacuum, vent and dump) are provided this current any time the speed control is ON and the brakes are disengaged.

When the driver applies the brakes, the contacts open and current is interrupted to the solenoids. The normally open contacts are fed battery voltage. When the brakes are applied, battery voltage is supplied to the brake lamps.

SERVO CABLE

DESCRIPTION

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage.

OPERATION

This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

VACUUM RESERVOIR

DESCRIPTION

The vacuum reservoir is a plastic storage tank connected to an engine vacuum source by vacuum lines.

OPERATION

The vacuum reservoir is used to supply the vacuum needed to maintain proper speed control operation when engine vacuum drops, such as in climbing a grade while driving. A one-way check valve is used in the vacuum line between the reservoir and the vacuum source. This check valve is used to trap engine vacuum in the reservoir. On certain vehicle applications, this reservoir is shared with the heating/air-conditioning system. The vacuum reservoir cannot be repaired and must be replaced if faulty.

VEHICLE SPEED INPUT

OPERATION

The Vehicle Speed Sensor (VSS) is no longer used for any Dodge Truck.

Vehicle speed and distance covered are measured by the Rear Wheel Speed Sensor. The sensor is mounted to the rear axle. A signal is sent from this sensor to the Controller Antilock Brake (CAB) computer. A signal is then sent from the CAB to the Powertrain Control Module (PCM) to determine vehicle speed and distance covered. The PCM will then determine strategies for speed control system operation.

DIAGNOSIS AND TESTING

ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to Group 8E, Instrument Panel and Gauges for speedometer diagnosis.

If a road test verifies a system problem and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose, damaged or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar MultiPurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir.
- Loose or leaking vacuum hoses or connections.
- Defective one-way vacuum check valve.
- Secure attachment of both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Failed speed control servo. Do the servo vacuum test.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

VACUUM SUPPLY TEST

(1) Disconnect vacuum hose at speed control servo and install a vacuum gauge into the disconnected hose.

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.

(3) If vacuum is less than ten inches of mercury, determine source of leak. Check vacuum line to engine for leaks. Also check actual engine intake manifold vacuum. If manifold vacuum does not meet this requirement, check for poor engine performance and repair as necessary.

(4) If vacuum line to engine is not leaking, check for leak at vacuum reservoir. To locate and gain access to reservoir, refer to Vacuum Reservoir Removal/Installation in this group. Disconnect vacuum line at reservoir and connect a hand-operated vacuum pump to reservoir fitting. Apply vacuum. Reservoir vacuum should not bleed off. If vacuum is being lost, replace reservoir.

(5) Verify operation of one-way check valve and check it for leaks.

(a) Locate one-way check valve. The valve is located in vacuum line between vacuum reservoir and engine vacuum source. Disconnect vacuum hoses (lines) at each end of valve.

(b) Connect a hand-operated vacuum pump to reservoir end of check valve. Apply vacuum. Vacuum should not bleed off. If vacuum is being lost, replace one-way check valve.

(c) Connect a hand-operated vacuum pump to vacuum source end of check valve. Apply vacuum. Vacuum should flow through valve. If vacuum is not flowing, replace one-way check valve. Seal the fitting at opposite end of valve with a finger and apply vacuum. If vacuum will not hold, diaphragm within check valve has ruptured. Replace valve.

REMOVAL AND INSTALLATION

SPEED CONTROL SERVO

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Disconnect vacuum hose (line) at servo (Fig. 1).

(3) Disconnect electrical connector at servo.

(4) Disconnect servo cable at throttle body. Refer to Servo Cable Removal/Installation in this group.

(5) Remove 2 mounting nuts holding servo cable sleeve to bracket (Fig. 1) or (Fig. 2).

(6) Pull speed control cable sleeve and servo away from servo mounting bracket to expose cable retaining clip (Fig. 2) and remove clip. Note: The servo mounting bracket displayed in (Fig. 2) is a typical bracket and may/may not be applicable to this model vehicle.

(7) Remove servo from mounting bracket. While removing, note orientation of servo to bracket.

INSTALLATION

(1) Position servo to mounting bracket.

(2) Align hole in cable connector with hole in servo pin. Install cable-to-servo retaining clip.

(3) Insert servo mounting studs through holes in servo mounting bracket.

(4) Install servo mounting nuts and tighten to 8.5 N·m (75 in. lbs.).

(5) Connect vacuum line at servo.

REMOVAL AND INSTALLATION (Continued)

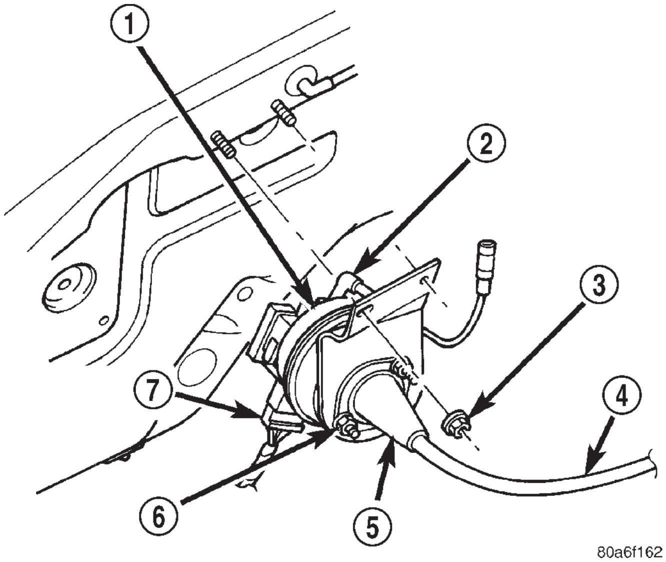


Fig. 1 Speed Control Servo Location

1 – SPEED CONTROL SERVO
2 – VACUUM HOSE
3 – SERVO BRACKET NUTS (2)
4 – SERVO CABLE
5 – CABLE SLEEVE
6 – SERVO MOUNTING NUTS (2)
7 – ELECTRICAL CONNECTOR

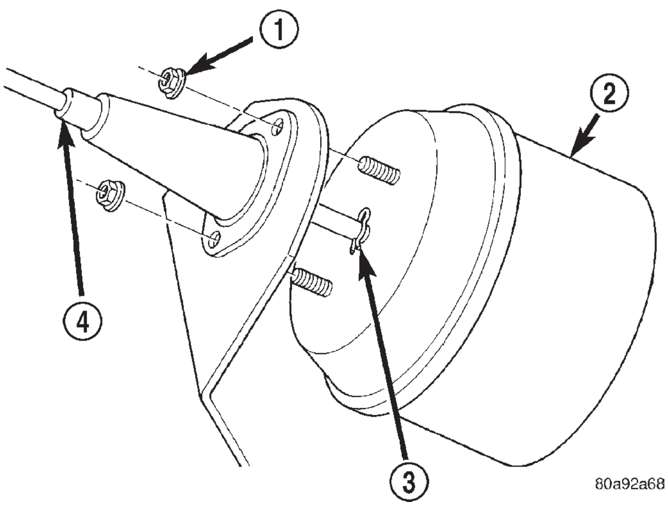


Fig. 2 Servo Cable Clip Remove/Install—Typical

1 – SERVO MOUNTING NUTS (2)
2 – SERVO
3 – CABLE RETAINING CLIP
4 – SERVO CABLE AND SLEEVE

(6) Connect electrical connector at servo.

(7) Connect servo cable to throttle body. Refer to Servo Cable Removal/Installation in this group.

(8) Connect negative battery cable to battery.

(9) Before starting engine, operate accelerator pedal to check for any binding.

SPEED CONTROL SWITCHES

REMOVAL

WARNING: BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION, REMOVE AND ISOLATE THE NEGATIVE (-) CABLE FROM THE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. THEN WAIT TWO MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE INJURY.

(1) Disconnect and isolate negative battery cable.

(2) Remove airbag module. Refer to Group 8M, Passive Restraint Systems for procedures.

(3) Remove switch-to-steering wheel mounting screws (Fig. 3).

(4) Remove switch.

(5) Remove electrical connector at switch.

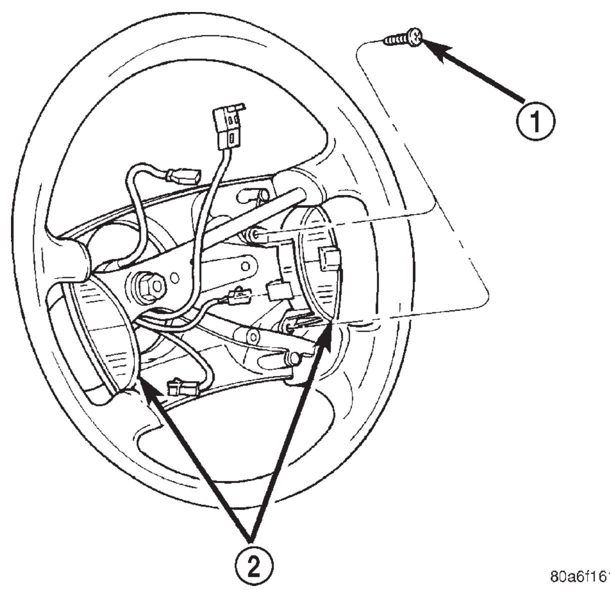


Fig. 3 Speed Control Switches

1 – MOUNTING SCREWS (2)
2 – SPEED CONTROL SWITCHES (2)

INSTALLATION

(1) Install electrical connector to switch.

(2) Install switch and mounting screws.

(3) Tighten screws to 1.5 N·m (14 in. lbs.) torque.

(4) Install airbag module. Refer to Group 8M, Passive Restraint Systems for procedures.

(5) Connect negative battery cable.

REMOVAL AND INSTALLATION (Continued)

SERVO CABLE (EXCEPT 4.7L ENGINE)

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Using finger pressure only, remove speed control cable connector at throttle body bellcrank by pushing connector off the bellcrank pin (Fig. 4) or (Fig. 5). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

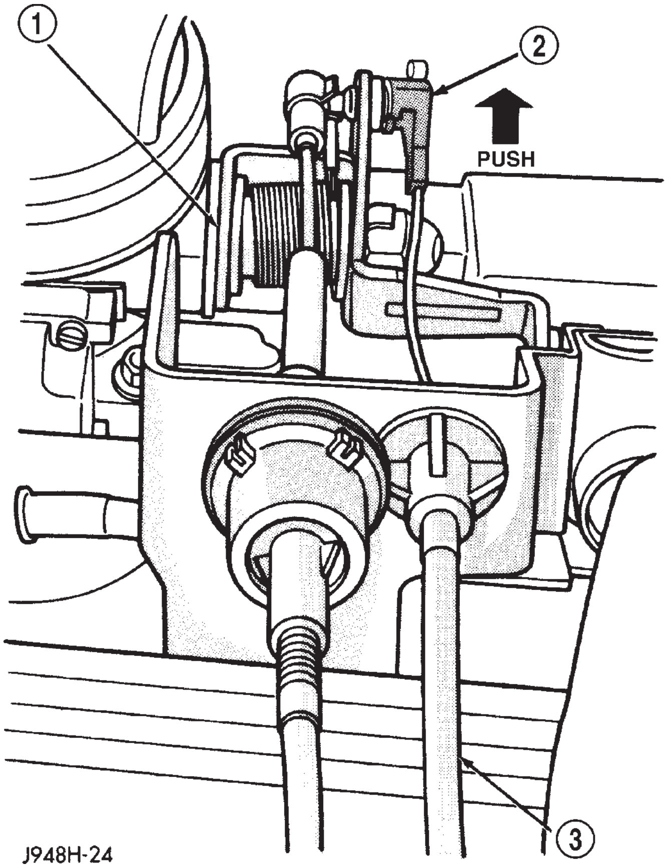


Fig. 4 Cable Connection at Throttle Body—2.5L Engine

1 – BELLCRANK
2 – CABLE CONNECTOR
3 – SPEED CONTROL CABLE

(3) 2.5L Engine: Remove cable from cable guide at top of valve cover.

(4) Squeeze 2 tabs on sides of speed control cable at throttle body mounting bracket (locking plate) and push out of bracket.

(5) Remove servo cable from servo. Refer to Speed Control Servo Removal/Installation in this group.

INSTALLATION

(1) Install end of cable to speed control servo. Refer to Speed Control Servo Removal and Installation in this group.

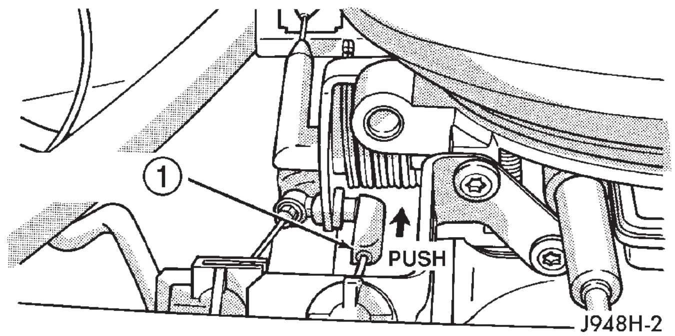


Fig. 5 Cable Connection at Throttle Body—3.9L/ 5.2L/5.9L Engines

1 – VEHICLE SPEED CONTROL CABLE

(2) Install cable into throttle body mounting bracket (snaps in).

(3) Install speed control cable connector at throttle body bellcrank pin (snaps on).

(4) 2.5L Engine: Install cable to cable guide at top of valve cover.

(5) Connect negative battery cable at battery.

(6) Before starting engine, operate accelerator pedal to check for any binding.

SERVO CABLE—4.7L V-8 ENGINE

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Remove air box housing from throttle body.

The accelerator cable must be partially removed to gain access to speed control cable.

(3) Using finger pressure only, disconnect accelerator cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 6). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(4) Lift accelerator cable from top of cable cam (Fig. 6).

(5) Press tab (Fig. 7) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (Fig. 7) towards passenger side of vehicle to remove cable from bracket.

(6) Using finger pressure only, disconnect speed control cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 6). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(7) Slide speed control cable plastic mount towards passenger side of vehicle to remove cable from bracket (Fig. 8).

REMOVAL AND INSTALLATION (Continued)

(8) Remove servo cable from servo. Refer to Speed Control Servo Removal/Installation.

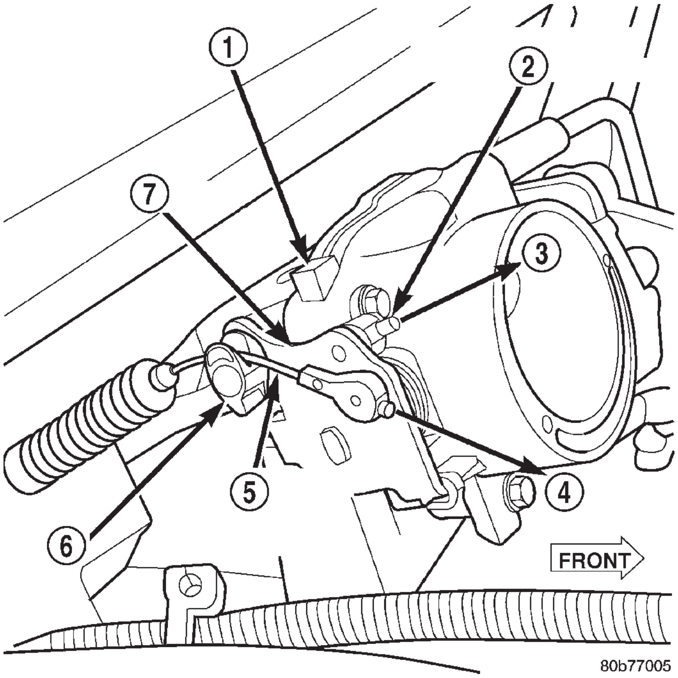


Fig. 6 Cable Connectors at Bell Crank—4.7L V-8 Engine

1 – THROTTLE BODY
2 – SPEED CONTROL CABLE CONNECTOR
3 – OFF
4 – OFF
5 – ACCELERATOR CABLE CONNECTOR
6 – CABLE CAM
7 – BELLCRANK

INSTALLATION

(1) Install end of cable to speed control servo. Refer to Speed Control Servo Removal/Installation.

(2) Slide speed control cable plastic mount into bracket.

(3) Install speed control cable connector onto throttle body bellcrank pin (snaps on).

(4) Slide accelerator cable plastic mount into bracket. Continue sliding until tab (Fig. 7) is aligned to hole in mounting bracket.

(5) Route accelerator cable over top of cable cam (Fig. 6).

(6) Install accelerator cable connector onto throttle body bellcrank pin (snaps on).

(7) Install air box housing to throttle body.

(8) Connect negative battery cable at battery.

(9) Before starting engine, operate accelerator pedal to check for any binding.

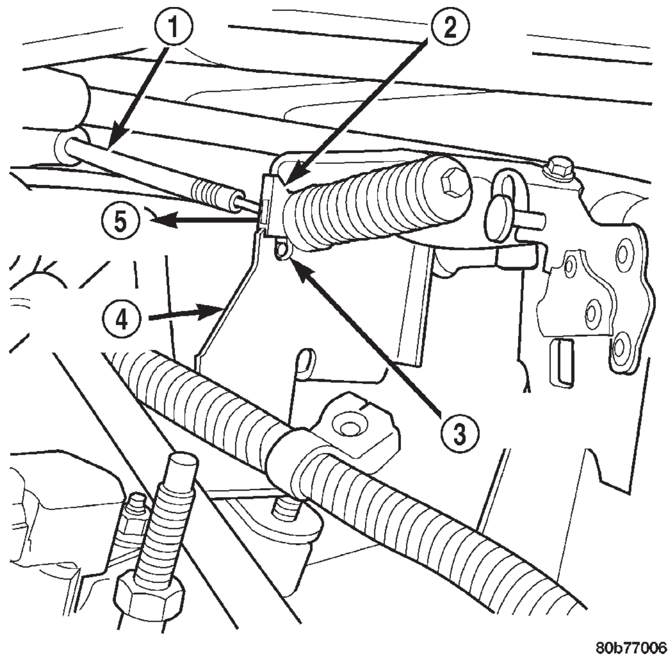


Fig. 7 Accelerator Cable Release Tab—4.7L V-8 Engine

1 – ACCELERATOR CABLE
2 – PLASTIC CABLE MOUNT
3 – PRESS TAB FOR REMOVAL
4 – CABLE BRACKET
5 – SLIDE FOR REMOVAL

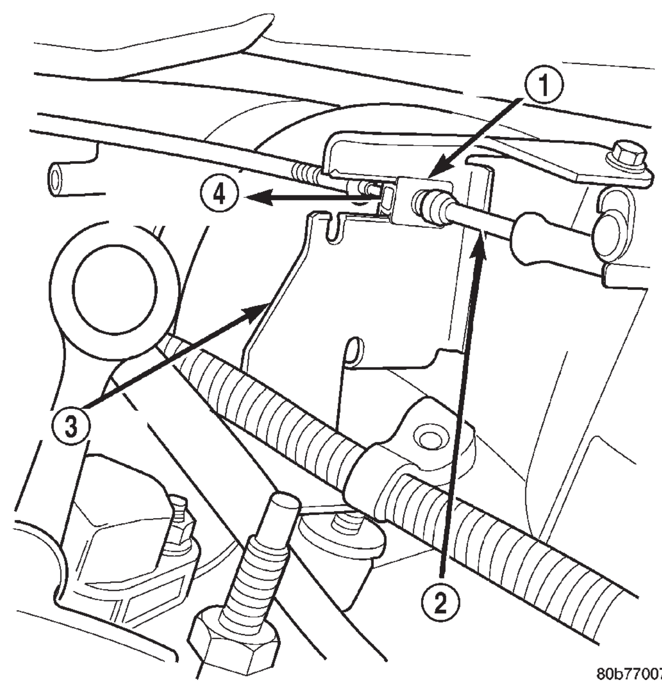


Fig. 8 Speed Control Cable at Bracket—4.7L V-8 Engine

1 – PLASTIC CABLE MOUNT
2 – SPEED CONTROL CABLE
3 – BRACKET
4 – SLIDE FOR REMOVAL

REMOVAL AND INSTALLATION (Continued)

VACUUM RESERVOIR

The vacuum reservoir is located under the plastic cowl plenum cover at lower base of windshield (Fig. 9) or (Fig. 11).

REMOVAL

(1) Disconnect and isolate negative battery at cable.

(2) Remove both windshield wiper arm/blade assemblies. Refer to Group 8K, Wiper and Washer Systems.

(3) Remove rubber weather-strip at front edge of cowl grill (Fig. 10).

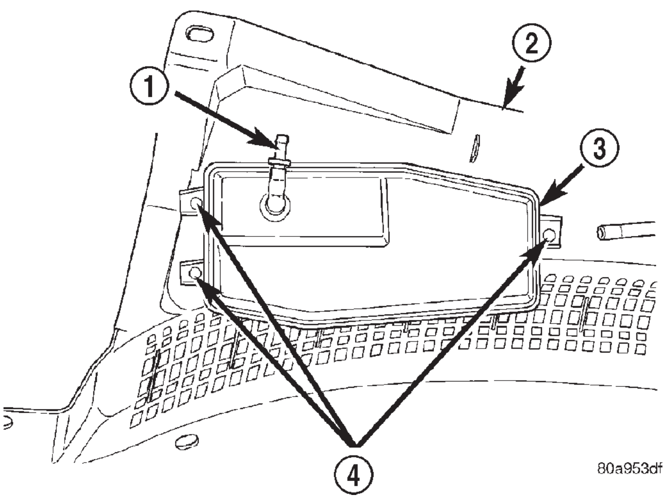


Fig. 9 Vacuum Reservoir Mounting

1 – VACUUM SUPPLY CONNECTOR
2 – COWL PLENUM COVER/GRILLE PANEL
3 – VACUUM RESERVOIR
4 – SCREWS

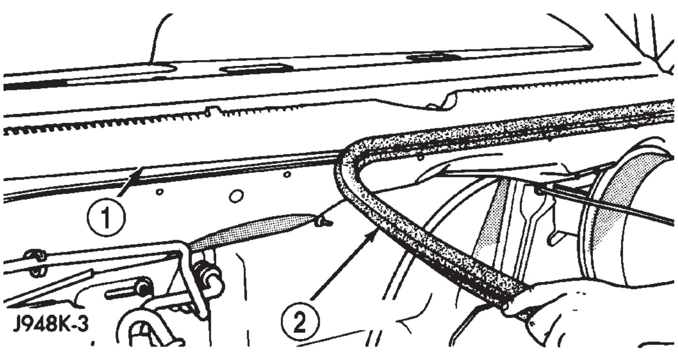


Fig. 10 Cowl Grille Panel Weather-strip

1 – COWL GRILLE
2 – WEATHERSTRIP

(4) Remove four plastic nuts securing cowl plenum cover/grille panel to studs on cowl top panel near base of windshield (Fig. 11).

(5) Remove two plastic rivets securing each side of the cowl plenum cover/grille panel to cowl plenum panel and cowl top panel.

(6) Lift cowl plenum cover/grille panel from vehicle far enough to access windshield washer and vacuum plumbing near right end of cowl plenum.

(7) Disconnect windshield washer supply hose at in-line connector.

(8) Disconnect vacuum supply hose from vacuum supply connector at vacuum reservoir (Fig. 9).

(9) Remove cowl plenum cover/grille panel from vehicle.

(10) Remove three reservoir mounting screws (Fig. 9).

(11) Remove vacuum reservoir from vehicle.

INSTALLATION

(1) Install vacuum reservoir and three mounting screws to plastic cowl cover. Tighten three screws to 2.2 N·m (20 in. lbs.) torque.

(2) Position cowl plenum cover/grille panel to vehicle.

(3) Connect vacuum supply hose to vacuum reservoir.

(4) Connect windshield washer supply hose at in-line connector.

(5) Install and tighten cowl cover fasteners to vehicle body.

(6) Install rubber weather-strip at front edge of cowl grill.

(7) Install windshield wiper arms. Refer to Group 8K, Wiper and Washer Systems.

(8) Connect negative battery to cable.

REMOVAL AND INSTALLATION (Continued)

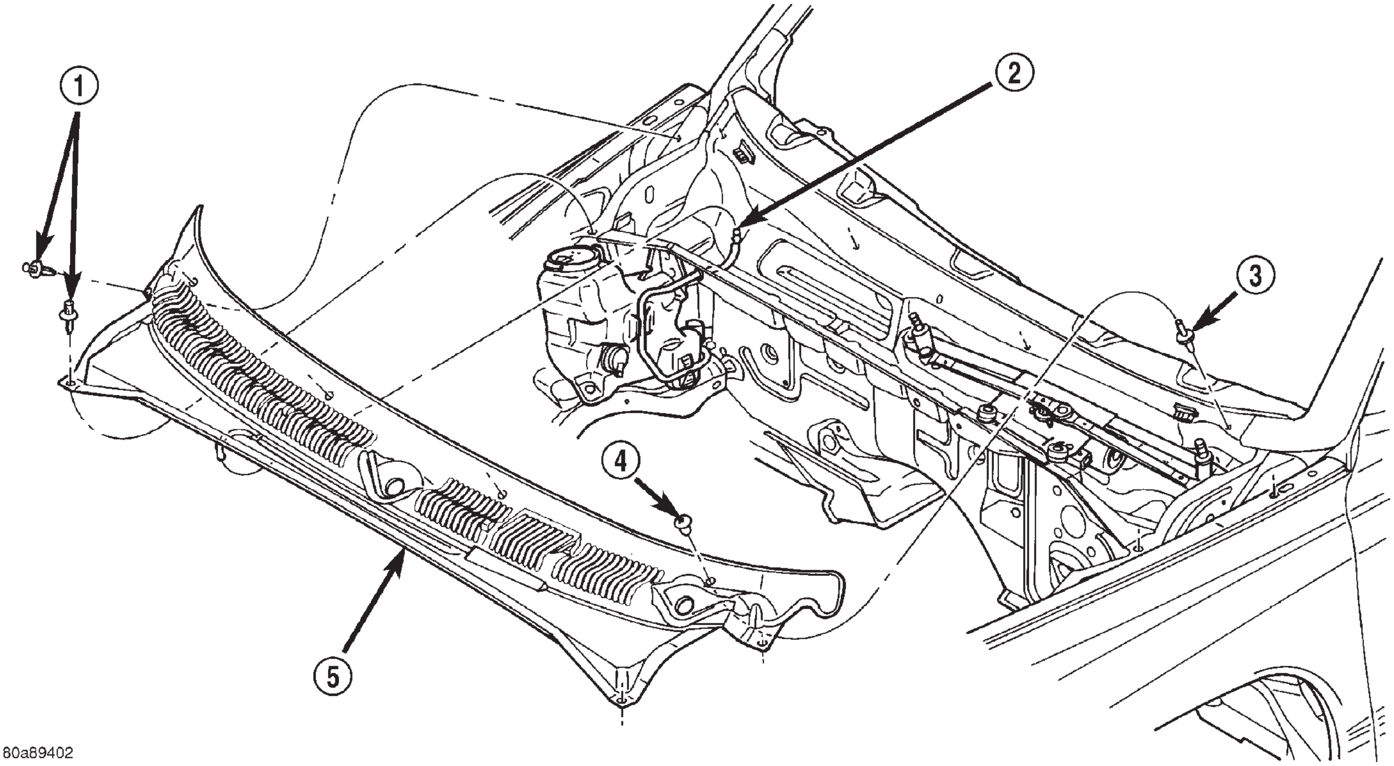


Fig. 11 Cowl Plenum Cover/Grille Panel Remove/Install

1 – PLASTIC RIVET
2 – IN-LINE WASHER SUPPLY HOSE CONNECTOR
3 – STUD
4 – PLASTIC NUT
5 – COWL PLENUM COVER/GRILLE PANEL

SPECIFICATIONS

TORQUE CHART

Description	Torque
Servo Mounting Bracket-to-Servo Nuts	8.5 N·m (75 in. lbs.)
Servo Mounting Bracket-to-Body Nuts	7–10 N·m (63–94 in. lbs.)
Switch Module Mounting Screws	1.5 N·m (14 in. lbs.)
Vacuum Reservoir Mounting Screws	2.2 N·m (20 in. lbs.)

TURN SIGNAL AND HAZARD WARNING SYSTEMS

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
TURN SIGNAL SYSTEM	1
HAZARD WARNING SYSTEM	1
TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH	2
TURN SIGNAL CANCELLING CAM	2
COMBINATION FLASHER	3
DIAGNOSIS AND TESTING	
TURN SIGNAL AND HAZARD WARNING SYSTEMS	4
TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH	5
REMOVAL AND INSTALLATION	
COMBINATION FLASHER	5
TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH	6

DESCRIPTION AND OPERATION

TURN SIGNAL SYSTEM

DESCRIPTION

A turn signal system is standard factory-installed safety equipment on this model. The turn signal system uses ignition switched battery current, and will operate only when the ignition switch is in the On or Accessory positions. The turn signal system includes the following components:

- Combination flasher
- Turn signal cancelling cam
- Turn signal indicator lamps
- Turn signal lamps
- Turn signal switch.

Refer to **Lamp** in the proper section of Group 8L - Lamps for more information on the exterior turn signal lamps. Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for more information on the turn signal indicator lamps. Following are general descriptions of the major components in the turn signal system. For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

With the ignition switch in the On or Accessory position, and the turn signal (multi-function) switch control stalk moved up (right turn) or down (left turn), the turn signal system is activated. When the turn signal system is activated, the circuitry of the turn signal switch and the combination flasher will cause the selected (right or left) turn signal indicator lamp, front park/turn signal lamp, and rear tail/stop/turn signal lamp to flash on and off in unison.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the turn signal system.

HAZARD WARNING SYSTEM

DESCRIPTION

A hazard warning system is standard factory-installed safety equipment on this model. Unlike the turn signal system, the hazard warning system uses a non-switched source of battery current so that the system will operate regardless of the ignition switch position. The hazard warning system includes the following components:

- Combination flasher
- Hazard warning switch
- Turn signal indicator lamps
- Turn signal lamps.

Refer to **Lamp** in the proper section of Group 8L - Lamps for more information on the exterior turn signal lamps. Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for more information on the turn signal indicator lamps. Following are general descriptions of the major components in the hazard warning system. For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

With the hazard warning switch in the On position, the hazard warning system is activated. When the hazard warning system is activated, the circuitry of the hazard warning switch and the combination flasher will cause both the right side and the left side turn signal indicator lamps, front park/turn signal

DESCRIPTION AND OPERATION (Continued)

lamps, and rear tail/stop/turn signal lamps to flash on and off in unison.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the hazard warning system.

TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH

DESCRIPTION

The turn signal and hazard warning switches are integral to the multi-function switch unit, which is secured to the left side of the steering column (Fig. 1). The only visible parts of the multi-function switch are the control stalk that extends from the left side of the steering column, and the hazard warning switch push button that protrudes from the top of the steering column. The multi-function switch control stalk has both nomenclature and international control symbols on it, which identify its many functions. The hazard warning switch push button is identified with a double triangle, which is the international control symbol for hazard warning. The remainder of the multi-function switch is concealed beneath the steering column shrouds.

The multi-function switch also contains circuitry for the following functions:

- Headlamp beam selection
- Headlamp optical horn
- Windshield wipers
- Windshield washers.

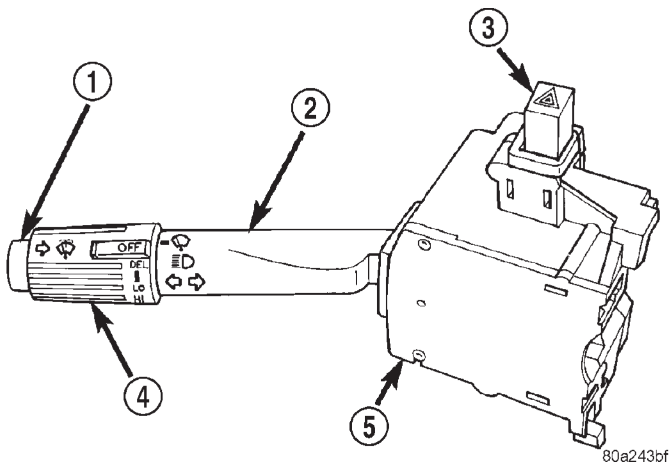


Fig. 1 Multi-Function Switch

1 – WINDSHIELD WASHER BUTTON
2 – CONTROL STALK
3 – HAZARD WARNING BUTTON
4 – WINDSHIELD WIPER CONTROL
5 – MULTI-FUNCTION SWITCH

The information contained in this group addresses only the multi-function switch turn signal and hazard warning functions. For information relative to the other systems that are controlled by and circuits that are integral to the multi-function switch, see the group in this service manual that covers that system. However, the turn signal and hazard warning switches cannot be repaired. If these switches or any other circuit or component of the multi-function switch unit is faulty or damaged, the entire multi-function switch unit must be replaced.

OPERATION

TURN SIGNAL SWITCH

The multi-function switch control stalk that extends from the left side of the steering column just below the steering wheel is moved up or down to activate the turn signal switch. When the control stalk is moved in the upward direction, the right turn signal switch circuitry is activated; and, when the control stalk is moved in the downward direction, the left turn signal switch circuitry is activated. The turn signal switch has a detent position in each direction that provides turn signals with automatic cancellation, and an intermediate momentary position in each direction that provides turn signals only until the multi-function switch control stalk is released.

When the turn signal switch is in a detent position, it is turned off by one of two turn signal cancelling cam lobes that are integral to the rotor of the clockspring mechanism. Turning the steering wheel causes the turn signal cancelling cam lobes to contact a cancel actuator in the multi-function switch, and the turn signal switch automatically returns to the off position.

HAZARD WARNING SWITCH

The hazard warning switch is controlled by the hazard warning switch push button. Push the switch button in to unlatch the switch and activate the hazard warning system, and push in on the button again to latch the switch and turn the system off. When the hazard warning switch is latched (hazard warning off), the push button will be in a lowered position on the top of the steering column shroud; and, when the hazard warning switch is unlatched (hazard warning on), the push button will be in a raised position.

TURN SIGNAL CANCELLING CAM

DESCRIPTION

The turn signal cancelling cam is concealed within the steering column below the steering wheel. The turn signal cancelling cam consists of two lobes that are integral to the lower surface of the clockspring

DESCRIPTION AND OPERATION (Continued)

rotor. The clockspring mechanism provides turn signal cancellation as well as a constant electrical connection between the horn switch, driver side airbag module, speed control switches and remote radio switches on the steering wheel and the instrument panel wire harness on the steering column. The housing of the clockspring is secured to the steering column and remains stationary. The rotor of the clockspring, including the turn signal cancelling cam lobes rotate with the steering wheel.

The turn signal cancelling cam is integral to the clockspring and cannot be repaired. If faulty or damaged, the entire clockspring assembly must be replaced. Refer to **Clockspring** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the clockspring service procedures.

OPERATION

The turn signal cancelling cam has two lobes molded into the lower surface of the clockspring rotor. When the turn signals are activated by moving the multi-function switch stalk to a detent position, a turn signal cancel actuator is extended from the inside surface of the multi-function switch housing toward the clockspring rotor. When the steering wheel is rotated during the turn, one of the two turn signal cancelling cam lobes will contact the turn signal cancel actuator, releasing the multi-function switch control stalk from its detent and cancelling the turn signal event.

COMBINATION FLASHER

DESCRIPTION

The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements. This flasher is designed to handle the current flow requirements of the factory-installed lighting. If supplemental lighting is added to the turn signal lamp circuits, such as when towing a trailer with lights, the combination flasher will automatically try to compensate to keep the flash rate the same.

While the combination flasher has a International Standards Organization (ISO)-type relay terminal configuration or footprint, the internal circuitry is much different. The combination flasher does not use standard ISO-relay inputs or provide ISO-relay type outputs or functions. The combination flasher should never be substituted for an ISO-relay or replaced with an ISO-relay, or else component and vehicle damage may occur.

Because of the active electronic elements within the combination flasher, it cannot be tested with conventional automotive electrical test equipment. If the combination flasher is believed to be faulty, test the turn signal system and hazard warning system circuits as described in this group. Then replace the combination flasher with a known good unit to confirm system operation.

The combination flasher has five blade-type terminals intended for the following inputs and outputs: fused B(+), fused ignition switch output, ground, turn signal circuit, and hazard warning circuit. Constant battery voltage and ground are supplied to the flasher so that it can perform the hazard warning function, and ignition switched battery voltage is supplied for the turn signal function. Refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

The combination flasher is located in the relay and fuse block which is located on the back of the junction block near the dash panel under the left end of the instrument panel. The combination flasher cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The IC within the combination flasher (Fig. 2) contains the logic that controls the flasher operation and the flash rate. Pin 6 of the IC receives a sense voltage from the hazard warning circuit of the multi-function switch. When the hazard warning switch is turned on, the ″hazard on sense" voltage will become low due to the circuit being grounded through the turn signal bulbs. This low voltage sense signals the IC to energize the flash control Positive-Negative-Positive (PNP) transistor at a pre-calibrated flash rate or frequency. Each time the PNP transistor energizes the hazard warning circuit, the pin 6 "hazard on sense" voltage will become high and the IC signals the PNP transistor to de-energize the circuit. This cycling will continue until the hazard warning switch is turned off.

Likewise, pin 8 of the IC receives a sense voltage from the turn signal circuits of the multi-function switch. When the left or right turn signal switch is turned on, the "turn signal on sense" voltage will become low due to the circuit being grounded through the turn signal bulbs. This low voltage sense signals the IC to energize the flash control PNP transistor at a pre-calibrated flash rate or frequency. Each time the PNP transistor energizes the turn signal circuit, the pin 8 "turn signal on sense" voltage will become high and the IC signals the PNP transistor to de-energize the circuit. This cycling will continue until the right or left turn signal switch is turned off.

A special design feature of the combination flasher allows it to "sense" that a turn signal circuit or bulb is not operating, and provide the driver an indication

DESCRIPTION AND OPERATION (Continued)

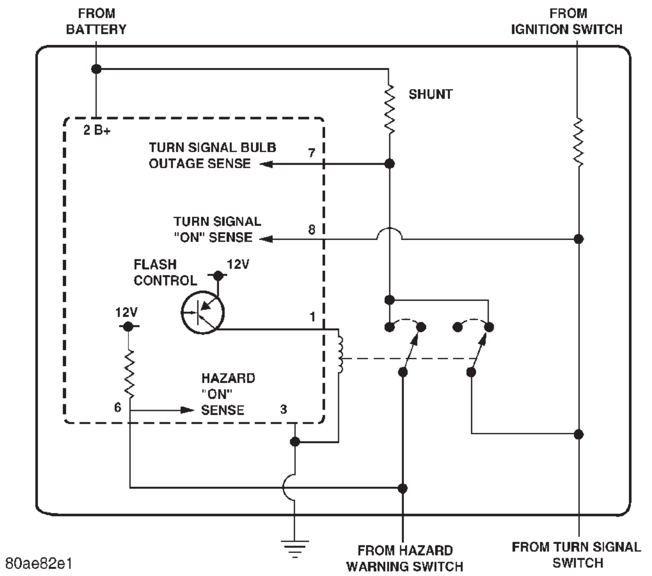


Fig. 2 Combination Flasher - Typical

of the condition by flashing the remaining bulbs in the affected circuit at a higher rate (120 flashes-per-minute or higher). Conventional flashers either continue flashing at their typical rate (heavy-duty type), or discontinue flashing the affected circuit entirely (standard-duty type). During turn signal operation, the combination flasher IC compares normal battery voltage input on pin 2 with the shunt resistor voltage input on pin 7. If the IC “senses” that the voltage difference between pin 2 and pin 7 is different than the pre-calibrated value of the IC, it will increase the rate at which it signals the PNP transistor to energize the pin 1 output. Thus, the inoperative half (left or right side) of the turn signal circuit will flash faster.

DIAGNOSIS AND TESTING

TURN SIGNAL AND HAZARD WARNING SYSTEMS

When diagnosing the turn signal or hazard warning circuits, remember that high generator output can burn out bulbs rapidly and repeatedly. If this is a problem on the vehicle being diagnosed, refer to **Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for further diagnosis of a possible generator overcharging condition.

If the problem being diagnosed is related to a failure of the turn signals to automatically cancel following completion of a turn, inspect the multi-function switch for a faulty or damaged cancel actuator and inspect the turn signal cancelling cam lobes on the clockspring mechanism for damage or improper installation. For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Actuate the turn signal switch or the hazard warning switch. Observe the turn signal indicator lamp(s) in the instrument cluster. If the flash rate is very high, check for a turn signal bulb that is not lit or is very dimly lit. Repair the circuits to that lamp or replace the faulty bulb, as required. If the turn signal indicator(s) fail to light, go to Step 2.

(2) Turn the ignition switch to the Off position. Check the turn signal fuse in the junction block and/or the hazard warning fuse in the Power Distribution Center (PDC). If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).

(3) Check for battery voltage at the hazard warning fuse in the PDC. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the battery as required.

(4) Turn the ignition switch to the On position. Check for battery voltage at the turn signal fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (accessory/run) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the combination flasher from the relay and fuse block and replace it with a known good unit. Connect the battery negative cable. Test the operation of the turn signal and hazard warning systems. If OK, discard the faulty combination flasher. If not OK, remove the test flasher and go to Step 6.

(6) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (accessory/run) circuit cavity for the combination flasher in the relay and fuse block. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (accessory/run) circuit to the turn signal fuse in the junction block as required.

(7) Turn the ignition switch to the Off position. Check for battery voltage at the fused B(+) circuit cavity for the combination flasher in the relay and fuse block. If OK, go to Step 8. If not OK, repair the open fused B(+) circuit to the hazard warning fuse in the PDC as required.

DIAGNOSIS AND TESTING (Continued)

(8) Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity for the combination flasher in the relay and fuse block and a good ground. There should be continuity. If OK, go to Step 9. If not OK, repair the open ground circuit to ground as required.

(9) Disconnect the instrument panel wire harness connector from the multi-function switch connector receptacle. Check for continuity between the hazard signal circuit cavities for the combination flasher in the relay and fuse block and in the instrument panel wire harness connector for the multi-function switch. There should be continuity. If OK, go to Step 10. If not OK, repair the open hazard signal circuit as required.

(10) Check for continuity between the turn signal circuit cavities for the combination flasher in the relay and fuse block and in the instrument panel wire harness connector for the multi-function switch. There should be continuity. If OK, refer to **Turn Signal Switch and Hazard Warning Switch** in the Diagnosis and Testing section of this group. If not OK, repair the open turn signal circuit as required.

TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH

The turn signal switch and the hazard warning switch are integral to the multi-function switch. Refer to **Turn Signal and Hazard Warning Systems** in the Diagnosis and Testing section of this group before testing the multi-function switch. For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the multi-function switch connector receptacle.

(2) Using an ohmmeter, perform the switch continuity checks at the connector receptacle terminals as shown in the Multi-Function Switch Continuity chart (Fig. 3).

(3) If the turn signal switch or hazard warning switch fails any of the continuity checks, replace the faulty multi-function switch assembly as required. If the switch circuits are OK, repair the lighting circuits as required.

REMOVAL AND INSTALLATION

COMBINATION FLASHER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Reach through the outboard side of the steering column opening in the instrument panel to access the relay and fuse block on the back of the junction block (Fig. 4).

(4) Refer to **Fuse/Fuse Block** in the Contents of Group 8W - Wiring Diagrams for combination flasher identification and location.

(5) Remove the combination flasher from the relay and fuse block.

INSTALLATION

(1) Refer to **Fuse/Fuse Block** in the Contents of Group 8W - Wiring Diagrams for proper combination flasher location.

(2) Position the combination flasher in the proper receptacle in the relay and fuse block.

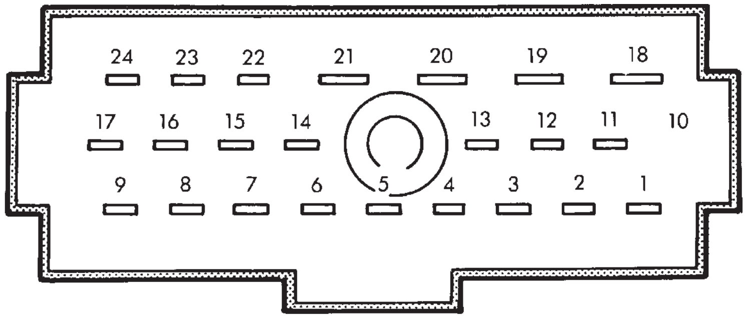
(3) Align the combination flasher terminals with the terminal cavities in the relay and fuse block receptacle.

(4) Push in firmly on the combination flasher until the terminals are fully seated in the terminal cavities in the relay and fuse block receptacle.

(5) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(6) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

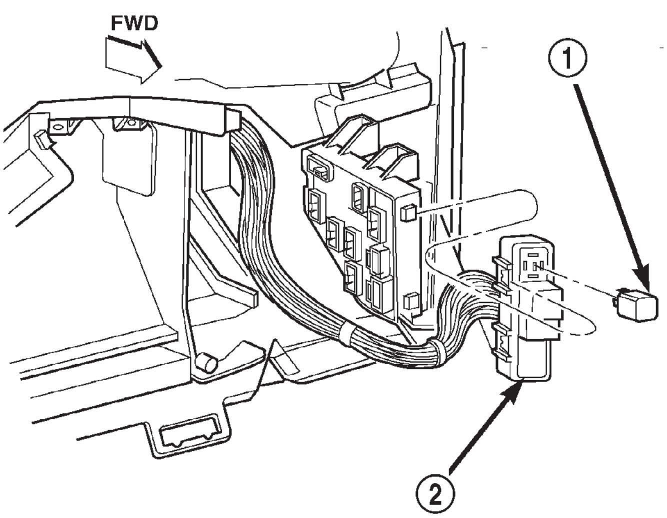


VIEW FROM TERMINAL CASE

SWITCH POSITIONS		
TURN SIGNAL	HAZARD WARNING	CONTINUITY BETWEEN
NEUTRAL	OFF	12 AND 14 AND 15
LEFT	OFF	15 AND 16 AND 17
LEFT	OFF	12 AND 14
LEFT	OFF	22 AND 23 WITH OPTIONAL CORNER LAMPS
RIGHT	OFF	11 AND 12 AND 17
RIGHT	OFF	14 AND 15
RIGHT	OFF	23 AND 24 WITH OPTIONAL CORNER LAMPS
NEUTRAL	ON	11 AND 12 AND 13 AND 15 AND 16

908J-4

Fig. 3 Multi-Function Switch Continuity



80ba7754

Fig. 4 Combination Flasher Remove/Install

1 – ELECTRONIC COMBINATION FLASHER
2 – RELAY AND FUSE BLOCK

TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, unscrew the lever from the tilt steering column adjuster mechanism located on the left side of the column just below the multi-function switch stalk. Turn the lever counter clockwise to unscrew it from the column.

(3) Remove both the upper and lower shrouds from the steering column (Fig. 5).

(4) Remove the lower fixed column shroud from the steering column.

(5) Move the upper fixed column shroud far enough to access the back of the multi-function switch (Fig. 6).

(6) Remove the tamper proof mounting screws (a Snap On tamper proof Torx bit TTXR20B2 or equivalent is required) that secure the multi-function switch to the steering column.

(7) Gently pull the multi-function switch away from the steering column far enough to access and

REMOVAL AND INSTALLATION (Continued)

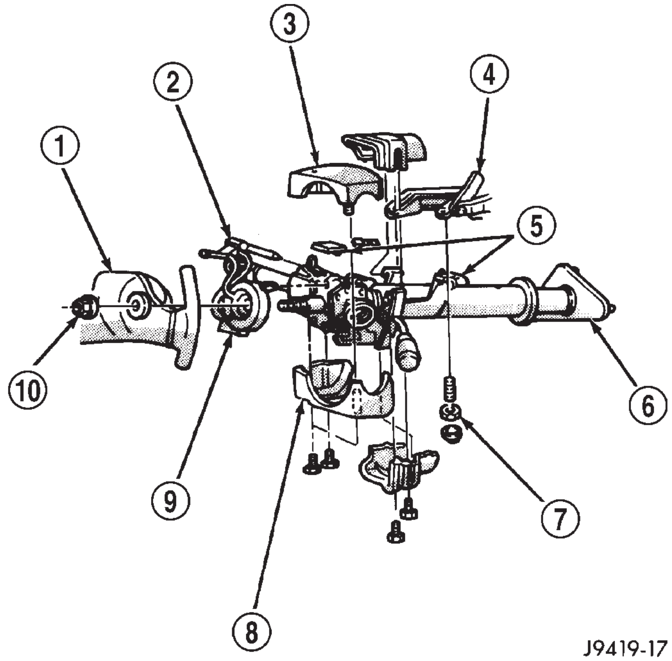


Fig. 5 Steering Column Shrouds Remove/Install - Typical

1 – STEERING WHEEL
2 – TILT LEVER
3 – UPPER SHROUD
4 – PANEL BRACKET
5 – SPACER
6 – TOE PLATE
7 – NUT
8 – LOWER SHROUD
9 – CLOCK SPRING
10 – NUT

remove the screw that secures the instrument panel wire harness connector to the multi-function switch connector receptacle.

(8) Disconnect the instrument panel wire harness connector from the multi-function switch connector receptacle.

(9) Remove the multi-function switch from the steering column.

INSTALLATION

(1) Position the multi-function switch onto the steering column.

(2) Reconnect the instrument panel wire harness connector to the multi-function switch connector receptacle.

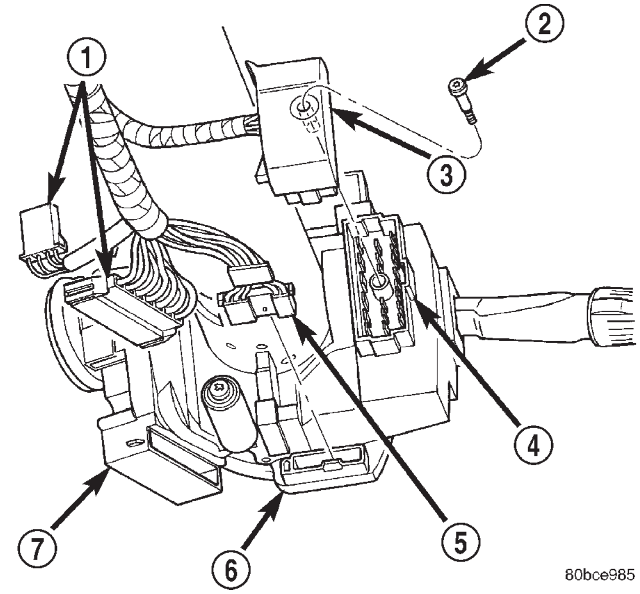


Fig. 6 Multi-Function Switch Connector

1 – WIRE HARNESS CONNECTORS
2 – SCREW
3 – WIRE HARNESS CONNECTOR
4 – MULTI-FUNCTION SWITCH
5 – WIRE HARNESS CONNECTOR
6 – CLOCKSPRING
7 – IGNITION SWITCH

(3) Install and tighten the screw that secures the instrument panel wire harness connector to the multi-function switch connector receptacle. Tighten the screw to 2 N·m (17 in. lbs.).

(4) Install and tighten the two screws that secure the multi-function switch to the steering column. Tighten the screws to 2 N·m (17 in. lbs.).

(5) Install the lower fixed column shroud onto the steering column.

(6) Install both the upper and lower shrouds onto the steering column.

(7) If the vehicle is so equipped, install the tilt steering column lever onto the left side of the steering column by screwing it into place.

(8) Reconnect the battery negative cable.

WIPER AND WASHER SYSTEMS

TABLE OF CONTENTS

	page
GENERAL INFORMATION	
INTRODUCTION	1
WINDSHIELD WIPER SYSTEM	1
WINDSHIELD WASHER SYSTEM	1
DESCRIPTION AND OPERATION	
WIPER ARM AND BLADE	2
WIPER LINKAGE AND PIVOT	2
WIPER MOTOR	2
WIPER SWITCH AND WASHER SWITCH	2
CENTRAL TIMER MODULE	3
INTERMITTENT WIPE RELAY	3
WASHER RESERVOIR	4
WASHER PUMP	4
WASHER FLUID LEVEL SENSOR	4
WASHER NOZZLE AND PLUMBING	4
DIAGNOSIS AND TESTING	
WIPER SYSTEM	4
WASHER SYSTEM	5
WIPER SWITCH AND WASHER SWITCH	6
INTERMITTENT WIPE RELAY	7
REMOVAL AND INSTALLATION	
WIPER BLADE	8
WIPER ARM	8
WIPER LINKAGE AND PIVOT	9
WIPER MOTOR	9
INTERMITTENT WIPE RELAY	11
WIPER SWITCH AND WASHER SWITCH	11
WASHER SYSTEM	12

GENERAL INFORMATION

INTRODUCTION

Windshield wiper and washer systems are standard factory-installed equipment on this model. Refer to 8W-53 - Wipers in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

WINDSHIELD WIPER SYSTEM

An intermittent windshield wiper system is standard equipment on this model. The intermittent wiper system lets the driver select from either of two wiper speeds, low or high, or the intermittent wipe delay mode. A knob on the end of the multi-function switch stalk is rotated to select the desired wiper speed, or the intermittent wipe delay mode and interval.

On models equipped with a base version of the Central Timer Module (CTM), the intermittent wipe mode delay times are driver adjustable from about one-half second to about eighteen seconds. On models equipped with a high-line version of the CTM, the intermittent wipe mode delay times are speed sensitive. Above about sixteen kilometers-per-hour (ten miles-per-hour) the delay is driver adjustable from about one-half second to about eighteen seconds. Below about sixteen kilometers-per-hour (ten miles-per-hour) the high-line CTM doubles the delay time, or provides delays of about one second to about thirty-six seconds. The intermittent wipe mode is provided by delay logic and relay control circuitry contained within the CTM, and an intermittent wipe relay.

The windshield wipers will operate only when the ignition switch is in the Accessory or On positions. A fuse located in the junction block protects the circuitry of the windshield wiper system.

Following are general descriptions of the major components in the windshield wiper system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the windshield wiper system.

WINDSHIELD WASHER SYSTEM

An electrically operated windshield washer system is standard equipment. A knob on the end of the multi-function switch stalk is depressed toward the steering column to activate the washer system. A washer reservoir in the engine compartment holds the washer fluid, which is pressurized by a pump when the windshield washer switch is actuated. The windshield washer pump feeds the pressurized washer fluid through the washer system plumbing to the windshield washer nozzles.

A standard equipment low washer fluid warning lamp in the instrument cluster will warn the driver when the washer fluid level needs to be checked. Refer to Group 8E - Instrument Panel Systems for more information on this feature.

The washers will operate only when the ignition switch is in the Accessory or On positions. A fuse located in the junction block protects the circuitry of the washer system.

GENERAL INFORMATION (Continued)

Following are general descriptions of the major components in the windshield washer system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the windshield washer system.

DESCRIPTION AND OPERATION

WIPER ARM AND BLADE

All Dakota truck models have two 50-centimeter (19.69-inch) windshield wiper blades with non-replaceable rubber elements (squeegees). The driver side and passenger side wiper blades are not interchangeable. The driver side blade features an additional bridge, which provides an additional set of claws to retain the wiper squeegees than the six sets of claws used on the passenger side blade. These wiper blades include an anti-lift feature. The wiper blades and squeegees must be oriented correctly when installed on the wiper arms for the anti-lift feature to be effective. See Wiper Blade in the Removal and Installation section of this group for more information.

Caution should be exercised to protect the rubber squeegees from any petroleum-based cleaners or contaminants, which will rapidly deteriorate the rubber. If the squeegees are damaged, worn, or contaminated, the entire wiper blade assembly must be replaced.

Wiper squeegees exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove deposits of salt and road film. The wiper blades, arms, and windshield should be cleaned with a sponge or cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the squeegees continue to streak or smear, the wiper blades should be replaced.

The blades are mounted to spring-loaded wiper arms. The spring tension of the wiper arms controls the pressure applied to the blades on the glass. The windshield wiper arms are secured by a nut to each of the two wiper pivots that protrude through the cowl plenum cover/grille panel at the base of the windshield.

The wiper arms and blades cannot be adjusted or repaired. If faulty or damaged, they must be replaced.

WIPER LINKAGE AND PIVOT

The wiper linkage and pivot module is secured with four screws through four rubber grommet-type insulators to the cowl plenum panel beneath the cowl plenum cover/grille panel. The wiper motor is secured with screws near the center of the tubular linkage and pivot module bracket, and the wiper pivots are secured to the ends of the module bracket.

The two wiper pivot crank arms and the wiper motor crank arm each have ball studs on their ends. The motor crank arm ball stud is the longer of the three. Two drive links connect the motor crank arm to the pivot crank arms.

The passenger side drive link has a plastic socket-type bushing on each end. The driver side drive link has a plastic socket-type bushing on one end, and a plastic sleeve-type bushing on the other end. The socket-type bushing on one end of each drive link is snap-fit over the ball stud on the crank arm of its respective pivot. The driver side drive link sleeve-type bushing end is then fit over the motor crank arm ball stud, and the second socket-type bushing of the passenger side drive link is snap-fit over the exposed end of the motor crank arm ball stud.

The wiper linkage, pivots, bushings, mounting bracket, and motor are only serviced as a complete unit. If any part of this assembly is faulty or damaged, the entire wiper module must be replaced.

WIPER MOTOR

The two-speed permanent magnet wiper motor has an integral transmission and park switch. The motor also contains an internal automatic resetting circuit breaker to protect the motor from overloads.

The motor is secured to the wiper linkage and pivot module bracket with three screws. The wiper motor output shaft passes through a hole in the module bracket, where a nut secures the wiper motor crank arm to the motor output shaft.

Wiper speed is controlled by current flow to the proper set of brushes. The wiper motor completes its wipe cycle when the windshield wiper switch on the end of the multi-function switch stalk is turned to the Off position, and parks the blades in the lowest portion of the wipe pattern.

The windshield wiper linkage, pivots, bushings, mounting bracket, and motor are only serviced as a complete unit. If any part of this unit is faulty or damaged, the entire wiper module must be replaced.

WIPER SWITCH AND WASHER SWITCH

The windshield wiper and washer switches are contained in the multi-function switch assembly (Fig. 1). The multi-function switch assembly is secured to the left side of the steering column. A knob on the end of the multi-function switch stalk is rotated to select the desired wiper speed or intermittent wipe delay, or depressed toward the steering column to activate the washer system.

The multi-function switch contains circuitry for the following functions:

- Turn signals

DESCRIPTION AND OPERATION (Continued)

- Hazard warning
- Headlamp beam selection
- Headlamp optical horn
- Windshield wipers
- Windshield washers.

The information contained in this group addresses only the switch functions for the windshield wiper and washer systems. For information relative to the other switch functions, refer to the proper group. However, the multi-function switch cannot be repaired. If any function of the multi-function switch is faulty, or if the switch is damaged, the entire switch assembly must be replaced.

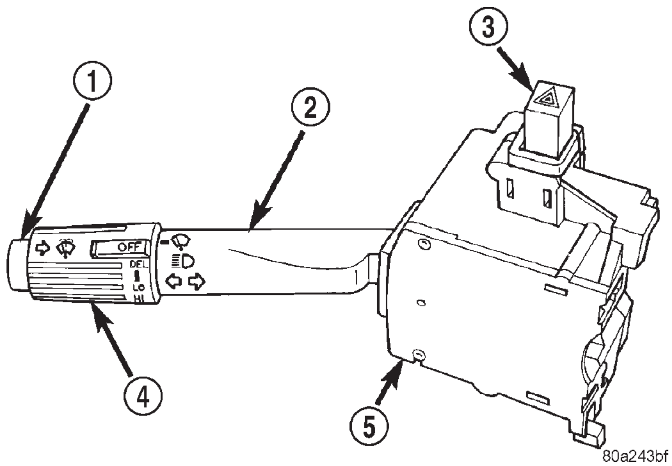


Fig. 1 Multi-Function Switch

1 – WINDSHIELD WASHER BUTTON
2 – CONTROL STALK
3 – HAZARD WARNING BUTTON
4 – WINDSHIELD WIPER CONTROL
5 – MULTI-FUNCTION SWITCH

CENTRAL TIMER MODULE

Two versions of the Central Timer Module (CTM) are available on this vehicle, a base version and a high-line version. The base version of the CTM is used on base models of the vehicle. The base version of the CTM combines the functions of a chime/buzzer module and an intermittent wipe module into a single unit. The base CTM also uses inputs from the door ajar switches, the headlamp switch and the key-in ignition switch to control the output to the dome lamp circuits, which allows the base CTM to provide load shedding to help protect the battery from becoming discharged.

The high-line version of the CTM is used on high-line vehicles. The high-line CTM provides all of the functions of the base version CTM, but also is used to control and integrate many of the additional electronic functions and features included on the high-line models. The high-line version of the CTM contains a central processing unit and interfaces with other modules in the vehicle on the Chrysler Collision Detection (CCD) data bus network.

The CCD data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

Both the base and the high-line versions of the CTM support the intermittent wipe and wipe-after-wash features, but only the high-line CTM supports the speed sensitive intermittent wipe. The intermittent wipe relay is one of the outputs that both the base and the high-line versions of the CTM can control. Each CTM is programmed to energize or de-energize the intermittent wipe relay in response to certain inputs from the windshield wiper and washer switches and from the windshield wiper motor park switch.

For the speed sensitive intermittent wipe feature, the high-line CTM also uses vehicle speed messages, which are received on the CCD data bus from the Powertrain Control Module (PCM). Refer to Group 14 - Fuel Systems for more information on the PCM and the PCM inputs.

Both versions of the CTM are mounted under the passenger side end of the instrument panel, outboard of the instrument panel glove box opening. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

See Wiper System in the Diagnosis and Testing section of this group for diagnosis of the base version of the CTM. For diagnosis of the high-line version of the CTM or the CCD data bus, a DRBIII® scan tool and the proper Diagnostic Procedures manual are recommended. The CTM cannot be repaired and, if faulty or damaged, it must be replaced.

INTERMITTENT WIPE RELAY

The intermittent wipe relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The intermittent wipe relay is a electromechanical device that switches battery current to the windshield wiper motor or wiper motor park switch when the relay coil is grounded by the Central Timer Module (CTM) in response to inputs from the windshield wiper (multi-function) switch. See Intermittent Wipe Relay in the Diagnosis and Testing section of this group for more information.

DESCRIPTION AND OPERATION (Continued)

The intermittent wipe relay is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the PDC label for relay identification and location.

The intermittent wipe relay cannot be repaired and, if faulty or damaged, it must be replaced.

WASHER RESERVOIR

The washer fluid reservoir is integral to and located on the right end of the upper radiator shroud in the engine compartment. Both the washer pump and motor unit and the washer fluid level sensor have barbed nipples, which are installed through a rubber grommet seal inserted in holes on the right end of the upper radiator shroud and reservoir unit. The washer pump and washer fluid level sensor are retained by an interference fit between the barbed nipple and the grommet seal, which is a light press fit.

The washer reservoir has a snap-fit filler cap with a rubber gasket. The cap hinges on and is secured to a molded-in hook formation on the top of the fan shroud, just inboard of the reservoir filler neck. The washer reservoir grommet seals and filler cap are each available for service. The washer reservoir is serviced only as a unit with the upper radiator shroud. Refer to Group 7 - Cooling System for the upper radiator shroud service procedures.

WASHER PUMP

The washer pump and motor are mounted near the bottom of the washer reservoir. A barbed nipple on the pump housing passes through a rubber grommet seal installed in a hole near the bottom of the reservoir. The washer pump is retained by an interference fit between the barbed pump nipple and the grommet seal, which is a light press fit.

A permanently lubricated and sealed motor is coupled to a rotor-type pump. Washer fluid is gravity-fed from the reservoir to the pump. When the motor is energized, the pump pressurizes the washer fluid and forces it through the plumbing to the nozzles.

The washer pump and motor unit cannot be repaired. If faulty, the entire washer pump and motor unit must be replaced.

WASHER FLUID LEVEL SENSOR

The standard washer fluid level sensor is mounted on the right outboard end of the upper radiator shroud near the front of the windshield washer reservoir. A barbed nipple on the sensor is press-fit into a rubber grommet seal installed in a hole in the side of the reservoir.

When the fluid level in the reservoir falls below the pivoting float on the sensor, the float changes position and closes the internal switch contacts of the sensor. Refer to Low Washer Fluid Warning Lamp in the Diagnosis and Testing section of Group 8E - Instrument Panel Systems for diagnosis of the low washer fluid warning lamp and circuit, including the sensor.

The washer fluid level sensor cannot be repaired. If faulty or damaged, the sensor unit must be replaced.

WASHER NOZZLE AND PLUMBING

Pressurized washer fluid is fed through a single hose, attached to a barbed nipple on the washer pump. The hose is routed from the washer reservoir to the dash panel along the top of the right front wheelhouse inner panel. At the dash panel, the hose passes through a grommet inserted in a hole in the cowl plenum panel to an in-line fitting located in the cowl plenum area, beneath the cowl plenum cover/grille panel.

A hose from the in-line fitting in the cowl plenum is routed through clips molded into the underside of the cowl plenum cover/grille panel to a wye fitting near the passenger side washer nozzle. Hoses from the wye fitting are routed to the two washer nozzles, which are snap-fit into openings in the cowl plenum cover/grille panel.

The wye fitting includes an integral check valve to prevent the washer fluid from draining from the nozzles back to the reservoir or from leaking out of the nozzles after washer operation is complete. The two fluidic washer nozzles are not adjustable. The nozzles and hose fittings cannot be repaired and, if faulty or damaged, they must be replaced.

DIAGNOSIS AND TESTING

WIPER SYSTEM

If the problem being diagnosed involves only the pulse wipe or wipe-after-wash modes, see Washer System in the Diagnosis and Testing section of this group. For circuit descriptions and diagrams, refer to 8W-53 - Wipers in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

DIAGNOSIS AND TESTING (Continued)

(1) Check the fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fuse in the junction block. If OK, go to Step 3. If not OK, repair the open circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Unplug the multi-function switch wire harness connector. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/accessory) circuit cavity of the multi-function switch wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the fuse in the junction block as required.

(4) If the problem being diagnosed involves only the intermittent wipe feature, go to Step 5. If the problem being diagnosed involves all wiper modes, or only the Low and/or High speed modes, go to Step 7.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Move the Central Timer Module (CTM) from its mounting position far enough so that the CTM wire harness connectors can be accessed. See Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures. Unplug the 14-way CTM wire harness connector. Check for continuity between the wiper switch mode sense circuit cavities of the multi-function switch wire harness connector and the CTM 14-way wire harness connector. There should be continuity. If OK, go to Step 6. If not OK, repair the open circuit as required.

(6) Check for continuity between the windshield wiper switch signal circuit cavities of the multi-function switch wire harness connector and the CTM 14-way wire harness connector. There should be continuity. If OK, see Intermittent Wipe Relay in the Diagnosis and Testing section of this group. If not OK, repair the open circuit as required.

(7) Check for continuity between the two wiper switch low speed output circuit cavities of the multi-function switch wire harness connector. There should be continuity. If OK, go to Step 8. If not OK, repair the open circuit as required.

(8) Test the wiper switch. See Wiper Switch and Washer Switch in the Diagnosis and Testing section of this group for the procedures. If the switch tests OK, plug in the multi-function switch wire harness connector and go to Step 9. If not OK, replace the faulty switch and test the wiper system operation. If still not OK, go to Step 9.

(9) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Move the wiper module far enough to access the wiper motor wire harness connector. Measure the resistance between the ground circuit cavity of the wiper motor wire harness connector and a good ground. The meter should read zero ohms. If OK, go to Step 10. If not OK, repair the circuit to ground as required.

(10) Connect the battery negative cable. Turn the ignition switch to the On position. Place the multi-function switch in the positions indicated in the tests below, and check for battery voltage at the wiper motor wire harness connector.

(a) Check for battery voltage at the fused ignition switch output (run/accessory) circuit cavity of the wiper motor wire harness connector with the wiper switch in any position. If OK, go to Step b. If not OK, repair the open circuit as required.

(b) Check for battery voltage at the wiper switch low speed output circuit cavity of the wiper motor wire harness connector with the wiper switch in the Low position. If OK, go to Step c. If not OK, repair the open circuit as required.

(c) Check for battery voltage at the wiper switch high speed output circuit cavity of the wiper motor wire harness connector with the wiper switch in the High position. If OK, go to Step d. If not OK, repair the open circuit as required.

(d) Check for battery voltage at the wiper park switch sense circuit cavity of the wiper motor wire harness connector with the wiper switch in the Low or High position, then move the switch to the Off position. The meter should switch between battery voltage and zero volts while the wipers are cycling. The meter should read battery voltage when the switch is moved to the Off position until the wipers park, and then read a steady zero volts. If not OK, replace the faulty wiper motor.

WASHER SYSTEM

The diagnosis found here addresses an inoperative washer pump or wipe-after-wash feature. If the washer pump operates, but no washer fluid is emitted from the washer nozzles, be certain to check the fluid level in the reservoir. Check for ice or other foreign material in the reservoir, and for pinched, disconnected, broken, or incorrectly routed washer system plumbing. For circuit descriptions and diagrams, refer to 8W-53 - Wipers in Group 8W - Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Turn the wiper switch to the Low or High speed position. Check whether the wipers operate. If OK, go to Step 2. If not OK, see Wiper System in the Diagnosis and Testing section of this group.

(2) Turn the wiper switch to the Off position. Depress the washer switch. The washer pump should operate and the wipers should operate for as long as the washer switch is depressed. The wipers should continue to operate for about three sweep cycles after the switch is released before they park. If the wipers are OK, but the washers are not, go to Step 3. If the washers are OK, but the wipers are not, go to Step 5.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Unplug the washer pump wire harness connector. Measure the resistance between the ground circuit cavity of the washer pump wire harness connector and a good ground. The meter should read zero ohms. If OK, go to Step 4. If not OK, repair the circuit to ground as required.

(4) Connect the battery negative cable. Turn the ignition switch to the On position. With the washer switch depressed, measure the voltage at the washer switch output circuit cavity of the washer pump wire harness connector. The meter should read battery voltage. If OK, replace the faulty pump. If not OK, repair the open circuit as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Move the Central Timer Module (CTM) from its mounting position far enough so that the CTM wire harness connectors can be accessed. See Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures. Unplug the 14-way wire harness connector from the CTM. Connect the battery negative cable. Turn the ignition switch to the On position. With the washer switch depressed, check for battery voltage at the washer switch sense circuit cavity of the 14-way CTM wire harness connector. If OK, see Intermittent Wipe Relay in the Diagnosis and Testing section of this group. If not OK, repair the open circuit as required.

WIPER SWITCH AND WASHER SWITCH

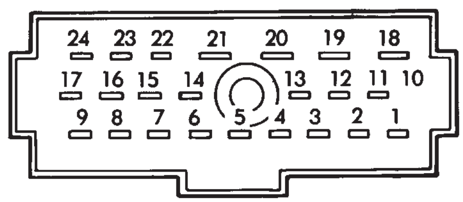
See Wiper System and/or Washer System in the Diagnosis and Testing section of this group before testing the multi-function switch. For circuit descriptions and diagrams, refer to 8W-53 - Wipers in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the multi-function switch wire harness connector from the multi-function switch.

(3) Using an ohmmeter, perform the switch continuity checks at the switch terminals as shown in the Multi-Function Switch Continuity chart (Fig. 2).



MULTIFUNCTION SWITCH PINS

SWITCH POSITION	CONTINUITY BETWEEN
OFF	PIN 6 AND PIN 7
DELAY	PIN 8 AND PIN 9 PIN 2 AND PIN 4 PIN 1 AND PIN 2 PIN 1 AND PIN 4
LOW	PIN 4 AND PIN 6
HIGH	PIN 4 AND PIN 5
WASH	PIN 3 AND PIN 4

*RESISTANCE AT MAXIMUM DELAY POSITION SHOULD BE BETWEEN 270,000 OHMS AND 330,000 OHMS.

*RESISTANCE AT MINIMUM DELAY POSITION SHOULD BE ZERO WITH OHMMETER SET ON HIGH OHM SCALE.

918J-4

Fig. 2 Multi-Function Switch Continuity

(4) If the switch fails any of the continuity checks, replace the faulty switch. If the switch is OK, repair the wiper system and/or washer system wire harness circuits as required.

DIAGNOSIS AND TESTING (Continued)

INTERMITTENT WIPE RELAY

For circuit descriptions and diagrams, refer to 8W-53 - Wipers in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

RELAY TEST

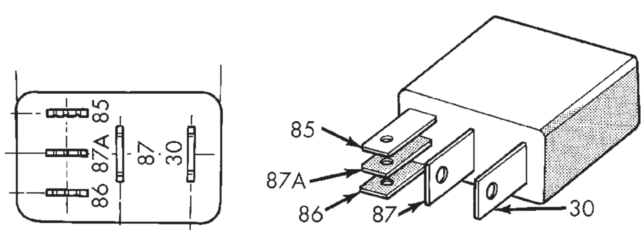
The intermittent wipe relay (Fig. 3) is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for intermittent wipe relay identification and location.

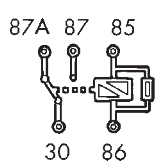
Remove the intermittent wipe relay from the PDC as described in the Removal and Installation section of this group to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, see Relay Circuit Test in the Diagnosis and Testing section of this group. If not OK, replace the faulty relay.





TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 3 Intermittent Wipe Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to the wiper (multi-function) switch. There should be continuity between the cavity for relay terminal 30 and the two fused ignition switch output circuit cavities of the multi-function switch wire harness connector at all times. If OK, go to Step 2. If not OK, repair the open circuit(s) to the multi-function switch as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position. There should be continuity between the cavity for relay terminal 87A and the wiper park switch sense circuit cavities of the wiper motor wire harness connector and the 14-way Central Timer Module (CTM) wire harness connector at all times. If OK, go to Step 3. If not OK, repair the open circuit(s) to the wiper motor and CTM as required.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. There should be battery voltage at the cavity for relay terminal 87 with the ignition switch in the On or Accessory positions. If OK, go to Step 4. If not OK, repair the open circuit to the ignition switch as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. There should be battery voltage at the cavity for relay terminal 86 with the ignition switch in the On or Accessory positions. If OK, go to Step 5. If not OK, repair the open circuit to the ignition switch as required.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. It is grounded by the CTM to energize the relay and cycle the wiper motor. Check for continuity between the cavity for relay terminal 85 and the intermittent wiper relay control circuit cavity of the 14-way CTM wire harness connector. There should be continuity. If OK, replace the faulty base version CTM; or, use a DRB scan tool and the proper Diagnostic Procedures manual for diagnosis of the high-line version CTM. If not OK, repair the open circuit to the CTM as required.

REMOVAL AND INSTALLATION

WIPER BLADE

NOTE: The driver side and passenger side wiper blades are not interchangeable. The driver side wiper blade has an extra bridge and eight pairs of claws securing the wiper element. The passenger side wiper blade has six pairs of claws securing the wiper element. The notched retainer end of both wiper elements should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

(1) Turn the windshield wiper switch to the On position. By turning the ignition switch to the On and Off positions, cycle the wiper blades to a convenient working location on the windshield.

(2) Lift the wiper arm to raise the wiper blade and element off of the windshield glass.

(3) To remove the wiper blade from the wiper arm, push the release tab under the arm tip and slide the blade away from the tip towards the pivot end of the arm (Fig. 4).

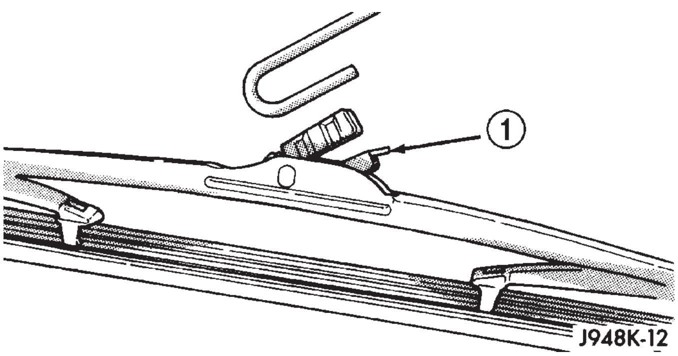


Fig. 4 Wiper Blade Remove/Install - Typical

1 – RELEASE TAB

(4) To install the wiper blade on the wiper arm, slide the blade retainer into the U-shaped formation on the tip of the wiper arm until the release tab snaps into its locked position. Be certain that the notched retainer for the wiper element is oriented towards the end of the wiper blade that is nearest to the wiper pivot.

WIPER ARM

CAUTION: The use of a screwdriver or other prying tool to remove a wiper arm may distort it. This distortion could allow the arm to come off of the pivot shaft, regardless of how carefully it is installed.

(1) Open the hood of the vehicle.

(2) Carefully pry the plastic nut cap off of the nut on the pivot end of the wiper arm (Fig. 5).

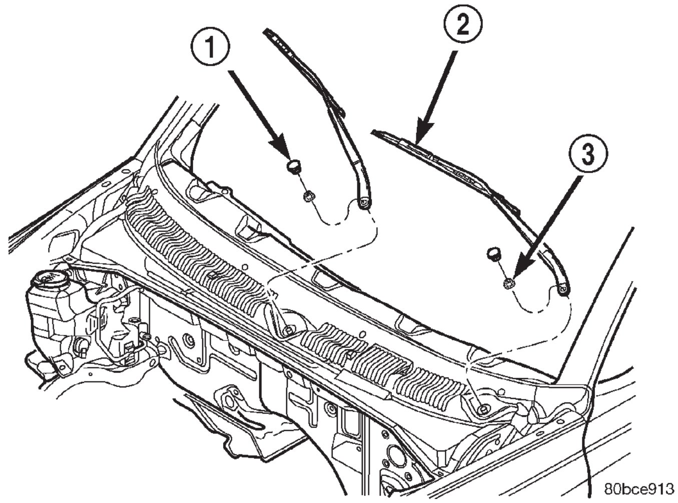


Fig. 5 Wiper Arm Remove/Install

1 – NUT CAP
2 – WIPER ARM AND BLADE
3 – NUT

(3) Remove the nut that secures the wiper arm to the wiper pivot.

(4) Use a battery terminal puller to remove the wiper arm from the wiper pivot (Fig. 6).

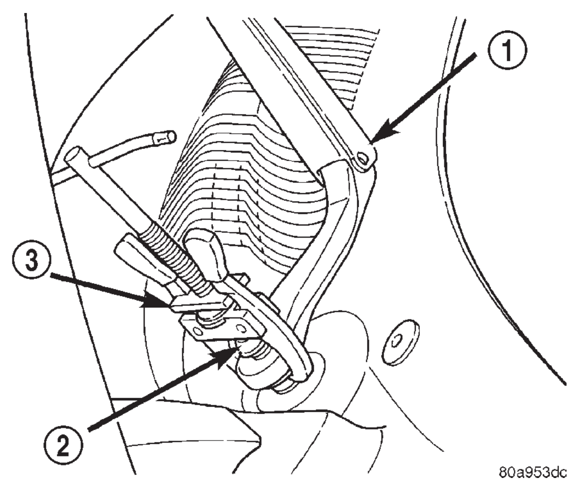


Fig. 6 Wiper Arm Puller

1 – WIPER ARM
2 – WIPER PIVOT
3 – BATTERY TERMINAL PULLER

REMOVAL AND INSTALLATION (Continued)

(5) Install the arm and blade with the wiper motor in the Park position. See the Wiper Arm Installation illustration (Fig. 7).

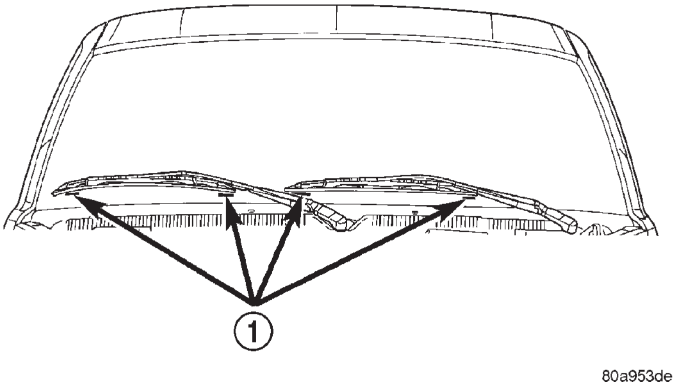


Fig. 7 Wiper Arm Installation
1 – WIPER ALIGNMENT LINES ± 15 mm (± 0.59 in.)

(6) Mount the arms on the pivot shafts so that the front and rear edges of the wiper blade are aligned with the wiper alignment lines concealed in the upper margin of the lower windshield blackout area, ± 15 mm (± 0.59 in.).

(7) Install the wiper arm pivot nuts and tighten to 24 N·m (212 in. lbs.).

(8) Operate the wipers with the windshield glass wet, then turn the wiper switch to the Off position. Check for the correct wiper arm positioning and readjust if required.

(9) Install the plastic nut caps onto the wiper arm pivot nuts.

WIPER LINKAGE AND PIVOT

The wiper linkage and pivots can only be removed from or installed in the vehicle as a unit with the wiper motor. See Wiper Motor in the Removal and Installation section of this group for the procedures.

WIPER MOTOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. See Wiper Arms in the Removal and Installation section of this group for the procedures.

(3) Remove the weatherstrip along the front edge of the cowl plenum cover/grille panel and the cowl plenum panel (Fig. 8).

(4) Remove the four plastic nuts that secure the cowl plenum cover/grille panel to the studs on the cowl top panel near the base of the windshield (Fig. 9).

(5) Remove the one plastic rivet that secures the front corner on each side of the cowl plenum cover/grille panel to the cowl plenum panel.

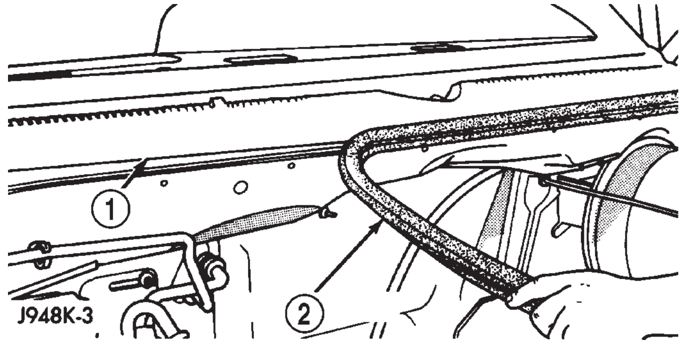


Fig. 8 Cowl Plenum Cover/Grille Panel Weatherstrip
1 – COWL GRILLE
2 – WEATHERSTRIP

(6) Remove the one plastic push-in retainer that secures the rear corner on each side of the cowl plenum cover/grille panel to the windshield reveal moulding.

(7) Unsnap the slotted center hole on each side of the cowl plenum cover/grille panel from the adhesive-backed snap fastener. This fastener is secured to the top of each cowl side panel with an adhesive backing, and should not be removed during cowl plenum cover/grille panel removal.

(8) Lift the cowl plenum cover/grille panel from the cowl top far enough to access the windshield washer nozzle and vacuum plumbing near the right end of the cowl plenum.

(9) Disconnect the windshield washer supply hose at the in-line connector.

(10) Disconnect the vacuum supply hose from the vacuum reservoir, which is secured to the underside of the right end of the cowl plenum cover/grille panel (Fig. 10).

(11) Remove the cowl plenum cover/grille panel from the vehicle and set it aside.

(12) Remove the four screws that secure the wiper module to the cowl plenum panel (Fig. 11).

(13) Move the wiper module as required to access the wiper motor wire harness connector.

(14) Unplug the wiper motor wire harness connector from the wiper motor.

(15) Remove the wiper module from the cowl plenum.

(16) Reverse the removal procedures to install. Be certain that the washer nozzle hoses are correctly routed and installed in the retainers on the underside of the cowl plenum cover/grille panel. Tighten the mounting screws to 8 N·m (72 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

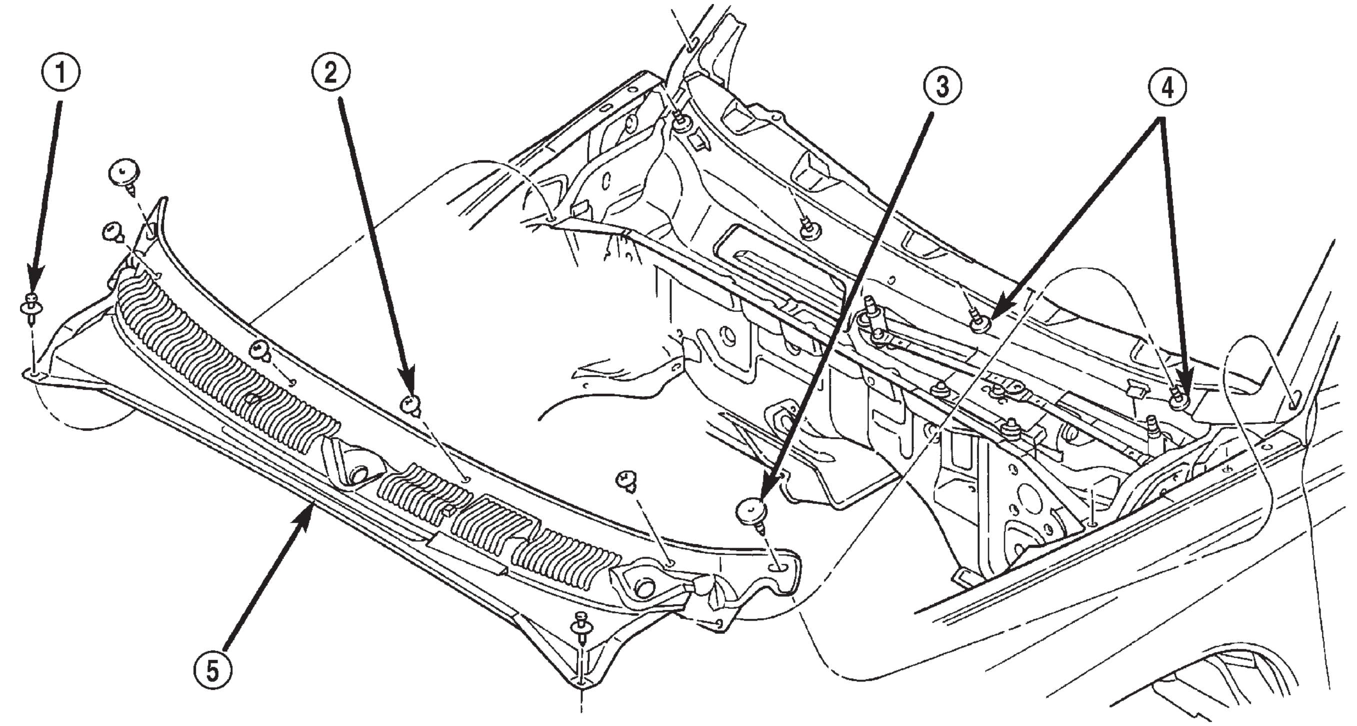


Fig. 9 Cowl Plenum Cover/Grille Panel Remove/Install

1 – PLASTIC RIVET (2)
2 – PLASTIC NUT (4)
3 – PUSH—IN PLASTIC RETAINER (2)
4 – STUD (4)
5 – COWL PLENUM COVER/GRILLE PANEL

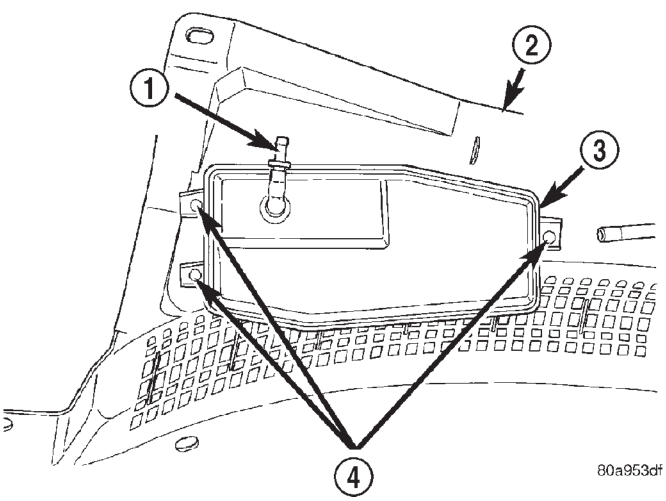


Fig. 10 Vacuum Reservoir

1 – VACUUM SUPPLY CONNECTOR
2 – COWL PLENUM COVER/GRILLE PANEL
3 – VACUUM RESERVOIR
4 – SCREWS

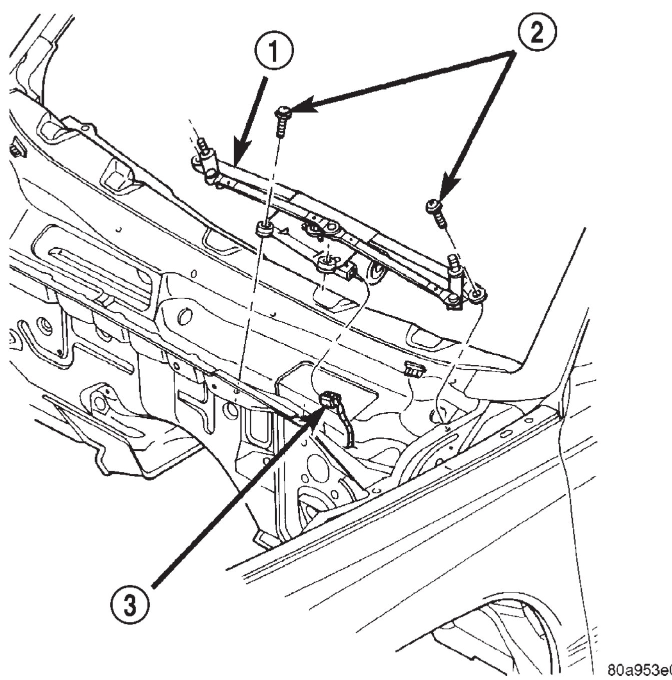


Fig. 11 Wiper Module Remove/Install

1 – WIPER MODULE
2 – SCREWS
3 – CONNECTOR

REMOVAL AND INSTALLATION (Continued)

INTERMITTENT WIPE RELAY

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 12).

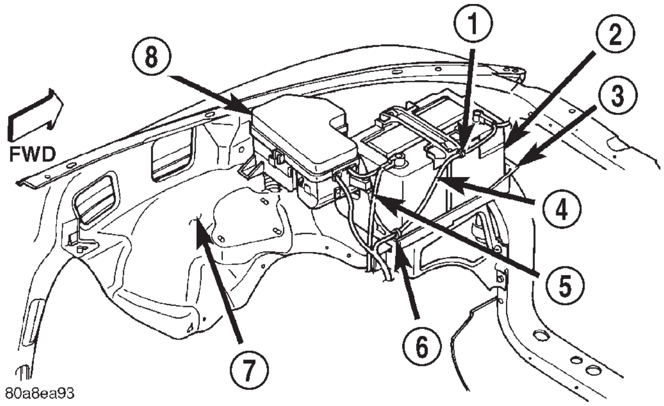


Fig. 12 Power Distribution Center

1 – CLIP
2 – BATTERY
3 – TRAY
4 – NEGATIVE CABLE
5 – POSITIVE CABLE
6 – CLIP
7 – FENDER INNER SHIELD
8 – POWER DISTRIBUTION CENTER

(3) Refer to the label on the PDC cover for intermittent wipe relay identification and location.

(4) Unplug the intermittent wipe relay from the PDC.

(5) Install the intermittent wipe relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.

(7) Connect the battery negative cable.

(8) Test the relay operation.

WIPER SWITCH AND WASHER SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, remove the tilt steering column lever.

(3) Remove both the upper and lower shrouds from the steering column (Fig. 13).

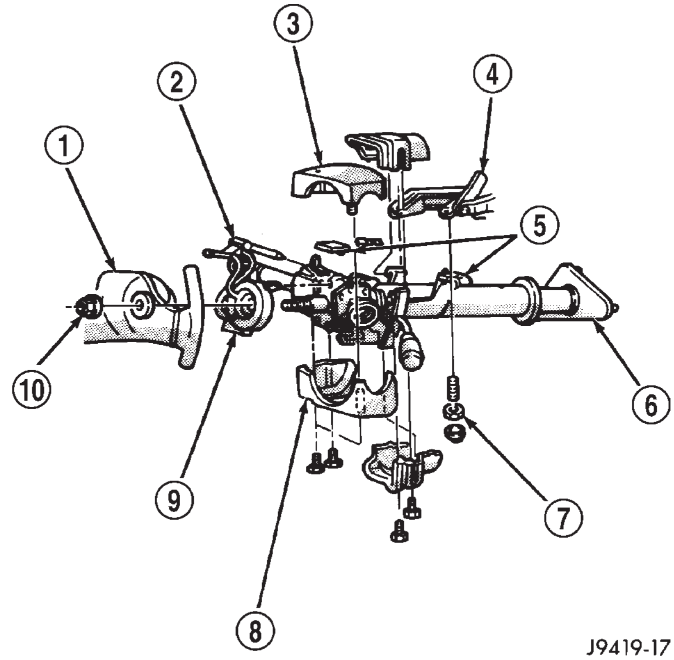


Fig. 13 Steering Column Shrouds Remove/Install - Typical

1 – STEERING WHEEL
2 – TILT LEVER
3 – UPPER SHROUD
4 – PANEL BRACKET
5 – SPACER
6 – TOE PLATE
7 – NUT
8 – LOWER SHROUD
9 – CLOCK SPRING
10 – NUT

(4) Remove the lower fixed column shroud.

(5) Move the upper fixed column shroud far enough to access the rear of the multi-function switch (Fig. 14).

(6) Remove the tamper proof mounting screws (a Snap On tamper proof torx bit TTXR20B2 or equivalent is required) that secure the multi-function switch to the steering column.

(7) Gently pull the switch away from the steering column far enough to access and remove the multi-function switch wire harness connector screw.

(8) Unplug the wire harness connector from the multi-function switch.

(9) Reverse the removal procedures to install. Tighten the fasteners as follows:

- Multi-function switch wire harness connector screw - 2 N·m (17 in. lbs.)
- Multi-function switch mounting screws - 2 N·m (17 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

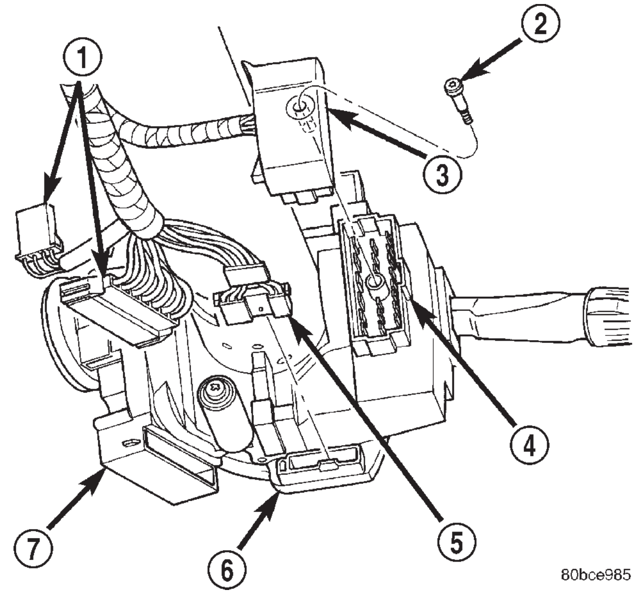


Fig. 14 Multi-Function Switch Connector

1 – WIRE HARNESS CONNECTORS
2 – SCREW
3 – WIRE HARNESS CONNECTOR
4 – MULTI-FUNCTION SWITCH
5 – WIRE HARNESS CONNECTOR
6 – CLOCKSPRING
7 – IGNITION SWITCH

WASHER SYSTEM

WASHER RESERVOIR

The washer reservoir is integral to the right end of the upper radiator shroud in the engine compartment (Fig. 15). Refer to Group 7 - Cooling System for the proper upper radiator shroud service procedures.

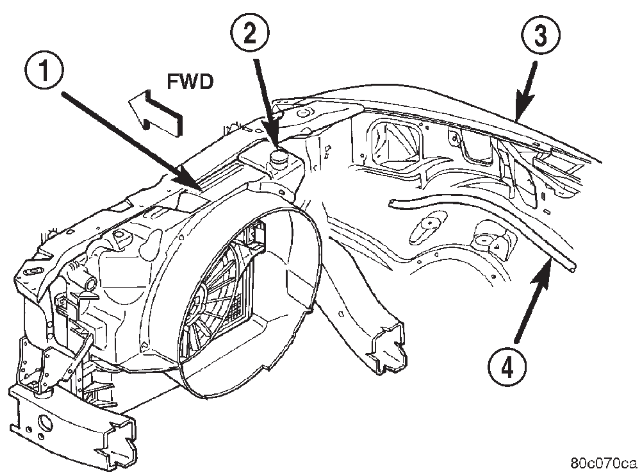


Fig. 15 Washer Reservoir Remove/Install

1 – UPPER RADIATOR SHROUD
2 – WASHER RESERVOIR FILLER CAP
3 – RIGHT FRONT FENDER
4 – WASHER SUPPLY HOSE

WASHER PUMP

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the headlamp and dash wire harness connector from the connector receptacle on the washer pump (Fig. 16).

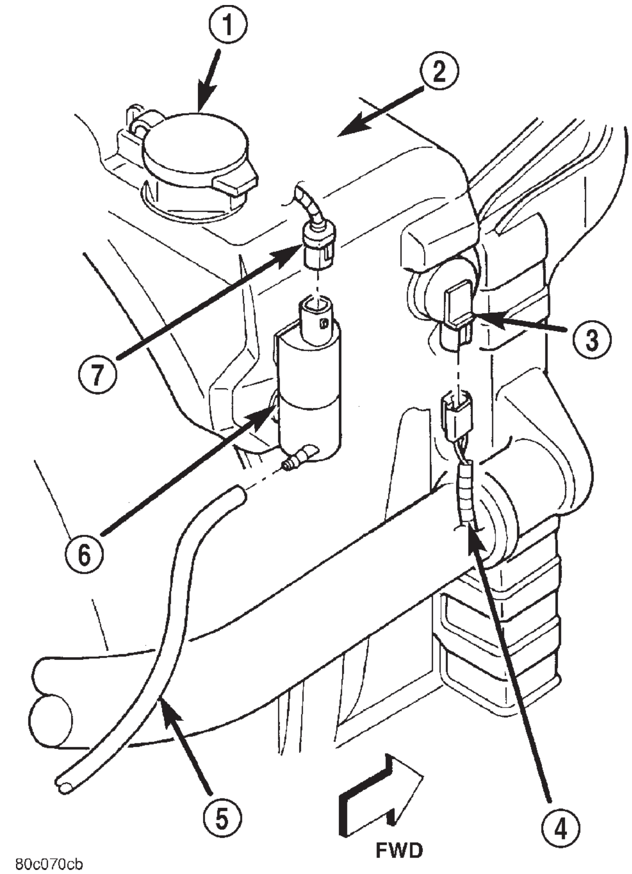


Fig. 16 Washer Pump and Washer Fluid Level Sensor Remove/Install

1 – WASHER RESERVOIR FILLER CAP
2 – UPPER RADIATOR SHROUD
3 – WASHER FLUID LEVEL SENSOR
4 – WIRE HARNESS CONNECTOR
5 – WASHER SUPPLY HOSE
6 – WASHER PUMP
7 – WIRE HARNESS CONNECTOR

(3) Disconnect the washer supply hose from the outlet nipple of the washer pump. Drain the washer fluid from the reservoir into a clean container for reuse.

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed inlet nipple of the washer pump out of the rubber grommet seal in the reservoir. Care must be taken not to damage the reservoir.

(5) Remove the rubber grommet seal from the reservoir and discard.

REMOVAL AND INSTALLATION (Continued)

(6) Reverse the removal procedures to install. Always use a new rubber grommet seal in the washer reservoir.

WASHER FLUID LEVEL SENSOR

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the headlamp and dash wire harness connector from the connector receptacle on the washer fluid level sensor (Fig. 16).

(3) Disconnect the washer supply hose from the outlet nipple of the washer pump. Drain the washer fluid from the reservoir into a clean container for reuse.

NOTE: The pivoting float of the washer fluid sensor must be in a horizontal position within the reservoir in order to be removed. With the reservoir empty and held in an upright position, the pivoting float will orient itself to the horizontal position when the sensor connector receptacle is pointed straight downwards.

(4) Using a trim stick or another suitable wide flat-bladed tool, gently pry the washer fluid level sensor out of the rubber grommet seal. Care must be taken not to damage the reservoir.

(5) Remove the rubber grommet seal from the reservoir and discard.

(6) Reverse the removal procedures to install. Always use a new rubber grommet seal in the washer reservoir.

WASHER NOZZLE

(1) Remove the cowl plenum cover/grille panel from the cowl top. See Wiper Motor in the Removal and Installation section of this group for the procedures.

(2) From the underside of the cowl plenum cover/grille panel, disconnect the washer supply hose from the nozzle fitting.

(3) From the underside of the cowl plenum cover/grille panel, compress the retaining tabs of the washer nozzle and push the nozzle out through the top of the panel.

(4) Reverse the removal procedures to install.

LAMPS

TABLE OF CONTENTS

page page

LAMP SYSTEMS 1
LAMP DIAGNOSIS 3
HEADLAMP ALIGNMENT 7
LAMP BULB SERVICE 11
LAMP SERVICE 14
LAMP SYSTEMS 18
BULB APPLICATION 19

LAMP SYSTEMS

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
LAMP SYSTEMS 1
SAFETY PRECAUTIONS 2

DESCRIPTION AND OPERATION

LAMP SYSTEMS

Each vehicle is equipped with various lamp assemblies. A good ground is necessary for proper lighting operation. Grounding is provided through a separate ground wire.

HEADLAMPS

DESCRIPTION

Headlamps on the Dakota are modular units. Each unit contains a headlamp module, a dual filament replaceable bulb, and parking lamp and turn signal bulbs.

OPERATION

The headlamps are controlled by the headlamp switch and the multifunction switch. Each headlamp unit can be serviced individually.

HEADLAMP SWITCH

DESCRIPTION

The headlamp switch is located on the instrument panel. The headlamp switch controls the parking lamps, the headlamps, the interior lamps, and instrument cluster illumination. The headlamp switch also contains a rheostat for controlling the illumination level of the instrument cluster lamps.

OPERATION

The headlamp switch has an off position, a parking lamp position, and a headlamp on position. High beams are controlled by the multifunction switch on the steering column. The headlamp switch cannot be repaired, it must be replaced. Refer to Group 8E for removal and installation procedures, and Group 8W for circuit information.

TAIL/TURN SIGNAL/STOP/BACK-UP LAMP

DESCRIPTION

The rear tail lamp modules are mounted on the truck bed, outboard of the tailgate, and molded into the lines of the vehicle. Each module contains two bulbs, a lens, and a housing. One bulb is a two filament bulb used for tail, stop, and turn signal functions. The other bulb is a single filament bulb used for back-up light illumination.

OPERATION

Each tail lamp module can be serviced separately. Each bulb can also be serviced separately. The headlamp switch controls tail lamp operation. The multifunction switch controls turn signal operation, and the back-up light switch controls the back-up light operation. The brake lamp switch controls the stop lamp function.

DESCRIPTION AND OPERATION (Continued)

FRONT TURN SIGNAL/PARKING LAMP

DESCRIPTION

The front turn signal/parking lamp is incorporated in the headlamp module. The bulbs are serviceable separately.

OPERATION

. The parking light function is controlled by the headlamp switch located on the instrument panel. The turn signal function is controlled by the multi-function switch located on the steering column. Each front turn signal/parking lamp module can be serviced separately.

CHMSL LAMP (CENTER HIGH MOUNTED STOP LAMP)

DESCRIPTION

The center high mounted stop lamp (CHMSL) is mounted above the cab rear window, below the roof. The module consists of a single filament bulb, a lens, and a housing.

OPERATION

CHMSL operation is controlled by the brake lamp switch.

DAYTIME RUNNING LAMPS

DESCRIPTION

The Daytime Running Lights (Headlamps) System is installed on vehicles manufactured for sale in Canada only. A separate module, mounted on the cowl, controls the DRL.

OPERATION

The headlamps are illuminated when the ignition switch is turned to the ON position. The DRL module receives a vehicle-moving signal from the vehicle speed sensor. This provides a constant **headlamps-on** condition as long as the vehicle is moving. The lamps are illuminated at less than 50 percent of normal intensity.

SAFETY PRECAUTIONS

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

Do not use bulbs with higher candle power than indicated in the Bulb Application table at the end of this group. Damage to lamp and/or Daytime Running Lamp Module can result.

Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges are not holding the component in place.

LAMP DIAGNOSIS

TABLE OF CONTENTS

page

DIAGNOSIS AND TESTING
SYSTEM DIAGNOSIS 3

DIAGNOSIS AND TESTING

SYSTEM DIAGNOSIS

A good ground is necessary for proper lighting operation. Grounding is provided by the lamp socket when it comes in contact with the metal body, or through a separate ground wire.

Always begin any diagnosis by testing all of the fuses and circuit breakers in the system. Refer to Group 8W, Wiring Diagrams.

HEADLAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
OR IGNITION TURNED OFF	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system, refer to Group 8A,
	4. Battery has insufficient charge.	4. Test battery state-of-charge, refer to Group 8A.
	5. Battery is sulfated or shorted.	5. Load test battery, refer to Group 8A.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	7. Both headlamp bulbs defective.	7. Replace both headlamp bulbs.
HEADLAMP BULBS BURN OUT	1. Charging system output too high.	1. Test and repair charging system, refer to Group 8A.
FREQUENTLY	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices, refer to Group 8W.
HEADLAMPS ARE DIM WITH ENGINE RUNNING	1. Charging system output too low.	1. Test and repair charging system, refer to Group 8A.
ABOVE IDLE*	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	3. High resistance in headlamp circuit.	3. Test amperage draw of headlamp circuit.
	4. Both headlamp bulbs defective.	4. Replace both headlamp bulbs.
HEADLAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	2. High resistance in headlamp circuit.	2. Test amperage draw of headlamp circuit. Should not exceed 30 amps.
	3. Faulty headlamps switch circuit breaker.	3. Replace headlamp switch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Loose or corroded terminals or splices in circuit.	4. Inspect and repair all connectors and splices, refer to Group 8W.
HEADLAMPS (HIGH & LOW) DO NOT ILLUMINATE	1. No voltage at either headlamp.	1. Voltage should always be present. Trace short circuit and replace BOTH headlamp fuses. Refer to Group 8W. Check wiring circuit from Right headlamp fuse to headlamp. (Repeat for Left side)
	2. No ground for high and low beam circuit.	2. Ground should always be present according to switch position. Check ground at headlamp switch. Check wiring circuit from headlamp switch to Multifunction switch. Check headlamp switch and Multifunction switch continuity. Repair circuit ground, refer to Group 8W.
	3. Headlamp bulb(s) defective.	3. Replace bulb(s).
	4. Faulty headlamp switch.	4. Replace headlamp switch.
	5. Faulty headlamp dimmer (Multifunction) switch.	5. Replace Multifunction switch.
	6. Broken connector terminal or wire splice in headlamp circuit.	6. Repair connector terminal or wire splice.
HEADLAMPS (LOW BEAM) DO NOT ILLUMINATE.	1. No ground for low beam circuit.	1. Ground should be present according to Multifunction switch position. Check wiring circuit from Multifunction switch to headlamp. Trace open circuit in wiring and repair. Refer to Group 8W. Check Multifunction Switch for continuity.
HEADLAMPS (HIGH BEAM) DO NOT ILLUMINATE.	1. No ground for high beam circuit.	1. Ground should be present according to Multifunction switch position. Check wiring circuit from Multifunction switch to headlamp. Trace open circuit in wiring and repair. Refer to Group 8W. Check Multifunction Switch for continuity.
HEADLAMPS (LOW BEAM) ALWAYS ILLUMINATE AND CAN NOT BE SHUT OFF.	1. Low beam circuit from bulb to Multifunction switch is shorted to ground.	1. Ground should be present according to Multifunction switch position. Check wiring circuit from Multifunction switch to headlamp. Trace short circuit in wiring and repair. Refer to Group 8W.
HEADLAMPS (HIGH BEAM) ALWAYS ILLUMINATE AND CAN NOT BE SHUT OFF.	1. High beam circuit from bulb to Multifunction switch is shorted to ground.	1. Ground should be present according to Multifunction switch position. Check wiring circuit from Multifunction switch to headlamp. Trace short circuit in wiring and repair. Refer to Group 8W.
HEADLAMP SWITCH OFF HEADLAMPS AND HIGHBEAM INDICATOR REMAIN ON AND ARE DIM.	1. Headlamp switch feed circuit shorted to ground.	1. Check wiring circuit from right headlamp fuse to headlamp. Repeat for left side. Trace short circuit in wiring and repair. Refer to Group W.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMP SWITCH ON (LOW BEAMS ON), ONE LOW BEAM ON AND BOTH HIGH BEAMS DIM.	1. Headlamp feed circuit shorted to ground.	1. Check wiring circuit from right headlamp fuse to headlamp. Repeat for left side. Trace short circuit in wiring and repair. Refer to Group W.
HEADLAMP SWITCH ON (HIGH BEAMS ON), ONE HIGH BEAM ON AND BOTH LOW BEAMS DIM.	1. Headlamp feed circuit shorted to ground.	1. Check wiring circuit from right headlamp fuse to headlamp. Repeat for left side. Trace short circuit in wiring and repair. Refer to Group W.
HEADLAMP SWITCH ON, ONE HEADLAMP FILAMENT WILL BE AT FULL INTENSITY AND ALL OTHER FILAMENTS ARE ON AND DIM.	1. Defective headlamp fuse.	1. Trace short circuit and replace fuse. Refer to Group 8W.
	2. Open circuit from headlamp fuse to headlamp.	2. Repair open headlamp circuit, refer to Group 8W.
1. HEADLAMPS STAY ON WITH KEY OUT (DRLM EQUIPPED VEHICLES).	1. Failed DRLM	1. Replace DRLM.
*Canada vehicles must have lamps ON.		

FOG LAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system. Refer to Group 8A,
	4. Battery has insufficient charge.	4. Test battery state-of -charge. Refer to Group 8A.
	5. Battery is sulfated or shorted.	5. Load test battery. Refer to Group 8A.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
FOG LAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system. Refer to Group 8A.
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low.	1. Test and repair charging system. Refer to Group 8A.
	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
	3. High resistance in fog lamp circuit.	3. Test amperage draw of fog lamp circuit.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
	2. High resistance in fog lamp circuit.	2. Test amperage draw of fog lamp circuit.
	3. Faulty fog lamp switch.	3. Replace fog lamp switch.
	4. Loose or corroded terminals or splices in circuit.	4. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS DO NOT ILLUMINATE	1. Blown fuse for fog lamp.	1. Replace fuse. Refer to Group 8W.
	2. No Z1-ground at fog lamps.	2. Repair circuit ground. Refer to Group 8W.
	3. Faulty fog lamp switch.	3. Replace fog lamp switch.
	4. Broken connector terminal or wire splice in fog lamp circuit.	4. Repair connector terminal or wire splice.
	5. Defective or burned out bulb.	5. Replace bulb.
FOG LAMPS ARE INOPERATIVE AND FOG LAMP INDICATOR LIGHT ALWAYS STAYS ON.	1. Fog lamp/DRL* feed shorted to ground.	1. Check wiring circuit from fog lamp/DRL* fuse to fog lamp. Trace short circuit in wiring and repair. Refer to Group 8W.
FOG LAMPS ARE INOPERATIVE AND FOG LAMP INDICATOR LIGHT IS ILLUMINATED.	1. Fog lamp/DRL* fuse defective.	1. Trace short circuit and replace fuse. Refer to Group 8W.
	2. Open circuit from fog lamp fuse to fog lamp.	2. Check wiring circuit from fog lamp/DRL* fuse to fog lamp. Trace open circuit in wiring and repair. Refer to Group 8W.
PARK LAMPS ARE INOPERATIVE. FOG LAMP INDICATOR IS ON WHEN ALL SWITCHES ARE OFF AND FUNCTIONS OPPOSITE TO FOG LAMPS.	1. Park lamp feed is shorted.	1. Check wiring circuit from park lamp fuse to headlamp switch. Trace short circuit in wiring and repair. Refer to Group 8W.
PARK LAMPS ARE INOPERATIVE. FOG LAMP INDICATOR FUNCTIONS OPPOSITE TO FOG LAMPS.	1. Park lamp fuse is defective.	1. Trace short circuit and replace fuse. Refer to Group 8W.
	2. Open circuit from park lamp fuse to headlamp switch.	2. Check wiring circuit from park lamp fuse to headlamp switch. Trace open circuit in wiring and repair. Refer to Group 8W.
*Canada vehicles use Daytime Running Lamps (DRL).		

HEADLAMP ALIGNMENT

TABLE OF CONTENTS

page page

ADJUSTMENTS
HEADLAMP ALIGNMENT 7
LAMP ALIGNMENT SCREEN PREPARATION 7
VEHICLE PREPARATION FOR HEADLAMP ALIGNMENT 7
HEADLAMP ALIGNMENT 7
FOG LAMP ALIGNMENT 9
SPECIAL TOOLS
HEADLAMP ALIGNMENT 10

ADJUSTMENTS

HEADLAMP ALIGNMENT

Headlamps can be aligned using the screen method provided in this section. Alignment Tool C-4466-A or equivalent can also be used. Refer to instructions provided with the tool for proper procedures.

LAMP ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft) away from front of headlamp lens (Fig. 1).

(2) If necessary, tape a line on the floor 7.62 meters (25 ft) away from and parallel to the wall.

(3) Measure from the floor up 1.27 meters (5 ft) and tape a line on the wall at the centerline of the vehicle. Sight along the centerline of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.

(4) Rock vehicle side-to-side three times to allow suspension to stabilize.

(5) Jounce front suspension three times by pushing downward on front bumper and releasing.

(6) Measure the distance from the center of headlamp lens to the floor. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

(7) Measure distance from the centerline of the vehicle to the center of each headlamp being aligned. Transfer measurements to screen (with tape) to each side of vehicle centerline. Use these lines for left/right adjustment reference.

VEHICLE PREPARATION FOR HEADLAMP ALIGNMENT

(1) Verify headlamp dimmer switch and high beam indicator operation.

(2) Correct defective components that could hinder proper headlamp alignment.

(3) Verify proper tire inflation.

(4) Clean headlamp lenses.

(5) Verify that luggage area is not heavily loaded.

(6) Fuel tank should be FULL. Add 2.94 kg (6.5 lbs.) of weight over the fuel tank for each estimated gallon of missing fuel.

HEADLAMP ALIGNMENT

A properly aimed low beam headlamp will project top edge of high intensity pattern on screen from 50 mm (2 in.) above to 50 mm (2 in.) below headlamp centerline. The side-to-side outboard edge of high intensity pattern should be from 50 mm (2 in.) left to 50 mm (2 in.) right of headlamp centerline (Fig. 1). **The preferred headlamp alignment is 1” down for the up/down adjustment and 0 for the left/right adjustment.** The high beam pattern should be correct when the low beams are aligned properly.

To adjust low beam headlamp, rotate alignment screws (Fig. 2) to achieve the specified aim.

ADJUSTMENTS (Continued)

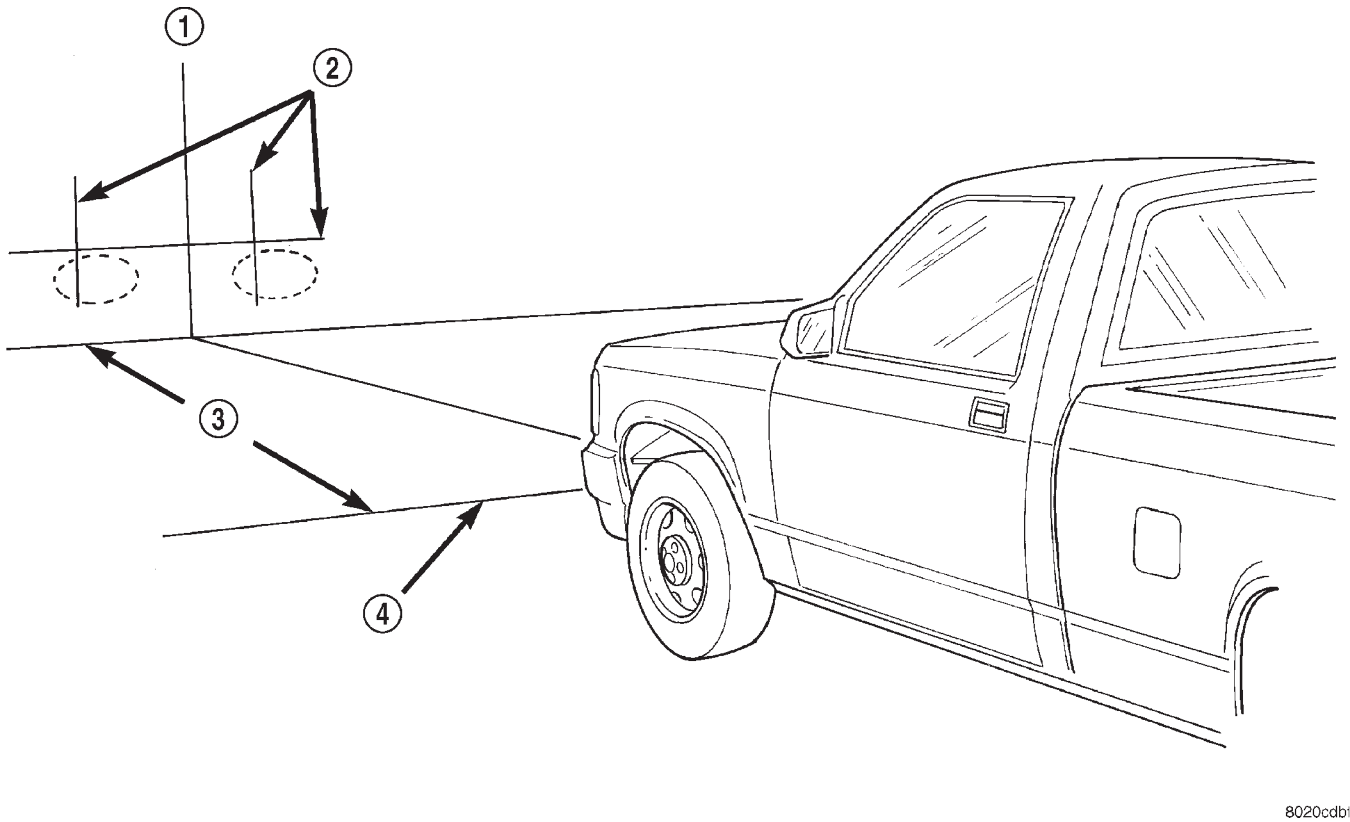


Fig. 1 Headlamp Alignment Screen

1 – CENTER OF VEHICLE
2 – CENTER OF HEADLAMP
3 – 7.62 METERS (25 FT.)
4 – FRONT OF HEADLAMP

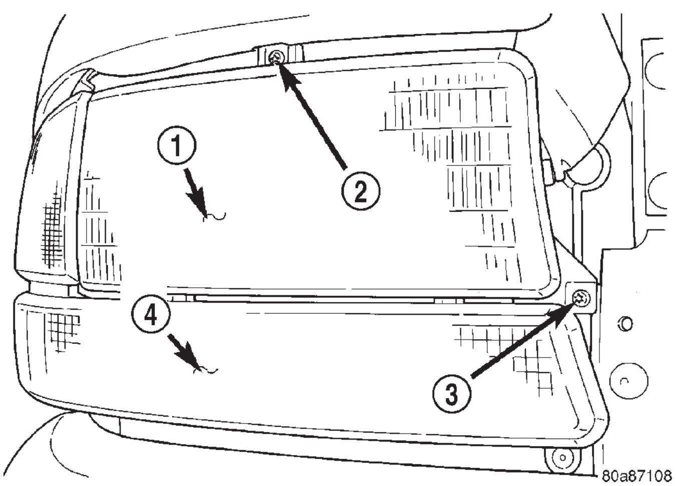


Fig. 2 Headlamp Adjustment Screws

1 – HEADLAMP
2 – UP/DOWN ADJUSTMENT
3 – LEFT/RIGHT ADJUSTMENT
4 – PARK LAMP

ADJUSTMENTS (Continued)

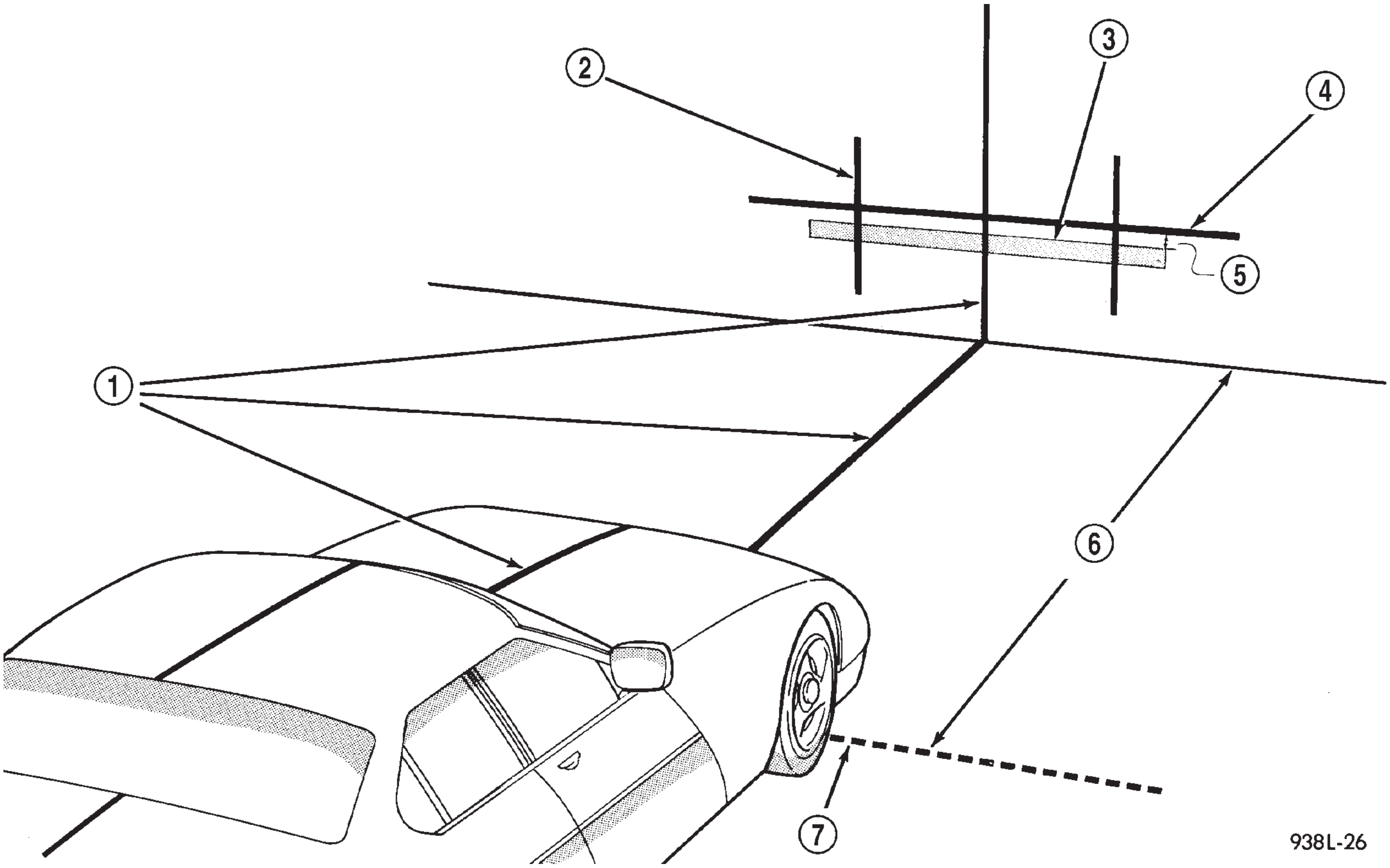


Fig. 3 Fog Lamp Alignment —Typical

1 – VEHICLE CENTERLINE
2 – CENTER OF VEHICLE TO CENTER OF FOG LAMP LENS
3 – HIGH-INTENSITY AREA
4 – FLOOR TO CENTER OF FOG LAMP LENS
5 – 100 mm (4 in.)
6 – 7.62 METERS (25 FEET)
7 – FRONT OF FOG LAMP

FOG LAMP ALIGNMENT

Prepare an alignment screen. Refer to Alignment Screen Preparation paragraph in this section. A properly aligned fog lamp will project a pattern on the alignment screen 100 mm (4 in.) below the fog lamp centerline and straight ahead (Fig. 3). Rotate the adjustment screw to adjust beam height (Fig. 4).

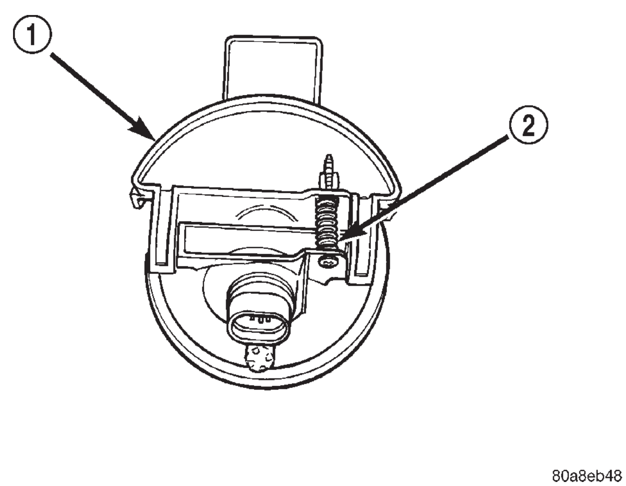
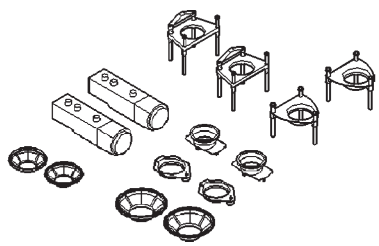


Fig. 4 Fog Lamp Adjustment

1 – FOG LAMP
2 – ADJUSTMENT SCREW

SPECIAL TOOLS

HEADLAMP ALIGNMENT



Headlamp Aiming Kit C-4466–A

LAMP BULB SERVICE

TABLE OF CONTENTS

page page

REMOVAL AND INSTALLATION
HEADLAMP BULB 11
FOG LAMP BULB 11
PARK AND TURN SIGNAL LAMP BULBS 12
FRONT SIDE MARKER LAMP BULB 12
CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB 12
CARGO LAMP BULB 12
TAIL, BRAKE, TURN SIGNAL AND BACK-UP LAMP BULBS 12
LICENSE PLATE LAMP BULB 13
UNDERHOOD LAMP BULB 13
DOME LAMP BULB 13
OVERHEAD CONSOLE READING LAMP BULB . . 13

REMOVAL AND INSTALLATION

HEADLAMP BULB

REMOVAL

(1) Open hood.
(2) Remove headlamp assembly. See headlamp removal in the lamp service section.
(3) Remove the retaining ring holding bulb to headlamp.
(4) Pull bulb socket from headlamp (Fig. 1).
(5) Grasp bulb and pull from socket.

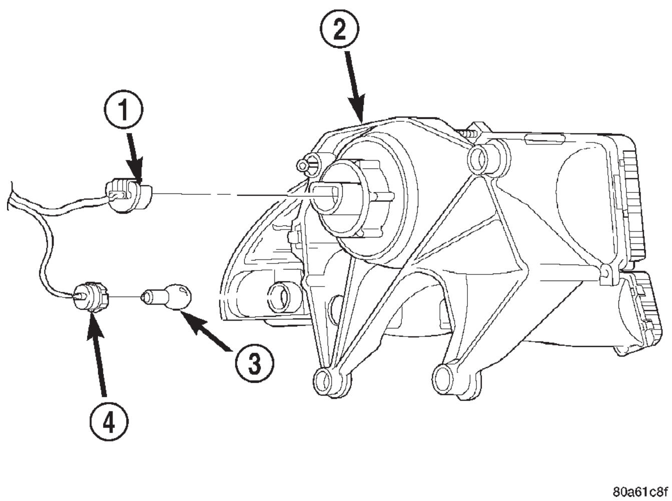


Fig. 1 Headlamp Bulb
1 – HEADLAMP BULB SOCKET
2 – HEADLAMP
3 – BULB
4 – SIDE MARKER LAMP BULB SOCKET

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Position bulb into socket and push into place.
(2) Position bulb socket in headlamp.
(3) Install retaining ring holding bulb to headlamp.
(4) Install headlamp assembly.

FOG LAMP BULB

REMOVAL

(1) Disengage fog lamp harness connector.
(2) Rotate bulb socket a 1/4 turn counterclockwise and pull from lamp to separate (Fig. 2).
(3) Grasp bulb and pull from lamp.

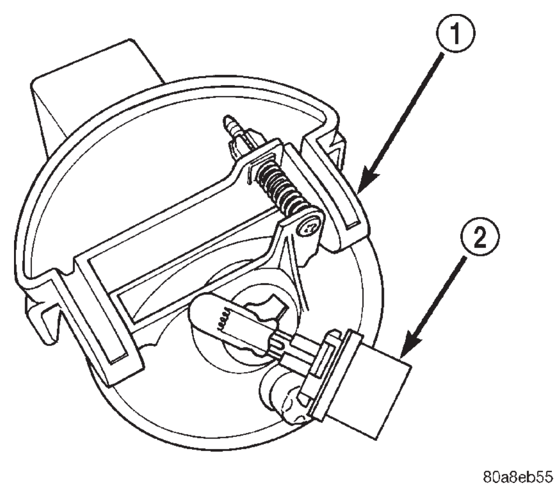


Fig. 2 Fog Lamp Bulb
1 – FOG LAMP
2 – FOG LAMP BULB

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Position bulb in lamp, push to seat and rotate a 1/4 turn clockwise.
(2) Connect fog lamp harness connector.

REMOVAL AND INSTALLATION (Continued)

PARK AND TURN SIGNAL LAMP BULBS

REMOVAL

(1) Remove park and turn signal lamp.

(2) Rotate bulb socket 1/4 turn counterclockwise and pull turn signal lamp socket from back of lamp (Fig. 3).

(3) Pull park and turn signal lamp bulb from socket.

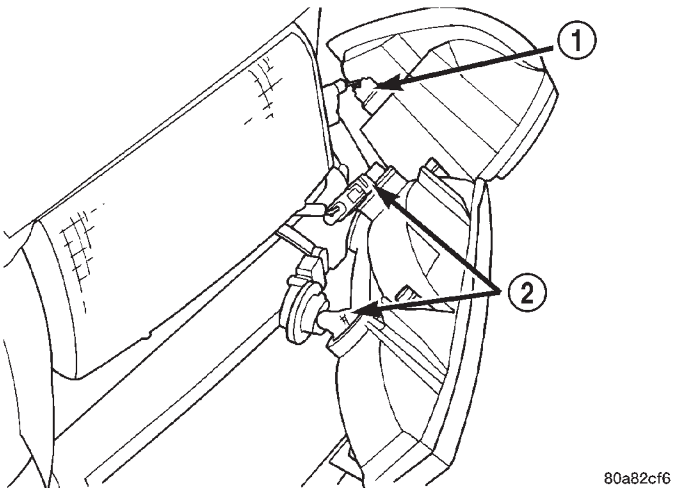


Fig. 3 Park And Turn Signal Lamp bulb

1 – SIDE MARKER LAMP BULB
2 – PARK/TURN SIGNAL LAMP BULB

INSTALLATION

(1) Install park and turn signal lamp bulb in socket.

(2) Install park and turn signal lamp socket into back of lamp.

(3) Install park/turn signal lamp.

FRONT SIDE MARKER LAMP BULB

REMOVAL

(1) Remove park and turn signal lamp.

(2) Remove side marker lamp socket from back of lamp (Fig. 1).

(3) Pull side marker lamp bulb from socket.

INSTALLATION

(1) Install side marker lamp bulb in socket.

(2) Install side marker lamp socket into back of lamp.

(3) Install park/turn signal lamp.

CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL

(1) Remove the CHMSL from the roof panel.

(2) Rotate sockets 1/4 turn clockwise and remove from lamp. (The center bulbs light the stoplamp and the outside bulbs light the cargo lamp.)

(3) Pull bulb from socket.

INSTALLATION

(1) Push bulb into socket.

(2) Position socket in lamp an rotate socket 1/4 turn counterclockwise.

(3) Install the CHMSL.

CARGO LAMP BULB

The cargo lamp bulb is incorporated in the CHMSL assembly, refer to the CHMSL bulb removal and installation procedure for bulb replacement.

TAIL, BRAKE, TURN SIGNAL AND BACK-UP LAMP BULBS

REMOVAL

(1) Remove screws from tail lamp.

(2) Grasp lamp, firmly pull lamp rearward to disengage retaining studs.

(3) Remove sockets from tail lamp (Fig. 4).

(4) Pull bulb from socket.

(5) Separate tail lamp from cargo box.

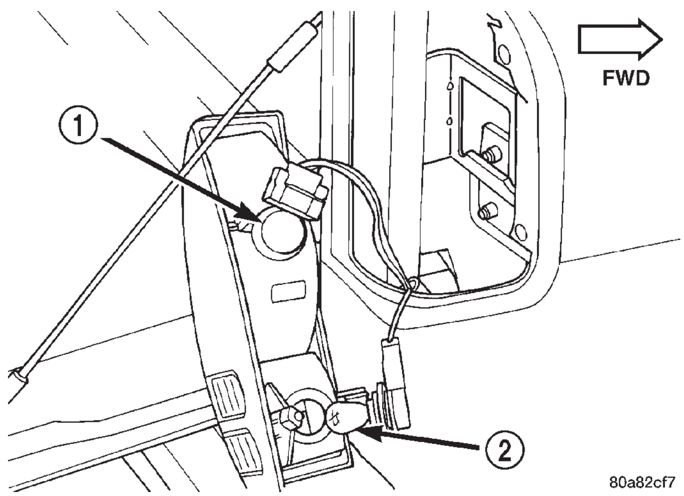


Fig. 4 Tail, Brake, Turn Signal And Back-Up Lamp Bulbs

1 – TAIL/STOP/TURN SIGNAL LAMP BULB
2 – BACK-UP LAMP BULB

INSTALLATION

(1) Install bulb in socket.

(2) Install socket in tail lamp.

(3) Position tail lamp in cargo box, engage retaining studs and install screws.

REMOVAL AND INSTALLATION (Continued)

LICENSE PLATE LAMP BULB

REMOVAL

(1) From the underside of the bumper, grasp the bulb socket and rotate counter clockwise.
(2) Pull bulb socket from lamp.
(3) Grasp bulb and pull from socket.

INSTALLATION

(1) Position bulb in socket and press into place.
(2) Position bulb socket in lamp and rotate clockwise to lock into place.

UNDERHOOD LAMP BULB

REMOVAL

(1) Insert a small flat blade in the access slot between the lamp base and lamp lens.
(2) Pry the lamp lens upward and remove the lamp lens (Fig. 5).
(3) Depress the bulb terminal inward (Fig. 6) to release the bulb.

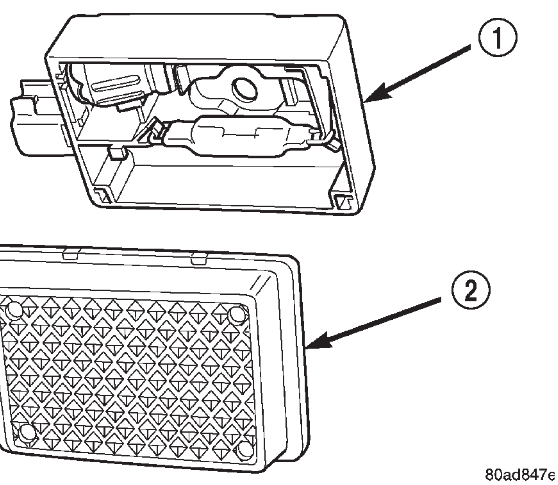


Fig. 5 Underhood Lamp Lens

1 – LAMP
2 – LAMP LENS

INSTALLATION

(1) Engage the replacement bulb wire loop to the terminal closest to the lamp base wire connector.
(2) Depress the opposite terminal inward and engage the remaining bulb wire loop.

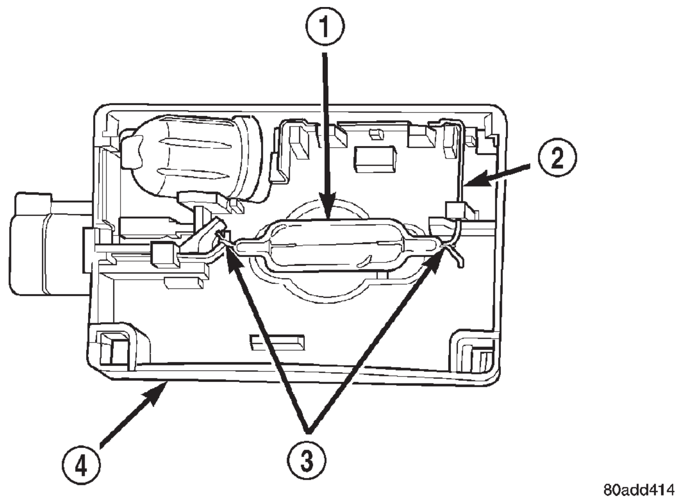


Fig. 6 Underhood Lamp Bulb

1 – BULB
2 – DEPRESS TERMINAL INWARD
3 – BULB WIRE LOOP
4 – LAMP BASE

(3) Position the lamp lens on the lamp base and press into place.

DOME LAMP BULB

REMOVAL

(1) Using a small flat blade, pry the left side (driver's side) of the lamp lens downward.
(2) Pull bulb from lamp.

INSTALLATION

(1) Install bulb in lamp.
(2) Position lens on lamp and snap into place.

OVERHEAD CONSOLE READING LAMP BULB

REMOVAL

(1) Insert a small flat blade between the front part of the lamp lens and overhead console. Carefully pry lens downward to release lens retaining tabs.
(2) Separate lens.
(3) Pull cartridge bulb from terminals.

INSTALLATION

(1) Position bulb on terminals and press into place.
(2) Replace lens by inserting switch tab of lens over console switch at outer wall of console.
(3) Position lens over retaining posts and seat lens by pushing lens at retaining tabs.

LAMP SERVICE

TABLE OF CONTENTS

page

REMOVAL AND INSTALLATION
HEADLAMP 14
FOG LAMP. 14
PARK, TURN SIGNAL AND SIDE MARKER LAMP 14
CENTER HIGH MOUNTED STOP LAMP (CHMSL) 15
CARGO LAMP 16
TAIL, STOP, TURN SIGNAL AND BACK-UP LAMP 16
LICENSE PLATE LAMP 16
UNDERHOOD LAMP 16
DOME LAMP 17
OVERHEAD CONSOLE READING LAMP 17

REMOVAL AND INSTALLATION

HEADLAMP

REMOVAL

(1) Open hood.
(2) Remove the bolts attaching headlamp to the inner fender panel (Fig. 1).
(3) Grasp the headlamp and firmly pull the headlamp to disengage it from the panel.
(4) Disengage the connector from the headlamp bulb.
(5) Separate bulb from headlamp.
(6) Remove the bulb sockets from the front park/turn signal/side marker lamps
(7) Separate headlamp module from vehicle.

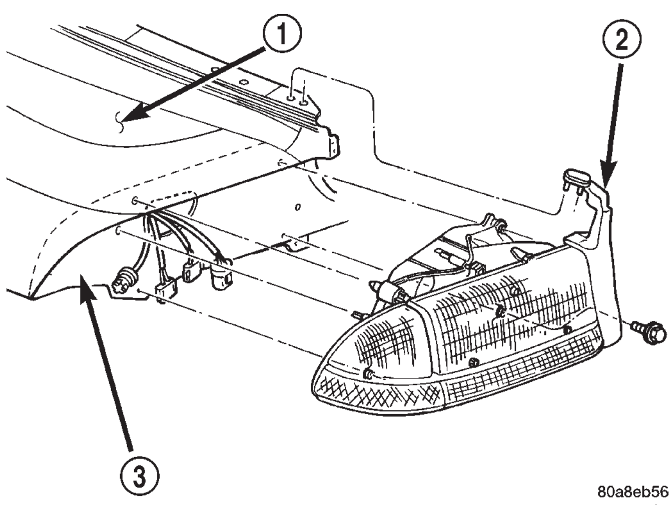


Fig. 1 Headlamp

1 – FENDER
2 – SEAL
3 – INNER FENDER

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Install bulb sockets for the front park/turn signal/side marker lamps
(2) Engage the connector to the headlamp bulb.
(3) Position headlamp in inner fender panel and firmly push headlamp inward to lock into place.
(4) Install the bolts attaching headlamp to the panel.

FOG LAMP

The fog lamps are serviced from the rearward side of the front bumper.

REMOVAL

(1) Disengage fog lamp harness connector.
(2) Remove the bolts attaching the fog lamp to the bumper (Fig. 2).
(3) Separate fog lamp from bumper.

INSTALLATION

(1) Position fog lamp in bumper.
(2) Install the bolts attaching the fog lamp to the bumper.
(3) Connect fog lamp harness connector.
(4) Check for proper operation and beam alignment.

PARK, TURN SIGNAL AND SIDE MARKER LAMP

REMOVAL

(1) Remove torx screw attaching park lamp to headlamp module (Fig. 3).
(2) Pull the park and turn signal lamp outward and separate from headlamp module.
(3) Remove park and turn signal sockets from back of lamp (Fig. 4).

REMOVAL AND INSTALLATION (Continued)

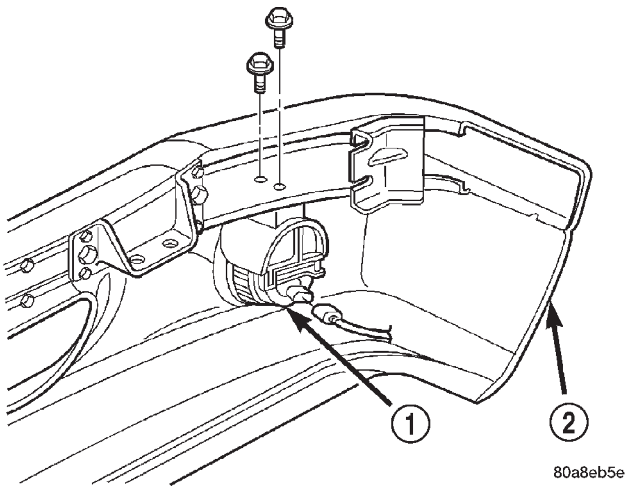


Fig. 2 Fog Lamp

1 – FOG LAMP
2 – FRONT BUMPER

(4) Remove side marker socket from back of lamp.

(5) Separate park and turn signal lamp from vehicle.

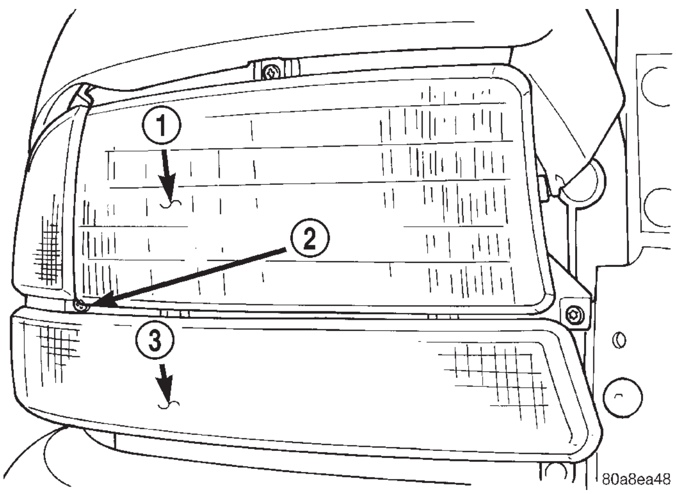


Fig. 3 Park Lamp Screw

1 – HEADLAMP
2 – HIDDEN SCREW
3 – PARK LAMP

INSTALLATION

(1) Install side marker socket in back of lamp.

(2) Install park and turn signal sockets in back of lamp.

(3) Using the guides on the bottom and side of the headlamp module, align the park and turn signal lamp under headlamp module.

(4) Slide the park and turn signal lamp inward under headlamp module. Push firmly until the lamp is seated.

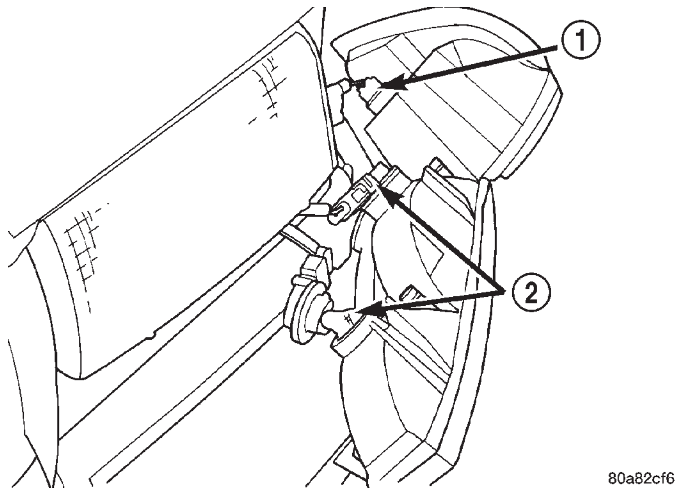


Fig. 4 Park, Turn Signal And Side Marker Lamp

1 – SIDE MARKER LAMP BULB
2 – PARK/TURN SIGNAL LAMP BULB

(5) Install screw attaching park lamp to headlamp module.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL

(1) Remove screws attaching CHMSL to cab roof panel (Fig. 5).

(2) Separate CHMSL from roof.

(3) Disengage wire connector from body wire harness.

(4) Separate CHMSL from vehicle.

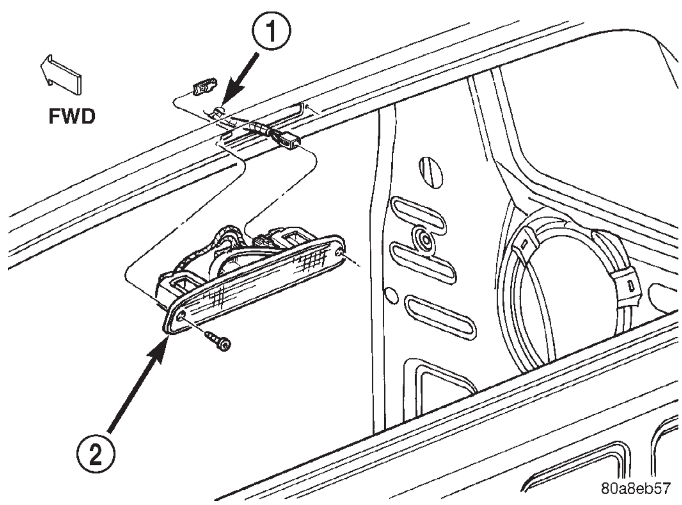


Fig. 5 Center High Mounted Stop Lamp

1 – ROOF
2 – CHMSL

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position lamp at cab roof and connect wire connector.

(2) Install screws attaching CHMSL to roof panel. Tighten securely.

CARGO LAMP

The cargo lamp is incorporated into the CHMSL, if equipped. Refer to Center High Mounted Stop Lamp paragraph for service procedures.

TAIL, STOP, TURN SIGNAL AND BACK-UP LAMP

REMOVAL

(1) Release tailgate latch and open tailgate.

(2) Remove screw holding tail lamp to cargo box (Fig. 6).

(3) Grasp lamp, firmly pull lamp rearward to disengage retaining studs.

(4) Remove sockets from tail lamp.

(5) Separate tail lamp from cargo box.

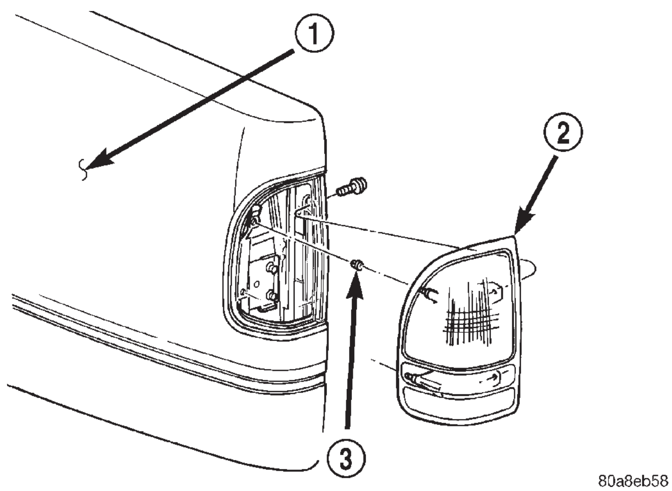


Fig. 6 Tail Lamp

1 – CARGO BOX
2 – TAIL/STOP BACK-UP LAMP
3 – ROUND CLIP

INSTALLATION

(1) Install sockets in tail lamp.

(2) Position tail lamp at cargo box, engage retaining studs (Fig. 7) and install screw.

(3) Close tailgate.

LICENSE PLATE LAMP

REMOVAL

(1) Remove license plate lamp bulb socket.

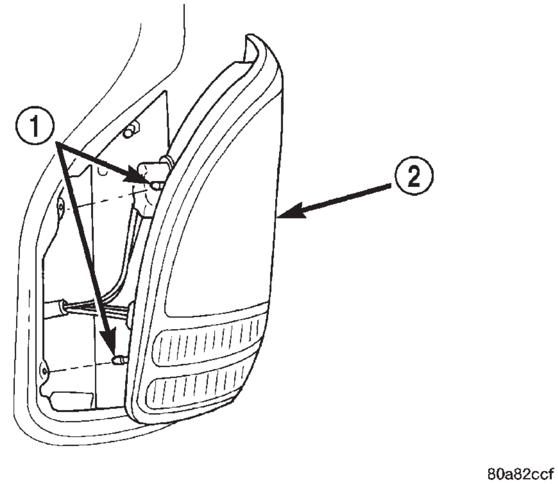


Fig. 7 Retaining Studs

1 – RETAINING STUDS
2 – TAIL LAMP

(2) From the underside of the bumper and using a small flat blade, push in retaining tab to release the lamp from the bumper.

(3) Separate lamp from bumper.

INSTALLATION

(1) Position lamp in bumper and press into place.

(2) Install license plate lamp bulb socket.

UNDERHOOD LAMP

REMOVAL

(1) Disconnect the wire harness connector from the lamp.

(2) Remove lamp lens.

(3) Remove bulb.

(4) Remove screw attaching underhood lamp to the inner hood panel.

(5) Separate underhood lamp from vehicle.

INSTALLATION

(1) Install bulb.

(2) Install lamp lens.

(3) Position the underhood lamp on the hood inner panel.

(4) Install the attaching screw through the lamp mounting flange and into the hood panel. (Fig. 8). Tighten the screw securely.

(5) Fold lamp housing over and firmly press onto base to snap into place.

(6) Connect the wire harness connector to the lamp.

REMOVAL AND INSTALLATION (Continued)

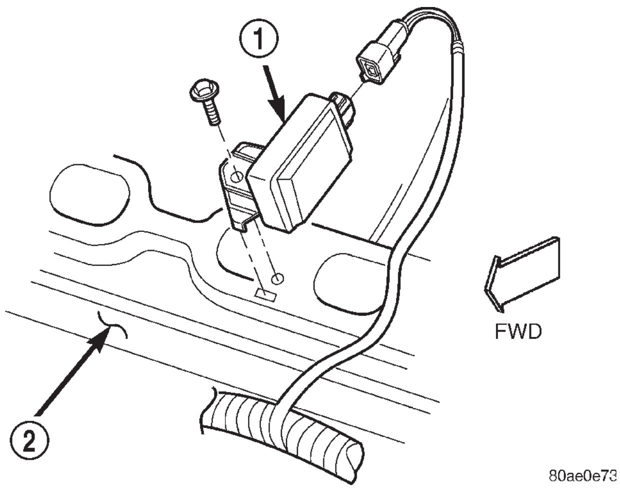


Fig. 8 Underhood Lamp

1 – UNDER HOOD LAMP
2 – HOOD

DOME LAMP

REMOVAL

(1) Using a small flat blade, pry the left side (driver's side) of the dome lamp lens downward from dome lamp.

(2) Allow the lens to hang down (Fig. 9), this will disengage the right side of the lamp (passenger's side) from the headliner.

(3) Pull the right side of the lamp down and slide the lamp to the right (Fig. 10).

(4) Separate the lamp from the headliner.

(5) Disengage dome lamp wire connector from body wire harness.

(6) Separate dome lamp from vehicle.

INSTALLATION

(1) Position dome lamp at headliner.

(2) Connect dome lamp wire connector to body wire harness.

(3) Position the left side of the lamp in the headliner opening and slide lamp to the left.

(4) Push the right side of the lamp in the headliner opening and push the lamp lens up into the lamp to secure.

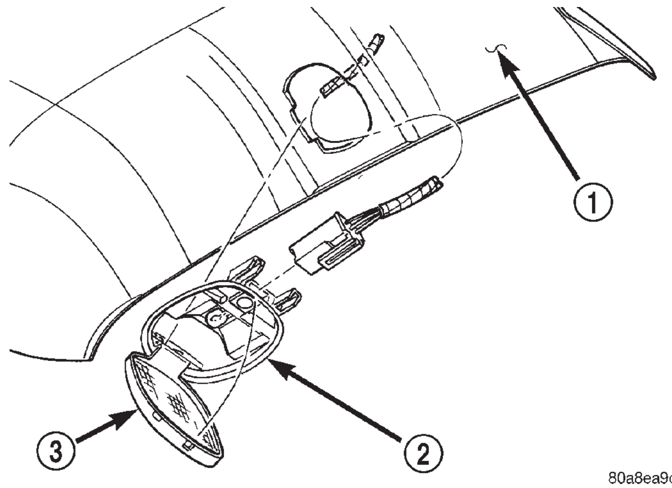


Fig. 9 Dome Lamp Lens

1 – HEAD LINER
2 – DOME LAMP
3 – LENS

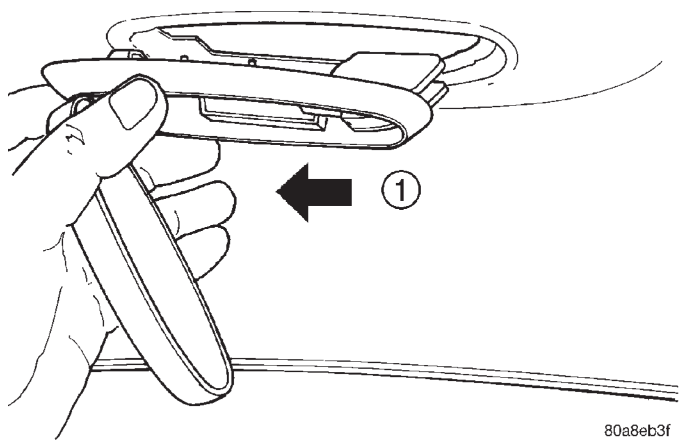


Fig. 10 Dome Lamp

1 – SLIDE LAMP

OVERHEAD CONSOLE READING LAMP

To service overhead reading lamp, refer to Group 8C, Overhead Console.

LAMP SYSTEMS

TABLE OF CONTENTS

page page

GENERAL INFORMATION
DAYTIME RUNNING LAMP MODULE (DRLM) . . . 18

REMOVAL AND INSTALLATION
DAYTIME RUNNING LAMP MODULE (DRLM) . . . 18

GENERAL INFORMATION

DAYTIME RUNNING LAMP MODULE (DRLM)

The headlamps on vehicles sold in Canada, will go on when the ignition is turned ON. The module must also receive a signal from the engine controller. This provides a constant Lights On condition while the vehicle is rolling. The lamps illuminate at less than 50% of normal intensity.

REMOVAL AND INSTALLATION

DAYTIME RUNNING LAMP MODULE (DRLM)

REMOVAL

The Daytime Running Lamp Module is located on the left inner fender.

(1) Remove the bolt attaching the module to the inner fender (Fig. 1).

(2) Disconnect the electrical connector.

INSTALLATION

(1) Connect the electrical connector.

(2) Insert the tab on the DRLM into the slot on the left inner fender.

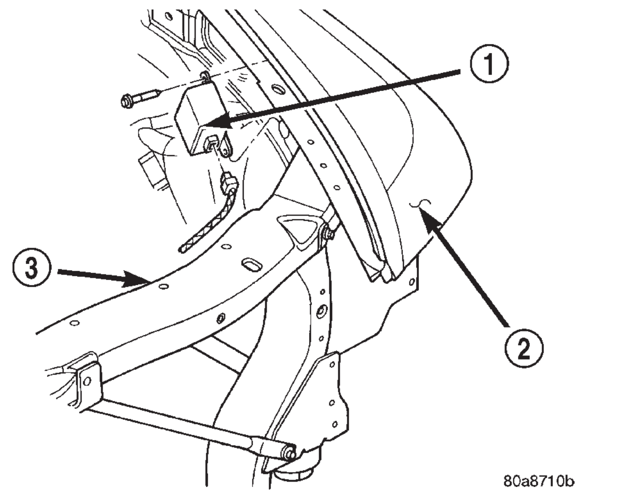


Fig. 1 Daytime Running Lamp Module

1 – DAYTIME RUNNING LAMP MODULE
2 – LEFT FENDER
3 – RADIATOR CLOSURE PANEL

(3) Install the bolt attaching the module to the left inner fender.

BULB APPLICATION

TABLE OF CONTENTS

	page
SPECIFICATIONS	
EXTERIOR LAMPS	19
INTERIOR LAMPS	19

SPECIFICATIONS

EXTERIOR LAMPS

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result. Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

The following Bulb Application Table lists the lamp title on the left side of the column and trade number or part number on the right.

LAMP	BULB
Back-up	3157
Cargo	921
Center High Mounted Stop	921
Front Fog Lamp	899
Front Side Marker	194
Headlamp	9007
License Plate	168
Park/Turn Signal	3157
Tail/Brake/Turn Signal	3157
Underhood	561

INTERIOR LAMPS

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result.

Service procedures for most of the lamps in the instrument panel, Instrument cluster and switches are located in Group 8E, Instrument Panel and Gauges. Some components have lamps that can only be serviced by an Authorized Service Center (ASC) after the component is removed from the vehicle.

The following Bulb Application Tables lists the lamp title on the left side of the column and trade number or part number on the right.

DIMMER CONTROLLED LAMPS

LAMP	BULB
A/C Heater Control	6233137
Ash Receiver	161
Headlamp Switch	158
Heater Control	6233137
Instrument Cluster	PC194
Overhead Console	578
Radio	ASC
Stepwell	904

INDICATOR LAMPS

LAMP	BULB
Airbag	LED
Anti-lock Brake	PC74
Brake Warning	LED
Check Engine	PC74
Check Gauges	LED
Cruise	PC74
Engine Oil Pressure	PC74
Four Wheel Drive	PC194
High Beam	PC74
Ignition Key	53
Low Fuel	PC74
Low Washer Fluid	PC74
Overdrive Off	PC74
RWAL	PC74
Seat Belt	LED
Security	PC74
Turn Signal	PC194
Upshift	PC74

NON-DIMMING LAMPS

LAMP	BULB
Dome	579
Glove Compartment	194

PASSIVE RESTRAINT SYSTEMS

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
AIRBAG SYSTEM 1
DRIVER SIDE AIRBAG MODULE 2
PASSENGER SIDE AIRBAG MODULE. 3
PASSENGER SIDE AIRBAG ON/OFF SWITCH . . . 3
AIRBAG CONTROL MODULE 3
CLOCKSPRING 4
DIAGNOSIS AND TESTING
AIRBAG SYSTEM 4
SERVICE PROCEDURES
AIRBAG SYSTEM 5
REMOVAL AND INSTALLATION
DRIVER SIDE AIRBAG MODULE 6

page

DRIVER SIDE AIRBAG MODULE TRIM COVER. 8
PASSENGER SIDE AIRBAG MODULE. 9
PASSENGER SIDE AIRBAG ON/OFF SWITCH . . 12
AIRBAG CONTROL MODULE 12
CLOCKSPRING 13
ADJUSTMENTS
CLOCKSPRING CENTERING. 15
SPECIAL TOOLS
PASSIVE RESTRAINT SYSTEMS 16

DESCRIPTION AND OPERATION

AIRBAG SYSTEM

DESCRIPTION

A dual front airbag system is standard factory-installed safety equipment on this model. The primary passenger restraints in this vehicle are the standard equipment factory-installed seat belts, which require active use by the vehicle occupants. The airbag system is a supplemental passive restraint that was designed and is intended to enhance the protection for the front seat occupants of the vehicle **only** when used in conjunction with the seat belts. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed passenger restraints, including the airbag system.

The dual front airbag system consists of the following components:
- Airbag Control Module (ACM)
- Airbag indicator lamp
- Clockspring
- Driver and passenger side airbag modules (including the airbag inflators)
- Driver and passenger side knee blockers
- Passenger side airbag on/off switch (except quad cab)
- Wire harness and connections.

This group provides complete service information for the ACM, both airbag modules, the clockspring, and the passenger side airbag on/off switch. Complete service information for the other airbag system components can be located as follows:
- Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for complete service information for the airbag indicator lamp.
- Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for complete service information on the driver side knee blocker.
- Refer to **Glove Box** in the Removal and Installation section of Group 8E - Instrument Panel Systems for complete service information on the passenger side knee blocker.
- Refer to **Airbag System** in the Contents of Group 8W - Wiring Diagrams for complete service information and circuit diagrams for the airbag system wiring components.

See the proper Diagnostic Procedures manual to test or diagnose a problem with any component of the airbag system.

OPERATION

The airbag system electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Airbag Control Module (ACM). The ACM also contains an impact sensor and a safing sensor, which are monitored by the ACM to determine when an impact occurs that is severe enough to require airbag system protection. When a frontal impact is severe enough, the ACM signals the inflator units of both airbag modules to deploy the airbags.

DESCRIPTION AND OPERATION (Continued)

An airbag indicator lamp in the instrument cluster lights for about seven seconds as a bulb test, each time the ignition switch is turned to the On or Start positions. Following the bulb test, the airbag indicator lamp is turned on or off by the ACM to indicate the status of the airbag system. If the airbag indicator lamp comes on at any time other than during the bulb test, it indicates that there is a problem in the airbag system circuits. Such a problem may cause the airbags not to deploy when required, or to deploy when not required.

The driver side airbag module includes an inflatable airbag and an inflator unit behind a trim cover in the hub area of the steering wheel. The passenger side airbag module includes a second inflatable airbag and an inflator unit behind an airbag door in the instrument panel above the glove box.

During a frontal vehicle impact, the knee blockers work in concert with properly adjusted seat belts to restrain the driver and front seat passenger in the proper position for an airbag deployment. The knee blockers also work to absorb and distribute the crash energy from the driver and front seat passenger to the structure of the instrument panel. The driver side knee blocker is integral to the instrument panel steering column opening cover. The passenger side knee blocker is integral to the glove box door.

Following are general descriptions of the major components in the airbag system.

WARNING:

- **THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**
- **THE DRIVER SIDE AIRBAG MODULE INFLATOR ASSEMBLY CONTAINS SODIUM AZIDE AND POTASSIUM NITRATE. THESE MATERIALS ARE POISONOUS AND EXTREMELY FLAMMABLE. CONTACT WITH ACID, WATER, OR HEAVY METALS MAY PRODUCE HARMFUL AND IRRITATING GASES (SODIUM HYDROXIDE IS FORMED IN THE PRESENCE OF MOISTURE) OR COMBUSTIBLE COMPOUNDS. THE PASSENGER AIRBAG MODULE CONTAINS ARGON GAS PRESSURIZED TO OVER 2500 PSI. DO NOT ATTEMPT TO DISMANTLE AN AIRBAG MODULE OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE, OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURES EXCEEDING 93° C (200° F).**
- **REPLACE AIRBAG SYSTEM COMPONENTS ONLY WITH PARTS SPECIFIED IN THE CHRYSLER MOPAR PARTS CATALOG. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.**
- **THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE AIRBAG SYSTEM COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANY TIME A NEW FASTENER IS NEEDED, REPLACE IT WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR SPECIFIED IN THE CHRYSLER MOPAR PARTS CATALOG.**
- **WHEN A STEERING COLUMN HAS AN AIRBAG MODULE ATTACHED, NEVER PLACE THE COLUMN ON THE FLOOR OR ANY OTHER SURFACE WITH THE STEERING WHEEL OR AIRBAG MODULE FACE DOWN.**

DRIVER SIDE AIRBAG MODULE

DESCRIPTION

The driver side airbag module protective trim cover is the most visible part of the driver side airbag system. The driver side airbag module is mounted directly to the steering wheel. Located under the airbag module trim cover are the horn switch, the folded airbag cushion, and the airbag cushion supporting components. The resistive membrane-type horn switch is secured with heat stakes to the inside surface of the airbag module trim cover, between the trim cover and the folded airbag cushion.

The driver side airbag module cannot be repaired, and must be replaced if deployed or in any way damaged. The driver side airbag module trim cover and the horn switch are available as a unit for service replacement.

OPERATION

The driver side airbag module includes a stamped metal housing to which the cushion and an inflator unit are attached and sealed. The conventional pyrotechnic-type inflator assembly is mounted to studs on the back of the airbag module housing. The inflator seals the hole in the airbag cushion so it can discharge the gas it produces directly into the cushion when supplied with the proper electrical signal. Following an airbag deployment, the airbag cushion quickly deflates by venting this gas towards the

DESCRIPTION AND OPERATION (Continued)

instrument panel through the porous fabric material used on the steering wheel side of the airbag cushion.

The protective trim cover is fitted to the front of the airbag module and forms a decorative cover in the center of the steering wheel. The inside of the trim cover has locking blocks molded into it that engage a lip on the airbag module metal housing. Two stamped metal retainers then fit over the inflator mounting studs on the back of the airbag module housing and are engaged in slots on the inside of the cover, securely locking the trim cover into place. The trim cover will split at predetermined breakout lines, then fold back out of the way along with the horn switch upon airbag deployment.

PASSENGER SIDE AIRBAG MODULE

DESCRIPTION

The passenger side airbag door on the instrument panel above the glove box is the most visible part of the passenger side airbag system. Located under the airbag door are the passenger side airbag cushion and the airbag cushion supporting components.

The passenger side airbag module includes an extruded aluminum housing within which the cushion and inflator are mounted and sealed. The airbag housing extrusion also includes two flanges. The flanges, one at the top and one at the bottom, serve as the mounting brackets for the module. Two stamped metal brackets, one on each end of the housing, enclose the cushion and inflator. The passenger side airbag module upper bracket is secured beneath the instrument panel top pad with rivets to a flange and bracket on the passenger side airbag door. The lower bracket is secured with screws to the instrument panel structural duct.

Following a passenger side airbag deployment, the passenger side airbag module and the instrument panel assembly must be replaced. The passenger side airbag module cannot be repaired, and must be replaced if deployed or in any way damaged.

OPERATION

The hybrid-type inflator assembly includes a small canister of highly compressed argon gas. The inflator seals the hole in the airbag cushion so it can discharge the gas it produces directly into the cushion when supplied with the proper electrical signal. Following an airbag deployment, the airbag cushion quickly deflates by venting this gas through the porous fabric material used on each end panel of the airbag cushion.

The molded plastic passenger side airbag door is secured to the instrument panel top cover with rivets. The airbag door has predetermined breakout lines concealed beneath its decorative cover. Upon airbag deployment, the airbag door will split at the breakout lines and the door will pivot out of the way. The passenger side airbag door is serviced only as a unit with the instrument panel top cover.

PASSENGER SIDE AIRBAG ON/OFF SWITCH

DESCRIPTION

A passenger side airbag on/off switch on all models except quad cab, which is located on the instrument panel, allows the passenger side airbag system to be disabled when certain child restraint devices are being used in the right front seating position. The passenger side airbag on/off switch is equipped with a key actuator that is designed so that the switch position can be changed using an ignition key. The key is inserted into the actuator far enough to fully depress a spring-loaded locking plunger, then rotated to the desired position. The key will not insert all the way into the actuator, and the spring-loaded locking plunger prevents the user from leaving a key in the actuator. When the ignition switch is in the On position and the passenger side airbag system is disabled, a Light-Emitting Diode (LED) illuminates an **Off** indicator lamp on the face plate of the switch.

The passenger side airbag on/off switch cannot be adjusted or repaired and, if faulty or damaged, the switch assembly must be replaced.

OPERATION

To actuate the passenger side airbag on/off switch, insert the ignition key in the switch key actuator far enough to fully depress the spring-loaded locking plunger. The switch key actuator is then rotated with the ignition key to its clockwise stop (the key actuator slot will be aligned with the Off indicator lamp) to disable the passenger side airbag system. When the switch key actuator is rotated with the ignition key to its counterclockwise stop (the key actuator slot will be in a vertical position), the Off indicator lamp will be extinguished and the passenger side airbag system will be enabled.

AIRBAG CONTROL MODULE

DESCRIPTION

The Airbag Control Module (ACM) is secured with screws to a mount welded onto the floor panel transmission tunnel behind the instrument panel center support bracket in the passenger compartment of the vehicle. The ACM contains an electronic microprocessor, an electronic impact sensor, an electromechanical safing sensor, and an energy storage capacitor.

The ACM cannot be repaired or adjusted and, if damaged or faulty, it must be replaced.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The microprocessor in the ACM contains the airbag system logic. The airbag system logic includes On-Board Diagnostics (OBD), and the ability to communicate with the instrument cluster circuitry over the Chrysler Collision Detection (CCD) data bus to control the airbag indicator lamp. The microprocessor continuously monitors all of the airbag system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sends messages to the instrument cluster over the CCD data bus to turn on the airbag indicator lamp. Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for more information on the airbag indicator lamp.

One electronic impact sensor is used in this airbag system. The impact sensor is an accelerometer that senses the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. The impact sensor is calibrated for the specific vehicle, and is only serviced as a unit with the ACM. A pre-programmed decision algorithm in the ACM microprocessor determines when the deceleration rate as signaled by the impact sensor indicates an impact that is severe enough to require airbag system protection. When the programmed conditions are met, the ACM sends an electrical signal to deploy the airbags.

In addition to the electronic impact sensor, there is an electromechanical sensor within the ACM called a safing sensor. The safing sensor is a normally open series switch located in the airbag deployment circuit of the ACM. This sensor detects impact energy of a lesser magnitude than the electronic impact sensor, and must be closed in order for the airbags to deploy.

The ACM also contains an energy-storage capacitor. This capacitor stores enough electrical energy to deploy the airbags for up to one second following a battery disconnect or failure during an impact. The purpose of the capacitor is to provide airbag system protection in a severe secondary impact, if the initial impact has damaged or disconnected the battery, but was not severe enough to deploy the airbags.

CLOCKSPRING

DESCRIPTION

The clockspring assembly is secured with two integral plastic latches onto the steering column lock housing near the top of the steering column behind the steering wheel. The clockspring is used to maintain a continuous electrical circuit between the fixed clockspring wire harness on the steering column and several electrical components that rotate with the steering wheel. The rotating components include the driver side airbag module, the horn switch and, if the vehicle is so equipped, the vehicle speed control switches and/or the remote radio switches.

The clockspring cannot be repaired. If the clockspring is faulty, damaged, or if the driver side airbag has been deployed, the clockspring must be replaced.

OPERATION

The clockspring assembly consists of a plastic case which contains a flat, ribbon-like, electrically conductive tape that winds and unwinds like a clockspring with the steering wheel rotation. The electrically conductive tape consists of several fine gauge copper wire leads sandwiched between two narrow strips of plastic film.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly. To prevent this from occurring, the clockspring is centered when it is installed on the steering column. Centering the clockspring indexes the clockspring tape to other steering components so that it can operate within its designed travel limits. However, if the clockspring is removed for service or if the steering column is disconnected from the steering gear allowing the clockspring tape to change position relative to the other steering components, it must be re-centered following completion of the service or it may be damaged. Refer to **Clockspring Centering** in the Adjustments section of this group for the proper centering procedures.

Service replacement clocksprings are shipped pre-centered and with a piece of tape covering the depressed clockspring auto-locking tabs. This tape should not be removed until the clockspring has been installed on the steering column. If the tape is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

DIAGNOSIS AND TESTING

AIRBAG SYSTEM

A DRB scan tool is required for diagnosis of the airbag system. See the proper Diagnostic Procedures manual for more information.

(1) Connect the DRB scan tool to the 16-way data link wire harness connector. The connector is located on the driver side lower edge of the instrument panel, below the steering column (Fig. 1).

(2) Turn the ignition switch to the On position. Exit the vehicle with the DRB. Be certain that the DRB contains the latest version of the proper DRB software.

(3) Using the DRB, read and record the active Diagnostic Trouble Code (DTC) data.

(4) Read and record any stored DTC data.

DIAGNOSIS AND TESTING (Continued)

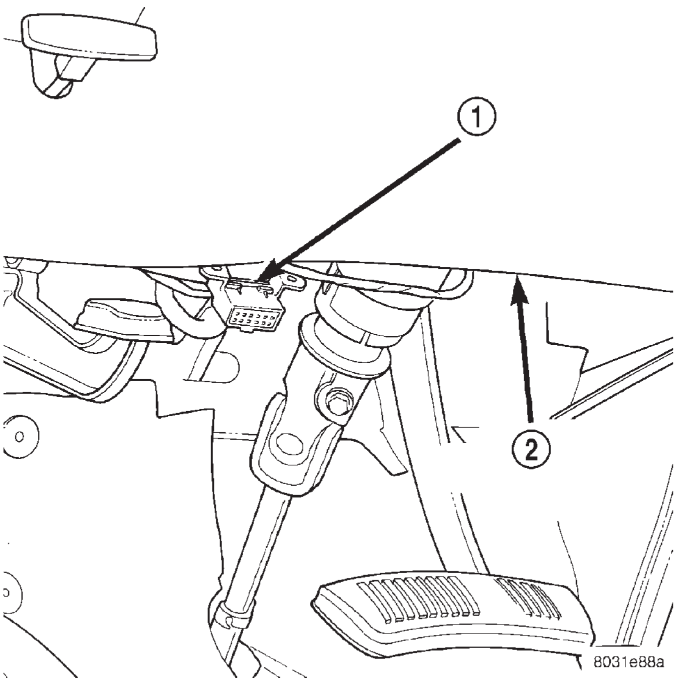


Fig. 1 16-Way Data Link Connector - Typical

1 – 16–WAY DATA LINK CONNECTOR
2 – BOTTOM OF INSTRUMENT PANEL

(5) See the proper Diagnostic Procedures manual if any DTC is found in Step 3 or Step 4.

(6) After completing the necessary repairs, try to erase the stored DTC data. If any problems remain, the stored DTC data will not erase. See the proper Diagnostic Procedures manual for the procedures to diagnose any stored DTC that will not erase.

(7) With the ignition switch still in the On position, check to be certain that nobody is in the vehicle.

(8) From outside of the vehicle (away from the airbags in case of an accidental deployment) turn the ignition switch to the Off position for about ten seconds, and then back to the On position. Observe the airbag indicator lamp in the instrument cluster. It should light for six to eight seconds, and then go out. This indicates that the airbag system is functioning normally.

NOTE: If the airbag indicator lamp fails to light, or lights and stays on, there is an airbag system malfunction. See the proper Diagnostic Procedures manual to diagnose the problem.

SERVICE PROCEDURES

AIRBAG SYSTEM

NON-DEPLOYED

At no time should any source of electricity be permitted near the inflator on the back of an airbag module. When carrying a non-deployed airbag module, the trim cover or airbag side of the module should be pointed away from the body to minimize injury in the event of an accidental deployment. If the module is placed on a bench or any other surface, the trim cover or airbag side of the module should be face up to minimize movement in the event of an accidental deployment.

In addition, the airbag system should be disarmed whenever any steering wheel, steering column, or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental airbag deployment and possible personal injury. Refer to **Group 8E - Instrument Panel Systems** for additional service procedures on the instrument panel components. Refer to **Group 19 - Steering** for additional service procedures on the steering wheel and steering column components.

DISPOSAL OF NON-DEPLOYED AIRBAG MODULES

All damaged or faulty and non-deployed driver side or passenger side airbag modules which are replaced on vehicles are to be returned. If an airbag module assembly is faulty or damaged and non-deployed, refer to the parts return list in the current Chrysler Corporation Warranty Policies and Procedures manual for the proper handling and disposal procedures.

DEPLOYED

Any vehicle which is to be returned to use after an airbag deployment, must have both airbag modules, the instrument panel assembly, the steering column assembly and the clockspring replaced. These components will be damaged or weakened as a result of an airbag deployment, which may or may not be obvious during a visual inspection, and are not intended for reuse.

Other vehicle components should be closely inspected, but are to be replaced only as required by the extent of the visible damage incurred.

STORAGE

An airbag module must be stored in its original, special container until used for service. Also, it must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store an airbag module on a surface with its trim cover or airbag side facing up, to minimize movement in case of an accidental deployment.

SERVICE PROCEDURES (Continued)

CLEANUP PROCEDURE

Following an airbag system deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge used to initiate the airbag deployment propellant. However, this residue will also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the nitrogen gas that inflates the airbag. Since sodium hydroxide powder can irritate the skin, eyes, nose, or throat, be sure to wear safety glasses, rubber gloves, and a long-sleeved shirt during cleanup (Fig. 2).

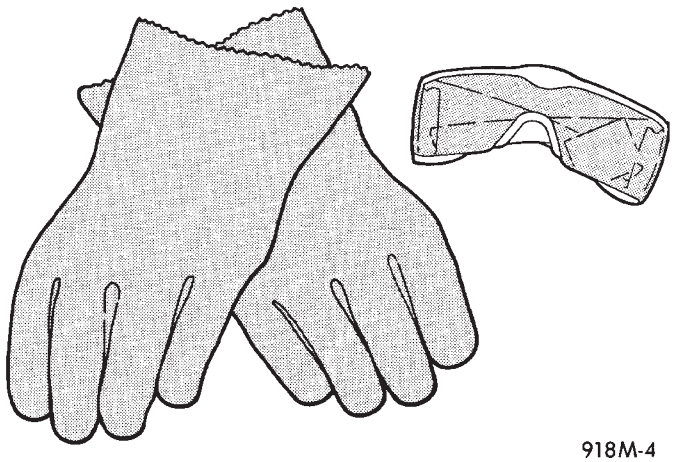


Fig. 2 Wear Safety Glasses and Rubber Gloves - Typical

WARNING: IF YOU EXPERIENCE SKIN IRRITATION DURING CLEANUP, RUN COOL WATER OVER THE AFFECTED AREA. ALSO, IF YOU EXPERIENCE IRRITATION OF THE NOSE OR THROAT, EXIT THE VEHICLE FOR FRESH AIR UNTIL THE IRRITATION CEASES. IF IRRITATION CONTINUES, SEE A PHYSICIAN.

Begin the cleanup by removing the airbag modules from the vehicle. Refer to **Driver Side Airbag Module** and **Passenger Side Airbag Module** in the Removal and Installation section of this group for the procedures.

Use a vacuum cleaner to remove any residual powder from the vehicle interior. Clean from outside the vehicle and work your way inside, so that you avoid kneeling or sitting on a non-cleaned area.

Be sure to vacuum the heater and air conditioning outlets as well (Fig. 3). Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets. You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

Place the deployed airbag modules in your vehicular scrap pile.

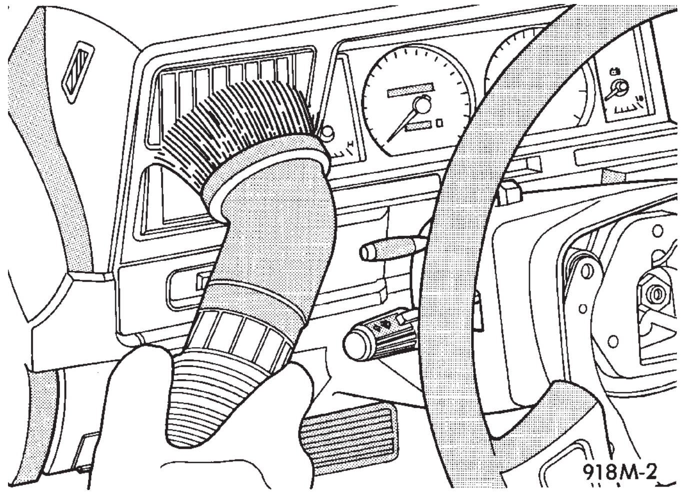


Fig. 3 Vacuum Heater and A/C Outlets - Typical

REMOVAL AND INSTALLATION

DRIVER SIDE AIRBAG MODULE

The following procedure is for replacement of a faulty or damaged driver side airbag module. If the driver side airbag has been deployed, the clockspring and the steering column assembly must also be replaced. Refer to **Clockspring** in the Removal and Installation section of this group for the additional service procedures for the clockspring. Refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for the additional service procedures for the steering column.

WARNING:

- **THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**
- **WHEN REMOVING A DEPLOYED AIRBAG MODULE, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG MODULE AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.**

REMOVAL AND INSTALLATION (Continued)

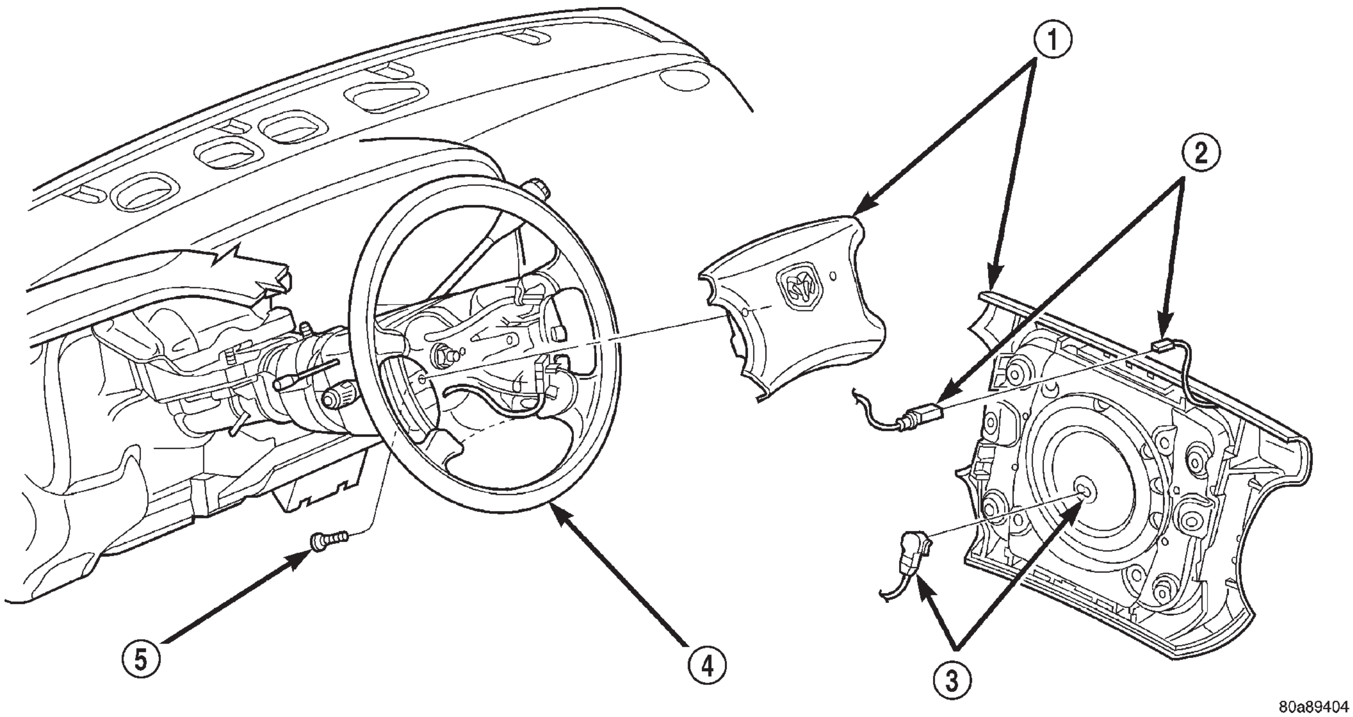


Fig. 4 Driver Side Airbag Module Remove/Install

1 – AIRBAG MODULE
2 – HORN SWITCH CONNECTOR
3 – AIRBAG CONNECTOR
4 – STEERING WHEEL
5 – SCREW

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) From the underside of the steering wheel, remove the two screws that secure the driver side airbag module to the steering wheel (Fig. 4).

(3) Pull the airbag module away from the steering wheel far enough to access the two wire harness connectors on the back of the airbag module.

(4) Disconnect the clockspring horn switch wire harness connector from the horn switch feed wire connector, which is located on the back of the airbag module.

(5) The clockspring airbag wire harness connector is a tight snap-fit into the airbag module connector receptacle, which is located on the airbag inflator on the back of the airbag module. Firmly grasp and pull or gently pry on the clockspring airbag wire harness connector to disconnect it from the airbag module. **Do not pull on the clockspring wire harness to disengage the connector from the airbag module connector receptacle.**

(6) Remove the driver side airbag module from the steering wheel.

(7) If the driver side airbag has been deployed, the clockspring and the steering column must be replaced. Refer to **Clockspring** in the Removal and Installation section of this group for the clockspring service procedures. Refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for the additional service procedures for the steering column.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

WARNING:

- **USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE AIRBAG CUSHION AND THE DRIVER SIDE AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**
- **THE DRIVER SIDE AIRBAG MODULE TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**

(1) When installing the driver side airbag module, reconnect the clockspring airbag wire harness connector to the airbag module connector receptacle by pressing straight in on the connector. You can be certain that the connector is fully engaged by listening carefully for a distinct audible click as the connector snaps into place.

(2) Reconnect the clockspring horn switch wire harness connector to the horn switch feed wire connector, which is located on the back of the airbag module.

(3) Carefully position the driver side airbag module in the steering wheel. Be certain that the clockspring wire harnesses in the steering wheel hub area are not pinched between the airbag module and the steering wheel.

(4) From the underside of the steering wheel, install and tighten the two driver side airbag module mounting screws. Tighten the screws to 10.2 N·m (90 in. lbs.).

(5) Do not reconnect the battery negative cable at this time. Refer to **Airbag System** in the Diagnosis and Testing section of this group for the proper procedures.

DRIVER SIDE AIRBAG MODULE TRIM COVER

The horn switch is integral to the driver side airbag module trim cover. If either component is faulty or damaged, the entire driver side airbag module trim cover and horn switch unit must be replaced.

WARNING:

- **THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**
- **THE HORN SWITCH IS INTEGRAL TO THE AIRBAG MODULE TRIM COVER. SERVICE OF THIS COMPONENT SHOULD BE PERFORMED ONLY BY CHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.**

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) Remove the driver side airbag module from the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

(3) Remove the four nuts that secure the upper and lower trim cover retainers to the studs on the back of the driver side airbag housing (Fig. 5).

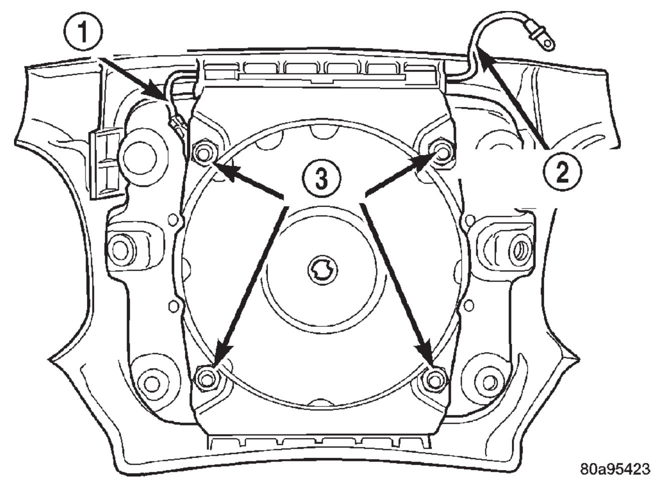


Fig. 5 Driver Side Airbag Trim Cover Retainer Nuts Remove/Install

1 – HORN SWITCH GROUND WIRE
2 – HORN SWITCH FEED WIRE
3 – NUTS

REMOVAL AND INSTALLATION (Continued)

(4) Remove the upper and lower trim cover retainers from the airbag housing studs (Fig. 6).

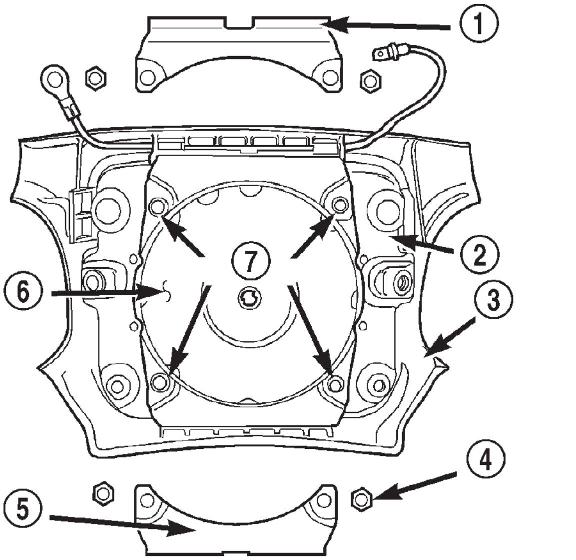


Fig. 6 Driver Side Airbag Trim Cover Retainers Remove/Install

1 – UPPER RETAINER
2 – AIRBAG HOUSING
3 – TRIM COVER
4 – NUT (4)
5 – LOWER RETAINER
6 – INFLATOR
7 – STUDS

(5) Remove the horn switch ground wire eyelet from the upper airbag housing stud.

(6) Disengage the six trim cover locking blocks from the lip around the outside edge of the driver side airbag housing and remove the housing from the cover (Fig. 7).

INSTALLATION

WARNING:

• USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE AIRBAG CUSHION AND THE DRIVER SIDE AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

• THE DRIVER SIDE AIRBAG MODULE TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

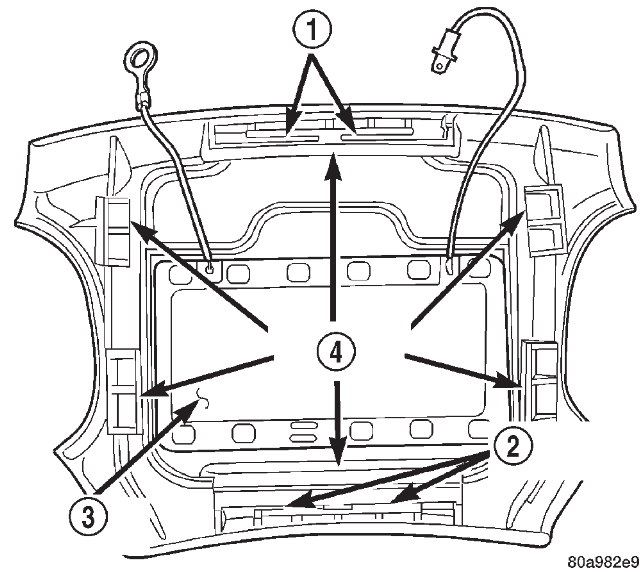


Fig. 7 Driver Side Airbag Trim Cover Remove/Install

1 – RETAINER SLOTS
2 – RETAINER SLOTS
3 – HORN SWITCH
4 – LOCKING BLOCKS

(1) Carefully position the driver side airbag module in the trim cover. Be certain that the horn switch feed and ground wires are not pinched between the airbag housing and the trim cover locking blocks.

(2) Engage the upper and lower trim cover locking blocks with the lip of the driver side airbag housing, then engage the locking blocks on each side of the trim cover with the lip of the housing. Be certain that each of the locking blocks is fully engaged on the lip of the airbag housing (Fig. 8).

(3) Install the horn switch ground wire eyelet over the upper airbag housing stud.

(4) Install the upper and lower airbag trim cover retainers over the airbag housing studs. Be certain that the tabs on each retainer are engaged in the retainer slots of the upper and lower trim cover locking blocks (Fig. 7).

(5) Install and tighten the trim cover retainer mounting nuts on the airbag housing studs. Tighten the nuts to 10 N·m (90 in. lbs.).

(6) Install the driver side airbag module onto the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

PASSENGER SIDE AIRBAG MODULE

The following procedure is for replacement of a faulty or damaged passenger side airbag module. If the passenger side airbag module has been deployed, the instrument panel assembly must be replaced. The instrument panel assembly includes the passenger side airbag module and the passenger side airbag

REMOVAL AND INSTALLATION (Continued)

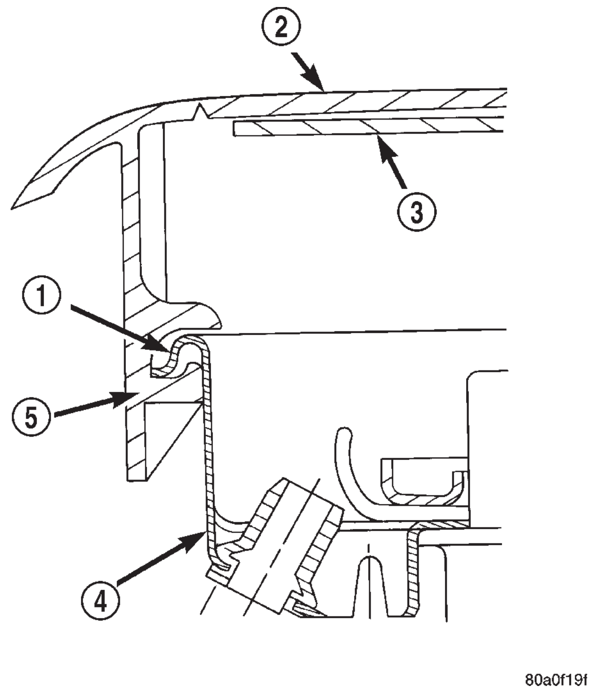


Fig. 8 Driver Side Airbag Trim Cover Locking Blocks Engaged

1 – LIP
2 – TRIM COVER
3 – HORN SWITCH
4 – AIRBAG HOUSING
5 – LOCKING BLOCK

door. Refer to **Instrument Panel Assembly** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the instrument panel assembly service procedures.

WARNING:

• THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

• WHEN REMOVING A DEPLOYED AIRBAG MODULE, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG MODULE AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) Remove the instrument panel top cover and the passenger side airbag module from the instrument panel as a unit. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Place the instrument panel top cover assembly on a suitable work surface. Be certain to take the proper precautions to protect the top cover from any possible cosmetic damage.

(4) Apply masking tape over the passenger side airbag module vents on each end of the module (Fig. 9). The tape will help to prevent foreign material from entering the airbag module through the vents during removal and installation of the module from the upper airbag door flange and bracket.

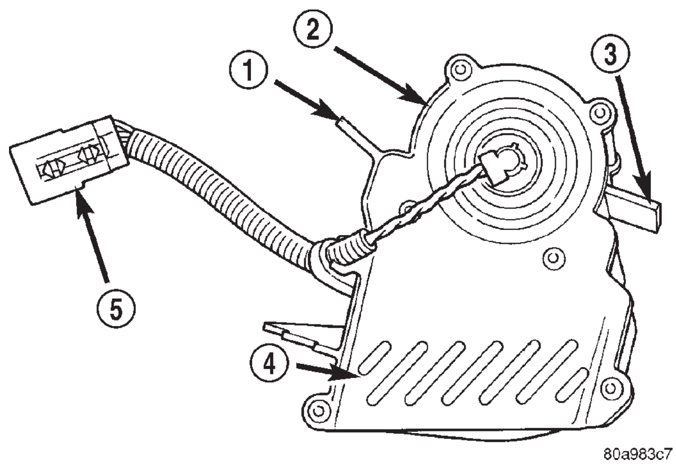


Fig. 9 Passenger Side Airbag Module Vents

1 – LOWER BRACKET
2 – PASSENGER SIDE AIRBAG MODULE
3 – UPPER BRACKET
4 – VENTS
5 – CONNECTOR

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE INSTRUMENT PANEL TOP COVER AND THE PASSENGER SIDE AIRBAG MODULE. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(5) Using a suitable center punch, carefully drive out the mandrels from the four rivets that secure the passenger side airbag module upper mounting

REMOVAL AND INSTALLATION (Continued)

bracket to the upper airbag door flange and bracket on the instrument panel top cover (Fig. 10).

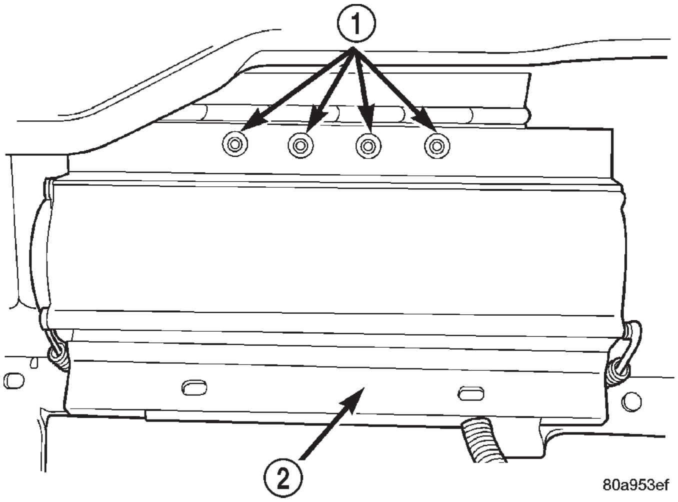


Fig. 10 Passenger Side Airbag Module Rivets

1 – RIVETS
2 – PASSENGER SIDE AIRBAG MODULE

(6) Use a suitable pair of rivet cutters or a large pair of side cutters to cut the rims or heads off of the four rivets that secure the passenger side airbag module upper mounting bracket to the upper airbag door flange and bracket on the underside of the instrument panel top cover.

WARNING: DO NOT USE A DRILL TO REMOVE THE RIVETS. SPARKS CREATED WHEN DRILLING COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY. ALSO, METAL SHAVINGS CREATED WHEN DRILLING COULD ENTER THE PASSENGER SIDE AIRBAG MODULE AND RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(7) Remove the passenger side airbag module from the upper airbag door flange and bracket on the underside of the instrument panel top cover (Fig. 11).

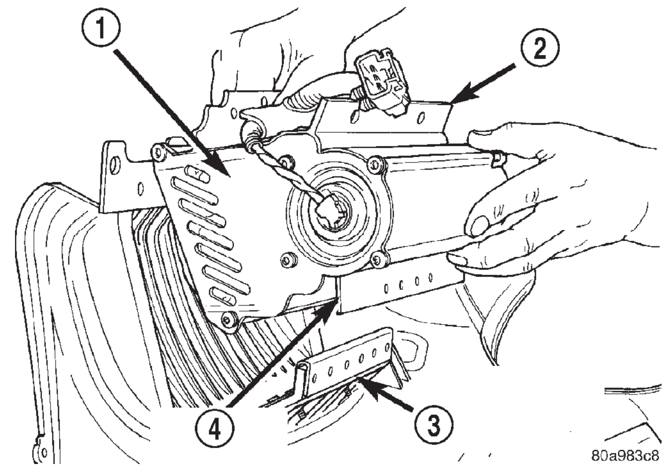


Fig. 11 Passenger Side Airbag Module Remove/Install

1 – PASSENGER SIDE AIRBAG MODULE
2 – LOWER BRACKET
3 – AIRBAG DOOR FLANGE AND BRACKET
4 – UPPER BRACKET

INSTALLATION

WARNING:

- **USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE AIRBAG CUSHION AND THE PASSENGER SIDE AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**
- **THE PASSENGER SIDE AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT INSTRUMENT PANEL ASSEMBLIES AND TOP COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE PASSENGER SIDE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**

(1) Carefully position the passenger side airbag module upper mounting bracket to the upper airbag door flange and bracket on the underside of the instrument panel top cover.

NOTE: Use only the correct rivets that are specified in the Chrysler Mopar Parts Catalog, or that are supplied in the service package with the new airbag module and/or the new instrument panel top cover when installing the passenger side airbag module.

(2) Secure the passenger side airbag module upper mounting bracket to the upper airbag door flange and bracket with four rivets.

(3) Remove the masking tape applied to the passenger side airbag module vents during the removal procedures.

(4) Install the instrument panel top cover and the passenger side airbag module onto the instrument panel as a unit. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(5) Be certain that the passenger side airbag module wire harness connector is fully engaged with and latched to the instrument panel wire harness connector.

REMOVAL AND INSTALLATION (Continued)

(6) Do not reconnect the battery negative cable at this time. Refer to **Airbag System** in the Diagnosis and Testing section of this group for the proper procedures.

PASSENGER SIDE AIRBAG ON/OFF SWITCH

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) Remove the lower bezel from the instrument panel. Refer to **Instrument Panel Lower Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the three screws that secure the passenger side airbag on/off switch to the back of the instrument panel lower bezel (Fig. 12).

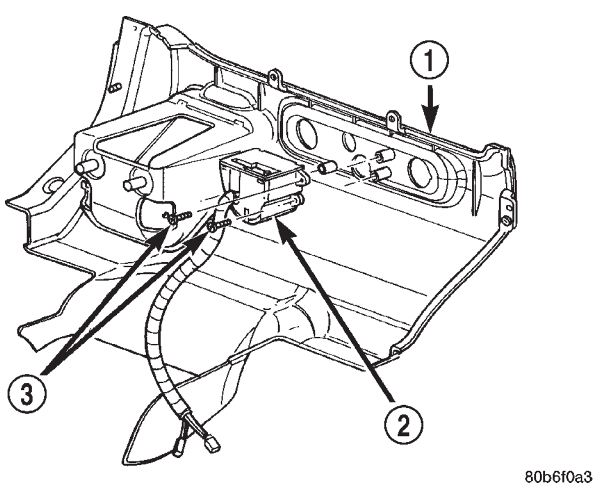


Fig. 12 Passenger Side Airbag On/Off Switch Remove/Install

1 – INSTRUMENT PANEL LOWER BEZEL
2 – PASSENGER SIDE AIRBAG ON/OFF SWITCH
3 – SCREWS

(4) Remove the passenger side airbag on/off switch from the instrument panel lower bezel.

INSTALLATION

(1) Position the passenger side airbag on/off switch to the back of the instrument panel lower bezel.

(2) Install and tighten the three screws that secure the passenger side airbag on/off switch to the instrument panel lower bezel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install the lower bezel onto the instrument panel. Refer to **Instrument Panel Lower Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(4) Do not reconnect the battery negative cable at this time. Refer to **Airbag System** in the Diagnosis and Testing section of this group for the proper procedures.

AIRBAG CONTROL MODULE

WARNING:

- **THE AIRBAG CONTROL MODULE CONTAINS THE IMPACT SENSOR, WHICH ENABLES THE SYSTEM TO DEPLOY THE AIRBAG. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**
- **NEVER STRIKE OR KICK THE AIRBAG CONTROL MODULE, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN AIRBAG CONTROL MODULE IS ACCIDENTALLY DROPPED DURING SERVICE, THE MODULE MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.**

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) Remove the center support bracket from the instrument panel. Refer to **Instrument Panel Center Support Bracket** in the Removal and Installa-

REMOVAL AND INSTALLATION (Continued)

tion section of Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the screw that secures the instrument panel wire harness ground eyelet to the left side of the mount that is welded onto the floor panel transmission tunnel (Fig. 13).

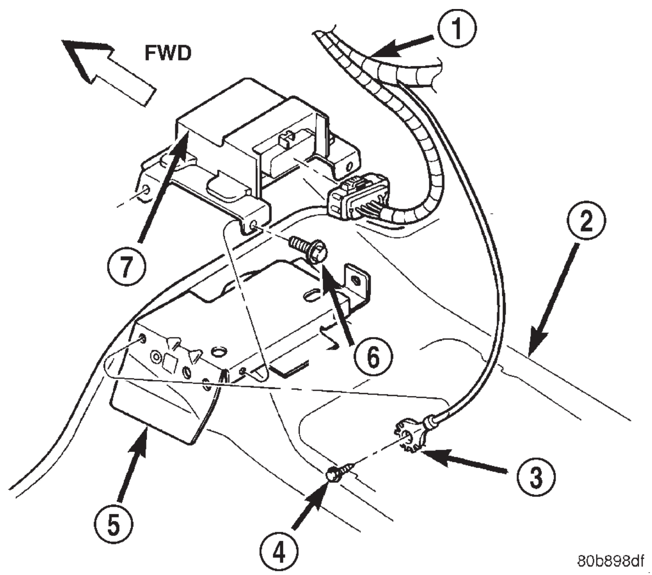


Fig. 13 Airbag Control Module Remove/Install

1 – INSTRUMENT PANEL WIRE HARNESS
2 – FLOOR PANEL TRANSMISSION TUNNEL
3 – GROUND EYELET
4 – SCREW
5 – MOUNT
6 – SCREW(3)
7 – AIRBAG CONTROL MODULE

(4) Disconnect the instrument panel wire harness connector from the Airbag Control Module (ACM). To disconnect the instrument panel wire harness connector from the ACM:

(a) Slide the red Connector Position Assurance (CPA) lock on the top of the connector toward the side of the vehicle.

(b) Depress the connector latch tab and pull the connector straight away from the ACM connector receptacle.

(5) Remove the three screws that secure the ACM to the mount that is welded onto the floor panel transmission tunnel.

(6) Remove the ACM from the mount on the floor panel transmission tunnel.

INSTALLATION

(1) Carefully position the ACM to the mount that is welded onto the floor panel transmission tunnel. When the ACM is correctly positioned the arrow on the ACM label will be pointed forward in the vehicle.

(2) Install and tighten the three screws that secure the ACM to the mount that is welded onto the floor panel transmission tunnel. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Install and tighten the screw that secures the instrument panel wire harness ground eyelet to the left side of the mount that is welded onto the floor panel transmission tunnel. Tighten the screw to 3.4 N·m (30 in. lbs.).

(4) Reconnect the instrument panel wire harness connector to the ACM connector receptacle. Be certain that the connector latch and the red CPA lock are fully engaged.

(5) Do not reconnect the battery negative cable at this time. Refer to **Airbag System** in the Diagnosis and Testing section of this group for the proper procedures.

CLOCKSPRING

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver side airbag has been deployed.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the driver side airbag module from the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

(3) If the vehicle is so equipped, disconnect the upper clockspring wire harness connectors from the vehicle speed control switches and the remote radio switches located within the hub cavity of the steering wheel.

REMOVAL AND INSTALLATION (Continued)

(4) Remove the nut that secures the steering wheel armature to the steering column upper shaft, which is located within the hub cavity of the steering wheel.

(5) Pull the steering wheel off of the steering column upper shaft spline using a steering wheel puller (Special Tool C-3428-B).

(6) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(7) If the vehicle is so equipped, unscrew the lever from the tilt steering column adjuster mechanism located on the left side of the column just below the multi-function switch stalk. Turn the lever counter clockwise to unscrew it from the column.

(8) Remove both the upper and lower shrouds from the steering column (Fig. 14).

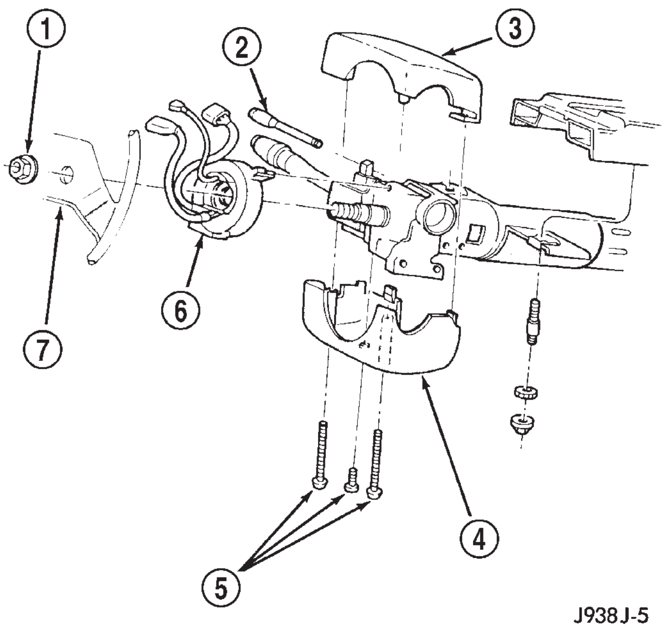


Fig. 14 Steering Column Shrouds Remove/Install - Typical

1 – NUT
2 – TILT LEVER
3 – UPPER SHROUD
4 – LOWER SHROUD
5 – SCREWS
6 – CLOCK SPRING
7 – STEERING WHEEL

(9) Remove the lower fixed column shroud from the steering column.

(10) Remove the two tamper proof mounting screws (a Snap On tamper proof Torx bit TTXR20B2 or equivalent is required) that secure the multi-function switch to the left side of the steering column lock housing.

(11) Gently pull the multi-function switch away from the left side of the steering column lock housing far enough to access the side latch of the clockspring assembly (Fig. 15).

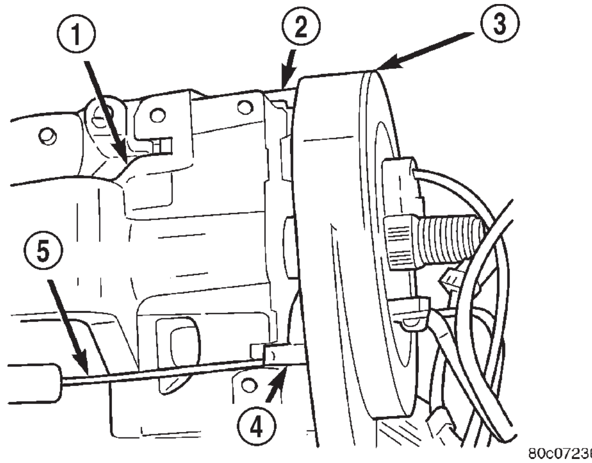


Fig. 15 Clockspring Latches

1 – STEERING COLUMN LOCK HOUSING
2 – TOP LATCH
3 – CLOCKSPRING
4 – SIDE LATCH
5 – SCREWDRIVER

(12) Disconnect the instrument panel wire harness connector from the lower clockspring connector receptacle.

(13) Disconnect the lower clockspring wire harness connector from the instrument panel wire harness, located on the instrument panel lower reinforcement below the steering column.

CAUTION: Failure to disengage the plastic latches of the clockspring from the receptacles in the steering column lock housing prior to clockspring removal will result in damage to the clockspring latches.

(14) Using a small screwdriver, gently pry under the plastic latches at the side and the top of the clockspring assembly to disengage them from the receptacles in the steering column lock housing and remove the clockspring from the column. The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver side airbag has been deployed.

INSTALLATION

If the clockspring is not properly centered in relation to the steering wheel, steering shaft and steering gear, it may be damaged. Refer to **Clockspring Centering** in the Adjustments section of this group before installing or reinstalling a clockspring.

REMOVAL AND INSTALLATION (Continued)

Service replacement clocksprings are shipped pre-centered and with a piece of tape covering the depressed clockspring auto-locking tabs. This tape should not be removed until the clockspring has been installed on the steering column. If the tape is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

(1) Carefully slide the centered clockspring down over the steering column upper shaft until the plastic latches at the side and the top of the clockspring assembly latches engage the receptacles in the steering column lock housing.

(2) Reconnect the lower clockspring wire harness connector to the instrument panel wire harness. Be certain that the wire harness locator clips are properly seated on the outside of the wiring trough and that the connector latches are fully engaged.

(3) Reconnect the instrument panel wire harness connector to the lower clockspring connector receptacle.

(4) Position the multi-function switch onto the left side of the steering column lock housing.

(5) Install and tighten the two screws that secure the multi-function switch to the left side of the steering column lock housing. Tighten the screws to 2 N·m (17 in. lbs.).

(6) Install the steering column shrouds. Be certain that the lower clockspring wire harness is routed inside the shrouds.

(7) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(8) Install the steering wheel onto the steering column upper shaft. Be certain to index the flats on the hub of the steering wheel with the formations on the inside of the clockspring hub. Pull the upper clockspring wire harnesses through the upper and lower holes between the steering wheel back trim cover and the steering wheel armature.

(9) Install and tighten the steering wheel mounting nut. Tighten the nut to 61 N·m (45 ft. lbs.). Be certain not to pinch the wire harnesses between the steering wheel and the nut.

(10) If the vehicle is so equipped, reconnect the upper clockspring wire harness connectors to the vehicle speed control switches and/or the remote radio switches. Be certain that the upper clockspring wire harnesses are routed between the steering wheel back trim cover and the steering wheel armature.

(11) If the vehicle is so equipped, install the tilt steering column lever onto the left side of the steering column by screwing it into place.

(12) Install the driver side airbag module onto the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

ADJUSTMENTS

CLOCKSPRING CENTERING

The clockspring is designed to wind and unwind when the steering wheel is rotated, but is only designed to rotate the same number of turns (about five complete rotations) as the steering wheel can be turned from stop to stop. Centering the clockspring indexes the clockspring tape to other steering components so that it can operate within its designed travel limits. The rotor of a centered clockspring can be rotated two and one-half turns in either direction from the centered position, without damaging the clockspring tape.

However, if the clockspring is removed for service or if the steering column is disconnected from the steering gear, the clockspring tape can change position relative to the other steering components. The clockspring must then be re-centered following completion of the service or the clockspring tape may be damaged.

Service replacement clocksprings are shipped pre-centered and with a piece of tape covering the depressed auto-locking tabs. This tape should not be removed until the clockspring has been installed on the steering column. If the tape is removed before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ADJUSTMENTS (Continued)

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the clockspring from the steering column. Refer to **Clockspring** in the Removal and Installation section of this group for the procedures.

(3) Depress the two plastic clockspring auto-locking tabs (Fig. 16).

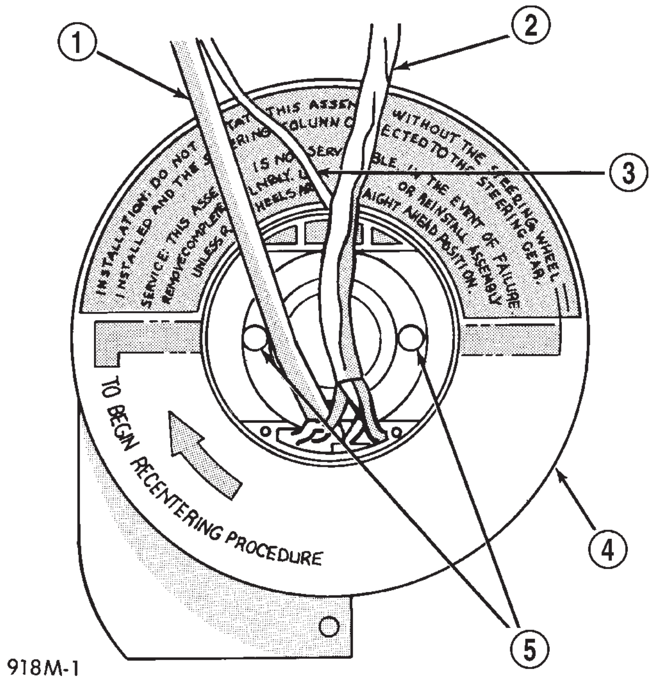


Fig. 16 Clockspring Auto-Locking Tabs

1 – AIRBAG MODULE WIRE
2 – SPEED CONTROL WIRING
3 – HORN WIRE
4 – CLOCKSPRING ASSEMBLY
5 – AUTO-LOCKING TABS

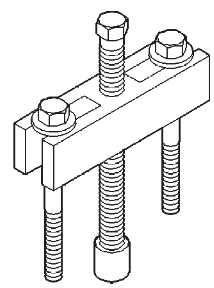
(4) Keeping the auto-locking tabs depressed, rotate the clockspring hub clockwise to the end of its travel. **Do not apply excessive torque.**

(5) From the end of the clockwise travel, rotate the hub about two and one-half turns counterclockwise, then release the auto-locking tabs. The clockspring horn wire harness should end up at the top, and the airbag, optional speed control and optional remote radio wire harnesses at the bottom.

(6) The front wheels should still be in the straight-ahead position. Install the clockspring onto the steering column. Refer to **Clockspring** in the Removal and Installation section of this group for the procedures.

SPECIAL TOOLS

PASSIVE RESTRAINT SYSTEMS



Puller C-3428-B

ELECTRICALLY HEATED SYSTEMS

TABLE OF CONTENTS

	page		page
GENERAL INFORMATION		**DIAGNOSIS AND TESTING**	
INTRODUCTION	1	DEFOGGER SYSTEM	2
REAR WINDOW DEFOGGER SYSTEM	1	REAR GLASS HEATING GRID	3
HEATED MIRROR SYSTEM	1	DEFOGGER SWITCH	3
DESCRIPTION AND OPERATION		**SERVICE PROCEDURES**	
REAR GLASS HEATING GRID	2	REAR GLASS HEATING GRID REPAIR	4
OUTSIDE MIRROR HEATING GRID	2	**REMOVAL AND INSTALLATION**	
DEFOGGER SWITCH	2	DEFOGGER SWITCH	5

GENERAL INFORMATION

INTRODUCTION

An electrically heated rear window defogger is an available factory-installed option on quad cab versions of this model. Electrically heated outside rear view mirrors are an available factory-installed option on quad cab models that are also equipped with the electrically heated rear window defogger. Refer to 8W-48 - Rear Window Defogger and 8W-62 - Power Mirrors in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

REAR WINDOW DEFOGGER SYSTEM

The rear window defogger system is an available option on quad cab versions of this model. The rear window defogger system will only operate when the ignition switch is in the On position. When the defogger switch is in the On position, an electric heater grid on the rear window glass is energized. Vehicles with the heated mirrors option also have heater grids located behind the outside rear view mirror glass. Each of these grids produce heat to help clear the rear window glass and outside rear view mirrors of ice, snow, or fog. The electric heater grid produces heat to help clear the rear window glass of ice, snow, or fog.

The rear window defogger system is controlled by a momentary rear window defogger switch located in the instrument panel lower bezel. An amber indicator lamp in the switch bezel will light to indicate when the defogger system is turned on. The rear window defogger switch also contains the defogger system control circuitry including the timer logic and the defogger relay.

The rear window defogger system will be automatically turned off after a programmed time interval of about ten minutes. After the initial time interval has expired, if the rear window defogger switch is turned on again during the same ignition cycle, the defogger system will be automatically turned off after about five minutes.

The rear window defogger system will automatically shut off if the ignition switch is turned to the Off position, or it can be turned off manually by depressing the rear window defogger switch a second time while the system is turned on. Following are general descriptions of the major components in the rear window defogger system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the rear window defogger system.

HEATED MIRROR SYSTEM

The heated mirror system is available on quad cab models of this vehicle that are also equipped the optional rear window defogger system. The heated mirror system will only operate when the ignition switch is in the On position. When the rear window defogger switch is in the On position, an electric heater grid located behind the glass of each of the outside rear view mirrors is energized. When energized, each of these heater grids produce heat to help clear the outside rear view mirrors of ice, snow, or fog.

The heated mirror system is controlled by a momentary rear window defogger switch located in the instrument panel lower bezel. An amber indicator lamp in the switch bezel will light to indicate when the defogger system is turned on. The rear window defogger switch also contains the rear window defogger system control circuitry including the timer logic and the defogger relay.

The heated mirror system only operates in concert with the rear window defogger system, and will be automatically turned off after a programmed time

GENERAL INFORMATION (Continued)

interval of about ten minutes. After the initial time interval has expired, if the rear window defogger switch is turned on again during the same ignition cycle, the heated mirror system will automatically turn off after about five minutes.

The heated mirror system will automatically shut off if the ignition switch is turned to the Off position, or it can be turned off manually by depressing the rear window defogger switch a second time while the system is turned on. Following are general descriptions of the major components in the heated mirror system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the heated mirror system.

DESCRIPTION AND OPERATION

REAR GLASS HEATING GRID

The heated rear window glass has two electrically conductive vertical bus bars and a series of horizontal grid lines made of a silver-ceramic material, which is baked on and bonded to the inside surface of the glass. The grid lines and bus bars comprise a parallel electrical circuit.

When the rear window defogger switch is placed in the On position, electrical current is directed to the rear window grid lines through the bus bars. The grid lines heat the rear window to clear the surface of fog or snow. Protection for the heating grid circuit is provided by a fuse in the Power Distribution Center (PDC).

The grid lines and bus bars are highly resistant to abrasion. However, it is possible for an open circuit to occur in an individual grid line, resulting in no current flow through the line.

The grid lines can be damaged or scraped off with sharp instruments. Care should be taken when cleaning the glass or removing foreign materials, decals, or stickers from the glass. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

A repair kit is available to repair the grid lines and bus bars, or to reinstall the heated glass terminals.

OUTSIDE MIRROR HEATING GRID

Vehicles equipped with the optional heated mirror system have an electric heating grid located behind the mirror glass of each outside rear view mirror. The heated mirrors are controlled by the rear window defogger switch. Electrical current is directed to the heating grid inside the mirror only when the rear window defogger switch is in the On position.

If the outside mirror heating grids are both inoperative, see Rear Window Defogger System in the Diagnosis and Testing section of this group. If only one of the outside mirror heating grids is inoperative, see Power Mirror System in the Diagnosis and Testing section of Group 8T - Power Mirror Systems for diagnosis of the outside mirror heating grid.

The heating grid behind each outside mirror glass cannot be repaired and, if faulty or damaged, the entire power mirror unit must be replaced. Refer to Power Mirror in the Removal and Installation section of Group 8T - Power Mirror Systems for the service procedures.

DEFOGGER SWITCH

The rear window defogger switch is installed in the instrument panel lower bezel, which is located near the center of the lower instrument panel, below the heater and air conditioner controls. The rear window switch pod also contains the rear window defogger logic and timer circuitry, an amber defogger indicator lamp, the rear window defogger relay and a switch illumination lamp. The indicator and illumination lamps in the switch have incandescent bulbs, which can be serviced.

The momentary-type rear window defogger switch provides a hard wired ground signal to the rear window defogger logic and timer circuitry, each time it is depressed. The rear window defogger timer and logic circuitry responds by energizing or de-energizing the rear window defogger relay and the amber defogger indicator lamp, which lights to indicate when the defogger system is turned On. Energizing the rear window defogger relay provides electrical current to the rear window defogger grid.

The rear window defogger switch cannot be repaired. If any function of the switch except lighting is faulty or damaged, the entire switch unit must be replaced.

DIAGNOSIS AND TESTING

DEFOGGER SYSTEM

For circuit descriptions and diagrams, refer to 8W-48 - Rear Window Defogger in Group 8W - Wiring Diagrams. The operation of the electrically heated rear window defogger system can be confirmed in one of the following manners:

1. Turn the ignition switch to the On position. While monitoring the instrument panel voltmeter, set the defogger switch in the On position. When the defogger switch is turned On, a distinct voltmeter needle deflection should be noted.

2. Turn the ignition switch to the On position. Set the defogger switch in the On position. The rear window defogger operation can be checked by feeling the rear window or outside rear view mirror glass. A distinct difference in temperature between the grid lines

DIAGNOSIS AND TESTING (Continued)

and the adjacent clear glass or the mirror glass can be detected within three to four minutes of operation.

3. Using a 12-volt DC voltmeter, contact the rear glass heating grid terminal A (right side) with the negative lead, and terminal B (left side) with the positive lead (Fig. 1). The voltmeter should read battery voltage.

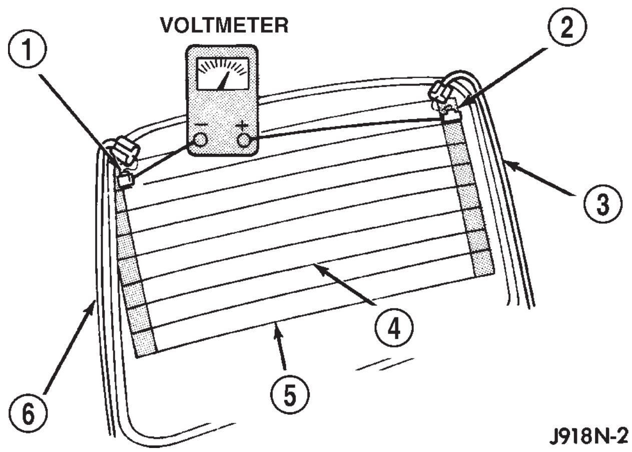


Fig. 1 Rear Window Glass Grid Test - Typical

1 – TERMINAL “A”
2 – TERMINAL “B”
3 – FEED WIRE
4 – MID-POINT “C” (TYPICAL)
5 – HEATED REAR WINDOW DEFOGGER GRID
6 – GROUND WIRE

The above checks will confirm system operation. Illumination of the defogger switch indicator lamp means that there is electrical current available at the output of the rear window defogger logic and timer circuitry, but does not confirm that the electrical current is reaching the rear glass heating grid lines.

If the defogger system does not operate, the problem should be isolated in the following manner:

(1) Confirm that the ignition switch is in the On position.

(2) Ensure that the rear glass heating grid feed and ground wires are connected to the glass. Confirm that the ground wire has continuity to ground.

(3) Check the fuses in the Power Distribution Center (PDC) and in the junction block. The fuses must be tight in their receptacles and all electrical connections must be secure.

When the above steps have been completed and the rear glass heating grid is still inoperative, one or more of the following is faulty:

- Rear window defogger switch
- Rear window grid lines (all grid lines would have to be broken or one of the feed wires disconnected for the entire system to be inoperative).

If setting the defogger switch to the On position produces a severe voltmeter deflection, check for a short circuit between the rear window defogger switch defogger relay output and the rear glass heating grid.

REAR GLASS HEATING GRID

For circuit descriptions and diagrams, refer to 8W-48 - Rear Window Defogger in Group 8W - Wiring Diagrams. To detect breaks in the grid lines, the following procedure is required:

(1) Turn the ignition switch to the On position. Set the defogger switch in the On position. The indicator lamp should light. If OK, go to Step 2. If not OK, see Defogger Switch in the Diagnosis and Testing section of this group.

(2) Using a 12-volt DC voltmeter, contact the vertical bus bar on the right side of the vehicle with the negative lead. With the positive lead, contact the vertical bus bar on the left side of the vehicle. The voltmeter should read battery voltage. If OK, go to Step 3. If not OK, repair the open circuit to the defogger relay as required.

(3) With the negative lead of the voltmeter, contact a good body ground point. The voltage reading should not change. If OK, go to Step 4. If not OK, repair the circuit to ground as required.

(4) Connect the negative lead of the voltmeter to the right side bus bar and touch each grid line at midpoint C with the positive lead. A reading of approximately six volts indicates a line is good. A reading of zero volts indicates a break in the grid line between midpoint C and the left side bus bar. A reading of ten to fourteen volts indicates a break between midpoint C and the right side bus bar. Move the positive lead on the grid line towards the break and the voltage reading will change as soon as the break is crossed.

DEFOGGER SWITCH

For complete circuit diagrams, refer to 8W-48 - Rear Window Defogger in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the lower bezel from the instrument panel and disconnect the instrument panel wire harness connector from the rear window defogger switch connector receptacle.

DIAGNOSIS AND TESTING (Continued)

(2) Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the rear window defogger switch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

(3) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the rear window defogger switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center (PDC) as required.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the instrument panel wire harness connector for the rear window defogger switch. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run) circuit to the fuse in the Junction Block (JB) as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Reconnect the instrument panel wire harness connector to the rear window defogger switch connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. Back probe the rear window defogger relay output circuit cavity of the instrument panel wire harness connector for the rear window defogger switch. Depress and release the rear window defogger switch button. There should be battery voltage. Depress and release the rear window defogger switch button again. There should be zero volts. If OK, go to Step 6. If not OK, replace the faulty rear window defogger switch.

(6) Depress and release the rear window defogger switch button. The rear window defogger indicator lamp should light. If the indicator lamp does not light, replace the bulb with a known good unit and test again. If the lamp is still inoperative, replace the faulty rear window defogger switch.

SERVICE PROCEDURES

REAR GLASS HEATING GRID REPAIR

Repair of the rear glass heating grid lines, bus bars, terminals or pigtail wires can be accomplished using a Mopar Rear Window Defogger Repair Kit (Part Number 4267922) or equivalent.

WARNING: MATERIALS CONTAINED IN THE REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION. THE KIT CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER, WHICH ARE HARMFUL IF SWALLOWED. AVOID CONTACT WITH THE SKIN AND EYES. FOR SKIN CONTACT, WASH THE AFFECTED AREAS WITH SOAP AND WATER. FOR CONTACT WITH THE EYES, FLUSH WITH PLENTY OF WATER. DO NOT TAKE INTERNALLY. IF TAKEN INTERNALLY, INDUCE VOMITING AND CALL A PHYSICIAN IMMEDIATELY. USE WITH ADEQUATE VENTILATION. DO NOT USE NEAR FIRE OR FLAME. CONTAINS FLAMMABLE SOLVENTS. KEEP OUT OF THE REACH OF CHILDREN.

(1) Mask the repair area so that the conductive epoxy can be applied neatly. Extend the epoxy application onto the grid line or the bus bar on each side of the break (Fig. 2).

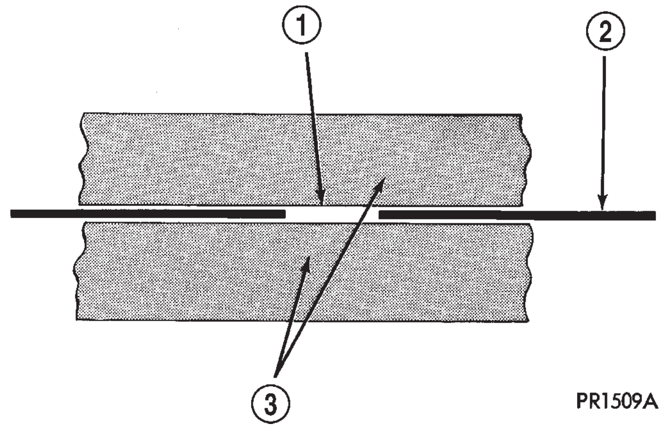


Fig. 2 Grid Line Repair - Typical

1 – BREAK
2 – GRID LINE
3 – MASKING TAPE

(2) Follow the instructions in the repair kit for preparing the damaged area.

(3) Remove the package separator clamp and mix the two conductive epoxy components thoroughly within the packaging. Fold the package in half and cut the center corner to dispense the epoxy.

(4) For grid line repairs, mask the area to be repaired with masking tape or a template.

(5) Apply the epoxy through the slit in the masking tape or template. Overlap both ends of the break by at least 19 millimeters (0.75 inch).

(6) For a terminal or pigtail wire replacement, mask the adjacent areas so the epoxy can be extended onto the adjacent grid line as well as the bus bar. Apply a thin layer of epoxy to the area where the terminal or pigtail wire was fastened and onto the adjacent grid line.

(7) Apply a thin layer of conductive epoxy to the terminal or bare wire end of the pigtail and place it in the proper location on the bus bar. To prevent the terminal or pigtail wire from moving while the epoxy is curing, it must be wedged or clamped.

(8) Carefully remove the masking tape or template.

SERVICE PROCEDURES (Continued)

CAUTION: Do not allow the glass surface to exceed 204° C (400° F) or the glass may fracture.

(9) Allow the epoxy to cure 24 hours at room temperature, or use a heat gun with a 260° to 371° C (500° to 700° F) range for fifteen minutes. Hold the heat gun approximately 25.4 centimeters (10 inches) from the repair.

(10) After the conductive epoxy is properly cured, remove the wedge or clamp from the terminal or pigtail wire. Do not attach the wire harness connectors until the curing process is complete.

(11) Check the operation of the rear window defogger glass heating grid.

REMOVAL AND INSTALLATION

DEFOGGER SWITCH

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel lower bezel from the instrument panel. Refer to **Instrument Panel Lower Bezel** in the index of this service manual for the location of the proper instrument panel lower bezel removal procedures.

(3) Remove the two screws that secure the rear window defogger switch to the back side of the instrument panel lower bezel (Fig. 3).

(4) Remove the rear window defogger switch from the instrument panel lower bezel.

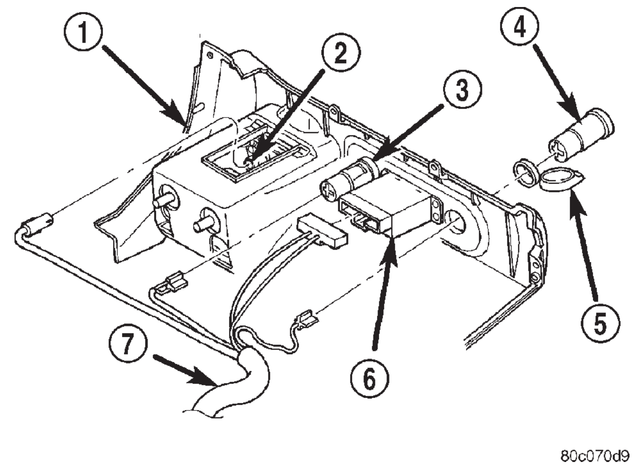


Fig. 3 Rear Window Defogger Switch Remove/Install

1 – INSTRUMENT PANEL LOWER BEZEL
2 – ASH RECEIVER LAMP
3 – CIGAR LIGHTER
4 – POWER OUTLET
5 – CAP
6 – REAR WINDOW DEFOGGER SWITCH
7 – INSTRUMENT PANEL WIRE HARNESS

INSTALLATION

(1) Position the rear window defogger switch onto the instrument panel lower bezel.

(2) Install and tighten the two screws that secure the rear window defogger switch to the back side of the instrument panel lower bezel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install the instrument panel lower bezel onto the instrument panel. Refer to **Instrument Panel Lower Bezel** in the index of this service manual for the location of the proper instrument panel lower bezel installation procedures.

(4) Reconnect the battery negative cable.

POWER DISTRIBUTION SYSTEMS

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
POWER DISTRIBUTION SYSTEM 1
POWER DISTRIBUTION CENTER 1
GENERATOR CARTRIDGE FUSE 2
JUNCTION BLOCK 2
IGNITION-OFF DRAW FUSE 3
RELAY AND FUSE BLOCK 4

page

REMOVAL AND INSTALLATION
POWER DISTRIBUTION CENTER 4
GENERATOR CARTRIDGE FUSE 6
JUNCTION BLOCK 6
IGNITION-OFF DRAW FUSE 7
RELAY AND FUSE BLOCK 8

DESCRIPTION AND OPERATION

POWER DISTRIBUTION SYSTEM

DESCRIPTION

This group covers the various standard and optional power distribution components used on this model. The power distribution system for this vehicle consists of the following components:

- Power Distribution Center (PDC)
- Junction Block (JB)
- Relay and Fuse Block.

The power distribution system also incorporates various types of circuit control and protection features, including:

- Automatic resetting circuit breakers
- Blade-type fuses
- Cartridge fuses
- Circuit splice blocks
- Flashers
- Relays.

Following are general descriptions of the major components in the power distribution system. See the owner's manual in the vehicle glove box for more information on the features and use of all of the power distribution system components. Refer to the index in this service manual for the location of complete circuit diagrams for the various power distribution system components.

OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution points for the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, security, comfort and convenience systems. At the same time, the power distribution system was designed to provide ready access to these electrical distribution points for the vehicle technician to use when conducting diagnosis and repair of faulty circuits. The power distribution system can also prove useful for the sourcing of additional electrical circuits that may be required to provide the electrical current needed to operate many accessories that the vehicle owner may choose to have installed in the aftermarket.

POWER DISTRIBUTION CENTER

DESCRIPTION

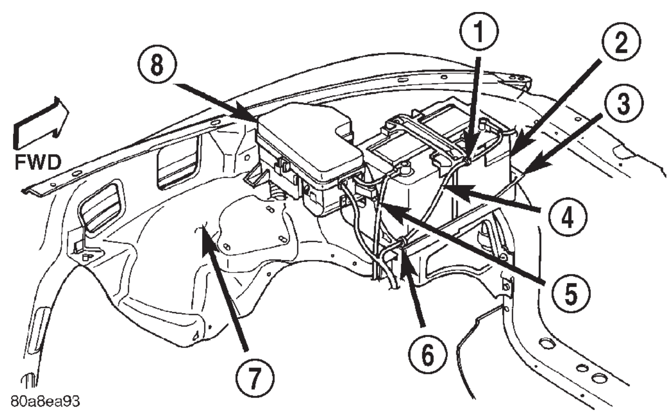


Fig. 1 Power Distribution Center Location

1 – CLIP
2 – BATTERY
3 – TRAY
4 – NEGATIVE CABLE
5 – POSITIVE CABLE
6 – CLIP
7 – FENDER INNER SHIELD
8 – POWER DISTRIBUTION CENTER

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Power Distribution Center (PDC) (Fig. 1). The molded plastic PDC housing is located in the left

DESCRIPTION AND OPERATION (Continued)

front corner of the engine compartment, just behind the battery. The PDC houses the generator cartridge fuse and up to ten maxi-type cartridge fuses, which replace all in-line fusible links. The PDC also houses up to seven blade-type mini fuses, up to thirteen International Standards Organization (ISO) relays (one standard-type and twelve micro-type), two joint connectors (one sixteen-way and one twenty-six-way) and a sixteen-way engine wire harness in-line connector.

The PDC housing is secured in the engine compartment at three points. Integral mounts on the front and inboard sides of the PDC housing engage and latch to stanchions that are integral to the molded plastic battery tray. An integral bracket on the rear of the PDC housing is secured with a screw to the top of the left front inner wheel house. The PDC housing has a molded plastic cover that includes two integral latches, one on each side. The PDC cover is easily opened and removed for service access and has a convenient fuse and relay layout map integral to the inside surface of the cover to ensure proper component identification.

The PDC unit cannot be repaired and is only serviced as a unit with the headlamp and dash wire harness. If the internal circuits or the PDC housing are faulty or damaged, the headlamp and dash wire harness unit must be replaced.

OPERATION

All of the current from the battery and the generator output enters the PDC through two cables with eyelets that are secured with nuts to the two B(+) terminal studs located just inside the inboard side of the PDC housing. The PDC cover is unlatched and removed to access the battery and generator output connection B(+) terminal studs, the fuses, the relays, the joint connectors and the engine wire harness in-line connector. Internal connection of all of the PDC circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to **Power Distribution** in the index of this service manual for the location of complete PDC circuit diagrams.

GENERATOR CARTRIDGE FUSE

DESCRIPTION

A 140 ampere generator cartridge fuse is used on this model. The generator cartridge fuse is similar to other cartridge fuses found in the Power Distribution Center (PDC). This fuse has a color-coded plastic housing and a clear plastic fuse conductor inspection cover like other cartridge fuses, but has a higher current rating and is connected and secured with screws instead of being pushed onto male spade-type terminals. The generator cartridge fuse cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The generator cartridge fuse is secured between the two B(+) terminal stud connection bus bars within the Power Distribution Center (PDC). This fuse protects the vehicle electrical system from damage that could be caused by excessive charging system output and/or excessive electrical system current levels resulting from a faulty generator or faulty charging system control circuits. If the current rating of the fuse is exceeded, the fuse conductor melts to open the generator output circuit connection to the PDC. If a generator cartridge fuse fails, be certain to completely inspect and test the vehicle charging system before replacing the fuse and returning the vehicle to service. Refer to **Charging System** in the index of this service manual for the charging system diagnostic procedures. Refer to **Power Distribution** in the index of this service manual for the location of complete PDC circuit diagrams.

JUNCTION BLOCK

DESCRIPTION

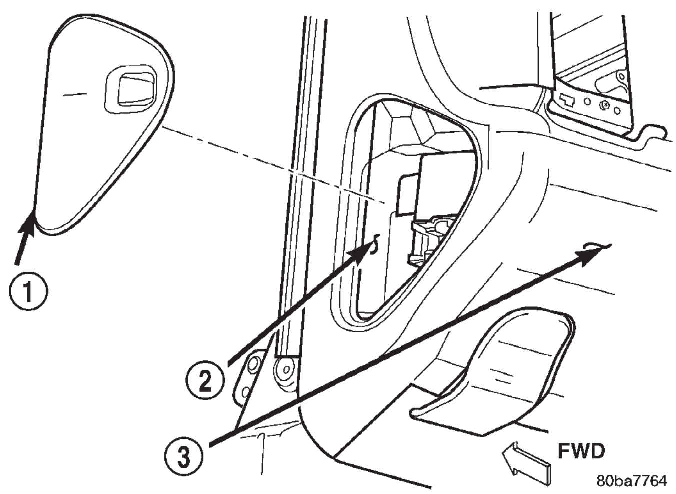


Fig. 2 Junction Block Location

1 – FUSE ACCESS PANEL
2 – JUNCTION BLOCK
3 – INSTRUMENT PANEL

An electrical Junction Block (JB) is concealed behind the left outboard end of the instrument panel cover (Fig. 2). The JB serves to simplify and centralize numerous electrical components, and to distribute electrical current to many of the accessory systems in the vehicle. It also eliminates the need for numerous splice connections and serves in place of a bulkhead connector between many of the engine compartment, instrument panel, and body wire harnesses. The JB

DESCRIPTION AND OPERATION (Continued)

houses up to nineteen blade-type fuses (two standard-type and seventeen mini-type), up to two blade-type automatic resetting circuit breakers, and two International Standards Organization (ISO) relays (one standard-type and one micro-type).

The molded plastic JB housing has integral mounting brackets that are secured with two screws to the left instrument panel end bracket. The left end of the instrument panel cover has a snap-fit fuse access panel that can be removed for service of the JB. A fuse puller and spare fuse holders are located on the back of the fuse access cover, as well as an adhesive-backed fuse layout map to ensure proper fuse identification.

The JB unit cannot be repaired and is only serviced as an assembly. If any internal circuit or the JB housing is faulty or damaged, the entire JB unit must be replaced.

OPERATION

All of the circuits entering and leaving the JB do so through up to nine wire harness connectors, which are connected to the JB through integral connector receptacles molded into the JB housing. Internal connection of all of the JB circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to **Junction Block** in the index of this service manual for the location of complete JB circuit diagrams.

IGNITION-OFF DRAW FUSE

DESCRIPTION

All vehicles are equipped with an Ignition-Off Draw (IOD) fuse (Fig. 3) that is disconnected within the Junction Block (JB) when the vehicle is shipped from the factory. Dealer personnel are to reconnect the IOD fuse in the JB as part of the preparation procedures performed just prior to new vehicle delivery.

The left end of the instrument panel cover has a snap-fit fuse access panel that can be removed to provide service access to the fuses in the JB. A finger recess is molded into the access panel for easy removal. An adhesive-backed fuse layout map is secured to the instrument panel side of the access panel to ensure proper fuse identification. The IOD fuse is a 15 ampere mini blade-type fuse. The fuse is secured within a black molded plastic fuse holder and puller unit that serves both as a tool for disconnecting and reconnecting the fuse in its JB cavity, and as a fuse holder that conveniently stores the fuse in the same JB cavity after it has been disconnected.

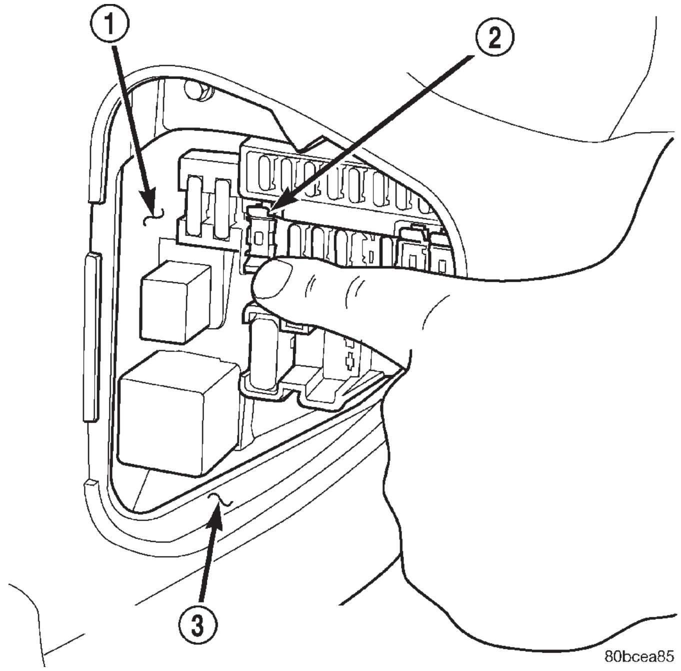


Fig. 3 Ignition-Off Draw Fuse - Typical

1 – JUNCTION BLOCK
2 – IGNITION—OFF DRAW FUSE AND HOLDER
3 – LEFT INSTRUMENT PANEL END BRACKET

OPERATION

The term ignition-off draw identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. The IOD fuse feeds the memory and sleep mode functions for some of the electronic modules in the vehicle as well as various other accessories that require battery current when the ignition switch is in the Off position, including the clock. The only reason the IOD fuse is disconnected is to reduce the normal IOD of the vehicle electrical system during new vehicle transportation and pre-delivery storage to reduce battery depletion, while still allowing vehicle operation so that the vehicle can be loaded, unloaded and moved as needed by both vehicle transportation company and dealer personnel.

The IOD fuse is disconnected from JB fuse cavity 12 when the vehicle is shipped from the assembly plant. Dealer personnel must reconnect the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation. Once the vehicle is prepared for delivery, the IOD function of this fuse becomes transparent and the fuse that has been assigned the IOD designation becomes only another Fused B(+) circuit fuse. The IOD fuse serves no useful purpose to the dealer technician in the service or diagnosis of any vehicle system or condition, other than the same purpose as that of any other standard circuit protection device.

DESCRIPTION AND OPERATION (Continued)

The IOD fuse can be used by the vehicle owner as a convenient means of reducing battery depletion when a vehicle is to be stored for periods not to exceed about thirty days. However, it must be remembered that disconnecting the IOD fuse will not eliminate IOD, but only reduce this normal condition. If a vehicle will be stored for more than about thirty days, the battery negative cable should be disconnected to eliminate normal IOD; and, the battery should be tested and recharged at regular intervals during the vehicle storage period to prevent the battery from becoming discharged or damaged. Refer to **Battery** in the index of this service manual for the location of additional service information covering the battery.

RELAY AND FUSE BLOCK

DESCRIPTION

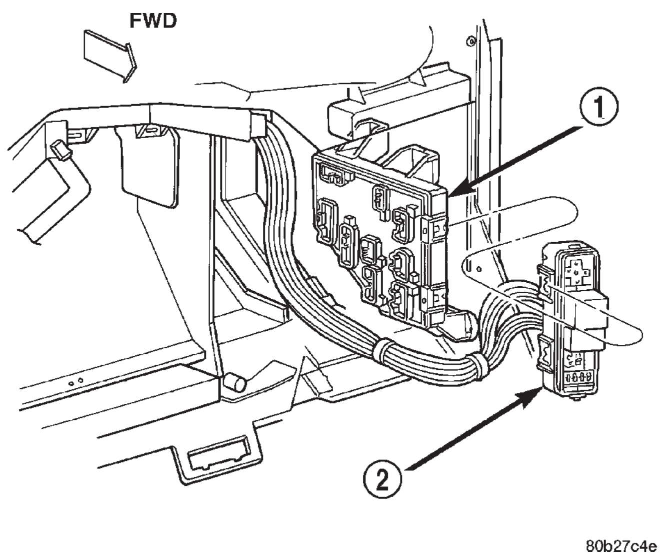


Fig. 4 Relay and Fuse Block Location

1 – JUNCTION BLOCK
2 – RELAY AND FUSE BLOCK

The relay and fuse block is snap fit onto mounting tabs located on the end of the Junction Block (JB) nearest to the dash panel, under the left outboard end of the instrument panel (Fig. 4). The relay and fuse block provides additional capacity for distribution and control of electrical current for some of the accessory systems that are unique to this vehicle, and which could not be accommodated by the JB or the Power Distribution Center (PDC). The relay and fuse block has cavities for up to four additional blade-type mini fuses, the electronic combination flasher, and three additional International Standards Organization relays (one standard-type and two micro-type).

The relay and fuse block components are accessed for service by removing the steering column opening cover from the instrument panel. The relay and fuse block is then disengaged from the JB mounting tabs and pulled out from under the instrument panel. Service replacement of the relay and fuse block unit requires instrument panel assembly removal.

The relay and fuse block unit cannot be repaired and is only serviced as a unit with the instrument panel wire harness assembly. If the relay and fuse block housing or its internal circuits are faulty or damaged, the entire instrument panel wire harness unit must be replaced.

OPERATION

The relay and fuse block is integral to the instrument panel wire harness, and all circuits entering or leaving this module do so through the instrument panel wire harness. Internal connection of all of the relay and fuse block circuits is accomplished by hard wiring. Refer to **Fuse/Fuse Block** in the index of this service manual for the location of complete circuit diagrams and cavity assignments for the relay and fuse block.

REMOVAL AND INSTALLATION

POWER DISTRIBUTION CENTER

The Power Distribution Center (PDC) is serviced as a unit with the headlamp and dash wire harness. If any internal circuit of the PDC or the PDC housing is faulty or damaged, the entire PDC and headlamp and dash wire harness unit must be replaced.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect each of the headlamp and dash wire harness connectors. Refer to **Connector Locations** in the index of this service manual for the location of more information on the headlamp and dash wire harness connector locations.

(3) Remove all of the fasteners that secure each of the headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the ground eyelet locations.

(4) Disengage each of the retainers that secure the headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the headlamp and dash wire harness retainer locations.

(5) Unlatch and remove the cover from the PDC.

REMOVAL AND INSTALLATION (Continued)

(6) Disconnect the engine wire harness in-line connector from the PDC connector receptacle (Fig. 5).

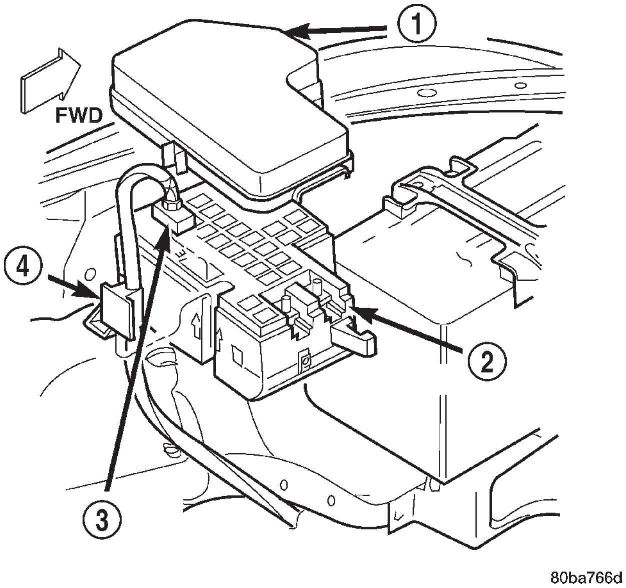


Fig. 5 Engine Wire Harness In-Line Connector

1 – COVER
2 – POWER DISTRIBUTION CENTER
3 – ENGINE WIRE HARNESS IN-LINE CONNECTOR
4 – CLIP

(7) Slide the engine wire harness retainer clip upward and disengage the harness from the trough on the rear of the PDC housing.

(8) Remove the nut that secures the eyelet of the battery negative cable generator output take out to the rearward B(+) terminal stud in the PDC and remove the eyelet from the stud (Fig. 6).

(9) Remove the nut that secures the eyelet of the battery positive cable PDC take out to the forward B(+) terminal stud in the PDC and remove the eyelet from the stud.

(10) Remove the screw that secures the PDC housing to the left front fender wheel housing (Fig. 7).

(11) Disengage the latches for the two PDC mounts and lift the unit off of the battery tray stanchions.

(12) Remove the PDC and the headlamp and dash wire harness from the engine compartment as a unit.

INSTALLATION

NOTE: If the PDC is being replaced with a new unit, be certain to transfer each of the blade-type fuses, cartridge fuses and relays from the faulty PDC to the proper cavities of the replacement PDC. Refer to Power Distribution in the index of this service manual for the location of complete PDC circuit diagrams and cavity assignments.

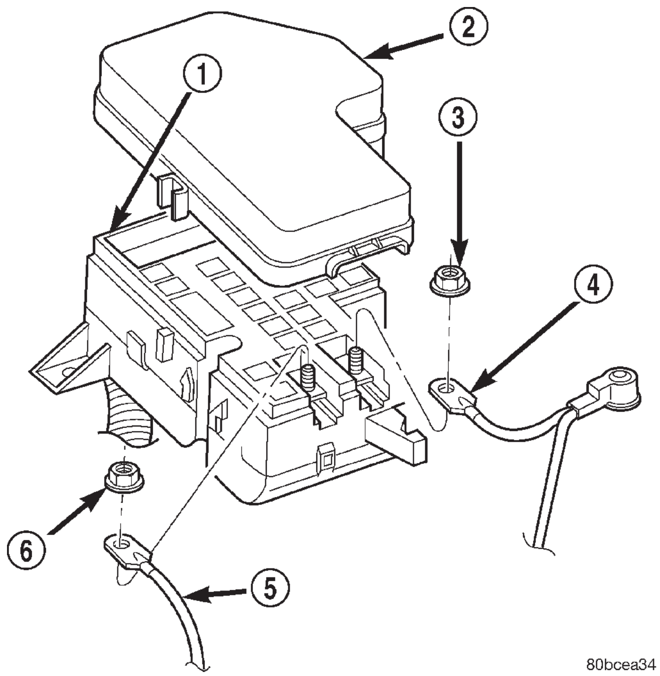


Fig. 6 Battery and Generator Connections to PDC

1 – POWER DISTRIBUTION CENTER
2 – COVER
3 – NUT
4 – BATTERY POSITIVE CABLE PDC TAKE OUT
5 – BATTERY NEGATIVE CABLE GENERATOR OUTPUT TAKE OUT
6 – NUT

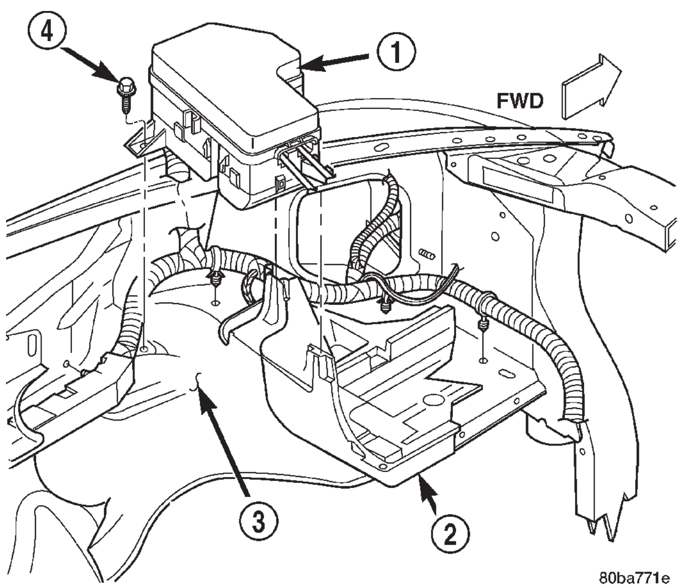


Fig. 7 Power Distribution Center Remove/Install

1 – POWER DISTRIBUTION CENTER
2 – BATTERY TRAY
3 – LEFT FRONT FENDER WHEEL HOUSING
4 – SCREW

REMOVAL AND INSTALLATION (Continued)

(1) Position the PDC and the headlamp and dash wire harness unit in the engine compartment.

(2) Install the two PDC mounts onto the two stanchions of the battery tray.

(3) Install and tighten the screw that secures the PDC housing to the left front fender wheel housing. Tighten the screw to 7.9 N·m (70 in. lbs.).

(4) Install the eyelet of the battery positive cable PDC take out onto the forward B(+) terminal stud in the PDC.

(5) Install and tighten the nut that secures the eyelet of the battery positive cable PDC take out to the forward B(+) terminal stud in the PDC. Tighten the nut to 9 N·m (80 in. lbs.).

(6) Install the eyelet of the battery negative cable generator output take out onto the rearward B(+) terminal stud in the PDC.

(7) Install and tighten the nut that secures the eyelet of the battery negative cable generator output take out to the rearward B(+) terminal stud in the PDC. Tighten the nut to 9 N·m (80 in. lbs.).

(8) Engage the engine wire harness in the trough on the back of the PDC housing and secure it with the retainer clip.

(9) Reconnect the engine wire harness in-line connector to the PDC in-line connector receptacle.

(10) Install and latch the cover onto the PDC.

(11) Engage each of the retainers that secure the headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the headlamp and dash wire harness retainer locations.

(12) Install all of the fasteners that secure each of the headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the ground eyelet locations.

(13) Reconnect each of the headlamp and dash wire harness connectors. Refer to **Connector Locations** in the index of this service manual for the location of more information on the headlamp and dash wire harness connector locations.

(14) Reconnect the battery negative cable.

GENERATOR CARTRIDGE FUSE

If a generator cartridge fuse fails, be certain to inspect and test the vehicle charging system before replacing the cartridge fuse and returning the vehicle to service. Refer to **Charging System** in the index of this service manual for the charging system diagnostic procedures.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unlatch and remove the cover from the Power Distribution Center (PDC).

(3) Remove the two screws that secure the generator cartridge fuse to the two B(+) terminal stud bus bars within the PDC.

(4) Remove the generator cartridge fuse from the PDC.

INSTALLATION

(1) Position the generator cartridge fuse onto the two B(+) terminal stud bus bars within the PDC.

(2) Install and tighten the two screws that secure the generator cartridge fuse to the two B(+) terminal stud bus bars within the PDC. Tighten the screws to 3.4 N·m (30 in. lbs.). **Be certain that both screws are tightened to the proper torque value.**

(3) Install and latch the cover onto the PDC.

(4) Reconnect the battery negative cable.

JUNCTION BLOCK

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse access panel by unsnapping it from the left outboard end of the instrument panel (Fig. 8).

(3) Reach through the instrument panel fuse access panel opening to access and remove the one screw that secures the Junction Block (JB) to the left instrument panel end bracket.

(4) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the index of this service manual for the location of the steering column opening cover removal procedures.

REMOVAL AND INSTALLATION (Continued)

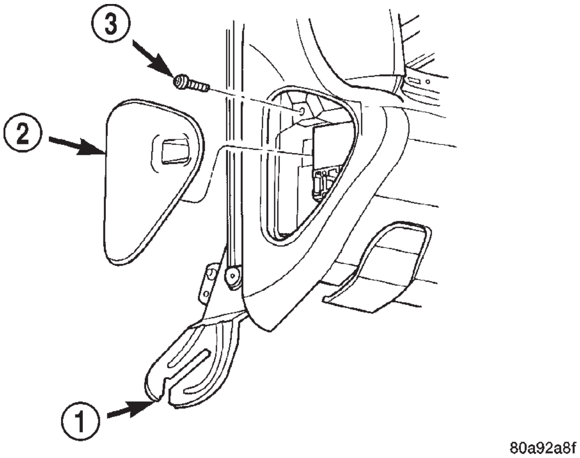


Fig. 8 Fuse Access Panel Remove/Install

1 – INSTRUMENT PANEL
2 – FUSE ACCESS PANEL
3 – SCREW

(5) Reach through the outboard side of the instrument panel steering column opening to access and disconnect all of the wire harness connectors from the JB connector receptacles (Fig. 9).

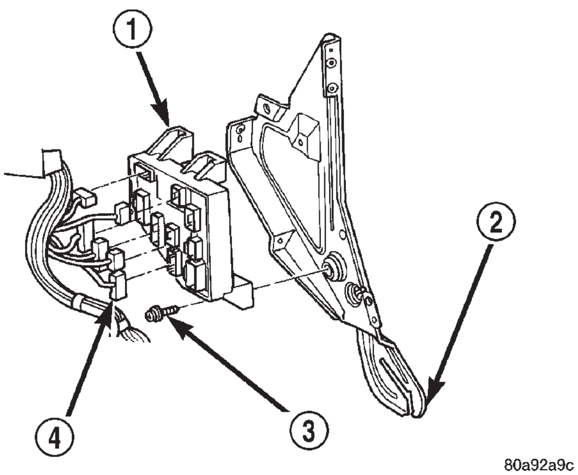


Fig. 9 Junction Block Remove/Install

1 – JUNCTION BLOCK
2 – INSTRUMENT PANEL
3 – SCREW
4 – CONNECTORS

(6) Reach through the outboard side of the instrument panel steering column opening to access and remove the relay and fuse block from the JB. Push the relay and fuse block towards the left end of the instrument panel to disengage its mounting slots from the tabs on the JB.

(7) Reach through the outboard side of the instrument panel steering column opening to access and remove the one screw that secures the JB to the left instrument panel end bracket.

(8) Reach through the outboard side of the instrument panel steering column opening to remove the JB from the left instrument panel end bracket.

INSTALLATION

NOTE: If the Junction Block (JB) is being replaced with a new unit, be certain to transfer each of the fuses, circuit breakers and relays from the faulty JB to the proper cavities of the replacement JB. Refer to Junction Block in the index of this service manual for the location of complete circuit diagrams and cavity assignments for the JB.

(1) Reach through the outboard side of the instrument panel steering column opening to position the JB onto the left instrument panel end bracket.

(2) Reach through the outboard side of the instrument panel steering column opening to install and tighten the one screw that secures the JB to the left instrument panel end bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(3) Reach through the outboard side of the instrument panel steering column opening to access and install the relay and fuse block onto the JB by engaging the relay and fuse block mounting slots with the tabs on the JB.

(4) Reach through the outboard side of the instrument panel steering column opening to access and reconnect all of the wire harness connectors to the JB connector receptacles.

(5) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the index of this service manual for the location of the steering column opening cover installation procedures.

(6) Reach through the instrument panel fuse access panel opening to install and tighten the one screw that secures the junction block to the left instrument panel end bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(7) Install the fuse access panel by snapping it onto the left outboard end of the instrument panel.

(8) Reconnect the battery negative cable.

IGNITION-OFF DRAW FUSE

The Ignition-Off Draw (IOD) fuse is disconnected from Junction Block (JB) fuse cavity 12 (Fig. 10) when the vehicle is shipped from the assembly plant. Dealer personnel must reconnect the IOD fuse when the vehicle is being prepared for delivery in order to restore full electrical system operation.

REMOVAL AND INSTALLATION (Continued)

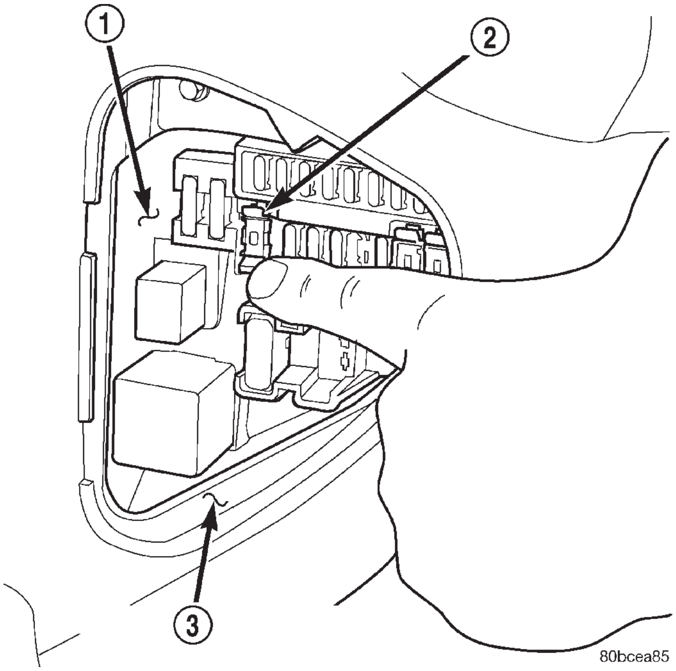


Fig. 10 Ignition-Off Draw Fuse - Typical

1 – JUNCTION BLOCK
2 – IGNITION—OFF DRAW FUSE AND HOLDER
3 – LEFT INSTRUMENT PANEL END BRACKET

NOTE: When removing or installing the IOD fuse, it is important that the ignition switch be in the Off position. Failure to place the ignition switch in the Off position can cause the radio display to become scrambled when the IOD fuse is installed. Removing and installing the IOD fuse again with the ignition switch in the Off position will usually correct the scrambled radio display condition.

REMOVAL

(1) Turn the ignition switch to the Off position.

(2) Remove the fuse access panel by unsnapping it from the left outboard end of the instrument panel.

(3) Grasp the upper and lower tabs of the IOD fuse holder unit in fuse cavity 12 of the JB between the thumb and forefinger and pull the unit firmly outward.

(4) Install the fuse access panel by snapping it onto the left outboard end of the instrument panel.

INSTALLATION

(1) Turn the ignition switch to the Off position.

(2) Remove the fuse access panel by unsnapping it from the left outboard end of the instrument panel.

(3) To install the IOD fuse, use a thumb to press the IOD fuse holder unit in fuse cavity 12 firmly into the JB.

(4) Install the fuse access panel by snapping it onto the left outboard end of the instrument panel.

RELAY AND FUSE BLOCK

The relay and fuse block is serviced as a unit with the instrument panel wire harness. If any internal circuit of the relay and fuse block or the relay and fuse block housing is faulty or damaged, the entire instrument panel wire harness unit must be replaced.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel assembly from the dash panel. Refer to **Instrument Panel Assembly** in the index of this service manual for the instrument panel assembly removal procedures.

(3) Disconnect each of the instrument panel wire harness connectors. Refer to **Connector Locations** in the index of this service manual for the location of more information on the instrument panel wire harness connector locations.

(4) Remove all of the fasteners that secure each of the instrument panel wire harness ground eyelets to the instrument panel components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the ground eyelet locations.

(5) Disengage each of the retainers that secure the instrument panel wire harness to the instrument panel components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the instrument panel wire harness retainer locations.

(6) Push the relay and fuse block towards the left end of the instrument panel to disengage its mounting slots from the tabs on the Junction Block (JB) (Fig. 11).

(7) Remove the relay and fuse block and the instrument panel wire harness from the instrument panel as a unit.

REMOVAL AND INSTALLATION (Continued)

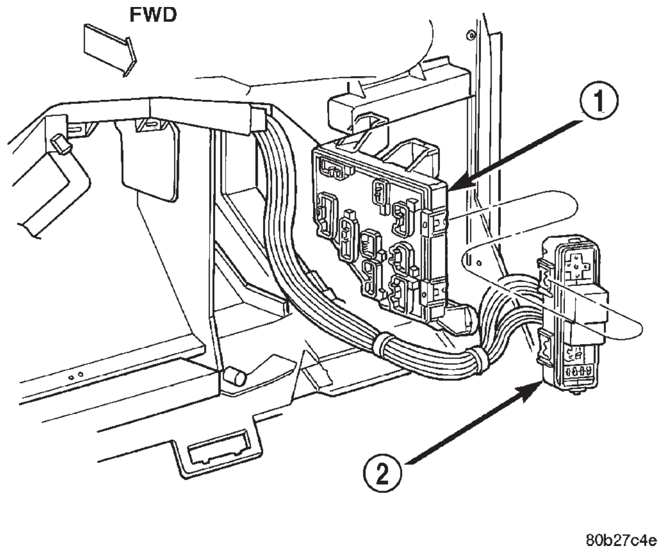


Fig. 11 Relay and Fuse Block Remove/Install

1 – JUNCTION BLOCK
2 – RELAY AND FUSE BLOCK

INSTALLATION

NOTE: If the relay and fuse block is being replaced with a new unit, be certain to transfer each of the fuses, the flasher and the relays from the faulty relay and fuse block to the proper cavities of the replacement relay and fuse block. Refer to Fuse/ Fuse Block in the index of this service manual for the location of complete relay and fuse block circuit diagrams and cavity assignments.

(1) Position the relay and fuse block and the instrument panel wire harness onto the instrument panel.

(2) Install the relay and fuse block by engaging its mounting slots onto the tabs on the Junction Block (JB).

(3) Engage each of the retainers that secure the instrument panel wire harness to the instrument panel components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the instrument panel wire harness retainer locations.

(4) Install all of the fasteners that secure each of the instrument panel wire harness ground eyelets to the instrument panel components. Refer to **Connector Locations** in the index of this service manual for the location of more information on the ground eyelet locations.

(5) Reconnect each of the instrument panel wire harness connectors. Refer to **Connector Locations** in the index of this service manual for the location of more information on the instrument panel wire harness connector locations.

(6) Install the instrument panel assembly onto the dash panel. Refer to **Instrument Panel Assembly** in the index of this service manual for the location of the instrument panel assembly installation procedures.

(7) Reconnect the battery negative cable.

POWER LOCK SYSTEMS

TABLE OF CONTENTS

page page

GENERAL INFORMATION
INTRODUCTION 1
POWER LOCK SYSTEM 1
REMOTE KEYLESS ENTRY SYSTEM 1
DESCRIPTION AND OPERATION
CENTRAL TIMER MODULE 2
POWER LOCK SWITCH 3
POWER LOCK MOTOR. 3
REMOTE KEYLESS ENTRY TRANSMITTER 3
REMOTE KEYLESS ENTRY RECEIVER. 4
DRIVER UNLOCK RELAY 4
HEADLAMP RELAY. 4
HORN RELAY 4
DIAGNOSIS AND TESTING
POWER LOCK SYSTEM AND REMOTE
KEYLESS ENTRY SYSTEM 4
POWER LOCK SWITCH 5
CENTRAL TIMER MODULE 6
POWER LOCK MOTOR. 7
REMOTE KEYLESS ENTRY TRANSMITTER 8
RELAYS. 8
SERVICE PROCEDURES
REMOTE KEYLESS ENTRY TRANSMITTER
BATTERY REPLACEMENT 8
REMOTE KEYLESS ENTRY TRANSMITTER
PROGRAMMING 9
REMOVAL AND INSTALLATION
POWER LOCK SWITCH 9
POWER LOCK MOTOR. 9
DRIVER UNLOCK RELAY 10
HEADLAMP RELAY. 10
HORN RELAY 10

GENERAL INFORMATION

INTRODUCTION

Power door locks are optional factory-installed equipment on this model. The Remote Keyless Entry (RKE) system, illuminated entry system and power windows are included on vehicles equipped with the power door lock option. Refer to 8W-61 - Power Door Locks in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

POWER LOCK SYSTEM

The power lock system allows the doors to be locked or unlocked electrically by operating the switch on either front door trim panel. The power lock system operates on non-switched battery current supplied through a fuse in the junction block so that the system remains functional, regardless of the ignition switch position.

The power lock system includes the power lock switches on each front door trim panel, and the power lock motors inside each door. The power lock control circuitry and the power lock and unlock relays are integral to the high-line version of the Central Timer Module (CTM), which is mounted under the instrument panel.

Following are general descriptions of the major components in the power lock system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the power lock system.

REMOTE KEYLESS ENTRY SYSTEM

The Remote Keyless Entry (RKE) system is a radio frequency system that allows the use of a remote battery-powered radio transmitter to control the power lock system. On vehicles with the RKE option, the power locks can be operated by depressing the Lock or Unlock buttons of the RKE transmitter. If the vehicle is so equipped, the RKE transmitter also arms and disarms the factory-installed vehicle theft alarm. Refer to Group 8Q - Vehicle Theft/Security Systems for more information on the optional vehicle theft alarm.

The RKE system includes an illuminated entry feature, which turns on the courtesy lamps for a timed interval (about thirty seconds), when the power door locks are unlocked using the RKE transmitter. The RKE system for this vehicle also features a programmable horn chirp, a programmable driver door unlock, a programmable rolling door lock, and a panic feature.

The programmable horn chirp feature allows the enabling or disabling of the horn chirp request that the RKE receiver issues as an audible indication that a valid Lock signal has been received from the RKE transmitter. The programmable driver door unlock feature allows one press of the RKE transmitter

GENERAL INFORMATION (Continued)

Unlock button to unlock just the driver door, and a second press within five seconds to unlock all of the doors. If disabled, one press of the RKE transmitter Unlock button will unlock all of the doors. The rolling door lock feature will lock all of the doors above a vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour). These features can be enabled or disabled using a DRBIII® scan tool as described in the proper Diagnostic Procedures manual. These features can also be enabled/disabled using the customer programmable feature. See the owner's manual in the vehicle glove box for more information on the customer programmable feature.

The panic feature allows the vehicle operator to cause the horn to pulse, the headlights to flash and the courtesy lamps to light for about three minutes by depressing the Panic button on the RKE transmitter. A second depression of the Panic button, or a vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour) will turn off the panic event prior to the expiration of the automatic three minute timer.

The RKE system can retain the vehicle access codes of up to four RKE transmitters. The transmitter codes are retained in RKE system memory, even if the battery is disconnected. If a transmitter is faulty or is lost, new transmitter vehicle access codes can be programmed into the system using a DRBIII® scan tool as described in the proper Diagnostic Procedures manual. If one functional transmitter is available, up to three additional transmitters can be programmed using the customer programmable feature. See the owner's manual in the vehicle glove box for more information on the customer programmable feature.

The RKE system consists of a driver unlock relay, a headlamp (or security) relay, a horn relay, a key fob remote radio transmitter and a radio receiver with program logic, which is integral to the high-line version of the Central Timer Module (CTM).

Following are general descriptions of the major components in the RKE system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the RKE system.

DESCRIPTION AND OPERATION

CENTRAL TIMER MODULE

Two versions of the Central Timer Module (CTM) are available on this vehicle, a base version and a high-line version. The base version of the CTM is used on base models of the vehicle. The base version of the CTM combines the functions of a chime/buzzer module, and an intermittent wipe module into a single unit. The base CTM also uses inputs from the door ajar switches, the headlamp switch and the key-in ignition switch to control the output to the dome lamp circuits, which allows the base CTM to provide load shedding to help protect the battery from becoming discharged.

The high-line version of the CTM is used on high-line vehicles. The high-line CTM provides all of the functions of the base version CTM, but also is used to control and integrate many of the additional electronic functions and features included on the high-line models. The high-line version of the CTM contains a central processing unit and interfaces with other modules in the vehicle on the Chrysler Collision Detection (CCD) data bus network.

The CCD data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

The high-line CTM controls features and functions of the power lock, illuminated entry, and Remote Keyless Entry (RKE) systems. The high-line CTM receives hard-wired inputs from the power lock switches, CCD message inputs from the Powertrain Control Module (PCM) and Airbag Control Module (ACM), and coded radio frequency inputs from the RKE transmitters. In response to those and many other inputs, the internal programming of the CTM sends the proper outputs to control the power lock motors, the headlamp and horn relays, and the courtesy lamps.

Some of the features and functions of the power lock, illuminated entry and RKE systems made possible because of the communication of the CTM on the CCD data bus network include:

- A door-lock inhibit feature which prevents the power lock system from being energized with a power door lock switch while the driver door is open if the key is in the ignition and/or the headlamps are on. However, the locks can still be operated manually, with a key, or energized with the RKE transmitter.
- A programmable driver door unlock feature. The driver door unlock feature allows one press of the RKE transmitter Unlock button to unlock just the driver door, and a second press within five seconds to unlock all doors and the liftgate. If disabled, one press of the RKE transmitter Unlock button will unlock all doors and the liftgate.
- A central locking feature. Central locking allows all of the doors on the vehicle to be locked when a key is used in either front door lock cylinder to lock either front door. Similarly, central locking will also unlock all of the doors on the vehicle when the key is rapidly cycled twice to the unlock position in either front door lock cylinder. This feature uses inputs

DESCRIPTION AND OPERATION (Continued)

from the two door lock cylinder switches, which are components of the Vehicle Theft Security System (VTSS). Refer to Group 8Q - Vehicle Theft/Security Systems for more information on the door lock cylinder switches.

- A panic mode feature which can provide additional personal security and protection. When the Panic button on the RKE transmitter is depressed the vehicle horn will pulse, the headlights will flash, and the interior lights will illuminate on the vehicle for about three minutes, or until the Panic button is depressed a second time. A vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour) will also cancel the panic mode.
- An enhanced accident response feature will unlock all of the doors, then prevent the power door locks from locking the doors for a predetermined time interval, after receiving a CCD message from the ACM indicating a frontal impact of the vehicle requiring airbag deployment. This feature will also turn on the courtesy lamps ten seconds after receiving the ACM deployment message, if the CCD vehicle speed message from the PCM indicates that the vehicle is not moving. Of course, these responses are dependent upon functional battery power and wiring circuitry following the impact.
- Rolling door locks is a programmable feature of the power lock system. This feature will automatically lock all of the doors after the vehicle reaches a speed of about 24 kilometers-per-hour (15 miles-per-hour) or greater. This feature will also lock the doors if a door is opened, then closed again, at any speed above 24 kilometers-per-hour (15 miles-per-hour).
- A programmable feature of the RKE system is the enabling or disabling of the horn chirp following activation of the RKE Lock function. This feature can be enabled or disabled and, if enabled, the horn chirp duration (twenty or forty milliseconds) can be selected.

Both versions of the CTM are mounted under the passenger side end of the instrument panel, outboard of the instrument panel glove box opening. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

The programmable features of the CTM can be enabled or disabled using the DRBIII® scan tool as described in the proper Diagnostic Procedures manual. Refer to Central Timer Module in the Diagnosis and Testing section of Group 8U for diagnosis of the base version of the CTM. For diagnosis of the high-line version of the CTM or of the CCD data bus, a DRBIII® scan tool and the proper Diagnostic Procedures manual are recommended. The CTM cannot be repaired and, if faulty or damaged, it must be replaced.

POWER LOCK SWITCH

On conventional cab and club cab models, the power locks can be controlled by a two-way switch integral to the power window and lock switch and bezel unit on the trim panel of each front door. On quad cab models, the power locks can be controlled by a two-way switch integral to the power window and lock switch and bezel unit on the driver side front door trim panel, or a two-way single gang switch on the passenger side front door trim panel.

The power lock switches control the battery feeds to the lock and unlock sense inputs of the high-line Central Timer Module (CTM). The CTM then relays the correct battery and ground feeds to the power lock motors. A Light-Emitting Diode (LED) in the paddle of each switch is illuminated whenever the ignition switch is in the On position.

On all models, the driver side power window and lock switch and bezel unit cannot be repaired and, if faulty or damaged, the entire switch unit must be replaced. On conventional cab and club cab models, the passenger side power window and lock switch and bezel unit cannot be repaired and, if faulty or damaged, the entire switch and bezel unit must be replaced. On quad cab models, the passenger side power lock switch cannot be repaired and, if faulty or damaged, the single gang switch unit must be replaced.

POWER LOCK MOTOR

In the power lock and Remote Keyless Entry (RKE) systems, the door latch lock mechanisms can be actuated by a reversible electric motor. The power lock motor is integral to the door latch mounted within each door. The power lock motor direction is controlled by the battery and ground feeds from the power lock and unlock relays, which are integral to the high-line Central Timer Module (CTM).

The power lock motor cannot be repaired and, if faulty or damaged, the entire door latch unit must be replaced.

REMOTE KEYLESS ENTRY TRANSMITTER

The Remote Keyless Entry (RKE) system transmitter is equipped with three buttons, labeled Lock, Unlock, and Panic. It is also equipped with a key ring and is designed to serve as a key fob. The operating range of the transmitter radio signal is up to 7 meters (23 feet) from the RKE receiver.

Each transmitter has a different vehicle access code, which must be programmed into the memory of the RKE receiver in the vehicle in order to operate the RKE system. See Remote Keyless Entry Transmitter Programming in the Service Procedures section this group for more information.

DESCRIPTION AND OPERATION (Continued)

The transmitter operates on two Duracell DL2016, Panasonic CR2016 (or equivalent) batteries. Typical battery life is from one to two years. The RKE transmitter cannot be repaired and, if faulty or damaged, it must be replaced.

REMOTE KEYLESS ENTRY RECEIVER

The Remote Keyless Entry (RKE) receiver is a radio frequency unit that is integral to the high-line version of the Central Timer Module (CTM). The CTM also contains the program logic and control circuitry for the RKE system. The CTM is mounted under the passenger side end of the instrument panel, outboard of the instrument panel glove box opening.

The RKE receiver has a memory function to retain the vehicle access codes of up to four RKE transmitters. The receiver is designed to retain the transmitter codes in memory, even if the battery is disconnected.

The RKE receiver is energized by one of three radio frequency inputs from the RKE transmitter; Unlock, Lock, or Panic. The programming of the CTM responds to these RKE inputs, as well as many other inputs, by sending the proper control outputs to the power lock motors, the courtesy lamp circuit, the driver unlock relay, the horn relay, and the headlamp relay.

For diagnosis or programming of the RKE receiver within the high-line CTM, a DRB scan tool and the proper Diagnostic Procedures manual are recommended. The RKE receiver is only serviced as a unit with the high-line CTM and, if faulty or damaged, the CTM unit must be replaced.

DRIVER UNLOCK RELAY

The driver unlock relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The driver unlock relay is a electromechanical device that switches battery current to the left front door power lock motor when the Remote Keyless Entry (RKE) receiver within the high-line Central Timer Module (CTM) grounds the relay coil. See Driver Unlock Relay in the Diagnosis and Testing section of this group for more information.

The driver unlock relay is located in the relay and fuse block attached to the back of the junction block, under the left side of the instrument panel in the passenger compartment. The driver unlock relay cannot be repaired and, if faulty or damaged, it must be replaced.

HEADLAMP RELAY

The headlamp (or security) relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The headlamp relay is a electromechanical device that switches battery current to the headlamps when the high-line Central Timer Module (CTM) grounds the relay coil. See Headlamp Relay in the Diagnosis and Testing section of this group for more information.

The headlamp relay is located in the Power Distribution Center (PDC), behind the battery on the left side of the engine compartment.

The headlamp relay cannot be repaired and, if faulty or damaged, it must be replaced.

HORN RELAY

The horn relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch or the high-line Central Timer Module (CTM) grounds the relay coil. Refer to **Relays** in the Diagnosis and Testing section of this group for more information.

The horn relay is located in the Junction Block (JB), on the left end of the instrument panel in the passenger compartment. See the fuse and relay layout label on the inside of the fuse access panel for relay identification and location.

If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the JB until further diagnosis is completed.

The horn relay cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

POWER LOCK SYSTEM AND REMOTE KEYLESS ENTRY SYSTEM

As a preliminary diagnosis for vehicles with the power lock and Remote Keyless Entry (RKE) systems (high-line version of the Central Timer Module), note the system operation while you actuate both the Lock

DIAGNOSIS AND TESTING (Continued)

and Unlock functions with the power lock switches and the RKE transmitter. Then, proceed as follows:

- If the driver side front door power lock motor fails to unlock following a single press of the RKE transmitter Unlock button, test the driver unlock relay. See Relays in the Diagnosis and Testing section of this group for the procedures.
- If the entire power lock system fails to function with either the power lock switches or the RKE transmitter, check the fuses in the junction block.
- If the power lock system functions with both power lock switches, but not with the RKE transmitter, see Remote Keyless Entry Transmitter in the Diagnosis and Testing section of this group.
- If the entire power lock system functions with the RKE transmitter, but not with one or both of the power lock switches, see Power Lock Switch in the Diagnosis and Testing section of this group.
- If one power lock motor fails to operate with both of the power lock switches and/or the RKE transmitter, see Power Lock Motor in the Diagnosis and Testing section of this group.

If the problem being diagnosed involves only the RKE horn chirp or panic mode features, test the horn relay and/or headlamp relay. See Relays in the Diagnosis and Testing section of this group for the procedures. If both of these relays check OK, further diagnosis should be performed using a DRB scan tool as described in the proper Diagnostic Procedures manual.

POWER LOCK SWITCH

CONVENTIONAL CAB AND CLUB CAB

The Light-Emitting Diode (LED) illumination lamps for all of the power window and lock switch and bezel unit switch paddles receive battery current through a fuse in the Junction Block (JB). If all of the LEDs are inoperative in either or both power window and lock switch and bezel units, refer to Group 8S - Power Window Systems for diagnosis. If only one LED in a power window and lock switch and bezel unit is inoperative, replace the faulty switch and bezel unit. For circuit descriptions and diagrams, refer to 8W-61 - Power Door Locks in Group 8W - Wiring Diagrams.

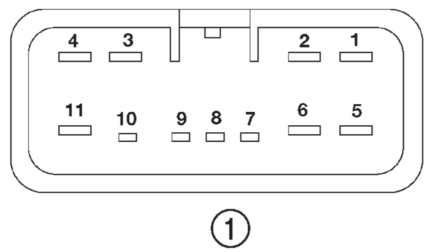
(1) Check the fuse in the JB. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fuse in the JB. If OK, go to Step 3. If not OK, repair the open circuit to the Power Distribution Center (PDC) as required.

(3) Disconnect and isolate the battery negative cable. Remove the power window and lock switch and bezel unit from the door trim panel. Unplug the wire harness connector from the switch and bezel unit.

(4) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the body half of the power window and lock switch and bezel unit wire harness connector. If OK, go to Step 5. If not OK, repair the open circuit to the JB as required.

(5) Test the power lock switch continuity. See the Power Lock Switch Continuity charts to determine if the continuity is correct in the Neutral, Lock and Unlock switch positions (Fig. 1) or (Fig. 2). If OK, repair the door lock switch output (lock and/or unlock) circuit(s) from the body half of the power window and lock switch and bezel unit wire harness connector to the power lock motors or the Central Timer Module (CTM) as required. If not OK, replace the faulty switch.



DRIVER SIDE LOCK SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
NEUTRAL	7 & 9, 8 & 9
LOCK	7 & 9, 8 & 10
UNLOCK	7 & 10, 8 & 9
LAMP	3 & 5

80b099e7

Fig. 1 Power Lock Switch Continuity - Driver Side - Conventional Cab and Club Cab

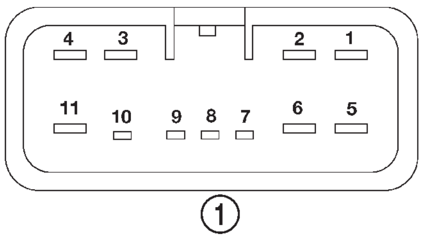
1 – VIEW OF SWITCH SIDE CONNECTOR

QUAD CAB

The Light-Emitting Diode (LED) illumination lamps for all of the power lock switch paddles receive battery current through a fuse in the Junction Block (JB). If the problem being diagnosed involves only the power lock switch illumination LEDs, check the fused ignition switch output (run) and ground circuits at the power lock switch connector. For circuit descriptions and diagrams, refer to 8W-61 - Power Door Locks in Group 8W - Wiring Diagrams.

(1) Check the fuse in the JB. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

DIAGNOSIS AND TESTING (Continued)



PASSENGER SIDE LOCK SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
NEUTRAL	6 & 7, 9 & 10
LOCK	5 & 7, 9 & 10
UNLOCK	5 & 9, 6 & 7
LAMP	8 & 11

80b099e8

Fig. 2 Power Lock Switch Continuity - Passenger Side - Conventional Cab and Club Cab

1 – VIEW OF SWITCH SIDE CONNECTOR

(2) Check for battery voltage at the fuse in the JB. If OK, go to Step 3. If not OK, repair the open circuit to the Power Distribution Center (PDC) as required.

(3) Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the power lock switch.

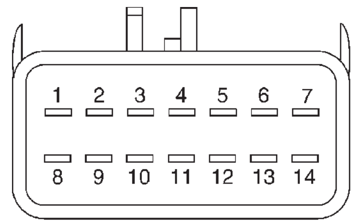
(4) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the body half of the power lock switch wire harness connector. If OK, go to Step 5. If not OK, repair the open circuit to the JB as required.

(5) Test the power lock switch continuity. See the Power Lock Switch Continuity charts to determine if the continuity is correct in the Off, Lock and Unlock switch positions (Fig. 3) or (Fig. 4). If OK, repair the door lock switch output (lock and/or unlock) circuit(s) from the body half of the power lock switch wire harness connector to the Central Timer Module (CTM) as required. If not OK, replace the faulty switch.

CENTRAL TIMER MODULE

NOTE: The following tests may not prove conclusive in the diagnosis of the high-line version of the Central Timer Module (CTM). The most reliable, efficient, and accurate means to diagnose the high-line CTM requires the use of a DRBIII® scan tool and the proper Diagnostic Procedures manual.

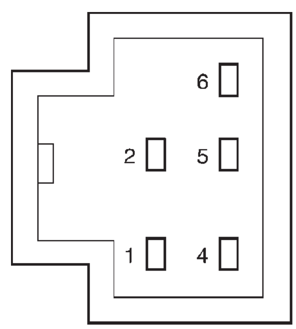
If the problem being diagnosed involves only the RKE horn chirp feature, see Relays in the Diagnosis



DRIVER SIDE LOCK SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	4 & 5 (LED)
LOCK	1 & 9
UNLOCK	9 & 10
LAMP (LED)	4 & 5

80b2a1ff

Fig. 3 Power Lock Switch Continuity - Driver Side - Quad Cab



PASSENGER SIDE LOCK SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	4 & 5 (LED)
LOCK	1 & 2
UNLOCK	2 & 6
LAMP (LED)	4 & 5

80c07179

Fig. 4 Power Lock Switch Continuity - Passenger Side - Quad Cab

and Testing section of this group to test the horn relay before testing the CTM. If the relay checks OK;

DIAGNOSIS AND TESTING (Continued)

or if the problem being diagnosed involves the rolling door locks, door lock inhibit, central locking or enhanced accident response features, further diagnosis of the CTM should be performed using a DRBIII® scan tool as described in the proper Diagnostic Procedures manual. If the problem being diagnosed involves only the RKE driver unlock feature, be certain that the feature is enabled using a DRBIII® scan tool and the proper Diagnostic Procedures manual. Also, if the problem being diagnosed involves only the driver side front door, see Relays in the Diagnosis and Testing section of this group to test the driver unlock relay before testing the CTM. For circuit descriptions and diagrams, refer to 8W-61 - Power Door Locks in Group 8W - Wiring Diagrams.

(1) Check the fuses in the Junction Block (JB). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fuse in the junction block. If OK, go to Step 3. If not OK, repair the open circuit to the Power Distribution Center (PDC) as required.

(3) Disconnect and isolate the battery negative cable. Remove the Central Timer Module (CTM) from its mounting bracket to access the CTM wire harness connectors. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(4) Unplug the wire harness connectors from the CTM. Check the wire harness connectors and the receptacles in the CTM for loose, corroded, or damaged terminals and pins. If OK, go to Step 5. If not OK, repair as required.

(5) Probe the ground circuit cavity of the 14-way CTM wire harness connector and check for continuity to a good ground. Repeat the check between the ground circuit cavity of the 18-way CTM wire harness connector and a good ground. In each case, there should be continuity. If OK, go to Step 6. If not OK, repair the open circuit(s) to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 14-way CTM wire harness connector. If OK, go to Step 7. If not OK, repair the open circuit to the JB as required.

(7) Probe the door lock switch output (lock) circuit cavity of the 18-way CTM wire harness connector and check for battery voltage as you actuate each power lock switch to the Lock position. If OK, go to Step 8. If not OK, repair the open circuit from either or both power lock switch(es) to the CTM as required.

(8) Probe the door lock switch output (unlock) circuit cavity of the 18-way CTM wire harness connector and check for battery voltage as you actuate each power lock switch to the Unlock position. If OK, go to Step 9. If not OK, repair the open circuit from either or both power lock switch(es) to the CTM as required.

(9) Disconnect and isolate the battery negative cable. Reinstall the wire harness connectors to the CTM. Connect the battery negative cable. Back-probe the door lock driver circuit cavity of the 18-way CTM wire harness connector and check for battery voltage as either power lock switch is moved to the Lock position. Repeat the test pressing the Lock button of the Remote Keyless Entry (RKE) transmitter. If OK, go to Step 10. If not OK using the power lock switch, but OK with the RKE transmitter, see Power Lock Switch in the Diagnosis and Testing section of this group. If not OK using the RKE transmitter, but OK with the power lock switch, see Remote Keyless Entry Transmitter in the Diagnosis and Testing section of this group. If not OK, with the power lock switch or the RKE transmitter, replace the faulty CTM.

(10) Back-probe the door unlock driver circuit cavity of the 18-way CTM wire harness connector and check for battery voltage as the power lock switch is moved to the Unlock position. Repeat the test pressing the Unlock button of the RKE transmitter twice within five seconds. If OK, see Power Lock Motor in the Diagnosis and Testing section of this group. If not OK using the power lock switch, but OK with the RKE transmitter, see Power Lock Switch in the Diagnosis and Testing section of this group. If not OK using the RKE transmitter, but OK with the power lock switch, see Remote Keyless Entry Transmitter in the Diagnosis and Testing section of this group. If not OK, with the power lock switch or the RKE transmitter, replace the faulty CTM.

POWER LOCK MOTOR

Before you proceed with this diagnosis, confirm proper power lock switch, Central Timer Module (CTM) and power lock switch output circuit operation. See Power Lock Switch and Central Timer Module in the Diagnosis and Testing section of this group. Remember, the CTM circuitry controls the output to each of the power lock motors. For circuit descriptions and diagrams, refer to 8W-61 - Power Door Locks in Group 8W - Wiring Diagrams.

(1) Check each power lock motor for correct operation while moving the power lock switch to both the Lock and Unlock positions. If both of the power lock motors are inoperative, go to Step 2. If one power lock motor is inoperative, go to Step 3.

(2) If both of the power lock motors are inoperative, the problem may be caused by one shorted motor. Unplugging a shorted power lock motor from the power lock circuit will allow the good power lock motor to operate. Unplug each power lock motor wire

DIAGNOSIS AND TESTING (Continued)

harness connector, one at a time, and recheck both the lock and unlock functions by operating the power lock switch. If both of the power lock motors are still inoperative after the above test, check for a short or open circuit between the power lock motors and the CTM. If unplugging one power lock motor causes the other motor to become functional, go to Step 3 to test the unplugged motor.

(3) Once it is determined which power lock motor is inoperative, that motor can be tested as follows. Unplug the wire harness connector at the inoperative power lock motor. Apply 12 volts to the motor terminals to check its operation in one direction. Reverse the polarity to check the operation in the other direction. If OK, repair the short or open circuits between the power lock motor and the CTM as required. If not OK, replace the faulty power lock motor.

REMOTE KEYLESS ENTRY TRANSMITTER

(1) Replace the Remote Keyless Entry (RKE) transmitter batteries. See Remote Keyless Entry Transmitter Battery Replacement in the Service Procedures section of this group. Test each of the transmitter functions. If OK, discard the faulty batteries. If not OK, go to Step 2.

(2) Program the suspect RKE transmitter and another known good transmitter into the RKE module. Use a DRB scan tool, as described in the proper Diagnostic Procedures manual. See Remote Keyless Entry Transmitter Programming in the Service Procedures section of this group.

(3) Test the RKE system operation with both transmitters. If both transmitters fail to operate the power lock system, use a DRB scan tool and the proper Diagnostic Procedures manual for further diagnosis of the RKE system. If the known good transmitter operates the power locks and the suspect transmitter does not, replace the faulty transmitter.

NOTE: Be certain to perform the Remote Keyless Entry Transmitter Programming procedure again following this test. This procedure will erase the access code of the test transmitter from the RKE receiver.

RELAYS

The headlamp (or security) relay is located in the Power Distribution Center (PDC) in the engine compartment. The horn relay is located in the Junction Block (JB), on the left end of the instrument panel in the passenger compartment. The driver unlock relay is located in the relay and fuse block on the back of the JB underneath the left end of the instrument panel in the passenger compartment. Each of these relays can be tested as described in the following procedure, however the circuits they are used in do vary. To test the relay circuits, refer to the circuit descriptions and diagrams in 8W-39 - Vehicle Theft Security System and 8W-61 - Power Locks in Group 8W - Wiring Diagrams.

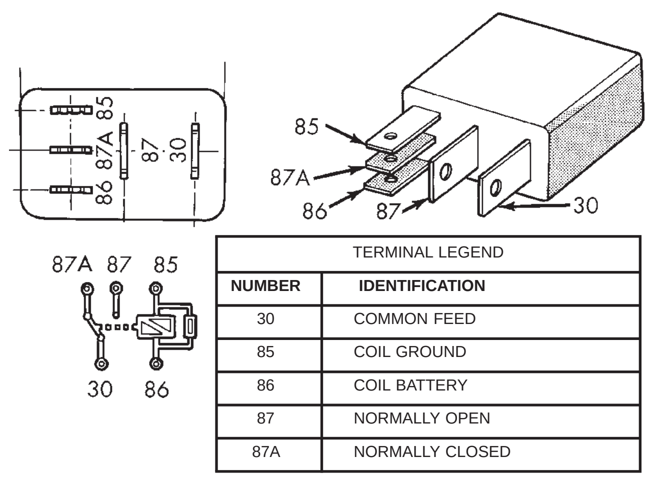
WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

Remove the relay (Fig. 5) from the PDC, JB or the relay and fuse block as described in this group to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, test the relay circuits. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 5 Relay Terminals

SERVICE PROCEDURES

REMOTE KEYLESS ENTRY TRANSMITTER BATTERY REPLACEMENT

The Remote Keyless Entry (RKE) transmitter case snaps open and shut for battery access. To replace the RKE transmitter batteries:

(1) Using a trim stick or another suitable wide flat-bladed tool, gently pry at the center seam of the

SERVICE PROCEDURES (Continued)

transmitter case halves near the key ring until the two halves unsnap.

(2) Lift the back half of the transmitter case off of the transmitter.

(3) Remove the two batteries from the transmitter.

(4) Replace the two batteries with new Duracell DL2016, or their equivalent. Be certain that the batteries are installed with their polarity correctly oriented.

(5) Align the two transmitter case halves with each other, and squeeze them firmly together until they snap back into place.

REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING

To program the Remote Keyless Entry (RKE) transmitter access codes into the RKE receiver in the Central Timer Module (CTM) requires the use of a DRB scan tool. Refer to the proper Diagnostic Procedures manual for more information.

REMOVAL AND INSTALLATION

POWER LOCK SWITCH

CONVENTIONAL CAB AND CLUB CAB

(1) Disconnect and isolate the battery negative cable.

(2) Using a wide flat-bladed tool such as a trim stick, gently pry the upper edge of the switch bezel at the front and the rear to release the clips that secure the switch bezel to the door trim panel opening (Fig. 6).

(3) Pull the switch and bezel unit away from the door trim panel opening far enough to access and unplug the wire harness connector.

(4) Remove the power window and lock switch and bezel unit from the door trim panel.

(5) Reverse the removal procedures to install. When installing the switch and bezel unit to the door trim panel opening, insert the rear of the bezel into the opening, then push down on the front of the bezel until the retaining clips snap into place.

QUAD CAB

DRIVER SIDE FRONT DOOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the inside of the driver side front door. Refer to Group 23 - Body for the procedures.

(3) From the back side of the trim panel, remove the screws that secure the power window and lock switch unit to the switch bezel in the door trim panel opening.

(4) Remove the power window and lock switch and the switch bezel from the door trim panel.

(5) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

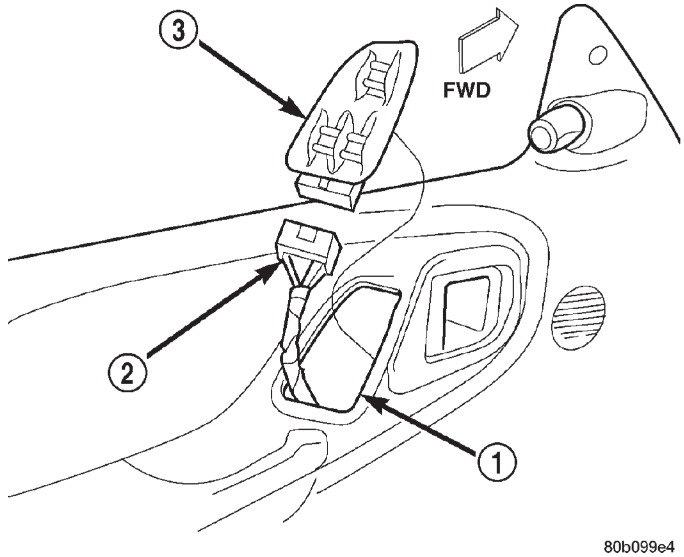


Fig. 6 Power Window and Lock Switch and Bezel Unit Remove/Install - Conventional Cab and Club Cab

1 – TRIM PANEL SWITCH BEZEL OPENING
2 – WIRE HARNESS CONNECTOR
3 – SWITCH AND BEZEL UNIT

PASSENGER SIDE FRONT DOOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the inside of the passenger side front door. Refer to Group 23 - Body for the procedures.

(3) With a small thin-bladed screwdriver, gently pry the snap clips at the sides of the power lock switch receptacle on the back of the door trim panel switch bezel and pull the switch out of the receptacle.

(4) Reverse the removal procedures to install. Be certain that both of the switch snap retainers in the receptacle on the back of the door trim panel switch bezel are fully engaged.

POWER LOCK MOTOR

The power lock motor is integral to the door latch unit. If the power lock motor is faulty or damaged, the entire door latch unit must be replaced. Refer to Group 23 - Body for the door latch service procedures.

REMOVAL AND INSTALLATION (Continued)

DRIVER UNLOCK RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover and knee blocker from the instrument panel. Refer to Steering Column Opening Cover and Knee Blocker in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Reach through the outboard side of the steering column opening in the instrument panel to access the relay and fuse block on the back of the junction block (Fig. 7).

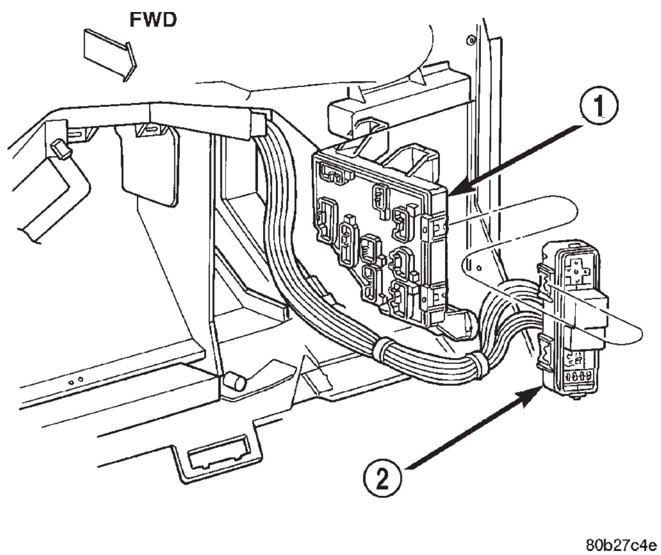


Fig. 7 Relay and Fuse Block

1 – JUNCTION BLOCK
2 – RELAY AND FUSE BLOCK

(4) Unplug the driver unlock relay from the relay and fuse block.

(5) Install the driver unlock relay by aligning the relay terminals with the cavities in the relay and fuse block and pushing the relay firmly into place.

(6) Connect the battery negative cable.

(7) Test the relay operation.

(8) Reverse the remaining removal procedures to complete the installation.

HEADLAMP RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 8).

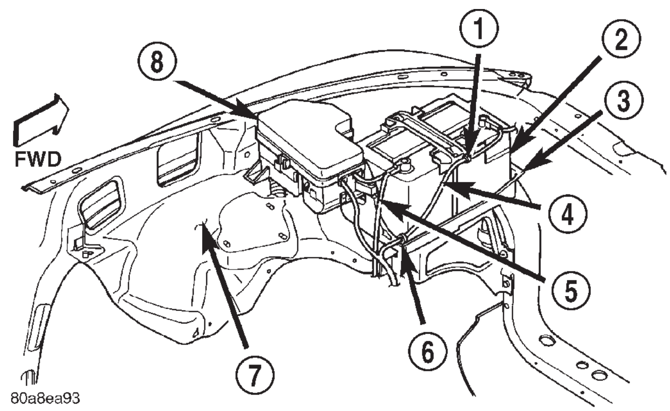


Fig. 8 Power Distribution Center

1 – CLIP
2 – BATTERY
3 – TRAY
4 – NEGATIVE CABLE
5 – POSITIVE CABLE
6 – CLIP
7 – FENDER INNER SHIELD
8 – POWER DISTRIBUTION CENTER

(3) Refer to the label on the PDC for headlamp relay identification and location.

(4) Unplug the headlamp relay from the PDC.

(5) Install the headlamp relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.

(7) Connect the battery negative cable.

(8) Test the relay operation.

HORN RELAY

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse access panel from the left end of the instrument panel (Fig. 9).

REMOVAL AND INSTALLATION (Continued)

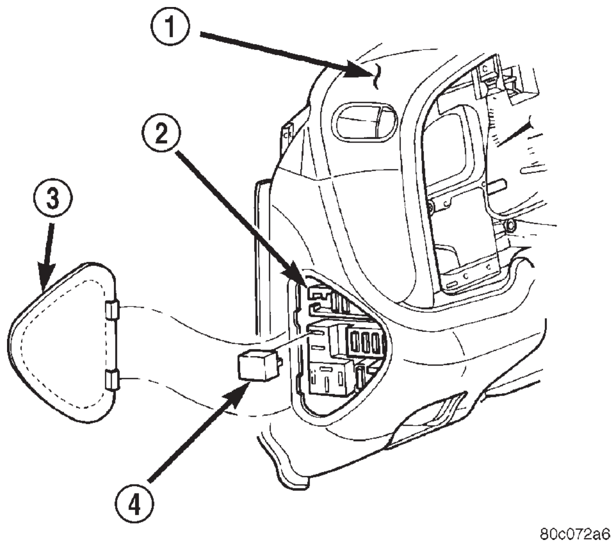


Fig. 9 Horn Relay Remove/Install

1 – INSTRUMENT PANEL
2 – JUNCTION BLOCK
3 – FUSE ACCESS PANEL
4 – HORN RELAY

(3) Refer to the label on the inside of the fuse access panel for horn relay identification and location.

(4) Unplug the horn relay from the Junction Block (JB).

(5) Install the horn relay by aligning the relay terminals with the cavities in the JB and pushing the relay firmly into place.

(6) Install the fuse access panel.

(7) Connect the battery negative cable.

(8) Test the relay operation.

VEHICLE THEFT/SECURITY SYSTEMS

TABLE OF CONTENTS

page

GENERAL INFORMATION
INTRODUCTION 1
VEHICLE THEFT SECURITY SYSTEM. 1
ENABLING. 1
ARMING 1
DISARMING 2
POWER-UP MODE 2
TAMPER ALERT 2
DESCRIPTION AND OPERATION
CENTRAL TIMER MODULE 2
DOOR AJAR SWITCH. 3
DOOR LOCK CYLINDER SWITCH. 3

page

HEADLAMP RELAY. 3
HORN RELAY 3
SECURITY LAMP 3
DIAGNOSIS AND TESTING
VEHICLE THEFT SECURITY SYSTEM. 4
DOOR LOCK CYLINDER SWITCH. 4
RELAYS. 4
REMOVAL AND INSTALLATION
DOOR AJAR SWITCH. 4
DOOR LOCK CYLINDER SWITCH. 4
HEADLAMP RELAY. 5
HORN RELAY 6

GENERAL INFORMATION

INTRODUCTION

The Vehicle Theft Security System (VTSS) is an available factory-installed option on this model. Refer to 8W-39 - Vehicle Theft Security System in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

VEHICLE THEFT SECURITY SYSTEM

The Vehicle Theft Security System (VTSS) is designed to provide perimeter protection against unauthorized use or tampering by monitoring the vehicle doors and the ignition system. If unauthorized use or tampering is detected, the system responds by sounding the horn, flashing the headlamps, and providing an engine no-run feature.

Following are general descriptions of the features and major components of the VTSS. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the vehicle theft security system.

ENABLING

If the vehicle is so equipped, the Vehicle Theft Security System (VTSS) feature is enabled in the high-line Central Timer Module (CTM) before the vehicle is shipped from the factory. However, if a vehicle with VTSS requires CTM replacement, the VTSS feature must be enabled in the new CTM using a DRB scan tool. Refer to the Vehicle Theft Security System menu item on the DRB scan tool for the procedures.

The VTSS engine no-run feature is disabled when it is shipped from the factory. This is done by programming within the Powertrain Control Module (PCM). The logic in the PCM prevents the VTSS engine no-run feature from arming until the engine start counter within the PCM sees twenty engine starts. The VTSS no-run feature must be enabled when the vehicle is received from the assembly plant.

Once the VTSS engine no-run feature has been enabled, it cannot be disabled unless the PCM is replaced with a new unit. The same VTSS engine no-run feature enable logic will apply anytime the PCM is replaced with a new unit.

ARMING

Passive arming of the Vehicle Theft Security System (VTSS) occurs when the vehicle is exited with the key removed from the ignition switch, the headlamps are turned off, and the doors are locked while they are open using the power lock switch or locked after they are closed by turning either front door lock cylinder to the lock position using the key. The power lock switch will not function if the key is in the ignition switch or the headlamps are turned on with the driver side front door open. The VTSS will not arm if the doors are locked using the mechanical lock button.

Active arming of the VTSS occurs when the Remote Keyless Entry (RKE) transmitter is used to lock the vehicle. For active arming to occur, the doors must be closed and the ignition switch must be in the Off position when the RKE transmitter Lock button is depressed. However, once the VTSS arming process has been completed, the ignition switch can be

GENERAL INFORMATION (Continued)

turned to the Accessory position without triggering the alarm.

Once the VTSS begins passive or active arming, the security lamp in the instrument cluster will flash rapidly for about fifteen seconds. This indicates that the VTSS arming is in progress. Turning a key in the ignition switch, opening a door, or unlocking a door by any means during the fifteen second arming process will cause the security lamp to stop flashing and the arming process to abort. Once the fifteen second arming function is successfully completed, the security lamp will stop flashing to indicate that the VTSS is armed.

DISARMING

Passive disarming of the Vehicle Theft Security System (VTSS) occurs when the vehicle is unlocked using the key to unlock either door. Active disarming of the VTSS occurs when the vehicle is unlocked by depressing the Unlock button of the Remote Keyless Entry (RKE) transmitter.

Once the alarm has been activated (horn sounding, headlamps flashing, and the engine no-run feature), either disarming method will also deactivate the alarm.

POWER-UP MODE

When the armed Vehicle Theft Security System (VTSS) senses that the battery has been disconnected and reconnected, it enters its power-up mode. In the power-up mode the alarm system remains armed following a battery failure or disconnect. If the VTSS was armed prior to a battery disconnect or failure, the system will have to be actively or passively disarmed after the battery is reconnected.

The power-up mode will also apply if the battery goes dead while the system is armed, and battery jump-starting is attempted. The engine no-run feature will prevent the engine from starting until the alarm system has been actively or passively disarmed.

TAMPER ALERT

The Vehicle Theft Security System (VTSS) tamper alert will sound the horn three times upon disarming, if the alarm was triggered and has since timed-out (about fifteen minutes). This feature alerts the vehicle operator that the VTSS was activated while the vehicle was unattended.

DESCRIPTION AND OPERATION

CENTRAL TIMER MODULE

Two versions of the Central Timer Module (CTM) are available on this vehicle, a base version and a high-line version. The base version of the CTM is used on base models of the vehicle. The base version of the CTM combines the functions of a chime/buzzer module and an intermittent wipe module into a single unit. The base CTM also uses inputs from the door ajar switches, the headlamp switch and the key-in ignition switch to control the output to the dome lamp circuits, which allows the base CTM to provide load shedding to help protect the battery from becoming discharged.

The high-line version of the CTM is used on high-line vehicles. The high-line CTM provides all of the functions of the base version CTM, but also is used to control and integrate many of the additional electronic functions and features included on the high-line models. The high-line version of the CTM contains a central processing unit and interfaces with other modules in the vehicle on the Chrysler Collision Detection (CCD) data bus network.

The CCD data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

One of the features that the high-line CTM supports and controls is the Vehicle Theft Security System (VTSS). In the VTSS, the CTM receives hard-wired inputs from the door jamb, door lock cylinder, and ignition switches. The programming in the CTM allows it to process the information from these inputs and send control outputs to energize or de-energize the headlamp relay, horn relay, and the security lamp. The CTM also sends CCD data bus messages to the Powertrain Control Module (PCM) to control the engine no-run feature of the VTSS

The high-line CTM also contains the receiver and control logic for the power lock and Remote Keyless Entry (RKE) systems, which are integrated into the arming, disarming, and triggering functions of the VTSS.

Both versions of the CTM are mounted under the passenger side end of the instrument panel, outboard of the instrument panel glove box opening. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

For diagnosis of the high-line version of the CTM or of the CCD data bus, a DRBIII® scan tool and the proper Diagnostic Procedures manual are recommended. The CTM cannot be repaired and, if faulty or damaged, it must be replaced.

DESCRIPTION AND OPERATION (Continued)

DOOR AJAR SWITCH

The door ajar switches are integral to the door latches on each door. The switches close a path to ground for the Central Timer Module (CTM) when a door is opened, and open the ground path when a door is closed.

The door ajar switches cannot be repaired and, if faulty or damaged, the door latch unit must be replaced.

DOOR LOCK CYLINDER SWITCH

DESCRIPTION

The door lock cylinder switches are mounted to the back of the key lock cylinder inside each front door. They are resistor multiplexed momentary switches that are hard wired between a body ground and the Central Timer Module (CTM) through the front door wire harnesses. These switches are driven by the key lock cylinders and contain three internal resistors. One resistor is used for the neutral switch position, one for the lock position and one for the unlock position.

The door lock cylinder switches cannot be adjusted or repaired and, if faulty or damaged, they must be replaced. For complete circuit diagrams, refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The door lock cylinder switches are actuated by the key lock cylinder when the key is inserted in the lock cylinder and turned to the lock or unlock positions. The door lock cylinder switch closes a path to ground through one of three internal resistors for the CTM when the front door key lock cylinder is in the lock, unlock or neutral positions. The CTM reads the switch status through an internal pull-up, then uses this input and its internal programming to control the proper Vehicle Theft Security System (VTSS) and power lock system outputs.

HEADLAMP RELAY

The headlamp (or security) relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The headlamp relay is a electromechanical device that switches battery current to the headlamps when the high-line Central Timer Module (CTM) grounds the relay coil. See Headlamp Relay in the Diagnosis and Testing section of this group for more information.

The headlamp relay is located in the Power Distribution Center (PDC), behind the battery on the left side of the engine compartment.

The headlamp relay cannot be repaired and, if faulty or damaged, it must be replaced.

HORN RELAY

The horn relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch or the high-line Central Timer Module (CTM) grounds the relay coil. Refer to **Relays** in the Diagnosis and Testing section of this group for more information.

The horn relay is located in the Junction Block (JB), on the left end of the instrument panel in the passenger compartment. See the fuse and relay layout label on the inside of the fuse access panel for relay identification and location.

If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the JB until further diagnosis is completed.

The horn relay cannot be repaired and, if faulty or damaged, it must be replaced.

SECURITY LAMP

The security lamp is located within the instrument cluster on the instrument panel. The security lamp is illuminated by a red Light-Emitting Diode (LED) that is integral to the instrument cluster circuit board. The security lamp receives fused battery feed at all times and is grounded by the high-line Central Timer Module (CTM) to give a visual indication of the Vehicle Theft Security System (VTSS) arming status.

The security lamp cannot be repaired and, if faulty or damaged, the instrument cluster unit must be replaced. Refer to Instrument Cluster in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

DIAGNOSIS AND TESTING

VEHICLE THEFT SECURITY SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The Vehicle Theft Security System (VTSS) and the Chrysler Collision Detection (CCD) data bus network should be diagnosed using a DRB scan tool and the proper Diagnostic Procedures manual. The DRB will provide confirmation that the data bus is functional, that the high-line Central Timer Module (CTM) is receiving and sending the proper messages on the data bus, that the CTM is receiving the proper hard-wired inputs and sending the proper hard-wired outputs, and that the Powertrain Control Module (PCM) is receiving the data bus messages from the CTM. Refer to the Vehicle Theft Security System menu item on the DRB scan tool for the procedures. Refer to 8W-39 - Vehicle Theft Security System in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

DOOR LOCK CYLINDER SWITCH

Refer to **Vehicle Theft Security System** in the index of this service manual for the location of complete door lock cylinder switch wiring diagrams.

(1) Disconnect the door lock cylinder switch wire harness connector from the door wire harness connector.

(2) Using an ohmmeter, perform the switch resistance checks between the two cavities of the door lock cylinder switch wire harness connector. Actuate the switch by rotating the key in the door lock cylinder to test for the proper resistance values in each of the three switch positions, as shown in the Door Lock Cylinder Switch chart.

DOOR LOCK CYLINDER SWITCH		
Switch Position		Resistance
Driver Side	Passenger Side	
Neutral	Neutral	12 Kilohms
Lock (Clockwise)	Lock (Counter Clockwise)	644 Ohms
Unlock (Counter Clockwise)	Unlock (Clockwise)	1565 Ohms

(3) If a door lock cylinder switch fails any of the resistance tests, replace the faulty switch as required.

RELAYS

The headlamp (or security) relay is located in the Power Distribution Center (PDC) in the engine compartment. The horn relay is located in the Junction Block (JB), on the left end of the instrument panel in the passenger compartment. Each of these relays can be tested as described in the following procedure, however the circuits they are used in do vary. To test the relay circuits, refer to the circuit descriptions and diagrams in 8W-39 - Vehicle Theft Security System in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

Remove the relay (Fig. 1) from the PDC or JB as described in this group to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, test the relay circuits. If not OK, replace the faulty relay.

REMOVAL AND INSTALLATION

DOOR AJAR SWITCH

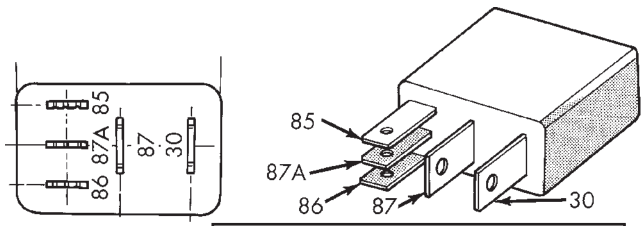
The door ajar switch is integral to the door latch unit. If the door ajar switch is faulty or damaged, the entire door latch unit must be replaced. Refer to Group 23 - Body for the door latch service procedures.

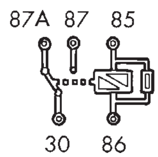
DOOR LOCK CYLINDER SWITCH

(1) Disconnect and isolate the battery negative cable.

(2) Remove the door outside latch handle mounting hardware and linkage from the inside of the door. Refer to Group 23 - Body for the procedures.

REMOVAL AND INSTALLATION (Continued)





TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 1 Relay Terminals

(3) From the outside of the door, pull the door outside latch handle out far enough to access the door lock cylinder switch (Fig. 2).

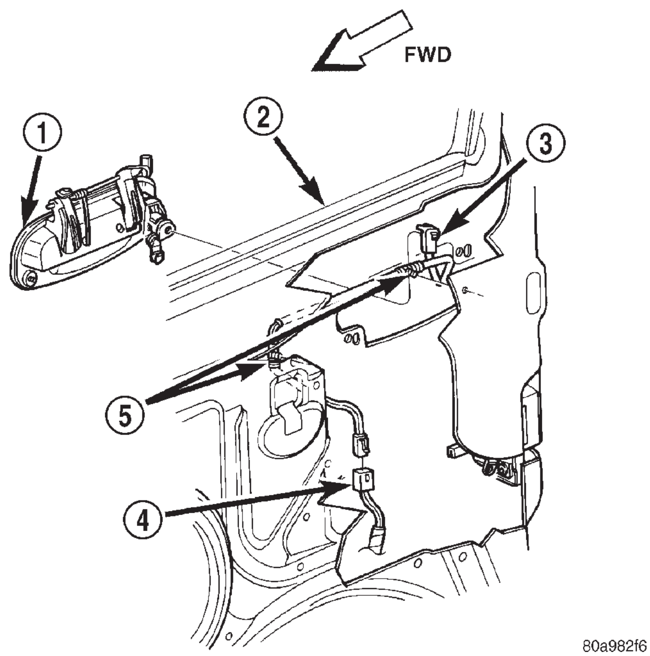


Fig. 2 Door Lock Cylinder Switch Remove/Install - Typical

1 – DOOR OUTSIDE LATCH HANDLE
2 – DOOR
3 – DOOR LOCK CYLINDER SWITCH
4 – CONNECTOR
5 – RETAINERS

(4) Disengage the door lock cylinder switch from the back of the lock cylinder.

(5) Unplug the door lock cylinder switch wire harness connector.

(6) Disengage the retainers that secure the door lock cylinder switch wire harness to the inner door panel.

(7) Remove the door lock cylinder switch from the door.

(8) Reverse the removal procedures to install.

HEADLAMP RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 3).

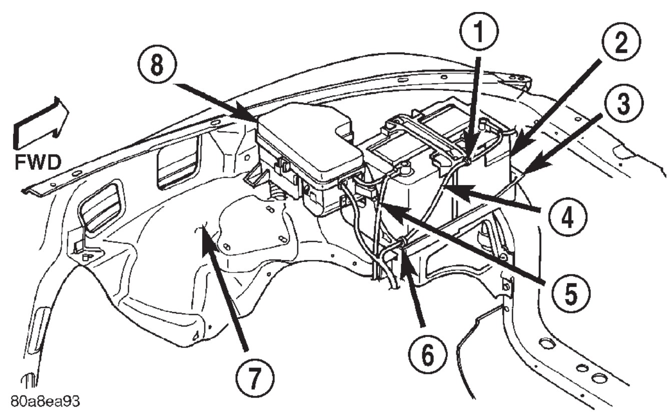


Fig. 3 Power Distribution Center

1 – CLIP
2 – BATTERY
3 – TRAY
4 – NEGATIVE CABLE
5 – POSITIVE CABLE
6 – CLIP
7 – FENDER INNER SHIELD
8 – POWER DISTRIBUTION CENTER

(3) Refer to the label on the PDC for headlamp relay identification and location.

(4) Unplug the headlamp relay from the PDC.

(5) Install the headlamp relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.

(7) Connect the battery negative cable.

(8) Test the relay operation.

REMOVAL AND INSTALLATION (Continued)

HORN RELAY

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse access panel from the left end of the instrument panel (Fig. 4).

(3) Refer to the label on the inside of the fuse access panel for horn relay identification and location.

(4) Unplug the horn relay from the Junction Block (JB).

(5) Install the horn relay by aligning the relay terminals with the cavities in the JB and pushing the relay firmly into place.

(6) Install the fuse access panel.

(7) Connect the battery negative cable.

(8) Test the relay operation.

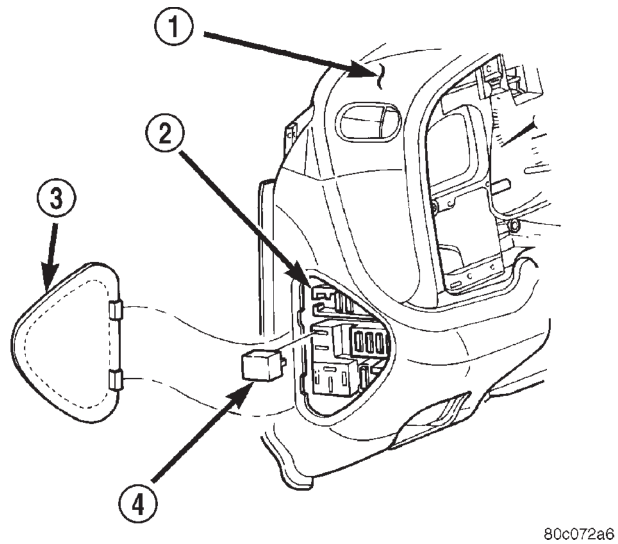


Fig. 4 Horn Relay Remove/Install

1 – INSTRUMENT PANEL
2 – JUNCTION BLOCK
3 – FUSE ACCESS PANEL
4 – HORN RELAY

POWER SEAT SYSTEMS

TABLE OF CONTENTS

page

GENERAL INFORMATION
INTRODUCTION 1
POWER SEAT SYSTEM 1
DESCRIPTION AND OPERATION
POWER SEAT SWITCH. 1
POWER SEAT ADJUSTER AND MOTORS 1
CIRCUIT BREAKER. 2
DIAGNOSIS AND TESTING
POWER SEAT SYSTEM 2

page

CIRCUIT BREAKER. 2
POWER SEAT ADJUSTER AND MOTORS 2
POWER SEAT SWITCH. 2
REMOVAL AND INSTALLATION
POWER SEAT SWITCH. 2
POWER SEAT ADJUSTER AND MOTORS 3

GENERAL INFORMATION

INTRODUCTION

A six-way driver side power seat is an available factory-installed option for this model, when it is also equipped with the bucket or split bench seat option. Refer to 8W-63 - Power Seat in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

POWER SEAT SYSTEM

The power seat system option allows the driver to electrically adjust his seating position for optimum control and comfort using the power seat switches located on the outboard seat cushion side shield. The power seat system allows the seating position to be adjusted forward, rearward, front up, front down, rear up, or rear down. The power seat system receives battery current through a fuse in the Power Distribution Center and a circuit breaker in the junction block, regardless of the ignition switch position.

The power seat system includes the power seat adjuster and motors unit, the power seat switch, and the circuit breaker. Following are general descriptions of the major components in the power seat system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the power seat system.

DESCRIPTION AND OPERATION

POWER SEAT SWITCH

The power seat can be adjusted in six different ways using the power seat switch. The switch is located on the lower outboard side of the seat cushion on the seat cushion side shield. Refer to the owner's manual for more information on the power seat switch functions and the seat adjusting procedures.

The individual switches in the power seat switch unit cannot be repaired. If one switch is damaged or faulty, the entire power seat switch unit must be replaced.

POWER SEAT ADJUSTER AND MOTORS

There are three reversible motors that operate the power seat adjuster. The motors are connected to worm-drive gearboxes that move the seat adjuster through a combination of screw-type drive units.

The front and rear of a seat are operated by different motors. They can be raised or lowered independently of each other. When the center seat switch is pushed to the Up or Down position, both the front and rear motors operate in unison, moving the entire seat up or down. The forward-rearward motor is operated by pushing the center seat switch to the Forward or Rearward position.

When a switch is actuated, a battery feed and a ground path are applied through the switch contacts to the motor(s). The motor(s) and drives operate to move the seat in the selected direction until the switch is released, or until the travel limit of the power seat adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor(s) are reversed through the switch contacts. This causes the motor to run in the opposite direction.

Each motor contains a self-resetting circuit breaker to protect it from overload. Consecutive or frequent resetting of the circuit breakers must not be allowed to continue, or the motors may be damaged. Make the necessary repairs.

The power seat adjuster and motors cannot be repaired, and are serviced only as a complete unit. If

DESCRIPTION AND OPERATION (Continued)

any component in this unit is faulty or damaged, the entire power seat adjuster and motors assembly must be replaced.

CIRCUIT BREAKER

An automatic resetting circuit breaker in the junction block is used to protect the power seat system circuit. The circuit breaker can protect the system from a short circuit, or from an overload condition caused by an obstructed or stuck seat adjuster.

The circuit breaker cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

POWER SEAT SYSTEM

Before any testing of the power seat system is attempted, the battery should be fully-charged and all wire harness connections and pins cleaned and tightened to ensure proper continuity and grounds. For circuit descriptions and diagrams, refer to 8W-63 - Power Seat in Group 8W - Wiring Diagrams.

With the dome lamp on, apply the power seat switch in the direction of the failure. If the dome lamp dims, the seat may be jamming. Check under and behind the seat for binding or obstructions. If the dome lamp does not dim, proceed with testing of the individual components and circuits.

CIRCUIT BREAKER

For circuit descriptions and diagrams, refer to 8W-63 - Power Seat in Group 8W - Wiring Diagrams.

(1) Locate the correct circuit breaker in the junction block. Pull out the circuit breaker slightly, but be certain that the circuit breaker terminals still contact the terminals in the junction block cavities.

(2) Connect the negative lead of a 12-volt DC voltmeter to a good ground.

(3) With the voltmeter positive lead, check both terminals of the circuit breaker for battery voltage.

If only one terminal has battery voltage, the circuit breaker is faulty and must be replaced. If neither terminal has battery voltage, repair the open circuit from the Power Distribution Center (PDC) as required.

POWER SEAT ADJUSTER AND MOTORS

For circuit descriptions and diagrams, refer to 8W-63 - Power Seat in Group 8W - Wiring Diagrams.

Operate the power seat switch to move all three seat motors in each direction. The seat should move in each of the selected directions. If the power seat adjuster fails to operate in only one direction, move the adjuster a short distance in the opposite direction and test again to be certain that the adjuster is not at its travel limit. If the power seat adjuster still fails to operate in only one direction, see Power Seat Switch in the Diagnosis and Testing section of this group. If the power seat adjuster fails to operate in more than one direction, proceed as follows:

(1) Test the circuit breaker in the junction block as described in this group. If OK, go to Step 2. If not OK, replace the faulty circuit breaker.

(2) Remove the power seat switch from the seat. Check for battery voltage at the fused B(+) circuit cavity of the power seat switch wire harness connector. If OK, go to Step 3. If not OK, repair the open circuit to the junction block as required.

(3) Check for continuity between the ground circuit cavity of the power seat switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open circuit to ground as required.

(4) Test the power seat switch as described in this group. If the switch tests OK, check the wire harness for the inoperative power seat motor(s) between the power seat switch and the motor for shorts or opens. If the circuits check OK, replace the faulty power seat adjuster and motors assembly. If the circuits are not OK, repair the wire harness as required.

POWER SEAT SWITCH

For circuit descriptions and diagrams, refer to 8W-63 - Power Seat in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power seat switch from the power seat.

(3) Use an ohmmeter to test the continuity of the power seat switches in each position. See the Power Seat Switch Continuity chart (Fig. 1). If OK, see Power Seat Adjuster and Motors in the Diagnosis and Testing section of this group. If not OK, replace the faulty power seat switch unit.

REMOVAL AND INSTALLATION

POWER SEAT SWITCH

(1) Disconnect and isolate the battery negative cable.

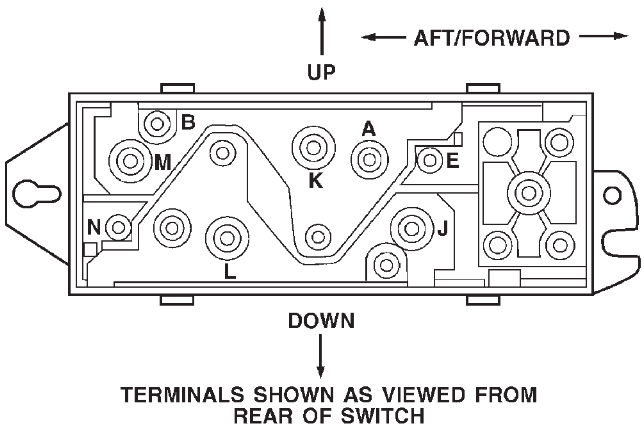
(2) Remove the screw that secures the recliner lever to the recliner mechanism release shaft on the outboard side of the driver side front seat.

(3) Pull the recliner lever off of the recliner mechanism release shaft.

(4) Remove the three screws that secure the driver side seat cushion side shield to the outboard seat cushion frame.

(5) Pull the driver side seat cushion side shield away from the seat cushion frame far enough to

REMOVAL AND INSTALLATION (Continued)



POWER SEAT SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	B & N, B & J, B & M, B & E, B & L, B & K
VERTICAL UP	A & E, A & M, B & N, B & J
VERTICAL DOWN	A & J, A & N, B & M, B & E
HORIZONTAL FORWARD	A & L, B & K
HORIZONTAL AFT	A & K, B & L
FRONT TILT UP	A & M, B & N
FRONT TILT DOWN	A & N, B & M
REAR TILT UP	A & E, B & J
REAR TILT DOWN	A & J, B & E

80b09a68

Fig. 1 Power Seat Switch Continuity

access the power seat switch module wire harness connector.

(6) Unplug the wire harness connector from the power seat switch module.

(7) Remove the seat cushion side shield and power seat switch module from the seat as a unit.

(8) Remove the two screws that secure the power seat switch to the inside of the seat cushion side shield (Fig. 2).

(9) Remove the power seat switch from the seat cushion side shield.

(10) Reverse the removal procedures to install. Tighten the switch mounting screws to 2.2 N·m (20 in. lbs.).

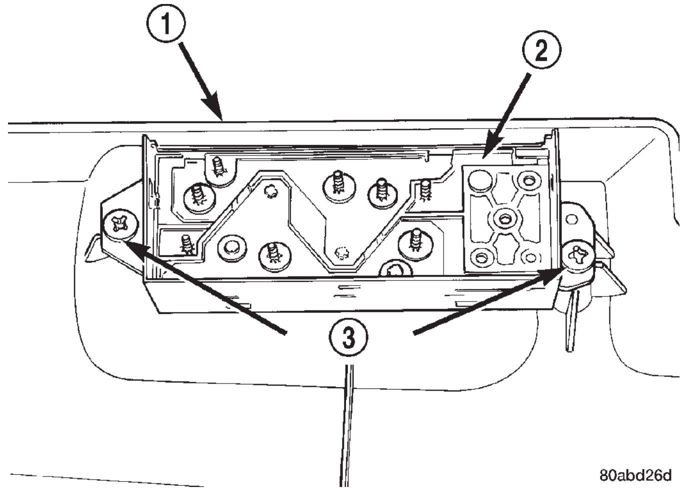


Fig. 2 Power Seat Switch Remove/Install - Typical

1 – SEAT SIDE SHIELD
2 – POWER SEAT SWITCH
3 – SCREWS

POWER SEAT ADJUSTER AND MOTORS

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side seat, adjuster and motors assembly from the vehicle as a unit. Refer to Group 23 - Body for the procedures.

(3) Unplug the power seat wire harness connectors at each of the three power seat motors.

(4) Release the power seat wire harness retainers from the seat adjuster and motors assembly.

(5) Remove the four screws that secure the power seat adjuster and motors assembly to the seat cushion frame.

(6) If the vehicle is equipped with a split bench seat, remove the fasteners that secure the center seat cushion section to the brackets on the power seat adjuster.

(7) Remove the power seat adjuster and motors assembly from the seat cushion frame.

CAUTION: Before installing the seat into the vehicle, be certain to adjust the seat fully rearward on its tracks. Then install and tighten the front track mounting screws before installing the rear screws or the tracks may be damaged.

(8) Reverse the removal procedures to install.

POWER WINDOW SYSTEMS

TABLE OF CONTENTS

	page
GENERAL INFORMATION	
INTRODUCTION	1
POWER WINDOW SYSTEM	1
DESCRIPTION AND OPERATION	
POWER WINDOW SWITCH	1
POWER WINDOW MOTOR	2
CIRCUIT BREAKER	2
DIAGNOSIS AND TESTING	
POWER WINDOW SYSTEM	2
CIRCUIT BREAKER	3
POWER WINDOW SWITCH	3
POWER WINDOW MOTOR	4
REMOVAL AND INSTALLATION	
POWER WINDOW SWITCH	5
POWER WINDOW MOTOR	6

GENERAL INFORMATION

INTRODUCTION

Power windows are available as factory-installed optional equipment on this model. The Remote Keyless Entry (RKE) system and power lock system are included on vehicles equipped with the power window option. Refer to 8W-60 - Power Windows in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

POWER WINDOW SYSTEM

The power window system allows each of the door windows to be raised and lowered electrically by actuating a switch on the trim panel of each respective door. A master switch on the driver side front door trim panel allows the driver to raise or lower each of the passenger door windows and, on quad cab models, to lock out the individual switches on the passenger doors from operation. The power window system receives battery feed through a circuit breaker in the junction block, only when the ignition switch is in the On position.

The power window system includes the power window switches on each door trim panel, the circuit breaker in the junction block, and the power window motors inside each door. This group covers diagnosis and service of only the electrical components in the power window system. For service of mechanical components, such as the regulator, lift plate, window tracks, or glass refer to Group 23 - Body.

Following are general descriptions of the major components in the power window system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the power window system.

DESCRIPTION AND OPERATION

POWER WINDOW SWITCH

On conventional cab and club cab models, the power windows are controlled by two-way switches integral to the power window and lock switch and bezel unit on the trim panel of each front door. A second power window switch in the driver side switch and bezel unit allows the driver to control the passenger side window. On quad cab models, the power windows are controlled by four two-way switches and a power window lockout switch that are integral to the power window and lock switch unit on the driver side front door trim panel. Additionally, each of the passenger doors has a single gang two-way power window switch mounted in a bezel on their respective door trim panels.

On all models, the power window switch for the driver side front door window has an Auto label on it. This switch has a second detent position beyond the normal Down position that provides an automatic one-touch window down feature. This feature is controlled by an electronic circuit and a relay that are integral to the driver side front door power window and lock switch unit.

The power window switches control the battery and ground feeds to the power window motors. All of the passenger door power window switches receive their battery and ground feeds through the circuitry of the driver side master switch unit. On quad cab models, when the power window lockout switch is in the Lock position, the battery feed for the individual passenger door power window switches is interrupted.

A Light-Emitting Diode (LED) in the paddle of each switch is illuminated whenever the ignition switch is in the On position. However, on quad cab

DESCRIPTION AND OPERATION (Continued)

models the LEDs for the passenger power window switches are extinguished whenever the driver selects the Lock position with the power window lockout switch.

On all models, the driver side power window and lock switch and bezel unit cannot be repaired and, if faulty or damaged, the entire switch unit must be replaced. On conventional cab and club cab models, the passenger side power window and lock switch and bezel unit cannot be repaired and, if faulty or damaged, the entire switch and bezel unit must be replaced. On quad cab models, the individual passenger power window switches cannot be repaired and, if faulty or damaged, the single gang switch unit must be replaced.

POWER WINDOW MOTOR

A permanent magnet reversible motor moves the window regulator through an integral gearbox mechanism. A positive and negative battery connection to the two motor terminals will cause the motor to rotate in one direction. Reversing the current through these same two connections will cause the motor to rotate in the opposite direction.

In addition, each power window motor is equipped with an integral self-resetting circuit breaker to protect the motor from overloads. The power window motor and gearbox assembly cannot be repaired and, if faulty or damaged, the entire power window regulator assembly must be replaced.

CIRCUIT BREAKER

An automatic resetting circuit breaker in the junction block is used to protect the power window system circuit. The circuit breaker can protect the system from a short circuit, or from an overload condition caused by an obstructed or stuck window glass or regulator.

The circuit breaker cannot be repaired and, if faulty, it must be replaced.

DIAGNOSIS AND TESTING

POWER WINDOW SYSTEM

For circuit descriptions and diagrams, refer to 8W-60 - Power Windows in Group 8W - Wiring Diagrams.

ALL WINDOWS INOPERATIVE

(1) Check the circuit breaker in the junction block, as described in this group. If OK, go to Step 2. If not OK, replace the faulty circuit breaker.

(2) Disconnect and isolate the battery negative cable. Remove the power window and lock master switch unit from the driver side front door trim panel. Unplug the wire harness connector from the master switch unit.

(3) Check for continuity between the ground circuit cavity of the power window and lock master switch unit wire harness connector and a good ground. If OK, go to Step 4. If not OK, repair the circuit to ground as required.

(4) Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the power window and lock master switch unit wire harness connector. If OK, see Power Window Switch in the Diagnosis and Testing section of this group. If not OK, repair the circuit to the junction block as required.

ONE WINDOW INOPERATIVE

The window glass must be free to slide up and down for the power window motor to function properly. If the glass is not free to move up and down, the motor will overload and trip the integral circuit breaker. To determine if the glass is free, disconnect the regulator plate from the glass. Then slide the window up and down by hand.

There is an alternate method to check if the glass is free. Position the glass between the up and down stops. Then, shake the glass in the door. Check that the glass can be moved slightly from side to side, front to rear, and up and down. Then check that the glass is not bound tight in the tracks. If the glass is free, proceed with the diagnosis that follows. If the glass is not free, refer to Group 23 - Body for the door window glass and hardware service and adjustment procedures.

If the only inoperative window is in the driver side front door and the preceding checks have not identified a problem, see Power Window Motor in the Diagnosis and Testing section of this group. If the problem being diagnosed involves only the Auto-down feature for the driver side front door window, but all of the power windows are operational, replace the faulty power window and lock master switch unit. If the problem being diagnosed involves only an inoperative power window switch Light-Emitting Diode (LED), but the power window that the switch controls operates satisfactorily from that switch, replace the faulty switch unit. For any other single power window problem proceed with diagnosis as follows:

(1) Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the power window switch unit on the door with the inoperative power window. Check for continuity between the ground circuit cavity of the power window switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 2. If not OK,

DIAGNOSIS AND TESTING (Continued)

repair the open circuit to the power window and door lock master switch as required.

(2) Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity in the body half of the power window switch unit wire harness connector. If OK, go to Step 3. If not OK, repair the open circuit to the power window and door lock master switch as required.

(3) Test the power window switch continuity. See Power Window Switch in the Diagnosis and Testing section of this group. If OK, go to Step 4. If not OK, replace the faulty power window switch unit.

(4) Refer to the circuit diagrams in 8W-60 - Power Windows in Group 8W - Wiring Diagrams. Check the continuity in each circuit between the inoperative power window switch wire harness connector cavities and the corresponding power window motor wire harness connector cavities. If OK, see Power Window Motor in the Diagnosis and Testing section of this group. If not OK, repair the open circuit(s) as required.

NOTE: All passenger door power window switches receive their battery and ground feed for operating the passenger door power window motors through the driver side power window and lock master switch and wire harness connector.

CIRCUIT BREAKER

For circuit descriptions and diagrams, refer to 8W-60 - Power Windows in Group 8W - Wiring Diagrams.

(1) Locate the circuit breaker in the junction block. Pull out the circuit breaker slightly, but be certain that the circuit breaker terminals still contact the terminals in the junction block cavities.

(2) Connect the negative lead of a 12-volt DC voltmeter to a good ground.

(3) With the voltmeter positive lead, check both terminals of the circuit breaker for battery voltage.

If only one terminal has battery voltage, the circuit breaker is faulty and must be replaced. If neither terminal has battery voltage, repair the open circuit from the Power Distribution Center (PDC) as required. If the circuit breaker checks OK, but no power windows operate, see Power Window System in the Diagnosis and Testing section of this group.

POWER WINDOW SWITCH

CONVENTIONAL CAB AND CLUB CAB

The Light-Emitting Diode (LED) illumination lamps for all of the power window and lock switch and bezel unit switch paddles receive battery current through the power window circuit breaker in the junction block. If all of the LEDs are inoperative in either or both power window and lock switch and bezel units and the power windows are inoperative, perform the diagnosis for Power Window System in this group. If the power windows operate, but any or all of the LEDs are inoperative, the power window and lock switch and bezel unit with the inoperative LED(s) is faulty and must be replaced. For circuit descriptions and diagrams, refer to 8W-60 - Power Windows in Group 8W - Wiring Diagrams.

(1) Check the circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty circuit breaker.

(2) Turn the ignition switch to the On position. Check for battery voltage at the circuit breaker in the junction block. If OK, turn the ignition switch to the Off position and go to Step 3. If not OK, repair the circuit to the ignition switch as required.

(3) Disconnect and isolate the battery negative cable. Remove the power window and lock switch and bezel unit from the door trim panel. Unplug the wire harness connector from the switch and bezel unit.

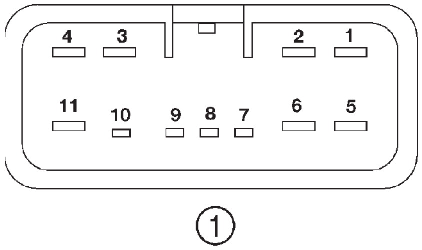
(4) Test the power window switch continuity. See the Power Window Switch Continuity charts to determine if the continuity is correct in the Neutral, Up and Down switch positions (Fig. 1) or (Fig. 2). If OK, see Power Window Motor in the Diagnosis and Testing section of this group. If not OK, replace the faulty switch.

NOTE: The auto down feature of the driver side power window switch is controlled by an electronic circuit within the switch unit. The auto down circuitry is activated when the driver side power window switch is moved to the second detent in the Down direction. The outputs from the auto down circuitry are carried through the same switch pins that provide the normal down function. The auto down circuit cannot be tested. If the driver side power window switch continuity tests are passed, but the auto down feature is inoperative, replace the faulty driver side power window switch unit.

QUAD CAB

The Light-Emitting Diode (LED) illumination lamps for all of the power window and lock switch and bezel unit switch paddles receive battery current through the power window circuit breaker in the junction block. If all of the LEDs are inoperative in both the power window and lock switch units and the power windows are inoperative, perform the diagnosis for Power Window System in this group. If the power windows operate, but any or all of the LEDs are inoperative, the power window and lock switch units with the inoperative LED(s) is faulty and must be replaced. For circuit descriptions and diagrams,

DIAGNOSIS AND TESTING (Continued)

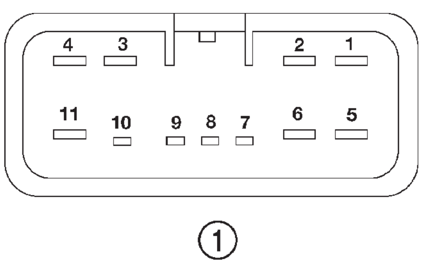


PASSENGER SIDE WINDOW SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
NEUTRAL	1 & 4, 2 & 3
UP	2 & 3, 4 & 11
DOWN	1 & 4, 3 & 11
LAMP	8 & 11

80b099eb

Fig. 1 Power Window Switch Continuity - Driver Side - Conventional Cab and Club Cab

1 – VIEW OF SWITCH SIDE CONNECTOR



PASSENGER SIDE WINDOW SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
NEUTRAL	1 & 4, 2 & 3
UP	2 & 3, 4 & 11
DOWN	1 & 4, 3 & 11
LAMP	8 & 11

80b099ec

Fig. 2 Power Window Switch Continuity - Passenger Side - Conventional Cab and Club Cab

1 – VIEW OF SWITCH SIDE CONNECTOR

refer to 8W-60 - Power Windows in Group 8W - Wiring Diagrams.

(1) Check the circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty circuit breaker.

(2) Turn the ignition switch to the On position. Check for battery voltage at the circuit breaker in the junction block. If OK, turn the ignition switch to the Off position and go to Step 3. If not OK, repair the circuit to the ignition switch as required.

(3) Disconnect and isolate the battery negative cable. Remove the power window switch unit from the door trim panel. Unplug the wire harness connector from the switch unit.

(4) Test the power window switch continuity. See the Power Window Switch Continuity charts to determine if the continuity is correct in the Off, Up and Down switch positions (Fig. 3) or (Fig. 4). If OK, see Power Window Motor in the Diagnosis and Testing section of this group. If not OK, replace the faulty switch.

NOTE: Because this switch contains active electronic elements for the Auto-down feature, this switch function cannot be checked with a continuity test. If the problem being diagnosed involves this function, reconnect the switch to its wire harness connector, connect the battery negative cable and turn the ignition switch to the On position. Back probe the wire harness connector cavity for switch pin number 8 and check for the proper switch output while actuating the switch. With the switch in the Up position, there should be continuity to ground at pin 8. With the switch in the Down position, there should be battery voltage at pin 8.

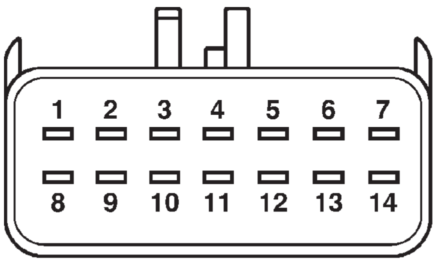
POWER WINDOW MOTOR

For circuit descriptions and diagrams, refer to 8W-60 - Power Windows in Group 8W - Wiring Diagrams. Before you proceed with this diagnosis, confirm proper switch operation. See Power Window Switch in the Diagnosis and Testing section of this group.

(1) Disconnect and isolate the battery negative cable. Remove the trim panel from the door with the inoperative power window.

(2) Unplug the power window motor wire harness connector. Apply 12 volts across the motor terminals to check its operation in one direction. Reverse the connections across the motor terminals to check the operation in the other direction. Remember, if the window is in the full up or full down position, the motor will not operate in that direction by design. If OK, repair the circuits from the power window motor to the power window switch as required. If not OK, replace the faulty motor.

DIAGNOSIS AND TESTING (Continued)

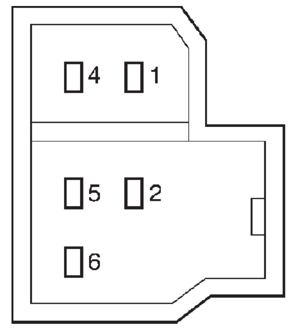


DRIVER SIDE FRONT WINDOW SWITCH (MASTER)	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	2 & 5, 3 & 5, 5 & 6, 5 & 11, 5 & 12, 5 & 13, 5 & 14
RIGHT REAR UP	4 & 12, 5 & 11
RIGHT REAR DOWN	4 & 11, 5 & 12
RIGHT FRONT UP	2 & 5, 3 & 4
RIGHT FRONT DOWN	2 & 4, 3 & 5
LEFT REAR UP	4 & 14, 5 & 13
LEFT REAR DOWN	4 & 13, 5 & 14
LEFT FRONT UP	4 & 6, SEE NOTE
LEFT FRONT DOWN	5 & 6, SEE NOTE
POWER WINDOW LOCKOUT OFF	4 & 7

80b2b3e3

Fig. 3 Power Window Switch Continuity - Driver Side Front - Quad Cab

(3) If the motor operates in both directions, check the operation of the window glass and lift mechanism through its complete up and down travel. There should be no binding or sticking of the window glass or lift mechanism through the entire travel range. If not OK, refer to Group 23 - Body to check the window glass, tracks, and regulator for sticking, binding, or improper adjustment.



PASSENGER SIDE WINDOW SWITCH	
SWITCH POSITION	CONTINUITY BETWEEN
OFF	1 & 4, 2 & 5
UP	1 & 6, 2 & 5
DOWN	1 & 4, 5 & 6

80c0717a

Fig. 4 Power Window Switch Continuity - Front and Rear Passenger Doors - Quad Cab

REMOVAL AND INSTALLATION

POWER WINDOW SWITCH

CONVENTIONAL CAB AND CLUB CAB

(1) Disconnect and isolate the battery negative cable.

(2) Using a wide flat-bladed tool such as a trim stick, gently pry the upper edge of the switch bezel at the front and the rear to release the clips that secure the switch bezel to the door trim panel opening (Fig. 5).

(3) Pull the switch and bezel unit away from the door trim panel opening far enough to access and unplug the wire harness connector.

(4) Remove the power window and lock switch and bezel unit from the door trim panel.

(5) Reverse the removal procedures to install. When installing the switch and bezel unit to the door trim panel opening, insert the rear of the bezel into the opening, then push down on the front of the bezel until the retaining clips snap into place.

QUAD CAB

DRIVER SIDE FRONT DOOR

(1) Disconnect and isolate the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

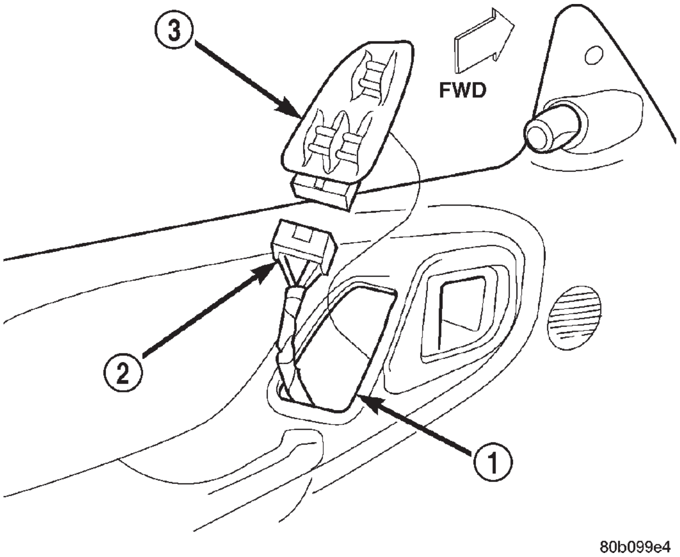


Fig. 5 Power Window and Lock Switch and Bezel Unit Remove/Install - Conventional Cab and Club Cab

1 – TRIM PANEL SWITCH BEZEL OPENING
2 – WIRE HARNESS CONNECTOR
3 – SWITCH AND BEZEL UNIT

(2) Remove the trim panel from the inside of the driver side front door. Refer to Group 23 - Body for the procedures.

(3) From the back side of the trim panel, remove the screws that secure the power window and lock switch unit to the switch bezel in the door trim panel opening.

(4) Remove the power window and lock switch and the switch bezel from the door trim panel.

(5) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

FRONT AND REAR PASSENGER DOORS

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the inside of the passenger front or rear door. Refer to Group 23 - Body for the procedures.

(3) With a small thin-bladed screwdriver, gently pry the snap clips at the sides of the power window switch receptacle on the back of the door trim panel switch bezel and pull the switch out of the receptacle.

(4) Reverse the removal procedures to install. Be certain that both of the switch snap retainers in the receptacle on the back of the door trim panel switch bezel are fully engaged.

POWER WINDOW MOTOR

The power window motor and mechanism is integral to the power window regulator unit. If the power window motor or mechanism is faulty or damaged, the entire power window regulator unit must be replaced. Refer to Group 23 - Body for the window regulator service procedures.

POWER MIRROR SYSTEMS

TABLE OF CONTENTS

page page

EXTERIOR MIRRORS 1

INTERIOR MIRRORS 5

EXTERIOR MIRRORS

TABLE OF CONTENTS

page page

GENERAL INFORMATION
INTRODUCTION 1
POWER MIRROR SYSTEM 1
DESCRIPTION AND OPERATION
POWER MIRROR. 1
POWER MIRROR SWITCH 2
DIAGNOSIS AND TESTING
POWER MIRROR SYSTEM 2
REMOVAL AND INSTALLATION
POWER MIRROR SWITCH 3
POWER MIRROR. 4

GENERAL INFORMATION

INTRODUCTION

Power operated outside rear view mirrors are an available factory-installed option on this model. Heated outside power mirrors are an available factory-installed option on quad cab models that are also equipped with the optional rear window defogger. Refer to 8W-62 - Power Mirrors in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

POWER MIRROR SYSTEM

The power operated or power operated and heated outside rear view mirrors allow the driver to adjust both outside mirrors electrically from the driver side front seat position by operating a switch on the driver side front door trim panel. The power mirrors receive a non-switched battery feed through a fuse in the junction block so that the system will remain operational, regardless of the ignition switch position.

The heated mirror option is available only on quad cab models with the rear window defogger option. The heated mirrors include an electric heating grid behind the mirror glass in each outside mirror, which can clear the mirror glass of ice, snow, or fog. The heating grid receives fused battery current through the relay integral to the rear window defogger switch only when the ignition switch is in the On position, and the rear window defogger system is turned on. Refer to Rear Window Defogger System in Group 8N - Electrically Heated Systems for more information.

Following are general descriptions of the major components in the power mirror system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the power mirror system.

DESCRIPTION AND OPERATION

POWER MIRROR

Each power mirror head contains two electric motors, two drive mechanisms, and the mirror glass. One motor and drive controls mirror up-and-down movement, and the other controls right-and-left movement.

The power mirrors in vehicles equipped with the available heated mirror system option also include an electric heating grid located behind the mirror glass. This heating grid is energized by the relay integral to the rear window defogger switch only when the ignition switch is in the On position, and the rear window defogger system is turned on. Refer to Rear Window Defogger System in Group 8N - Electrically Heated Systems for more information.

The power mirror assembly cannot be repaired. If any component of the power mirror unit is faulty or

DESCRIPTION AND OPERATION (Continued)

damaged, the entire power mirror unit must be replaced.

POWER MIRROR SWITCH

Both the right and left power outside mirrors are controlled by a single multi-function switch unit located on and mounted to the upper flag area of the driver side door trim panel. The switch knob is rotated clockwise (right mirror control), or counter-clockwise (left mirror control) to select the mirror to be adjusted. The switch knob is then moved in a joystick fashion to control movement of the selected mirror up, down, right, or left.

The power mirror switch cannot be repaired and, if faulty or damaged, it must be replaced. The power mirror switch knob is available for service replacement.

DIAGNOSIS AND TESTING

POWER MIRROR SYSTEM

For circuit descriptions and diagrams, refer to 8W-62 - Power Mirrors in Group 8W - Wiring Diagrams.

(1) Check the fuses in the Power Distribution Center (PDC) and the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).

(2) Check for battery voltage at the fuse in the junction block. If OK, go to Step 3. If not OK, repair the open circuit to the PDC as required.

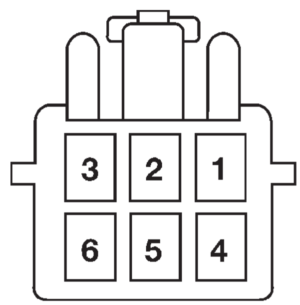
(3) Disconnect and isolate the battery negative cable. Remove the driver side door trim panel and unplug the wire harness connector from the power mirror switch. Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity in the door wire harness half of the power mirror switch wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the junction block as required.

(4) Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity in the door wire harness half of the power mirror switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the circuit to ground as required.

(5) If the problem being diagnosed is an inoperative power mirror electric heating grid, proceed as follows. If not, go to Step 8. Disconnect and isolate the battery negative cable. Remove the front door trim panel on the side of the vehicle with the inoperative mirror heating grid. Unplug the wire harness connector at the mirror. Check for continuity between the ground circuit cavity in the body half of the power mirror wire harness connector and a good ground. If OK, go to Step 6. If not OK, repair the open circuit to ground as required.

(6) Connect the battery negative cable. Turn the ignition switch to the On position. Turn on the rear window defogger system. Check for battery voltage at the rear window defogger relay output circuit cavity in the body half of the power mirror wire harness connector. If OK, go to Step 7. If not OK, repair the open circuit to the rear window defogger relay as required.

(7) Check for continuity between the ground circuit and the rear window defogger relay output circuit cavities in the mirror half of the power mirror wire harness connector. There should be continuity. If not OK, replace the faulty power mirror. If OK, check the resistance through the electric heating grid circuit (Fig. 1). Correct resistance through the electric heating grid should be from 6 to 8.2 ohms when measured at an ambient temperature of 21° C (70° F). If not OK, replace the faulty power mirror.



OUTSIDE MIRROR HEATING GRID TEST		
CAVITY	FUNCTION	*RESISTANCE
4	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT	6.0 TO 8.2 OHMS
5	GROUND	
*WHEN MEASURED AT AN AMBIENT TEMPERATURE OF 21°C (70°F)		

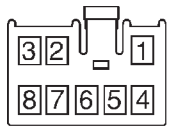
80bce959

Fig. 1 Outside Mirror Heating Grid Test

(8) Check the power mirror switch continuity as shown in (Fig. 2). If OK, go to Step 9. If not OK, replace the faulty switch.

(9) Unplug the wire harness connector at the inoperative power mirror. Use two jumper wires, one connected to a 12-volt battery feed, and the other connected to a good body ground. See the Power Mirror Test chart for the correct jumper wire connections to the power mirror half of the power mirror wire harness connector (Fig. 3). If the power mirror(s) do not respond as indicated in the chart, replace the

DIAGNOSIS AND TESTING (Continued)

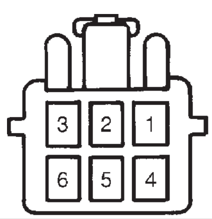


MIRROR SELECTOR KNOB IN “L” POSITION	
MOVE LEVER	**CONTINUITY BETWEEN**
UP	Pins 3 and 8, 1 and 7, 4 and 7
RIGHT	Pins 3 and 7, 2 and 8, 5 and 8
DOWN	Pins 3 and 7, 1 and 8, 4 and 8
LEFT	Pins 3 and 8, 2 and 7, 5 and 7
MIRROR SELECTOR KNOB IN “R” POSITION	
MOVE LEVER	**CONTINUITY BETWEEN**
UP	Pins 6 and 8, 1 and 7, 4 and 7
RIGHT	Pins 6 and 7, 2 and 8, 4 and 8
DOWN	Pins 6 and 7, 1 and 8, 4 and 8
LEFT	Pins 6 and 8, 2 and 7, 5 and 7

80a9b33a

Fig. 2 Power Mirror Switch Continuity

faulty power mirror assembly. If the power mirror(s) do respond as indicated in the chart, repair the circuits between the power mirror and the power mirror switch for a short or open as required.



		Left or Right Mirror
12 Volts	Ground	MIRROR MOVEMENT
Pin 3	Pin 1	UP
Pin 1	Pin 3	DOWN
Pin 2	Pin 1	LEFT
Pin 1	Pin 2	RIGHT

80a9b33b

Fig. 3 Power Mirror Test

REMOVAL AND INSTALLATION

POWER MIRROR SWITCH

(1) Disconnect and isolate the battery negative cable.

(2) Pull the power mirror switch control knob rearward to remove it from the switch stem (Fig. 4).

(3) Remove the nut that secures the power mirror switch to the driver side door trim panel (Fig. 5).

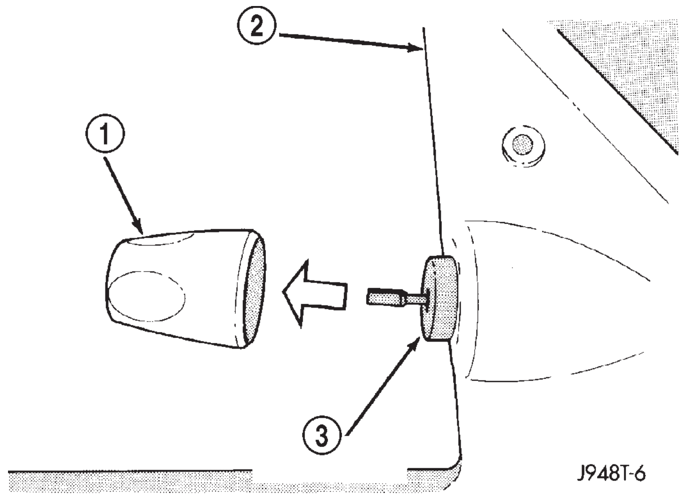


Fig. 4 Power Mirror Switch Control Knob Remove/ Install - Typical

1 – SWITCH CONTROL KNOB
2 – DOOR TRIM PANEL
3 – POWER MIRROR SWITCH

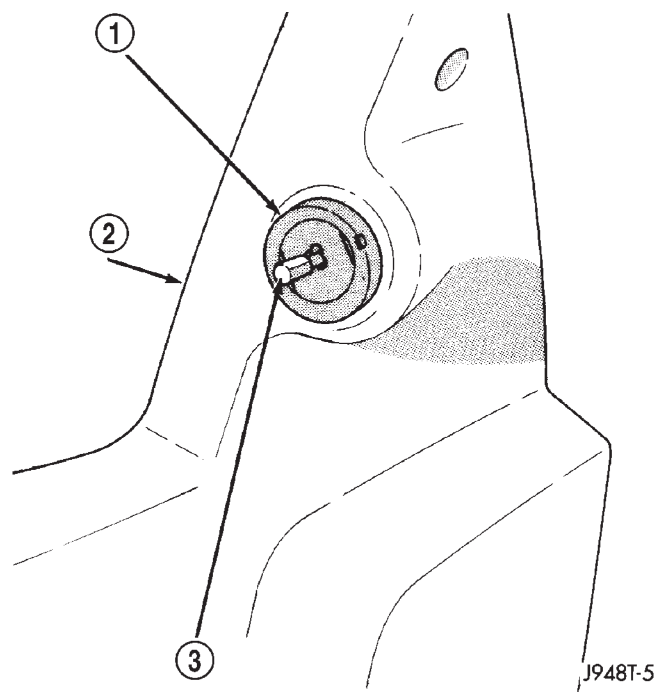


Fig. 5 Power Mirror Switch Nut - Typical

1 – SWITCH RETAINING NUT
2 – DOOR TRIM PANEL
3 – POWER MIRROR SWITCH

(4) Remove the trim panel from the front door. Refer to **Front Door Trim Panel** in the index of this service manual for the location of the proper front door trim panel service procedures.

REMOVAL AND INSTALLATION (Continued)

(5) Pull the front door trim panel away from the inner door panel far enough to access the power mirror switch wire harness connector.

(6) Unplug the power mirror switch wire harness connector (Fig. 6).

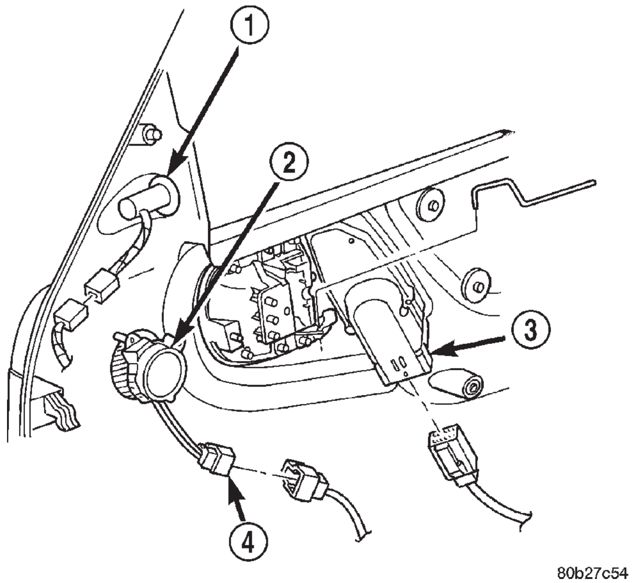


Fig. 6 Door Trim Panel Wire Harness Connectors

1 – POWER MIRROR SWITCH
2 – TWEETER
3 – POWER WINDOW SWITCH
4 – WIRE HARNESS CONNECTOR

(7) Remove the power mirror switch from the back of the front door trim panel.

(8) Reverse the removal procedures to install.

POWER MIRROR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. Refer to **Front Door Trim Panel** in the index of this service manual for the location of the proper front door trim panel service procedures.

(3) Remove the mirror flag seal from the inner door panel (Fig. 7).

(4) Unplug the wire harness connector from the power mirror (Fig. 8).

(5) Remove the three nuts that secure the power mirror to the inner door panel.

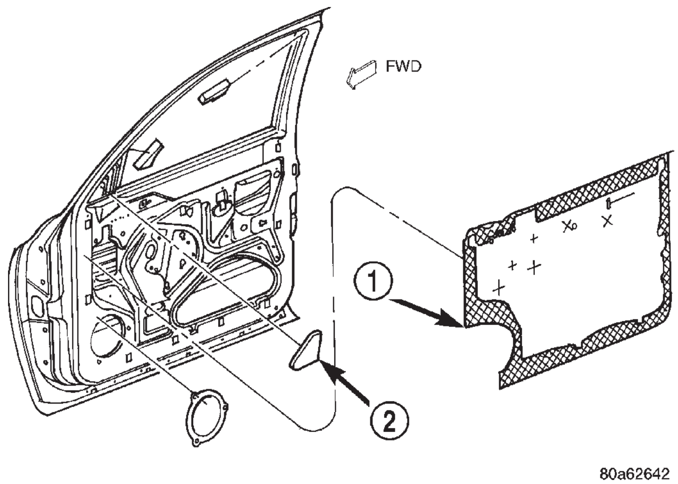


Fig. 7 Mirror Flag Seal Remove/Install

1 – WATER DAM
2 – MIRROR FLAG SEAL

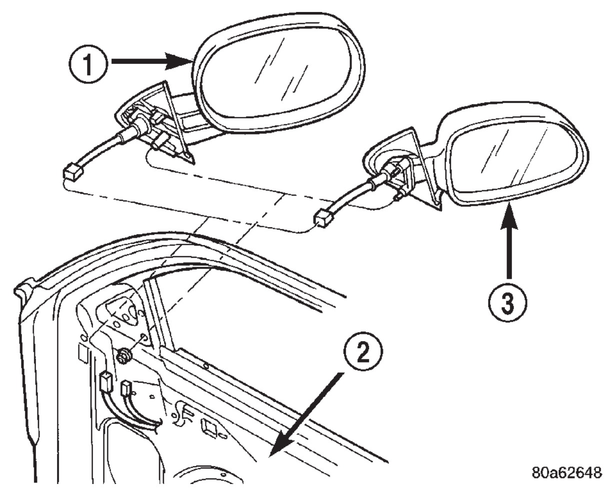


Fig. 8 Power Mirror Remove/Install

1 – ELECTRIC FOLD AWAY SIDEVIEW MIRROR
2 – DOOR
3 – ELECTRIC SIDEVIEW MIRROR

(6) Unseat the power mirror wire harness grommet by pushing it out through the hole in the door flag from the inside.

(7) Pull the mirror from the outside of the door while feeding the wire harness, grommet, and connector out through the hole from the inside of the door.

(8) Reverse the removal procedures to install. Tighten the mirror mounting nuts to 7.5 N·m (65 in. lbs.).

INTERIOR MIRRORS

TABLE OF CONTENTS

	page
GENERAL INFORMATION	
INTRODUCTION	5
AUTOMATIC DAY/NIGHT MIRROR SYSTEM	5
DESCRIPTION AND OPERATION	
AUTOMATIC DAY/NIGHT MIRROR	5
DIAGNOSIS AND TESTING	
AUTOMATIC DAY/NIGHT MIRROR	5
REMOVAL AND INSTALLATION	
AUTOMATIC DAY/NIGHT MIRROR	6

GENERAL INFORMATION

INTRODUCTION

An automatic dimming inside day/night rear view mirror is an available factory-installed option on this model. Refer to 8W-44 - Interior Lighting in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

AUTOMATIC DAY/NIGHT MIRROR SYSTEM

The automatic day/night mirror system is able to automatically change the reflectance of the inside rear view mirror in order to reduce the glare of headlamps approaching the vehicle from the rear. The automatic day/night rear view mirror receives battery current through a fuse in the junction block only when the ignition switch is in the On position.

A switch located on the bottom of the automatic day/night mirror housing allows the vehicle operator to select whether the automatic dimming feature is operational. When the automatic day/night mirror is turned on, the mirror switch is lighted by an integral Light-Emitting Diode (LED). The mirror will automatically disable its self-dimming feature whenever the vehicle is being driven in reverse.

Following is a general description of the automatic day/night mirror. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the automatic day/night mirror system.

DESCRIPTION AND OPERATION

AUTOMATIC DAY/NIGHT MIRROR

The automatic day/night mirror uses a thin layer of electrochromic material between two pieces of conductive glass to make up the face of the mirror. When the mirror switch is in the On position, two photocell sensors are used by the mirror circuitry to monitor external light levels and adjust the reflectance of the mirror.

The ambient photocell sensor is located on the forward-facing (windshield side) of the rear view mirror housing, and detects the ambient light levels outside of the vehicle. The headlamp photocell sensor is located inside the rear view mirror housing behind the mirror glass and faces rearward, to detect the level of the light being received at the rear window side of the mirror. When the circuitry of the automatic day/night mirror detects that the difference between the two light levels is too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), it begins to darken the mirror.

The automatic day/night mirror circuitry also monitors the transmission using an input from the backup lamp circuit. The mirror circuitry is programmed to automatically disable its self-dimming feature whenever it senses that the transmission backup lamp circuit is energized.

The automatic day/night mirror is a completely self-contained unit and cannot be repaired. If faulty or damaged, the entire mirror assembly must be replaced.

DIAGNOSIS AND TESTING

AUTOMATIC DAY/NIGHT MIRROR

For circuit descriptions and diagrams, refer to 8W-44 - Interior Lighting in Group 8W - Wiring Diagrams.

(1) Check the fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fuse in the junction block. If OK, go to Step 3. If not OK, repair the open circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the automatic day/night mirror (Fig. 1). Connect the battery negative cable. Turn the ignition switch to the On

DIAGNOSIS AND TESTING (Continued)

position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the automatic day/night mirror wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the junction block as required.

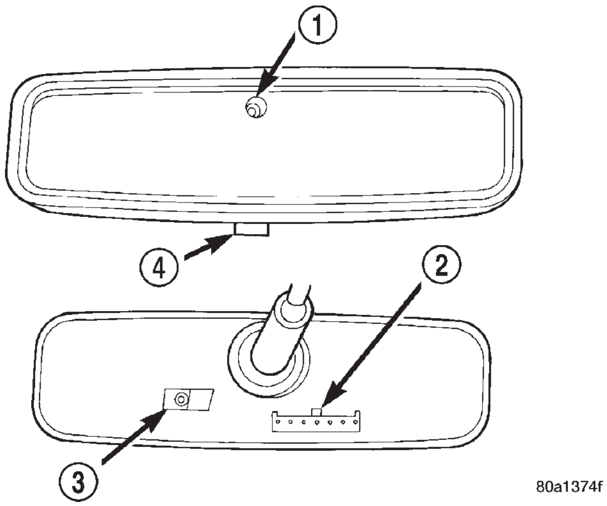


Fig. 1 Automatic Day/Night Mirror

1 – REAR FACING SENSOR
2 – CONNECTOR
3 – FORWARD FACING SENSOR
4 – SWITCH

(4) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Check for continuity between the ground circuit cavity of the automatic day/night mirror wire harness connector and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the circuit to ground as required.

(5) Connect the battery negative cable. Turn the ignition switch to the On position. Set the parking brake. Place the transmission gear selector lever in the Reverse position. Check for battery voltage at the backup lamp switch output circuit cavity of the automatic day/night mirror wire harness connector. If OK, go to Step 6. If not OK, repair the open circuit as required.

(6) Turn the ignition switch to the Off position. Disconnect the battery negative cable. Plug in the automatic day/night mirror wire harness connector. Connect the battery negative cable. Turn the ignition switch to the On position. Place the transmission gear selector lever in the Neutral position. Place the mirror switch in the On (the LED in the mirror switch is lighted) position. Cover the forward facing ambient photocell sensor to keep out any ambient light.

NOTE: The ambient photocell sensor must be covered completely, so that no light reaches the sensor. Use a finger pressed tightly against the sensor, or cover the sensor completely with electrical tape.

(7) Shine a light into the rearward facing headlamp photocell sensor. The mirror glass should darken. If OK, go to Step 8. If not OK, replace the faulty automatic day/night mirror unit.

(8) With the mirror glass darkened, place the transmission gear selector lever in the Reverse position. The mirror should return to its normal reflectance. If not OK, replace the faulty automatic day/night mirror unit.

REMOVAL AND INSTALLATION

AUTOMATIC DAY/NIGHT MIRROR

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the automatic day/night mirror (Fig. 2).

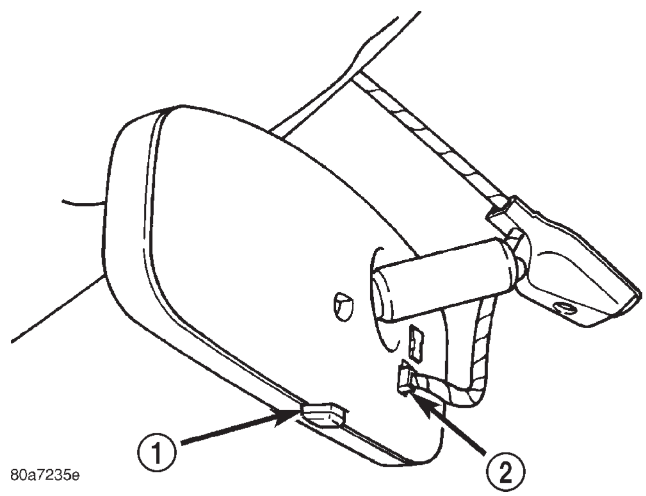


Fig. 2 Automatic Day/Night Mirror Remove/Install

1 – ON/OFF SWITCH
2 – ELECTRICAL CONNECTOR

(3) Remove the set screw that secures the automatic day/night mirror to the windshield support button.

(4) Push the automatic day/night mirror upwards far enough for the mounting bracket to clear the support button and remove the mirror from the windshield support button.

(5) Reverse the removal procedures to install. Tighten the mounting screw to 1.7 N·m (15 in. lbs.).

CHIME/BUZZER WARNING SYSTEMS

TABLE OF CONTENTS

page page

GENERAL INFORMATION
INTRODUCTION 1
CHIME WARNING SYSTEM 1
DESCRIPTION AND OPERATION
CENTRAL TIMER MODULE 1
INSTRUMENT CLUSTER. 2
DRIVER DOOR AJAR SWITCH. 2
KEY-IN IGNITION SWITCH 2
HEADLAMP SWITCH 2
DRIVER SEAT BELT SWITCH 2
DIAGNOSIS AND TESTING
CENTRAL TIMER MODULE 3
DRIVER DOOR AJAR SWITCH. 3
KEY-IN IGNITION SWITCH 4
HEADLAMP SWITCH 4
DRIVER SEAT BELT SWITCH 5
INSTRUMENT CLUSTER. 5
REMOVAL AND INSTALLATION
CHIME WARNING SYSTEM SWITCHES. 5

GENERAL INFORMATION

INTRODUCTION

A chime warning system is standard factory-installed equipment on this model. Refer to 8W-44 - Interior Lighting or 8W-45 - Central Timer Module in Group 8W - Wiring Diagrams for complete circuit descriptions and diagrams.

CHIME WARNING SYSTEM

The chime warning system provides an audible warning to the driver under the following conditions:

- ABS lamp illumination
- Airbag indicator lamp illumination
- Check gauges lamp illumination
- Door is ajar with vehicle in motion
- Driver side seat belt is not fastened with the ignition switch in the On position
- Head or park lamps are turned on with the ignition switch Off and the driver side front door open
- Key is in the ignition switch with the ignition switch Off and the driver side front door open
- Low fuel warning lamp illumination - less than about one-eighth tank of fuel remaining
- Low washer fluid warning lamp illumination
- Transmission oil temperature warning lamp illumination.

Following are general descriptions of the major components in the chime warning system. Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the chime warning system.

DESCRIPTION AND OPERATION

CENTRAL TIMER MODULE

Two versions of the Central Timer Module (CTM) are available on this vehicle, a base version and a high-line version. The base version of the CTM is used on base models of the vehicle. The base version of the CTM combines the functions of a chime/buzzer module and an intermittent wipe module into a single unit. The base CTM also uses inputs from the door ajar switches, the headlamp switch and the key-in ignition switch to control the output to the dome lamp circuits, which allows the base CTM to provide load shedding to help protect the battery from becoming discharged.

The high-line version of the CTM is used on high-line vehicles. The high-line CTM provides all of the functions of the base version CTM, but also is used to control and integrate many of the additional electronic functions and features included on the high-line models. The high-line version of the CTM contains a central processing unit and interfaces with other modules in the vehicle on the Chrysler Collision Detection (CCD) data bus network.

The CCD data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

One of the functions and features that both versions of the CTM support is the chime warning system. The CTM contains a chime tone generator to perform the functions of the chime warning module. The CTM uses hard-wired switch inputs, internal

DESCRIPTION AND OPERATION (Continued)

programming, and a hard-wired chime request input from the instrument cluster circuitry to detect when a chime tone is required.

Both versions of the CTM are mounted under the passenger side end of the instrument panel, outboard of the instrument panel glove box opening. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

This group covers the diagnosis and service of only the hard-wired inputs used by the CTM to determine that a chime tone should be generated. See Central Timer Module in the Diagnosis and Testing section of this group for diagnosis of the base version of the CTM. For diagnosis of the high-line version of the CTM or of the CCD data bus, a DRBIII® scan tool and the proper Diagnostic Procedures manual are recommended. The CTM cannot be repaired and, if faulty or damaged, it must be replaced.

INSTRUMENT CLUSTER

The instrument cluster is an electromechanical unit that contains integrated circuitry and internal programming to perform a variety of functions. The instrument cluster circuitry monitors hard-wired switch inputs, as well as message inputs received from other vehicle electronic modules on the Chrysler Collision Detection (CCD) data bus network.

The instrument cluster uses these many inputs along with its internal programming to provide hard-wired chime tone requests to the Central Timer Module (CTM), which performs the functions of the chime warning module on this model. The instrument cluster circuitry also has a self-diagnostic capability. Refer to Instrument Cluster in the Diagnosis and Testing section of Group 8E - Instrument Panel Systems for more information on this feature.

The only instrument cluster diagnosis found in this group consists of confirming the viability of the hard-wired chime request circuit between the instrument cluster circuitry and the CTM, and diagnosis of the hard-wired seat belt switch input to the instrument cluster. For diagnosis of the CCD data bus and the data bus message inputs, a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

Refer to Instrument Cluster in the Removal and Installation section of Group 8E - Instrument Panel Systems for the instrument cluster service procedures. Refer to the Diagnosis and Testing section of Group 8E - Instrument Panel systems for more information on the remaining hard-wired instrument cluster inputs. The instrument cluster chime warning circuitry cannot be repaired and, if faulty or damaged, the instrument cluster assembly must be replaced.

DRIVER DOOR AJAR SWITCH

The driver door ajar switch is integral to the driver side front door latch. The switch closes a path to ground for the Central Timer Module (CTM) when the driver door is opened, and opens the ground path when the driver door is closed.

The driver door ajar switch cannot be repaired and, if faulty or damaged, the door latch unit must be replaced. Refer to Group 23 - Body for the door latch service procedures.

KEY-IN IGNITION SWITCH

The key-in ignition switch is integral to the ignition switch, which is mounted on the right side of the steering column. It closes a path to ground for the Central Timer Module (CTM) when the ignition key is inserted in the ignition lock cylinder and the driver door ajar switch is closed (driver door is open). The key-in ignition switch opens the ground path when the key is removed from the ignition lock cylinder. The ground path is also opened when the driver door ajar switch is open (driver door is closed).

The key-in ignition switch cannot be repaired and, if faulty or damaged, the entire ignition switch must be replaced. Refer to Group 8D - Ignition Systems for the service procedures.

HEADLAMP SWITCH

The headlamp switch is located in the instrument panel, outboard of the steering column. It closes a path to ground for the Central Timer Module (CTM) when the park or head lamps are on and the driver door ajar switch is closed (driver door is open). The headlamp switch opens the ground path when the headlamp switch is turned off. The ground path is also opened when the driver door ajar switch is open (driver door is closed).

The headlamp switch cannot be repaired and, if faulty or damaged, it must be replaced. Refer to Headlamp Switch in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

DRIVER SEAT BELT SWITCH

The driver seat belt switch is integral to the driver seat belt retractor assembly. The driver seat belt switch is normally closed, providing a ground signal to the instrument cluster when the ignition switch is in the On or Start positions.

The seat belt switch monitors the amount of seat belt webbing wound onto the seat belt retractor spool. When the seat belt tip-half webbing is pulled out of the retractor far enough to engage the seat belt buckle-half, the switch opens the seat belt switch sense circuit.

DESCRIPTION AND OPERATION (Continued)

The driver seat belt switch cannot be repaired and, if faulty or damaged, the entire driver seat belt and retractor unit must be replaced. Refer to Group 23 - Body for the service procedures.

DIAGNOSIS AND TESTING

CENTRAL TIMER MODULE

Before testing the Central Timer Module (CTM) for an inoperative chime function, be sure to test the hard-wired switch and instrument cluster chime request circuits as described in this group. For circuit descriptions and diagrams, refer to 8W-45 - Central Timer Module in Group 8W - Wiring Diagrams.

NOTE: The following tests may not prove conclusive in the diagnosis of the high-line version of the Central Timer Module (CTM). The most reliable, efficient, and accurate means to diagnose the high-line CTM requires the use of a DRB scan tool and the proper Diagnostic Procedures manual.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fuses in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fuse in the junction block. If OK, go to Step 3. If not OK, repair the open circuit to the Power Distribution Center (PDC) as required.

(3) Disconnect and isolate the battery negative cable. Remove the CTM from its mounting bracket to access the CTM wire harness connectors. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(4) Unplug the wire harness connectors from the CTM. Check the wire harness connectors and the receptacles in the module for loose, corroded, or damaged terminals and pins. If OK, go to Step 5. If not OK, repair as required.

(5) Probe the ground circuit cavity of the 14-way CTM wire harness connector and check for continuity to a good ground. On the high-line version of the CTM, repeat the check between the ground circuit cavity of the 18-way CTM wire harness connector and a good ground. In each case, there should be continuity. If OK, go to Step 6. If not OK, repair the open circuit(s) to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 14-way CTM wire harness connector. If OK, go to Step 7. If not OK, repair the open circuit to the junction block as required.

(7) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the 14-way CTM wire harness connector. On the high-line version of the CTM, repeat the check at the fused ignition switch output (run/accessory) circuit cavity of the 18-way CTM wire harness connector. If OK, replace the faulty CTM. If not OK, repair the open circuit from the CTM to the junction block as required.

DRIVER DOOR AJAR SWITCH

For circuit descriptions and diagrams, refer to 8W-45 - Central Timer Module in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Rotate the headlamp switch knob counterclockwise to ensure that the dome lamps are not switched off. Open the driver door and note whether the interior lamps light. They should light. If OK, see Key-In Ignition Switch and/or Headlamp Switch in the Diagnosis and Testing section of this group. If not OK, go to Step 2.

(2) Disconnect and isolate the battery negative cable. Unplug the driver door latch wire harness connector. Check for continuity between the ground circuit cavity in the body half of the driver door latch wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the circuit to ground as required.

(3) Check for continuity between the driver door ajar switch ground circuit terminal and the driver door ajar switch sense circuit terminal of the driver door latch wire harness connector. There should be continuity with the driver door open, and no continuity with the driver door closed. If OK, go to Step 4. If not OK, replace the faulty latch.

(4) Remove the Central Timer Module (CTM) from its mounting bracket to access the CTM wire harness connectors. Refer to Central Timer Module in the

DIAGNOSIS AND TESTING (Continued)

Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures. Unplug the 14-way CTM wire harness connector. Check for continuity between the driver door ajar switch sense circuit cavity of the 14-way CTM wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the short circuit as required.

(5) Check for continuity between the driver door ajar switch sense circuit cavities of the 14-way CTM wire harness connector and the driver door latch wire harness connector. There should be continuity. If OK, see Key-In Ignition Switch and/or Headlamp Switch in the Diagnosis and Testing section of this group. If not OK, repair the open circuit as required.

KEY-IN IGNITION SWITCH

For circuit descriptions and diagrams, refer to 8W-40 - Instrument Cluster or 8W-44 - Interior Lighting in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the steering column shrouds. Refer to Group 8D - Ignition Systems for the procedures. Unplug the key-in ignition switch wire harness connector from the ignition switch.

(2) Check for continuity between the key-in ignition switch sense and ground terminals of the key-in ignition switch. There should be continuity with the key in the ignition lock cylinder, and no continuity with the key removed from the ignition lock cylinder. If OK, go to Step 3. If not OK, replace the faulty ignition switch assembly.

(3) Open the driver door. Check for continuity between the ground circuit cavity of the key-in ignition switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open circuit to the driver door ajar switch as required.

(4) Remove the Central Timer Module (CTM) from its mounting bracket to access the CTM wire harness connectors. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures. Unplug the 14-way CTM wire harness connector. Close the driver door. Check for continuity between the key-in ignition switch sense circuit cavity of the CTM wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the short circuit as required.

(5) Check for continuity between the key-in ignition switch sense circuit cavities of the key-in ignition switch wire harness connector and the 14-way CTM wire harness connector. There should be continuity. If OK, test the CTM as described in this group. If not OK, repair the open circuit as required.

HEADLAMP SWITCH

For circuit descriptions and diagrams, refer to 8W-45 - Central Timer Module in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the headlamp switch from the instrument panel. Refer to Headlamp Switch in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures. Unplug the headlamp switch wire harness connectors. Check for continuity between the driver door ajar switch sense circuit cavity of the headlamp switch wire harness connector and a good ground. There should be continuity with the driver door open, and no continuity with the driver door closed. If OK, go to Step 2. If not OK, repair the circuit to the driver door ajar switch as required.

(2) Remove the Central Timer Module (CTM) from its mounting bracket to access the CTM wire harness connectors. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures. Unplug the 14-way CTM wire harness connector. Remove the key from the ignition lock cylinder. Check for continuity between the key-in ignition switch sense circuit cavity of the 14-way CTM wire harness connector and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the short circuit as required.

(3) Check for continuity between the key-in ignition switch sense circuit cavities of the 14-way CTM wire harness connector and the headlamp switch wire harness connector. There should be continuity. If OK, go to Step 4. If not OK, repair the open circuit as required.

DIAGNOSIS AND TESTING (Continued)

(4) Check for continuity between the driver door ajar switch sense circuit terminal and the key-in ignition switch sense circuit terminal of the headlamp switch. There should be no continuity with the switch in the Off position, and continuity with the switch in the park or head lamps On position. If OK, see Central Timer Module in the Diagnosis and Testing section of this group. If not OK, replace the faulty headlamp switch.

DRIVER SEAT BELT SWITCH

For circuit descriptions and diagrams, refer to 8W-40 - Instrument Cluster or 8W-44 - Interior Lighting in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Unplug the wire harness connector from the driver seat belt retractor. Check for continuity between the circuit cavity in the body half of the driver seat belt switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 2. If not OK, repair the open circuit as required.

(2) Check for continuity between the two cavities in the seat belt half of the driver seat belt switch wire harness connector. There should be no continuity with the seat belt webbing retracted, and continuity with the seat belt webbing pulled out of the retractor far enough to engage the seat belt buckle. If OK, go to Step 3. If not OK, replace the faulty driver side seat belt and retractor assembly.

(3) Remove the instrument cluster from the instrument panel. Check for continuity between the seat belt switch sense circuit cavities of the instrument cluster wire harness connector (connector B) and the body half of the driver seat belt switch wire harness connector. There should be continuity. If OK, see Instrument Cluster in the Diagnosis and Testing section of this group for diagnosis of the chime request circuit. If not OK, repair the open circuit as required.

INSTRUMENT CLUSTER

Before performing this test, see Driver Seat Belt Switch in the Diagnosis and Testing section of this group, and Instrument Cluster in the Diagnosis and Testing section of Group 8E - Instrument Panel Systems. For circuit descriptions and diagrams, refer to 8W-40 - Instrument Cluster or 8W-45 - Central Timer Module in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster from the instrument panel. Refer to Instrument Cluster in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(2) Remove the Central Timer Module (CTM) from its mounting bracket to access the CTM wire harness connectors. Refer to Central Timer Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures. Unplug the 14-way CTM wire harness connector.

(3) Check for continuity between the chime request circuit cavity of the 14-way CTM wire harness connector and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the short circuit as required.

(4) Check for continuity between the chime request circuit cavities of the 14-way CTM wire harness connector and the instrument cluster wire harness connector (connector B). There should be continuity. If OK, test the CTM as described in this group. If not OK, repair the open circuit as required.

REMOVAL AND INSTALLATION

CHIME WARNING SYSTEM SWITCHES

Service procedures for the various hard-wired switches used in the chime warning system can be found in the Removal and Installation section of the proper group, as follows:

- Driver door ajar switch - refer to Group 23 - Body for the door latch service procedures
- Driver seat belt switch - refer to Group 23 - Body for the seat belt retractor service procedures
- Headlamp switch - refer to Headlamp Switch in the Removal and Installation section of Group 8E - Instrument Panel Systems
- Key-in ignition switch - refer to Group 8D - Ignition Systems for the ignition switch service procedures.

OVERHEAD CONSOLE SYSTEMS

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
OVERHEAD CONSOLE SYSTEM 1
OVERHEAD CONSOLE 1
COMPASS MINI-TRIP COMPUTER 2
OVERHEAD CONSOLE READING AND COURTESY LAMP 3
GARAGE DOOR OPENER STORAGE BIN 3
PAPERCLIP 4
SUNGLASSES STORAGE BIN 4
AMBIENT TEMPERATURE SENSOR 4
DIAGNOSIS AND TESTING
COMPASS MINI-TRIP COMPUTER 5
AMBIENT TEMPERATURE SENSOR 5
SERVICE PROCEDURES
COMPASS VARIATION ADJUSTMENT 6
COMPASS CALIBRATION 6

page

COMPASS DEMAGNETIZING 7
REMOVAL AND INSTALLATION
OVERHEAD CONSOLE READING AND COURTESY LAMP LENS 8
OVERHEAD CONSOLE 9
PAPERCLIP 10
COMPASS MINI-TRIP COMPUTER 11
OVERHEAD CONSOLE READING AND COURTESY LAMP HOUSING 11
SUNGLASSES STORAGE BIN 12
GARAGE DOOR OPENER STORAGE BIN DOOR 12
AMBIENT TEMPERATURE SENSOR 13
SPECIAL TOOLS
OVERHEAD CONSOLE SYSTEMS 13

DESCRIPTION AND OPERATION

OVERHEAD CONSOLE SYSTEM

DESCRIPTION

An overhead console unit is an available factory-installed option on this model. The overhead console unit features a garage door opener storage bin, a sunglasses storage bin, two reading and courtesy lamps and either a standard paperclip or an optional compass mini-trip computer. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the overhead console components and systems. Refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

OVERHEAD CONSOLE

DESCRIPTION

The overhead console (Fig. 1) for this model includes two front-mounted reading and courtesy lamps, a garage door opener storage bin, a sunglasses storage bin and either a standard paperclip or an optional compass mini-trip computer.

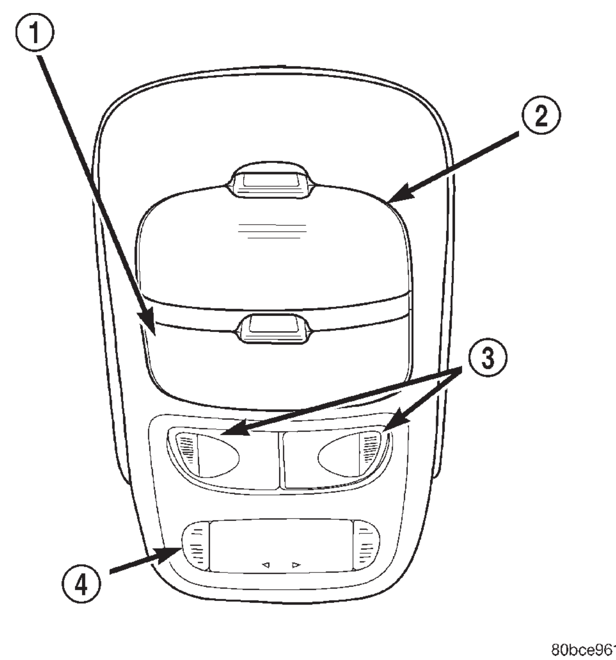


Fig. 1 Overhead Console

1 – SUNGLASSES STORAGE BIN
2 – GARAGE DOOR OPENER STORAGE BIN
3 – READING AND COURTESY LAMPS
4 – PAPERCLIP OR COMPASS MINI—TRIP COMPUTER

The overhead console is secured with two snap clips at the rear and a single screw at the front to the overhead console mounting bracket. The front of the overhead console mounting bracket is secured to the roof header near the windshield with two screws, and the rear of the bracket is secured with double-

DESCRIPTION AND OPERATION (Continued)

faced tape to the inside surface of the roof panel. A single electrical connection joins the overhead console wire harness to the roof wire harness.

Following are general descriptions of the major components used in the overhead console. See the owner's manual in the vehicle glove box for more information on the use and operation of the various overhead console features.

COMPASS MINI-TRIP COMPUTER

DESCRIPTION

The compass mini-trip computer is located in the overhead console on models equipped with this option. The compass mini-trip computer units include the electronic control module, a Vacuum-Fluorescent Display (VFD), a compass sensor unit and two push button function switches.

The compass mini-trip computer module contains a central processing unit and interfaces with other electronic modules in the vehicle on the Chrysler Collision Detection (CCD) data bus network. The CCD data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

The compass mini-trip computer provides several electronic functions and features. Some of the functions and features that the compass mini-trip computer module supports and/or controls, include the following display options:

- **Compass and temperature** - provides the outside temperature and one of eight compass readings to indicate the direction the vehicle is facing.
- **Trip odometer (TRIP ODO)** - shows the distance travelled since the last trip computer reset.
- **Average fuel economy (AVG ECO)** - shows the average fuel economy since the last trip computer reset.
- **Instant fuel economy (ECO)** - shows the present fuel economy based upon the current vehicle distance and fuel used information.
- **Distance to empty (DTE)** - shows the estimated distance that can be travelled with the fuel remaining in the fuel tank. This estimated distance is computed using the average miles-per-gallon from the last 30 gallons of fuel used.
- **Elapsed time (ET)** - shows the accumulated ignition-on time since the last trip computer reset.
- **Blank screen** - the compass mini-trip VFD is turned off.

The ambient temperature sensor is hard wired to the compass mini-trip computer module. Data input for all other compass mini-trip computer functions, including VFD dimming level, is received through CCD data bus messages. The compass mini-trip computer uses its internal programming and all of these inputs to calculate and display the requested data. If the data displayed is incorrect, perform the self-diagnostic tests as described in this group. If these tests prove inconclusive, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended for further testing of the compass mini-trip computer module and the CCD data bus.

The compass mini-trip computer module cannot be repaired, and is available for service only as a unit. This unit includes the push button switches and the plastic module and display lens. If any of these components is faulty or damaged, the complete compass mini-trip computer module must be replaced.

COMPASS

While in the compass/temperature mode, the compass will display the direction in which the vehicle is pointed using the eight major compass headings (Examples: north is N, northeast is NE). The self-calibrating compass unit requires no adjusting in normal use. The only calibration that may prove necessary is to drive the vehicle in three complete circles, on level ground, in not less than forty-eight seconds. This will reorient the compass unit to its vehicle.

The compass unit also will compensate for magnetism the body of the vehicle may acquire during normal use. However, avoid placing anything magnetic directly on the roof of the vehicle. Magnetic mounts for an antenna, a repair order hat, or a funeral procession flag can exceed the compensating ability of the compass unit if placed on the roof panel. Magnetic bit drivers used on the fasteners that hold the overhead console assembly to the roof header can also affect compass operation. If the vehicle roof should become magnetized, the demagnetizing and calibration procedures found in this group may be required to restore proper compass operation.

THERMOMETER

The thermometer displays the outside ambient temperature in whole degrees. The temperature display can be changed from Fahrenheit to Celsius using the U. S./Metric push button. The displayed temperature is not an instant reading of conditions, but an average temperature. It may take the thermometer display several minutes to respond to a major temperature change, such as driving out of a heated garage into winter temperatures.

When the ignition switch is turned to the Off position, the last displayed temperature reading stays in the thermometer unit memory. When the ignition

DESCRIPTION AND OPERATION (Continued)

switch is turned to the On position again, the thermometer will display the memory temperature if the engine coolant temperature is above about 52° C (125° F). If the engine coolant temperature is below about 52° C (125° F), the thermometer will display the actual temperature sensed by the ambient temperature sensor. The thermometer temperature display update interval varies with the vehicle speed.

The thermometer function is supported by an ambient temperature sensor. The sensor is mounted outside the passenger compartment near the front and center of the vehicle, and is hard wired to the module. The ambient temperature sensor is available as a separate service item.

OPERATION

The compass mini-trip computer only operates with the ignition switch in the On position. When the ignition switch is turned to the On position, all of the segments in the compass mini-trip computer VFD will be turned off for one second, then the display will return to the last function being displayed before the ignition was turned to the Off position. With the ignition switch in the On position, momentarily depressing and releasing the Step push button switch will cause the compass-mini-trip computer to change its mode of operation, and momentarily depressing and releasing the U. S./Metric push button will cause the unit to toggle between U. S. and Metric measurements.

This compass mini-trip computer features several functions that can be reset. If both the Step and U. S./Metric push buttons are depressed at the same time for more than one second with the ignition switch in the On position, the trip computer information that can be reset is reset. However, the reset will only occur if the function currently displayed is a function that can be reset. The functions that can be reset are: TRIP ODO, AVG ECO, and ET.

For more information on the features and control functions of the compass mini-trip computer, see the owner's manual in the vehicle glove box.

OVERHEAD CONSOLE READING AND COURTESY LAMP

DESCRIPTION

The overhead console in this vehicle is equipped with two individual reading and courtesy lamps. The lamp lenses are the only visible components of these lamps. The reading and courtesy lamp lenses are mounted in the overhead console housing between the compass mini-trip computer display and the sunglasses storage bin. Each lamp has its own switch, bulb, and lens; but both lamps share a common lamp housing within the overhead console.

The overhead console reading and courtesy lamps operate on battery current that is provided at all times, regardless of the ignition switch position. The ground feed for the lamps is switched through the integral reading and courtesy lamp switches or through the door jamb switches. Each lamp is designed and aimed to provide illumination that will be directed only to that side of the vehicle on which the lamp is located.

The reading and courtesy lamp lenses, bulbs and the lamp housing are available for service replacement. The reading and courtesy lamp switches, bulb holders and wiring are only available as part of the overhead console wire harness. If either of the lamp switches or bulb holders is faulty or damaged, the entire overhead console wire harness assembly must be replaced.

For service of the reading and courtesy lamp bulbs, refer to **Overhead Console Reading Lamp Bulbs** in the Removal and Installation section of Group 8L - Lamps. For diagnosis of the reading and courtesy lamps, refer to **Lamp Diagnosis** in the Diagnosis and Testing section of Group 8L - Lamps. For complete circuit diagrams, refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

All reading and courtesy lamps located in the overhead console are activated by the door jamb switches. When all of the doors are closed, these lamps can be individually activated by depressing the corresponding lens. When any door is open, depressing the lamp lenses to activate the lamp switches will not turn the lamps off.

See the owner's manual in the vehicle glove box for more information on the use and operation of the overhead console reading and courtesy lamps.

GARAGE DOOR OPENER STORAGE BIN

DESCRIPTION

A compartment near the rear of the overhead console is designed to hold most garage door opener remote control transmitters. The door for the garage door opener compartment features a spring-loaded latch mechanism and has a small depression with tactile ribs just forward of the latch. The transmitter is mounted within the compartment with an adhesive-backed hook and loop fastener patch and, when the compartment is closed, the depressed area of the compartment door is pressed upward to actuate the transmitter.

A transmitter mounting kit including the adhesive-backed hook and loop fastener material and additional adapter pegs is available for service. The garage door opener storage bin door is also available

DESCRIPTION AND OPERATION (Continued)

for service replacement. The door unit includes the spring-loaded latch mechanism. If any of these components is damaged or faulty, the garage door opener storage bin door unit must be replaced.

OPERATION

The garage door opener storage compartment door is opened by pressing the spring-loaded latch towards the front of the vehicle. When the compartment door is opened, the garage door opener transmitter can be installed in the compartment using the adhesive-backed hook and loop fastener material provided.

With the transmitter mounted in the storage bin, adapter pegs located on the inside of the garage door opener door are selected and mounted on one of several posts on the back side of the door. The adapter pegs can be stacked if additional length is required. The combination of the adapter peg length and the peg location selected must be suitable to depress the button of the transmitter when the center of the garage door opener storage bin door is depressed. When the proper combination has been selected, the compartment door is closed and need not be reopened except to replace the transmitter batteries.

See the owner's manual in the vehicle glove box for more information on the use and operation of the overhead console garage door opener storage bin.

PAPERCLIP

DESCRIPTION

A paperclip is standard equipment on the base version of the overhead console. The paperclip provides a convenient place for storage and easy retrieval of notes, maps, toll tickets or stubs and other paper items that may be required or desired while driving. The paperclip is located near the front of the overhead console and is secured in the overhead console housing by four screws.

The paperclip is available for service replacement, but it cannot be adjusted or repaired. If the paperclip is damaged or faulty it must be replaced.

SUNGLASSES STORAGE BIN

DESCRIPTION

A sunglasses storage bin is included in the overhead console. The storage bin is located near the center of the overhead console and is held in the closed position by a spring-loaded latch mechanism that is integral to the storage bin door. The interior of the bin is lined with a foam rubber padding material to protect the sunglasses from being scratched. A damper spring is snapped onto the pivot shaft of the sunglasses storage bin door. The damper spring engages two flats on the shaft and is anchored in a slot in the rear flange of the overhead console reading and courtesy lamp housing to provide a smooth opening action and an open detent position for the storage bin unit.

The sunglasses storage bin and door unit is available for service replacement. The bin and door unit includes the spring-loaded latch mechanism, the bin liner and the damper spring. If any of these components is damaged or faulty, the sunglasses storage bin and door unit must be replaced.

OPERATION

The sunglasses storage bin is opened by pressing the latch on the rear edge of the door towards the front of the vehicle, then pulling the bin downward to the open detent position. The spring-loaded latch mechanism on the sunglasses bin door will automatically engage when the bin is closed. See the owner's manual in the vehicle glove box for more information on the use and operation of the sunglasses storage bin.

AMBIENT TEMPERATURE SENSOR

DESCRIPTION

Ambient air temperature is monitored by the compass mini-trip computer module through the ambient temperature sensor. The ambient temperature sensor is a variable resistor mounted to a bracket that is secured with a screw to the right side of the radiator yoke, behind the radiator grille and in front of the engine compartment.

For complete circuit diagrams, refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams. The ambient temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The ambient temperature sensor is a variable resistor that operates on a five-volt reference signal sent to it by the compass mini-trip computer module. The resistance in the sensor changes as temperature changes, changing the temperature sensor signal circuit voltage to the compass mini-trip computer module. Based upon the resistance in the sensor, the compass mini-trip computer module senses a specific voltage on the temperature sensor signal circuit, which it is programmed to correspond to a specific temperature.

DIAGNOSIS AND TESTING

COMPASS MINI-TRIP COMPUTER

If the problem with the compass mini-trip computer module is an “OC” or “SC” in the compass/thermometer display, refer to **Ambient Temperature Sensor** in the Diagnosis and Testing section of this group. If the problem with the compass mini-trip computer module is an inaccurate or scrambled display, refer to **Self-Diagnostic Test** in the Diagnosis and Testing section of this group. If the problem with the compass mini-trip computer module is incorrect Vacuum Fluorescent Display (VFD) dimming levels, use a DRB scan tool and the proper Diagnostic Procedures manual to test for the correct dimming message inputs being received from the instrument cluster over the Chrysler Collision Detection (CCD) data bus. If the problem is a no-display condition, use the following procedures. For complete circuit diagrams, refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the overhead console. Check for continuity between the ground circuit cavities of the roof wire harness connector for the overhead console and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the roof wire harness connector for the overhead console. If OK, refer to **Self-Diagnostic Test** in the Diagnosis and Testing section of this group for further diagnosis of the compass mini-trip computer module and the CCD data bus. If not OK, repair the open fused ignition switch output (run/start) circuit to the junction block fuse as required.

SELF-DIAGNOSTIC TEST

A self-diagnostic test is used to determine that the compass mini-trip computer module is operating properly electrically. Initiate the self-diagnostic test as follows:

(1) With the ignition switch in the Off position, simultaneously depress and hold the Step button and the U. S./Metric button.

(2) Turn the ignition switch to the On position.

(3) Continue to hold both buttons depressed until the compass mini-trip computer module enters the display segment test. In this test, all of the Vacuum Fluorescent Display (VFD) segments are lighted while the compass mini-trip computer module performs the following checks:

a. Microprocessor compass circuit test

b. Non-volatile memory read/write test

c. Microprocessor ROM verification test

d. CCD communications test.

(4) Following completion of these tests, the compass mini-trip computer will return to normal operation or display one of two messages: “FAIL” or “CCd.” Respond to these test results as follows:

a. If no test result message is displayed, but compass mini-trip computer operation is still improper, the use of a DRB scan tool and the proper Diagnostic Procedures manual are required for further diagnosis.

b. If the “FAIL” message is displayed, the compass mini-trip computer module is faulty and must be replaced.

c. If the “CCd” message is displayed, the use of a DRB scan tool and the proper Diagnostic Procedures manual are required for further diagnosis.

d. If any VFD segment should fail to light during the display segment test, the compass mini-trip computer module is faulty and must be replaced.

(5) If all tests are passed, or if the ignition switch is turned to the Off position, the compass mini-trip computer module will automatically return to normal operation.

NOTE: If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the compass unit to accommodate variations in the earth’s magnetic field strength, based on geographic location. Refer to Compass Variation Adjustment in the Service Procedures section of this group.

NOTE: If the compass reading has blanked out, and only “CAL” appears in the display, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle. Refer to Compass Demagnetizing in the Service Procedures section of this group.

AMBIENT TEMPERATURE SENSOR

The thermometer function is supported by the ambient temperature sensor, a wiring circuit, and a

DIAGNOSIS AND TESTING (Continued)

portion of the compass mini-trip computer module. If any portion of the ambient temperature sensor circuit fails, the compass/thermometer display function will self-diagnose the circuit. An “SC” (short circuit) will appear in the display in place of the temperature, when the sensor is exposed to temperatures above 110° C (230° F), or if the sensor circuit is shorted. An “OC” (open circuit) will appear in the display in place of the temperature, when the sensor is exposed to temperatures below –50° C (–58° F), or if the sensor circuit is open.

The ambient temperature sensor circuit can also be diagnosed using the following Sensor Test, and Sensor Circuit Test. If the temperature sensor and circuit are confirmed to be OK, but the temperature display is inoperative or incorrect, refer to **Compass Mini-Trip Computer** in the Diagnosis and Testing section of this group. For complete circuit diagrams, refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams.

SENSOR TEST

(1) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor wire harness connector.

(2) Measure the resistance of the ambient temperature sensor. At –40° C (–40° F), the sensor resistance is 336 kilohms. At 55° C (131° F), the sensor resistance is 2.488 kilohms. The sensor resistance should read between these two values. If OK, refer to **Sensor Circuit Test** in the Diagnosis and Testing section of this group. If not OK, replace the faulty ambient temperature sensor.

SENSOR CIRCUIT TEST

(1) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor wire harness connector and the overhead console wire harness connector.

(2) Connect a jumper wire between the two terminals in the body half of the ambient temperature sensor wire harness connector.

(3) Check for continuity between the sensor return circuit and the ambient temperature sensor signal circuit cavities of the roof wire harness overhead console connector. There should be continuity. If OK, go to Step 4. If not OK, repair the open sensor return circuit or ambient temperature sensor signal circuit to the ambient temperature sensor as required.

(4) Remove the jumper wire from the body half of the ambient temperature sensor wire harness connector. Check for continuity between the sensor return circuit cavity of the roof wire harness overhead console connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted sensor return circuit as required.

(5) Check for continuity between the ambient temperature sensor signal circuit cavity of the roof wire harness overhead console connector and a good ground. There should be no continuity. If OK, refer to **Compass Mini-Trip Computer** in the Diagnosis and Testing section of this group. If not OK, repair the shorted ambient temperature sensor signal circuit as required.

SERVICE PROCEDURES

COMPASS VARIATION ADJUSTMENT

Compass variance, also known as magnetic declination, is the difference in angle between magnetic north and true geographic north. In some geographic locations, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this problem occurs, the compass variance must be set.

To set the compass variance:

(1) Using the Variance Settings map, find your geographic location and note the zone number (Fig. 2).

(2) Turn the ignition switch to the On position. If the compass/temperature data is not currently being displayed, momentarily depress and release the Step push button to step through the display options until you have reached the compass/temperature display.

(3) Depress both the U. S./Metric, and the Step push buttons and hold the buttons down until “VAR” appears in the display. This takes about five seconds.

(4) Release both of the push buttons. “VAR” along with the current variance zone will appear in the display.

(5) Momentarily depress and release the U. S./Metric push button to step through the zone numbers, until the zone number for your geographic location appears in the display.

(6) Momentarily depress and release the Step push button to enter the displayed zone number into the compass unit memory.

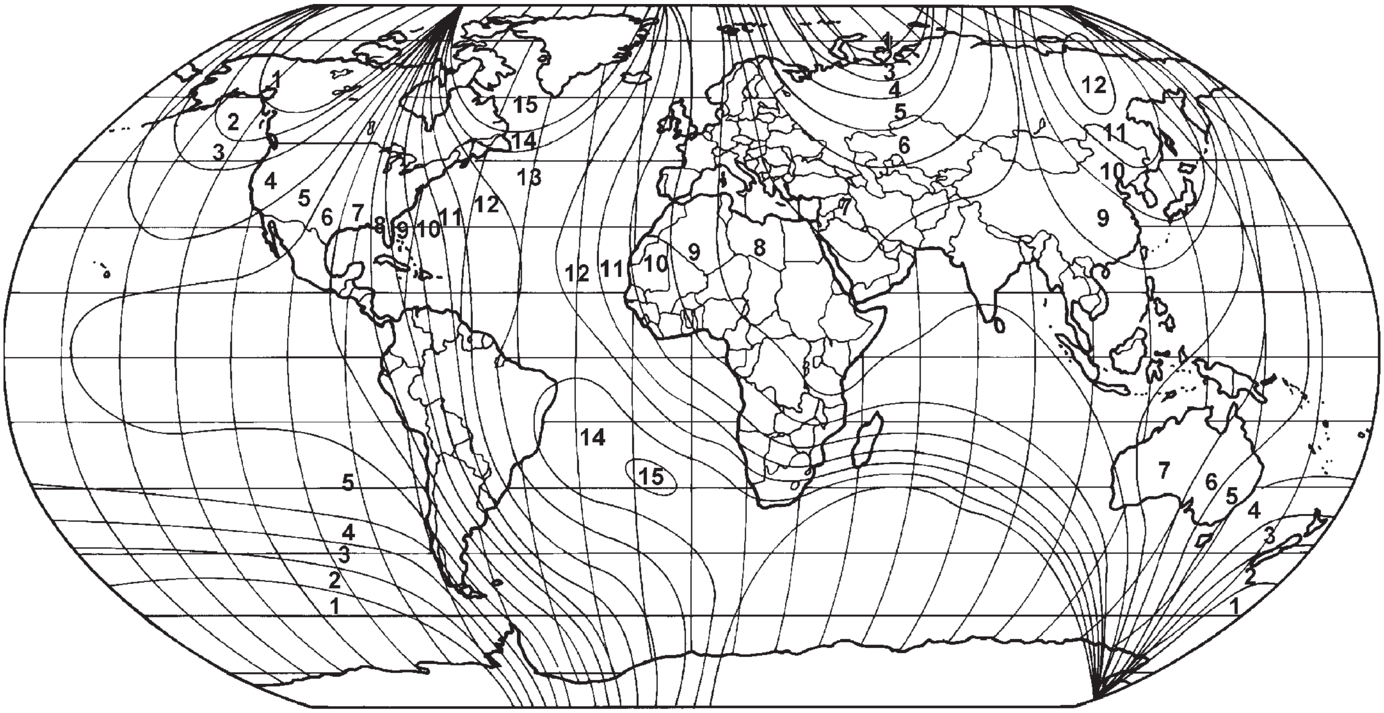
(7) Confirm that the correct directions are now indicated by the compass.

COMPASS CALIBRATION

CAUTION: Do not place any external magnets, such as magnetic roof mount antennas, in the vicinity of the compass. Do not use magnetic tools when servicing the overhead console.

The electronic compass unit features a self-calibrating design, which simplifies the calibration pro-

SERVICE PROCEDURES (Continued)



80a13863

Fig. 2 Variance Settings

cedure. This feature automatically updates the compass calibration while the vehicle is being driven. This allows the compass unit to compensate for small changes in the residual magnetism that the vehicle may acquire during normal use. If the compass readings appear to be erratic or out of calibration, perform the following calibration procedure. Also, new service replacement compass mini-trip computer modules must have their compass calibrated using this procedure. Do not attempt to calibrate the compass near large metal objects such as other vehicles, large buildings, or bridges; or, near overhead or underground power lines.

NOTE: Whenever the compass is calibrated manually, the variation number must also be reset. See Compass Variation Adjustment in the Service Procedures section of this group.

Calibrate the compass manually as follows:

(1) Turn the ignition switch to the On position. If the compass/temperature data is not currently being displayed, momentarily depress and release the Step push button to step through the display options until you have reached the compass/temperature display.

(2) Depress both the U. S./Metric and the Step push buttons. Hold the push buttons down until “CAL” appears in the display. This takes about ten seconds, and appears about five seconds after “VAR” is displayed.

(3) Release both of the push buttons.

(4) Drive the vehicle on a level surface, away from large metal objects and power lines, through three or more complete circles in not less than 48 seconds. The “CAL” message will disappear from the display to indicate that the compass is now calibrated.

NOTE: If the “CAL” message remains in the display, either there is excessive magnetism near the compass, or the unit is faulty. Repeat the calibration procedure at least one more time.

NOTE: If the wrong direction is still indicated in the compass display, the area selected for calibration may be too close to a strong magnetic field. Repeat the calibration procedure in another location.

COMPASS DEMAGNETIZING

A degaussing tool (Special Tool 6029) is used to demagnetize, or degauss, the overhead console forward mounting screw and the roof panel above the overhead console. Equivalent units must be rated as continuous duty for 110/115 volts and 60 Hz. They must also have a field strength of over 350 gauss at 7 millimeters (0.25 inch) beyond the tip of the probe.

To demagnetize the roof panel and the overhead console forward mounting screw, proceed as follows:

SERVICE PROCEDURES (Continued)

(1) Be certain that the ignition switch is in the Off position, before you begin the demagnetizing procedure.

(2) Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.

(3) Slowly approach the head of the overhead console forward mounting screw with the degaussing tool connected.

(4) Contact the head of the screw with the plastic coated tip of the degaussing tool for about two seconds.

(5) With the degaussing tool still energized, slowly back it away from the screw. When the tip of the tool is at least 61 centimeters (2 feet) from the screw head, disconnect the tool.

(6) Place a piece of paper approximately 22 by 28 centimeters (8.5 by 11 inches), oriented on the vehicle lengthwise from front to rear, on the center line of the roof at the windshield header (Fig. 3). The purpose of the paper is to protect the roof panel from scratches, and to define the area to be demagnetized.

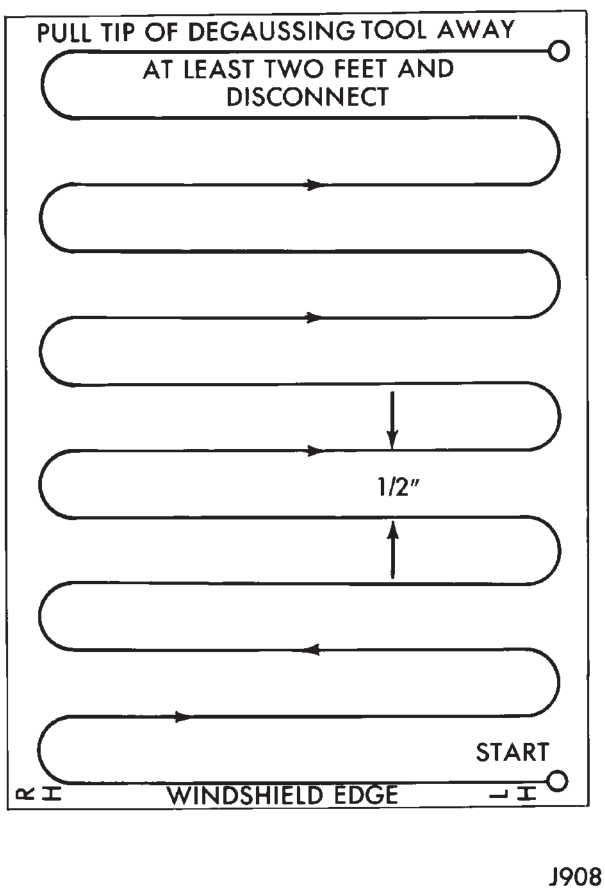


Fig. 3 Roof Demagnetizing Pattern

(7) Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.

(8) Slowly approach the center line of the roof panel at the windshield header, with the degaussing tool connected.

(9) Contact the roof panel with the plastic coated tip of the degaussing tool. Be sure that the template is in place to avoid scratching the roof panel. Using a slow, back-and-forth sweeping motion, and allowing 13 millimeters (0.50 inch) between passes, move the tool at least 11 centimeters (4 inches) to each side of the roof center line, and 28 centimeters (11 inches) back from the windshield header.

(10) With the degaussing tool still energized, slowly back it away from the roof panel. When the tip of the tool is at least 61 centimeters (2 feet) from the roof panel, disconnect the tool.

(11) Calibrate the compass and adjust the compass variance. Refer to **Compass Variation Adjustment** and **Compass Calibration** in the Service Procedures section of this group for the procedures.

REMOVAL AND INSTALLATION

OVERHEAD CONSOLE READING AND COURTESY LAMP LENS

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Insert a long, narrow, flat-bladed tool between the edge of the reading and courtesy lamp lens and the overhead console housing just inboard of the lens pivots (Fig. 4).

(3) Gently pry downward against the reading and courtesy lamp lens until the pivot of the lens is disengaged from the pivot pin in the lens opening of the overhead console housing.

(4) Repeat the procedure to disengage the second lens pivot from its pivot pin.

(5) Pull the pivot end (inboard side) of the reading and courtesy lamp lens horizontally inboard far enough to disengage the switch actuator tab on the outboard side of the lens from the overhead console housing.

(6) Remove the reading and courtesy lamp lens from the overhead console housing.

INSTALLATION

(1) Position the switch actuator tab on the outboard side of the reading and courtesy lamp lens into the lens opening of the overhead console housing. The lens actuator tab should be positioned directly over the switch plunger, which is located just outboard of the lens opening.

(2) Align the two pivots on the inboard side of the reading and courtesy lamp lens with the two pivot

REMOVAL AND INSTALLATION (Continued)

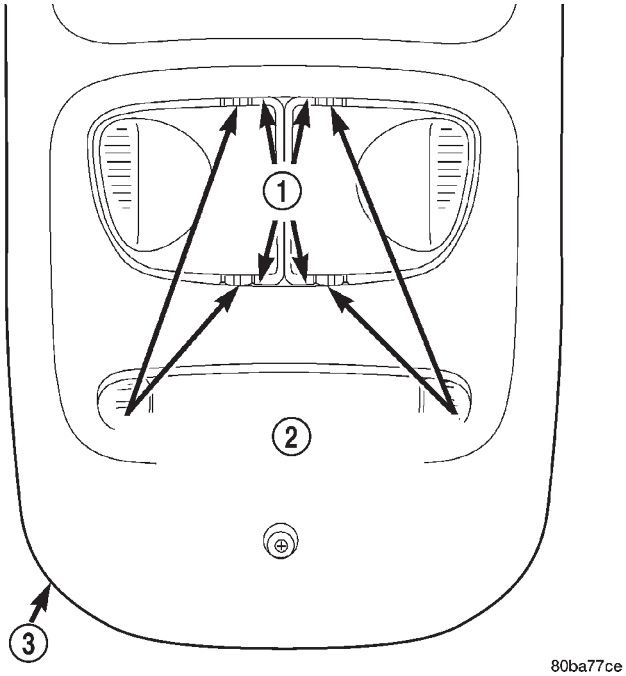


Fig. 4 Overhead Console Reading and Courtesy Lamp Lens Remove/Install

1 – PRY HERE
2 – READING AND COURTESY LAMP LENS PIVOTS
3 – OVERHEAD CONSOLE

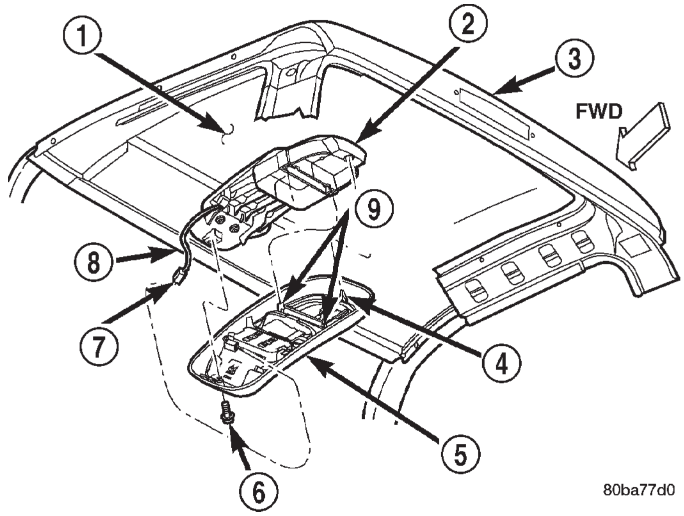


Fig. 5 Overhead Console Remove/Install

1 – HEADLINER
2 – BRACKET
3 – ROOF PANEL
4 – LOCATING PIN
5 – OVERHEAD CONSOLE
6 – SCREW
7 – ROOF WIRE HARNESS CONNECTOR
8 – FRONT HEADER
9 – SNAP CLIP (2)

pins on the inboard end of the lens opening in the overhead console housing.

(3) Push firmly and evenly upward on the reading and courtesy lamp lens directly over each of the two pivots until they snap into place over the pivot pins in the lens opening of the overhead console housing.

(4) Reconnect the battery negative cable.

OVERHEAD CONSOLE

REMOVAL

OVERHEAD CONSOLE

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screw that secures the front of the overhead console to the front of the overhead console bracket (Fig. 5).

(3) Insert the fingertips of both hands between the headliner and the sides of the overhead console housing in the area between the garage door opener storage bin and the sunglasses storage bin.

(4) Pull downward on the sides of the overhead console housing firmly and evenly to disengage the two snap clips that secure the rear of the unit from their receptacles in the overhead console bracket.

(5) Lower the overhead console from the headliner far enough to access the wire harness connector.

(6) Disconnect the roof wire harness connector from the overhead console wire harness connector.

(7) Remove the overhead console from the headliner.

OVERHEAD CONSOLE BRACKET

(1) Disconnect and isolate the battery negative cable.

(2) Remove the overhead console from the overhead console bracket. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(3) Remove the headliner from the roof panel. Refer to **Headliner** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Remove the two screws that secure the front of the overhead console bracket to the roof front header (Fig. 6).

(5) Using a sharp utility knife, cut through the double-faced tape that secures the rear flange of the overhead console bracket to the roof panel.

(6) Remove the overhead console bracket from the roof panel.

INSTALLATION

OVERHEAD CONSOLE

(1) Position the overhead console near the mounting location on the headliner.

REMOVAL AND INSTALLATION (Continued)

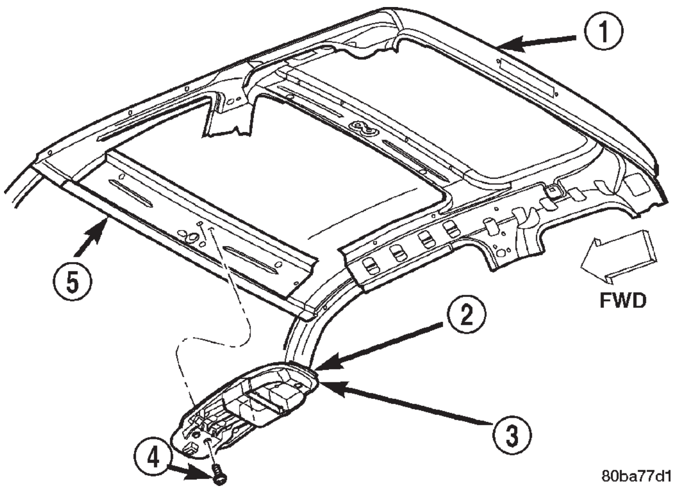


Fig. 6 Overhead Console Bracket Remove/Install

1 – ROOF PANEL
2 – DOUBLE-FACED TAPE
3 – OVERHEAD CONSOLE BRACKET
4 – SCREW (2)
5 – FRONT HEADER

(2) Reconnect the roof wire harness connector to the overhead console wire harness connector.

(3) Align the locating pin on the rear of the overhead console housing with the receptacle in the rear of the overhead console bracket.

(4) Align the two snap clips on the overhead console housing with their receptacles in the overhead console bracket.

(5) Push upward firmly and evenly on the sides of the overhead console housing over both of the snap clip locations until each of the two snap clips is fully engaged with its receptacle in the overhead console bracket.

(6) Install and tighten the screw that secures the front of the overhead console housing to the overhead console bracket. Tighten the screw to 1.9 N·m (17 in. lbs.).

(7) Reconnect the battery negative cable.

OVERHEAD CONSOLE BRACKET

(1) Remove any remnants of the old double-faced tape from the roof panel and the rear flange of the overhead console bracket and clean these areas with a suitable solvent to remove any traces of grease, oil or adhesive residue. When installing the overhead console bracket, always apply a new piece of double-faced tape to the rear flange of the bracket.

(2) Align the two locating pins on the front of the overhead console bracket with the receptacles in the roof front header.

(3) Lower the rear flange of the overhead console bracket from the roof panel far enough to access and remove the release paper from the double-faced tape.

(4) Push upward firmly and evenly on the rear flange of the overhead console bracket over the double-faced tape to ensure complete adhesion to the roof panel.

(5) Install and tighten the two screws that secure the front of the overhead console bracket to the roof front header. Tighten the screws to 1.9 N·m (17 in. lbs.).

(6) Install the headliner onto the roof panel. Refer to **Headliner** in the Removal and Installation section of Group 23 - Body for the procedures.

(7) Install the overhead console onto the overhead console bracket. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(8) Reconnect the battery negative cable.

PAPERCLIP

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the overhead console from the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(3) Remove the four screws that secure the paperclip to the overhead console housing.

(4) Pull the paperclip away from the overhead console far enough to access the wire harness connectors.

(5) Disengage the overhead console wire harness connector from the mount on the paperclip by pushing the connector firmly toward the left side of the overhead console housing.

(6) Remove the paperclip from the overhead console housing.

INSTALLATION

(1) Position the paperclip onto the overhead console housing.

(2) Engage the overhead console wire harness connector onto the mount on the paperclip by aligning the channels on the connector with the tab on the mount and pushing the connector firmly toward the right side of the overhead console housing.

(3) Install and tighten the four screws that secure the paperclip to the overhead console housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Install the overhead console onto the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(5) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

COMPASS MINI-TRIP COMPUTER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the overhead console from the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(3) Remove the four screws that secure the compass mini-trip computer module to the overhead console housing (Fig. 7).

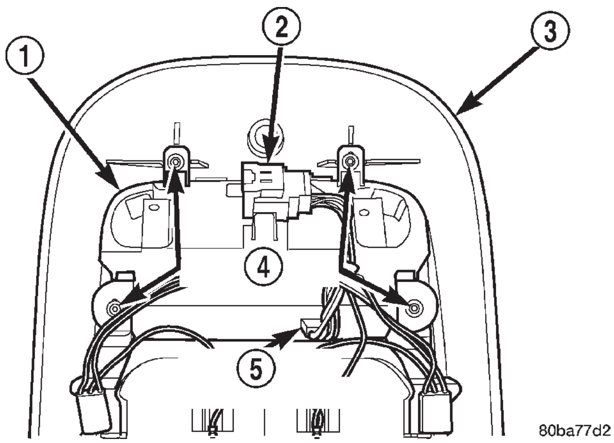


Fig. 7 Compass Mini-Trip Computer Remove/Install

1 – COMPASS MINI-TRIP COMPUTER MODULE
2 – OVERHEAD CONSOLE WIRE HARNESS CONNECTOR
3 – OVERHEAD CONSOLE HOUSING
4 – SCREW (4)
5 – COMPUTER CONNECTOR

(4) Pull the compass mini-trip computer module away from the overhead console far enough to access the wire harness connectors.

(5) Disengage the overhead console wire harness connector from the mount on the compass mini-trip computer module housing by pushing the connector firmly toward the left side of the overhead console housing.

(6) Disconnect the overhead console wire harness connector from the compass mini-trip computer module connector receptacle.

(7) Remove the compass mini-trip computer module from the overhead console housing.

INSTALLATION

(1) Position the compass mini-trip computer module onto the overhead console housing.

(2) Reconnect the overhead console wire harness connector to the compass mini-trip computer module connector receptacle.

(3) Engage the overhead console wire harness connector onto the mount on the compass mini-trip computer module housing by aligning the channels on the connector with the tab on the mount and pushing the connector firmly toward the right side of the overhead console housing.

(4) Install and tighten the four screws that secure the compass mini-trip computer module to the overhead console housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the overhead console onto the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

NOTE: If a new compass mini-trip computer has been installed, the compass will have to be calibrated and the variance set. Refer to Compass Variation Adjustment and Compass Calibration in the Service Procedures section of this group for the procedures.

OVERHEAD CONSOLE READING AND COURTESY LAMP HOUSING

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the compass mini-trip computer module from the overhead console housing. Refer to **Compass Mini-Trip Computer** in the Removal and Installation section of this group for the procedures.

(3) Remove the two screws that secure the reading and courtesy lamp housing to the overhead console housing (Fig. 8).

(4) Pull the reading and courtesy lamp housing away from the overhead console housing far enough to turn it over for access to the lamp bulbs.

(5) Remove both reading and courtesy lamp bulbs from their bulb holders by pulling them straight out from the holders.

(6) Remove both switches from their mounting slots by sliding them towards their respective outboard ends of the reading and courtesy lamp housing.

(7) Remove the four bulb holders from their mounting holes in the reading and courtesy lamp housing by depressing the latch on each side of each holder and pushing the bulb side of the holder out through the wire side of the mounting hole.

(8) Remove the reading and courtesy lamp housing from the overhead console housing.

INSTALLATION

(1) Install each of the four bulb holders into their mounting holes in the reading and courtesy lamp housing by inserting the bulb side of the holder into the wire side of the mounting hole and pushing it

REMOVAL AND INSTALLATION (Continued)

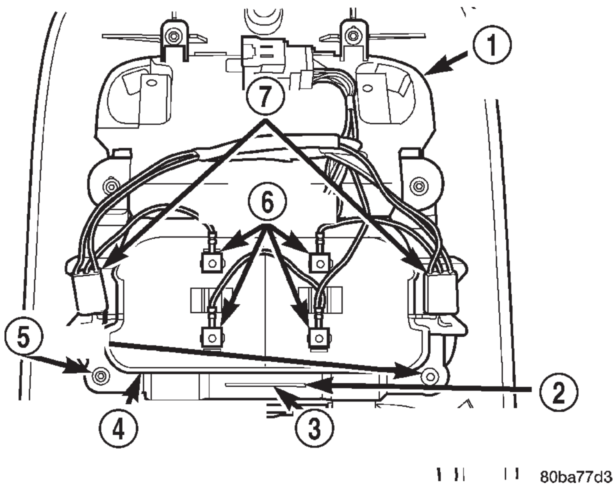


Fig. 8 Overhead Console Reading and Courtesy Lamp Housing Remove/Install

1 – COMPASS MINI-TRIP COMPUTER
2 – SLOT
3 – SUNGLASSES STORAGE BIN DAMPER SPRING
4 – OVERHEAD CONSOLE READING AND COURTESY LAMP HOUSING
5 – SCREWS (2)
6 – BULB HOLDERS
7 – SWITCHES

through the mounting hole until both latches are engaged with the lamp housing.

(2) Install both switches into their mounting slots by sliding them inboard from their respective ends of the reading and courtesy lamp housing until they snap into place.

(3) Install both reading and courtesy lamp bulbs into their bulb holders by pushing them straight into the holders.

(4) Position the reading and courtesy lamp housing onto the overhead console housing. Be certain that the sunglasses storage bin damper spring is engaged in the slot on the rear flange of the reading and courtesy lamp housing.

(5) Install and tighten the two screws that secure the reading and courtesy lamp housing to the overhead console housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Install the compass mini-trip computer module into the overhead console housing. Refer to **Compass Mini-Trip Computer** in the Removal and Installation section of this group for the procedures.

(7) Reconnect the battery negative cable.

SUNGLASSES STORAGE BIN

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the reading and courtesy lamp housing from the overhead console. Refer to **Overhead Console Reading and Courtesy Lamp Housing** in the Removal and Installation section of this group for the procedures.

(3) Unlatch and remove the sunglasses storage bin from the overhead console housing.

INSTALLATION

(1) Position the sunglasses storage bin into the overhead console housing.

(2) Engage the latch of the sunglasses storage bin with the latch striker on the rear of the storage bin opening in the overhead console housing.

(3) Be certain that the sunglasses storage bin pivot shaft is located in the two pivot receptacles just behind the reading and courtesy lamp lenses in the overhead console housing.

(4) Be certain that the sunglasses storage bin damper spring is installed on the pivot shaft with the two end tabs of the spring engaged with the flats on the rear of the shaft, and the center tab engaged over the front of the shaft.

(5) Install the reading and courtesy lamp housing onto the overhead console. Refer to **Overhead Console Reading and Courtesy Lamp Housing** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

GARAGE DOOR OPENER STORAGE BIN DOOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the overhead console from the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(3) Remove the two screws that secure the garage door opener storage bin door pivot and bumper block to the overhead console housing (Fig. 9).

(4) Remove the garage door opener storage bin door pivot and bumper block from the overhead console housing.

(5) Unlatch and remove the garage door opener storage bin door from the overhead console housing.

INSTALLATION

(1) Position the garage door opener storage bin door into the overhead console housing.

(2) Engage the latch of the garage door opener storage bin door with the latch striker on the rear of the storage bin opening in the overhead console housing.

REMOVAL AND INSTALLATION (Continued)

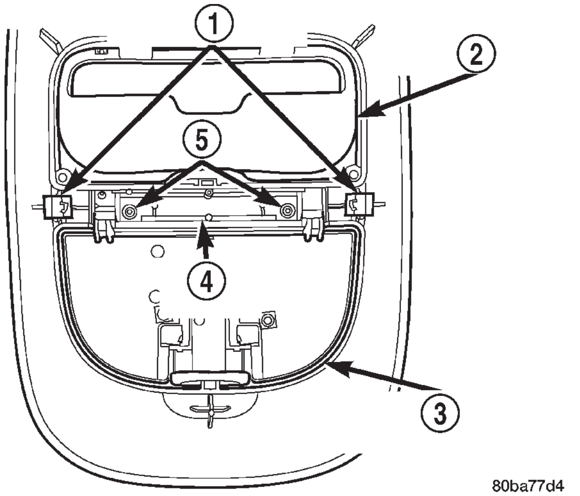


Fig. 9 Garage Door Opener Storage Bin Door Remove/Install

1 – SPRING CLIPS
2 – SUNGLASSES STORAGE BIN
3 – GARAGE DOOR OPENER STORAGE BIN DOOR
4 – PIVOT AND BUMPER BLOCK
5 – SCREW (2)

(3) Be certain that both garage door opener storage bin door pivot pins are located in the two pivot receptacles in the overhead console housing just behind the sunglasses storage bin.

(4) Position the garage door opener storage bin door pivot and bumper block onto the overhead console housing.

(5) Install and tighten the two screws that secure the garage door opener storage bin door pivot and bumper block to the overhead console housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Install the overhead console onto the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(7) Reconnect the battery negative cable.

AMBIENT TEMPERATURE SENSOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Locate the ambient temperature sensor, on the right side of the radiator yoke behind the grille (Fig. 10).

(3) Disconnect the wire harness connector from the ambient temperature sensor connector receptacle.

(4) Remove the one screw that secures the ambient temperature sensor bracket to the radiator yoke.

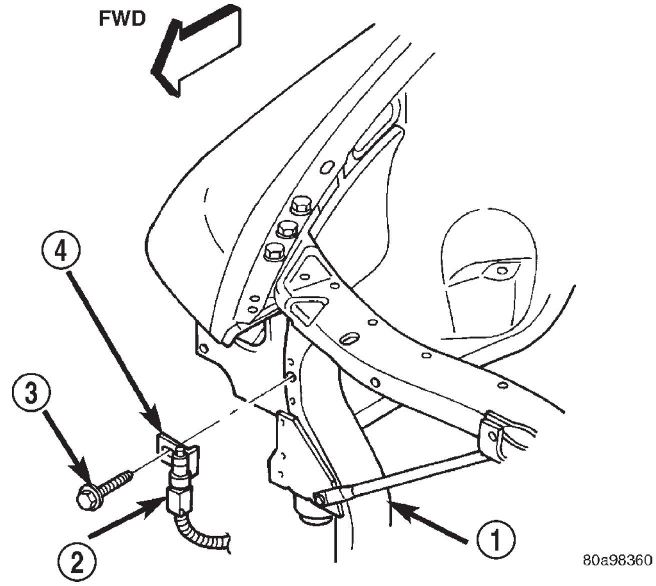


Fig. 10 Ambient Temperature Sensor Remove/Install

1 – YOKE
2 – CONNECTOR
3 – SCREW
4 – SENSOR

(5) Remove the ambient temperature sensor from the radiator yoke.

INSTALLATION

(1) Position the ambient temperature sensor onto the radiator yoke.

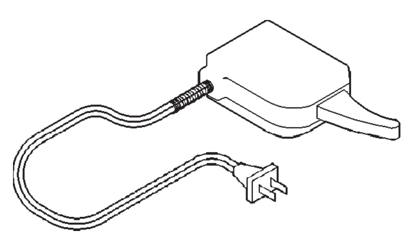
(2) Install and tighten the one screw that secures the ambient temperature sensor bracket to the radiator yoke. Tighten the screw to 5.6 N·m (50 in. lbs.).

(3) Reconnect the wire harness connector to the ambient temperature sensor connector receptacle.

(4) Reconnect the battery negative cable.

SPECIAL TOOLS

OVERHEAD CONSOLE SYSTEMS



Degaussing Tool 6029

WIRING DIAGRAMS

CONTENTS

	page
AIR CONDITIONING/HEATER	8W-42-1
AIRBAG SYSTEM	8W-43-1
ALL-WHEEL ANTI-LOCK BRAKES	8W-35-1
AUDIO SYSTEM	8W-47-1
CENTRAL TIMER MODULE	8W-45-1
CHARGING SYSTEM	8W-20-1
COMPONENT INDEX	8W-02-1
CONNECTOR LOCATIONS	8W-90-1
CONNECTOR PIN-OUTS	8W-80-1
FRONT LIGHTING	8W-50-1
FUEL/IGNITION SYSTEMS	8W-30-1
FUSE/RELAY BLOCK	8W-11-1
GENERAL INFORMATION	8W-01-1
GROUND DISTRIBUTION	8W-15-1
HORN/CIGAR LIGHTER/POWER OUTLET	8W-41-1
INSTRUMENT CLUSTER	8W-40-1
INTERIOR LIGHTING	8W-44-1
JUNCTION BLOCK	8W-12-1
OVERHEAD CONSOLE	8W-49-1
POWER DISTRIBUTION	8W-10-1
POWER DOOR LOCKS	8W-61-1
POWER MIRRORS	8W-62-1
POWER SEAT	8W-63-1
POWER WINDOWS	8W-60-1
REAR LIGHTING	8W-51-1
REAR WHEEL ANTI-LOCK BRAKES	8W-34-1
SPLICE INFORMATION	8W-70-1
SPLICE LOCATIONS	8W-95-1
STARTING SYSTEM	8W-21-1
TRAILER TOW	8W-54-1
TRANSMISSION CONTROL SYSTEM	8W-31-1
TURN SIGNALS	8W-52-1
VEHICLE SPEED CONTROL	8W-33-1
VEHICLE THEFT SECURITY SYSTEM	8W-39-1
WIPERS	8W-53-1

8W-01 GENERAL INFORMATION

INDEX

page

DESCRIPTION AND OPERATION
INTRODUCTION 1
CIRCUIT INFORMATION 4
CIRCUIT FUNCTIONS 4
SECTION IDENTIFICATION 5
SYMBOLS 5
CONNECTOR INFORMATION 7
SPLICE LOCATIONS 7
NOTES, CAUTIONS, and WARNINGS 7
TAKE OUTS 7
ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES 8
DIAGNOSIS AND TESTING
TROUBLESHOOTING TOOLS 8
INTERMITTENT AND POOR CONNECTIONS 8
TROUBLESHOOTING TESTS 9
TROUBLESHOOTING WIRING PROBLEMS 9
SERVICE PROCEDURES
WIRING REPAIR 10
TERMINAL/CONNECTOR REPAIR-MOLEX CONNECTORS 10
TERMINAL/CONNECTOR REPAIR—THOMAS AND BETTS CONNECTORS 10
CONNECTOR REPLACEMENT. 11
CONNECTOR AND TERMINAL REPLACEMENT 12
TERMINAL REPLACEMENT 13
DIODE REPLACEMENT 14
SPECIAL TOOLS
WIRING/TERMINAL 15

DESCRIPTION AND OPERATION

INTRODUCTION

DaimlerChrysler wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use DaimlerChrysler wiring diagrams to diagnose and repair a DaimlerChrysler vehicle, it is important to understand all of their features and characteristics.

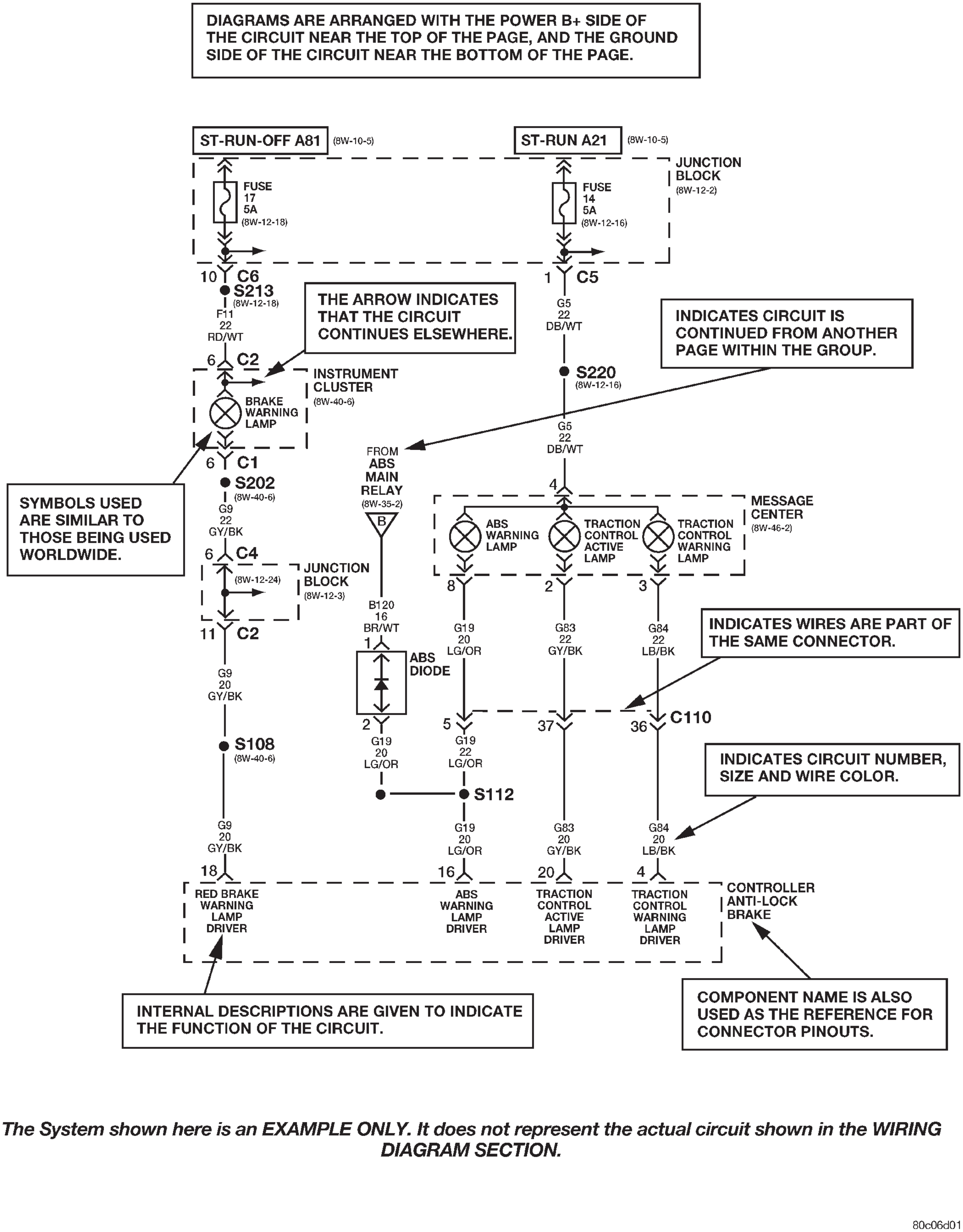
Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition.

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around a component indicates that the component being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

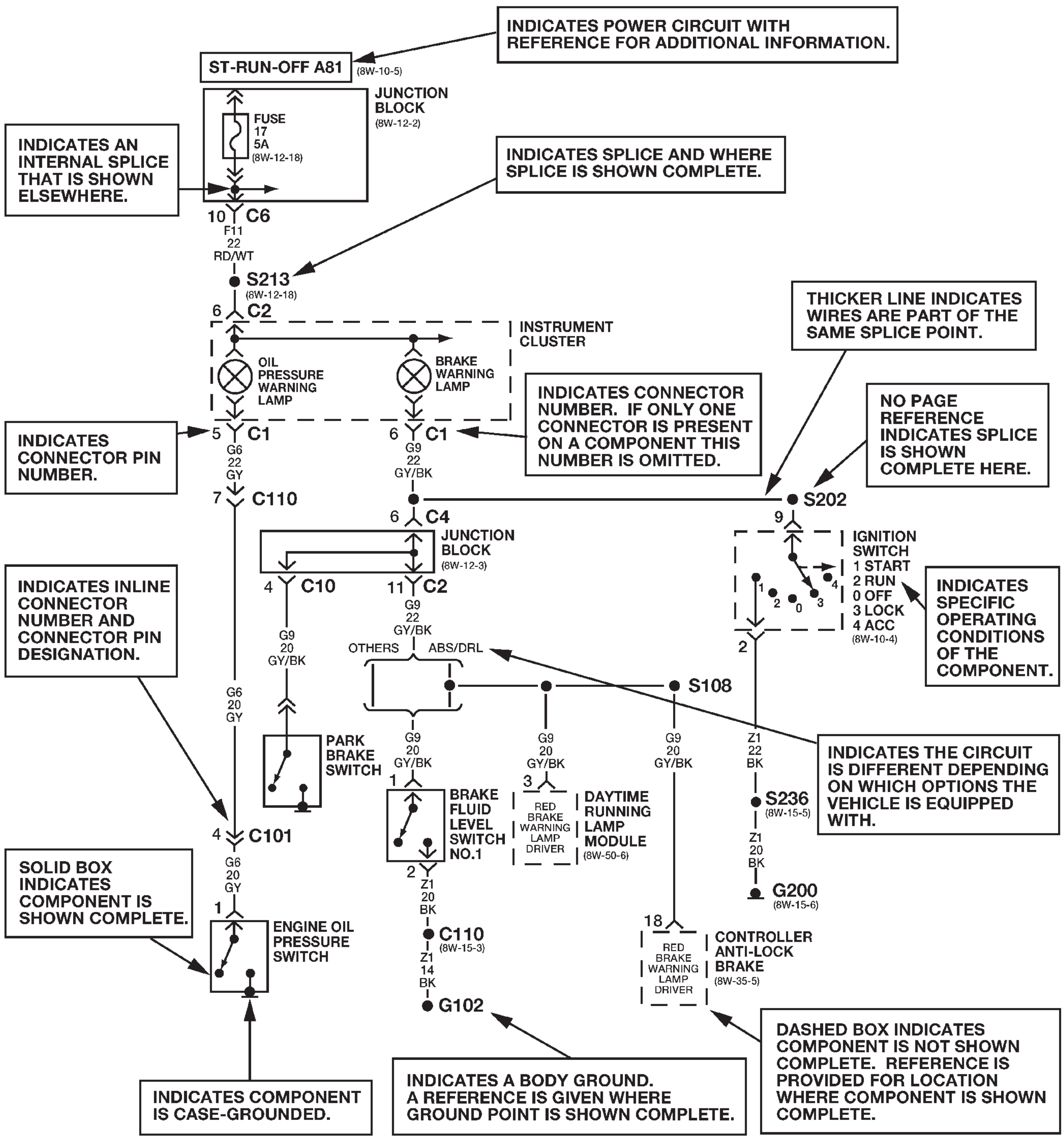
It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

DESCRIPTION AND OPERATION (Continued)



Wiring Diagram Example No.1

DESCRIPTION AND OPERATION (Continued)



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

80c06d02

Wiring Diagram Example No.2

DESCRIPTION AND OPERATION (Continued)

CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, part of the main circuit, gage of wire, and color (Fig. 1).

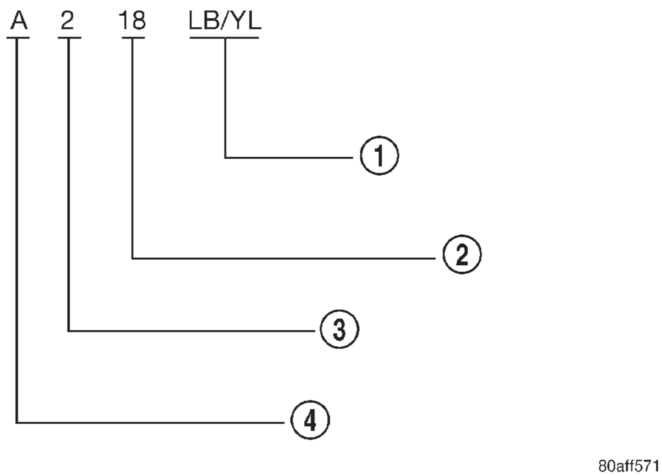


Fig. 1 Wire Code Identification

1 – COLOR OF WIRE (LIGHT BLUE WITH YELLOW TRACER)
2 – GAUGE OF WIRE (18 GAUGE)
3 – PART OF MAIN CIRCUIT (VARIES DEPENDING ON EQUIPMENT)
4 – MAIN CIRCUIT IDENTIFICATION

WIRE COLOR CODE CHART

COLOR CODE	COLOR	STANDARD TRACER COLOR
BL	BLUE	WT
BK	BLACK	WT
BR	BROWN	WT
DB	DARK BLUE	WT
DG	DARK GREEN	WT
GY	GRAY	BK
LB	LIGHT BLUE	BK
LG	LIGHT GREEN	BK
OR	ORANGE	BK
PK	PINK	BK or WT
RD	RED	WT
TN	TAN	WT
VT	VIOLET	WT
WT	WHITE	BK
YL	YELLOW	BK
*	WITH TRACER	

CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and its function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	OPEN
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	NOT USED
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/WASHER
W	OPEN
X	AUDIO SYSTEMS
Y	OPEN
Z	GROUNDS

DESCRIPTION AND OPERATION (Continued)

SECTION IDENTIFICATION

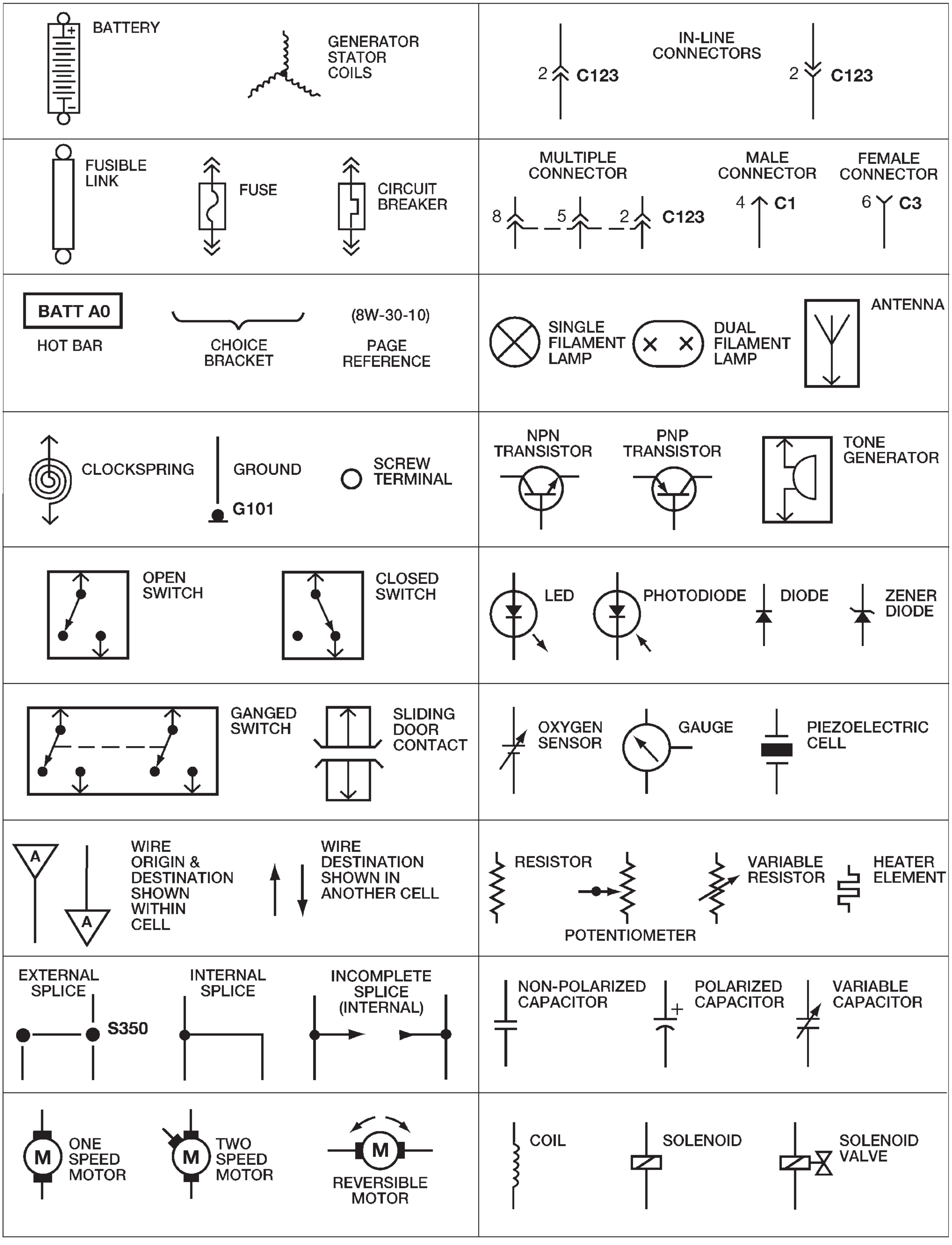
The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world

GROUP	TOPIC
8W-01 thru 8W-09	General Information and Diagram Overview
8W-10 thru 8W-19	Main Sources of Power and Vehicle Grounding
8W-20 thru 8W-29	Starting and Charging
8W-30 thru 8W-39	Powertrain/Drivetrain Systems
8W-40 thru 8W-49	Body Electrical items and A/C
8W-50 thru 8W-59	Exterior Lighting, Wipers, and Trailer Tow
8W-60 thru 8W-69	Power Accessories
8W-70	Splice Information
8W-80	Connector Pin Outs
8W-90	Connector Locations (including grounds)
8W-95	Splice Locations

DESCRIPTION AND OPERATION (Continued)



Wiring Diagram Symbols

DESCRIPTION AND OPERATION (Continued)

CONNECTOR INFORMATION

CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located on the **engine compartment harness** are **C100** series numbers.
- Connectors located on the **instrument panel harness** are **C200** series numbers.
- Connectors located on the **body harness** are **C300** series numbers.
- **Jumper harness connectors** are **C400** series numbers.
- **Grounds and ground connectors** are identified with a **"G"** and follow the same series numbering as the in-line connector.

Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

LOCATIONS

Section 8W-90 contains connector/ground location illustrations. The illustrations contain the connector name (or number)/ground number and component identification. Connector/ground location charts in Section 8W-90 reference the illustration number for components and connectors.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the Diagram pages.

SPLICE LOCATIONS

Splice Location charts in Section 8W-70 show the entire splice, and provide references to other sections the splice serves.

Section 8W-95 contains illustrations that show the general location of the splices in each harness. The illustrations show the splice by number, and provide a written location.

NOTES, CAUTIONS, and WARNINGS

Throughout this group additional important information is presented in three ways; Notes, Cautions, and Warnings.

NOTES are used to help describe how switches or components operate to complete a particular circuit. They are also used to indicate different conditions that may appear on the vehicle. For example, an up-to and after condition.

CAUTIONS are used to indicate information that could prevent making an error that may damage the vehicle.

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.

WARNING: USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.

WARNING: BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.

WARNING: SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.

WARNING: OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.

WARNING: KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.

WARNING: TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD(S), TAIL PIPE, CATALYTIC CONVERTER, AND MUFFLER.

WARNING: DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.

WARNING: ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY, AND LOOSE CLOTHING.

TAKE OUTS

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component.

DESCRIPTION AND OPERATION (Continued)

ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 2) is used to indicate this. When handling any component with this symbol comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.

(1) Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.

(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.

(3) When using a voltmeter, be sure to connect the ground lead first.

(4) Do not remove the part from its protective packing until it is time to install the part.

(5) Before removing the part from its package, ground the package to a known good ground on the vehicle.

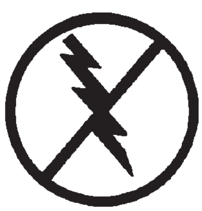


Fig. 2 Electrostatic Discharge Symbol

DIAGNOSIS AND TESTING

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

• Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: NEVER USE A JUMPER WIRE ACROSS A LOAD, SUCH AS A MOTOR, CONNECTED BETWEEN A BATTERY FEED AND GROUND.

• Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today's vehicle are solid state. When checking voltages in these circuits use a meter with a 10-megohm or greater impedance rating.

• Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: - Most of the electrical components used in today's vehicle are Solid State. When checking resistance in these circuits use a meter with a 10-megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle electrical system can cause damage to the equipment and provide false readings.

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 3). Select the proper size tool from Special Tool Package 6807, and insert it into the terminal being tested. Use the other end of the tool to insert the meter probe.

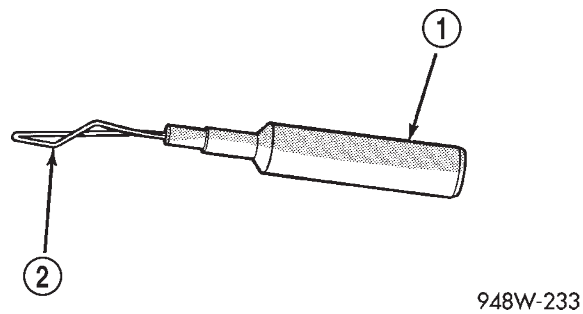


Fig. 3 Probing Tool

1 – SPECIAL TOOL 6801
2 – PROBING END

INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly check the following items.

• Connectors are fully seated
• Spread terminals, or terminal push out
• Terminals in the wiring assembly are fully seated into the connector/component and locked in position
• Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
• Damaged connector/component casing exposing the item to dirt and moisture
• Wire insulation that has rubbed through causing a short to ground
• Some or all of the wiring strands broken inside of the insulation covering.
• Wiring broken inside of the insulation

DIAGNOSIS AND TESTING (Continued)

TROUBLESHOOTING TESTS

Before beginning any tests on a vehicles electrical system use the Wiring Diagrams and study the circuit. Also refer to the Troubleshooting Wiring Problems in this section.

TESTING FOR VOLTAGE POTENTIAL

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 4).

(2) Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.

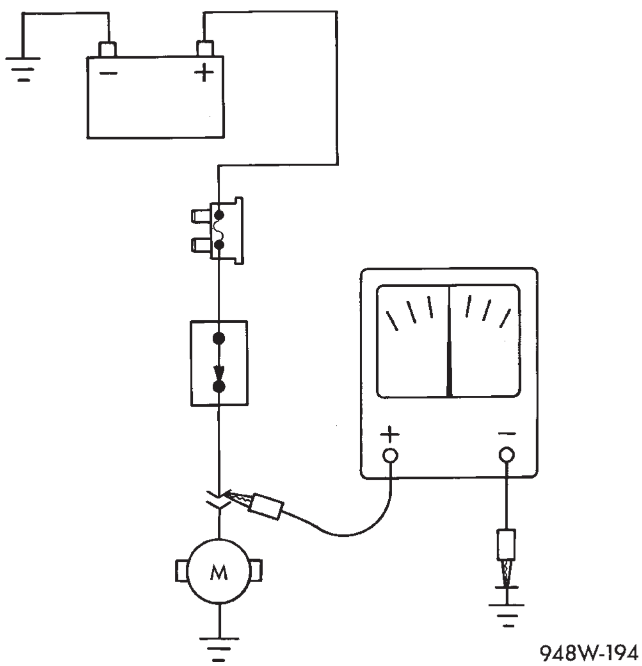


Fig. 4 Testing for Voltage Potential

TESTING FOR CONTINUITY

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 5).

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

TESTING FOR A SHORT TO GROUND

(1) Remove the fuse and disconnect all items involved with the fuse.

(2) Connect a test light or a voltmeter across the terminals of the fuse.

(3) Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.

(4) If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

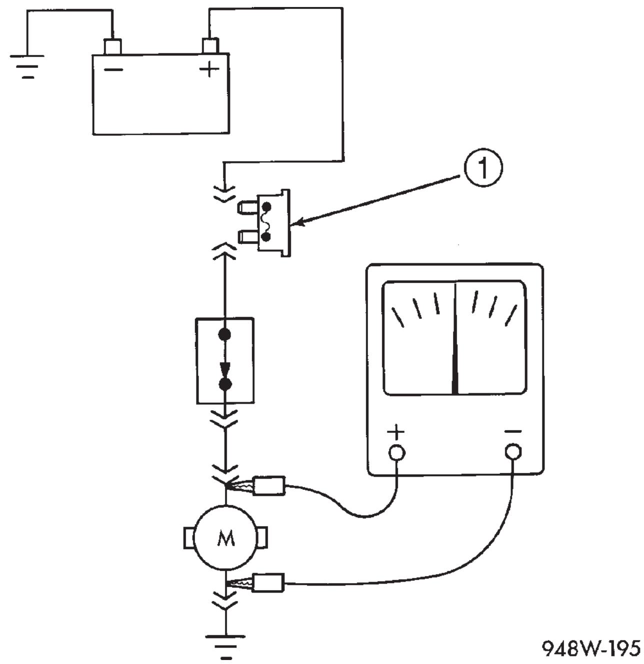


Fig. 5 Testing for Continuity

1 – FUSE REMOVED FROM CIRCUIT

TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

(1) Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.

(2) Replace the blown fuse.

(3) Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.

(4) Start connecting the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

TESTING FOR A VOLTAGE DROP

(1) Connect the positive lead of the voltmeter to the side of the circuit closest to the battery (Fig. 6).

(2) Connect the other lead of the voltmeter to the other side of the switch or component.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

(1) Verify the problem.

DIAGNOSIS AND TESTING (Continued)

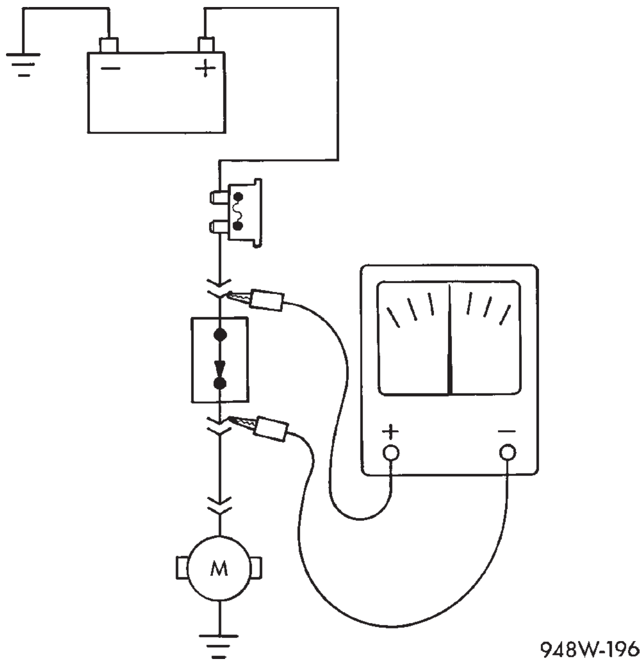


Fig. 6 Testing for Voltage Drop

(2) Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.

(3) Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.

(4) Isolate the problem area.

(5) Repair the problem.

(6) Verify proper operation. For this step check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

SERVICE PROCEDURES

WIRING REPAIR

When replacing or repairing a wire, it is important that the correct gage be used as shown in the wiring diagrams. The wires must also be held securely in place to prevent damage to the insulation.

(1) Disconnect battery negative cable

(2) Remove 1 inch of insulation from each end of the wire.

(3) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(4) Spread the strands of the wire apart on each part of the exposed wire (example 1). (Fig. 7)

(5) Push the two ends of wire together until the strands of wire are close to the insulation (example 2) (Fig. 7)

(6) Twist the wires together (example 3) (Fig. 7)

(7) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(8) Center the heat shrink tubing over the joint, and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(9) Secure the wire to the existing ones to prevent chafing or damage to the insulation

(10) Connect battery and test all affected systems.

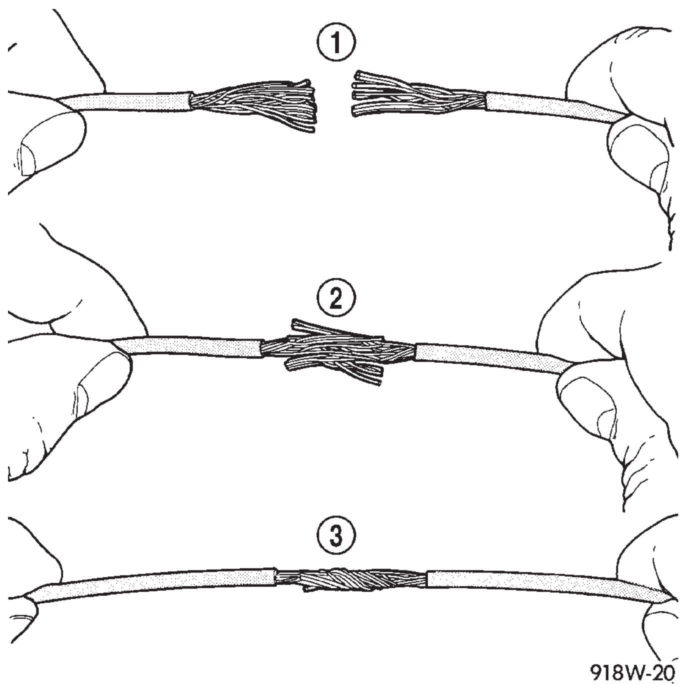


Fig. 7 Wire Repair

1 – EXAMPLE 1
2 – EXAMPLE 2
3 – EXAMPLE 3

TERMINAL/CONNECTOR REPAIR-MOLEX CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

(3) Insert the terminal releasing special tool 6742 into the terminal end of the connector (Fig. 8).

(4) Using special tool 6742 release the locking fingers on the terminal (Fig. 9).

(5) Pull on the wire to remove it from the connector.

(6) Repair or replace the connector or terminal, as necessary.

TERMINAL/CONNECTOR REPAIR—THOMAS AND BETTS CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

SERVICE PROCEDURES (Continued)

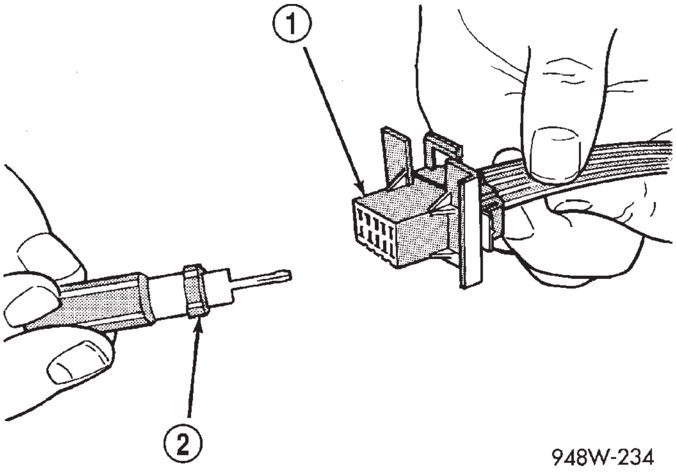


Fig. 8 Molex Connector Repair

1 – CONNECTOR
2 – SPECIAL TOOL 6742

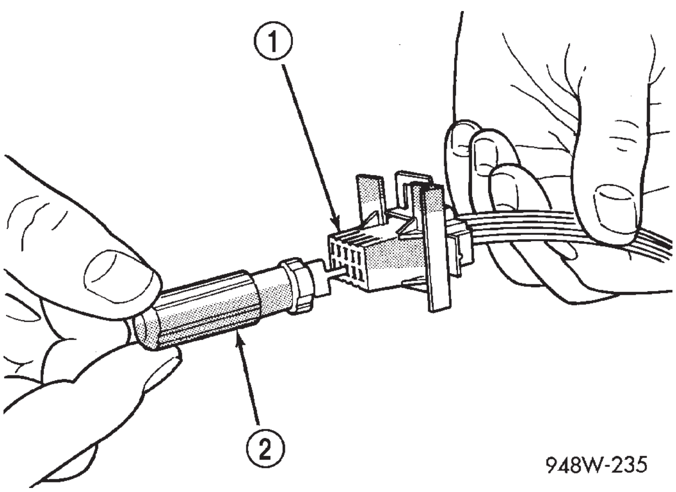


Fig. 9 Using Special Tool 6742

1 – CONNECTOR
2 – SPECIAL TOOL 6742

(3) Push in the two lock tabs on the side of the connector (Fig. 10).

(4) Insert the probe end of special tool 6934 into the back of the connector cavity (Fig. 11).

(5) Grasp the wire and tool 6934 and slowly remove the wire and terminal from the connector.

(6) Repair or replace the terminal.

(7) Install the wire and terminal in the connector. Fully seat the terminal in the connector.

(8) Push in the single lock tab on the side of the connector (Fig. 12).

CONNECTOR REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector that is to be repaired from its mating half/component

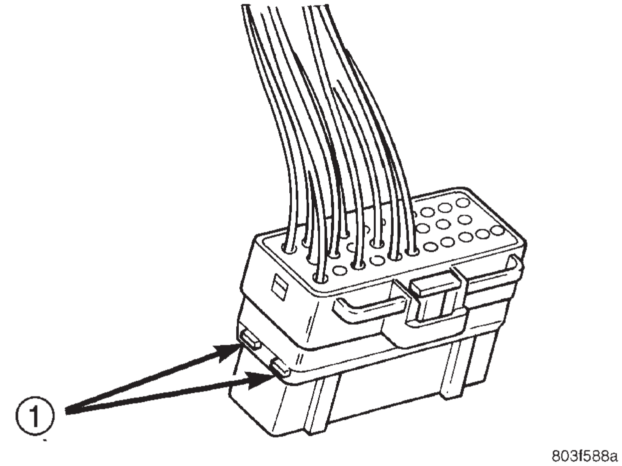


Fig. 10 Thomas and Betts Connector Lock Release Tabs

1 – LOCK TABS

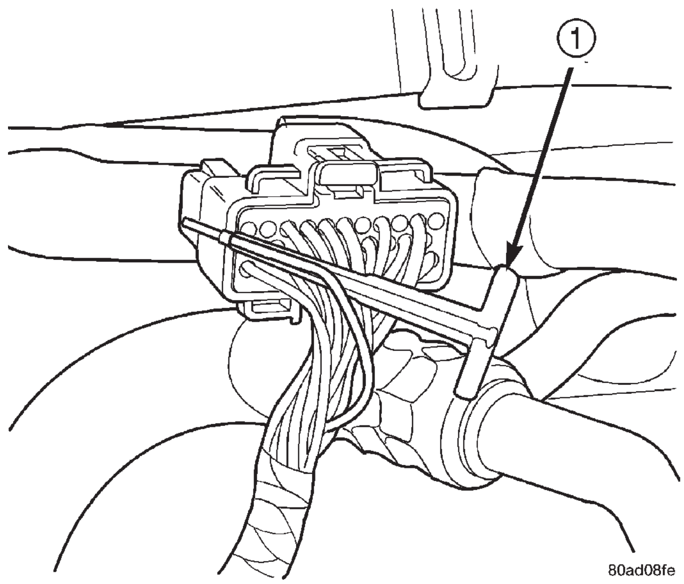


Fig. 11 Removing Wire Terminal

1 – SPECIAL TOOL 6934

(3) Remove the connector locking wedge, if required (Fig. 13)

(4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 14) (Fig. 15).

(5) Reset the terminal locking tang, if it has one.

(6) Insert the removed wire in the same cavity on the repair connector.

(7) Repeat steps four through six for each wire in the connector, being sure that all wires are inserted into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.

SERVICE PROCEDURES (Continued)

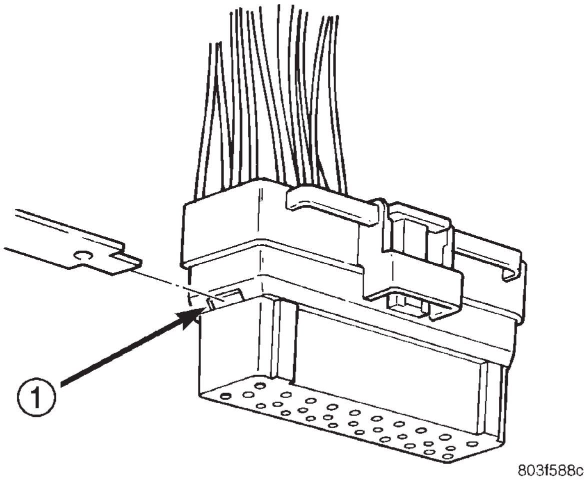


Fig. 12 Single Lock Tab

1 – SINGLE LOCK TAB

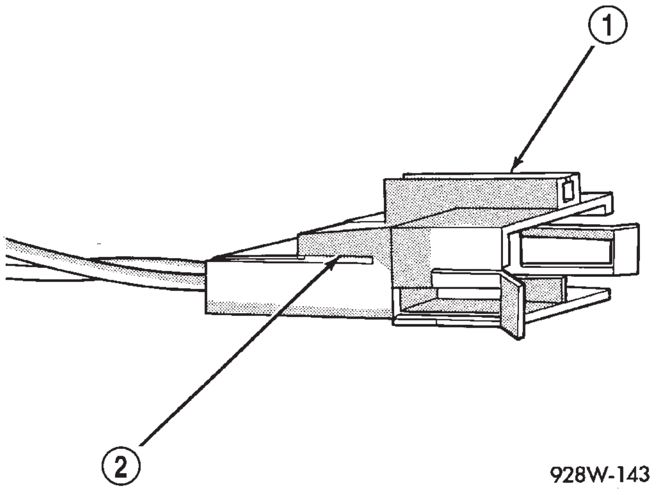


Fig. 13 Connector Locking Wedge

1 – CONNECTOR
2 – CONNECTOR LOCKING WEDGE TAB

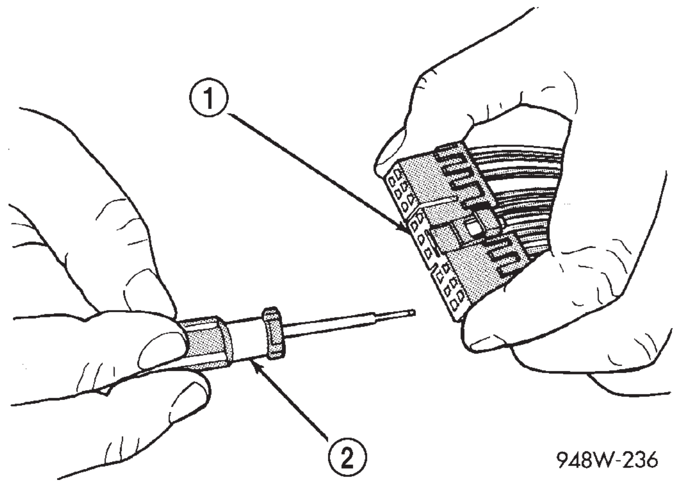


Fig. 14 Terminal Removal

1 – CONNECTOR
2 – FROM SPECIAL TOOL KIT 6680

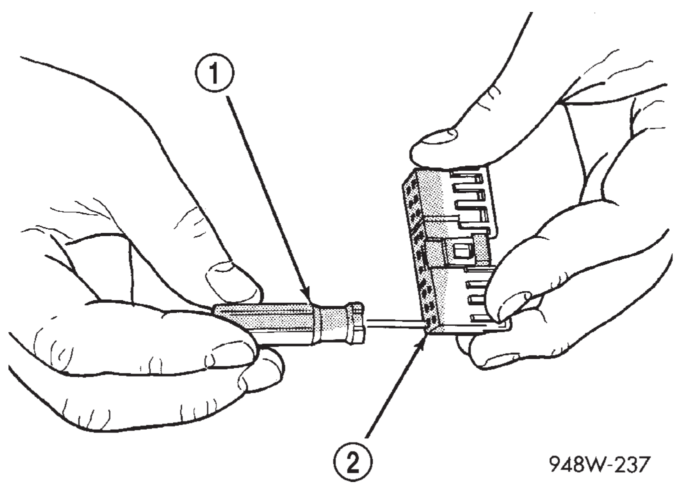


Fig. 15 Terminal Removal Using Special Tool

1 – FROM SPECIAL TOOL KIT 6680
2 – CONNECTOR

(8) Insert the connector locking wedge into the repaired connector, if required.

(9) Connect connector to its mating half/component.

(10) Connect battery and test all affected systems.

CONNECTOR AND TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector (that is to be repaired) from its mating half/component.

(3) Cut off the existing wire connector directly behind the insulator. Remove six inches of tape from the harness.

(4) Stagger cut all wires on the harness side at 1/2 inch intervals (Fig. 16).

(5) Remove 1 inch of insulation from each wire on the harness side.

(6) Stagger cut the matching wires on the repair connector assembly in the opposite order as was done on the harness side of the repair. Allow extra length for soldered connections. Check that the overall length is the same as the original (Fig. 16).

(7) Remove 1 inch of insulation from each wire.

(8) Place a piece of heat shrink tubing over one side of the wire. Be sure the tubing will be long enough to cover and seal the entire repair area.

(9) Spread the strands of the wire apart on each part of the exposed wires.

(10) Push the two ends of wire together until the strands of wire are close to the insulation.

(11) Twist the wires together.

SERVICE PROCEDURES (Continued)

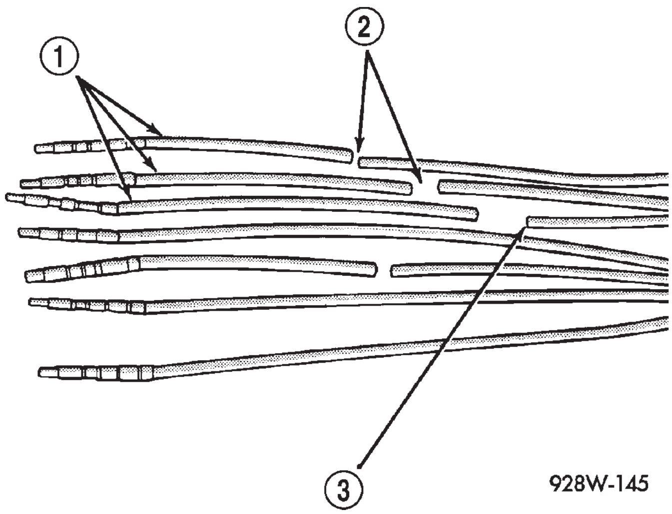


Fig. 16 Stagger Cutting Wires

1 – REPAIR SIDE WIRES
2 – STAGER CUTS
3 – HARNESS WIRES

(12) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(13) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing

(14) Repeat steps 8 through 13 for each wire.

(15) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(16) Re-connect the repaired connector.

(17) Connect the battery, and test all affected systems.

TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector being repaired from its mating half. Remove connector locking wedge, if required (Fig. 17).

(3) Remove connector locking wedge, if required (Fig. 17).

(4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 18) (Fig. 19).

(5) Cut the wire 6 inches from the back of the connector.

(6) Remove 1 inch of insulation from the wire on the harness side.

(7) Select a wire from the terminal repair assembly that best matches the color wire being repaired.

(8) Cut the repair wire to the proper length and remove 1 inch of insulation.

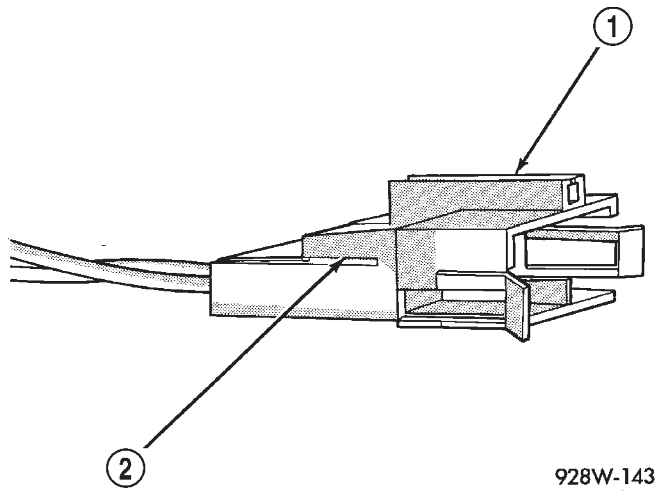


Fig. 17 Connector Locking Wedge Tab (Typical)

1 – CONNECTOR
2 – CONNECTOR LOCKING WEDGE TAB

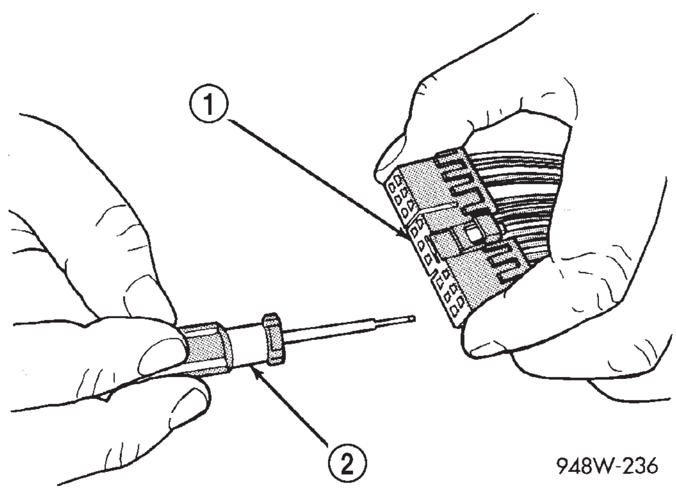


Fig. 18 Terminal Removal

1 – CONNECTOR
2 – FROM SPECIAL TOOL KIT 6680

(9) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(10) Spread the strands of the wire apart on each part of the exposed wires.

(11) Push the two ends of wire together until the strands of wire are close to the insulation.

(12) Twist the wires together.

(13) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(14) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(15) Insert the repaired wire into the connector.

SERVICE PROCEDURES (Continued)

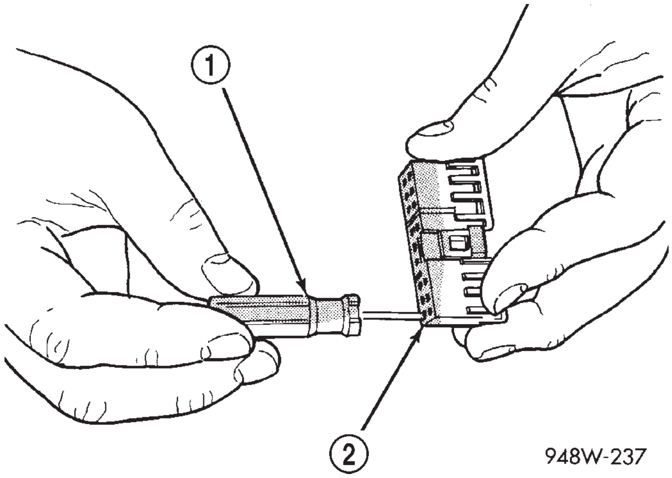


Fig. 19 Terminal Removal Using Special Tool

1 – FROM SPECIAL TOOL KIT 6680
2 – CONNECTOR

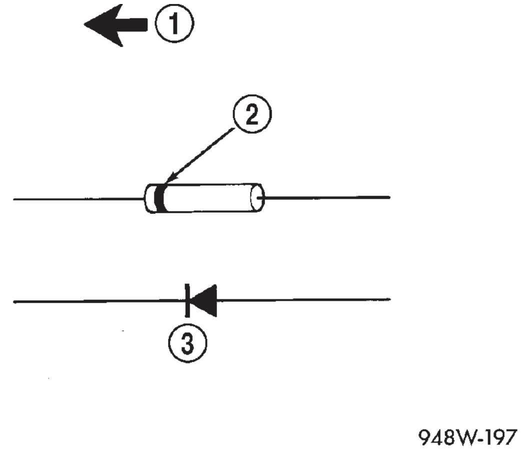


Fig. 20 Diode Identification

1 – CURRENT FLOW
2 – BAND AROUND DIODE INDICATES CURRENT FLOW
3 – DIODE AS SHOWN IN THE DIAGRAMS

(16) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(17) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(18) Connect battery, and test all affected systems.

DIODE REPLACEMENT

(1) Disconnect the battery.

(2) Locate the diode in the harness, and remove the protective covering.

(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 20).

(4) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

(5) Install the new diode in the harness, making sure current flow is correct. If necessary refer to the appropriate wiring diagram for current flow.

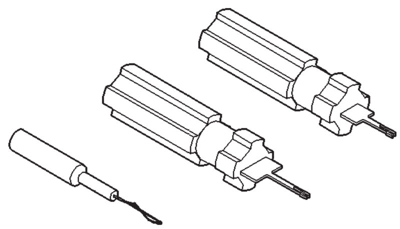
(6) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(7) Tape the diode to the harness using electrical tape making, sure the diode is completely sealed from the elements.

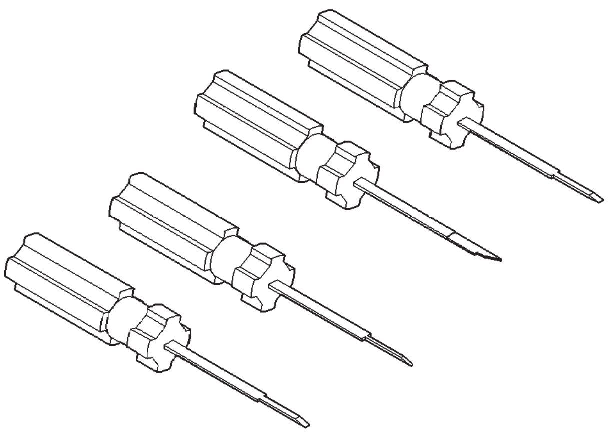
(8) Re-connect the battery, and test affected systems.

SPECIAL TOOLS

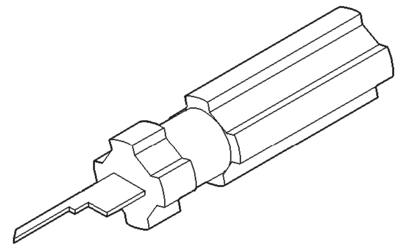
WIRING/TERMINAL



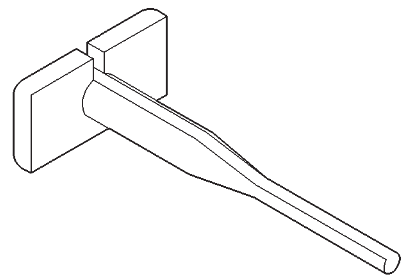
Probing Tool Package 6807



Terminal Pick 6680



Terminal Removing Tool 6932



Terminal Removing Tool 6934

8W-02 COMPONENT INDEX

Component	Page
4WD Switch	8W-31
A/C Compressor Clutch Relay	8W-42
A/C Compressor Clutch	8W-42
A/C- Heater Control	8W-42
A/C Pressure Switches	8W-42
Aftermarket CHMSL Connector	8W-51
Airbag Control Module	8W-43
Airbags	8W-43
Ambient Temperature Sensor	8W-49
Ash Receiver Lamp	8W-44
Automatic Day/Night Mirror	8W-44
Automatic Shut Down Relay	8W-30
Back-Up Lamp Switch	8W-51
Back-Up Lamps	8W-51
Base Console	8W-49
Battery Temperature Sensor	8W-20, 30
Battery	8W-20
Blower Motor Relay	8W-42
Blower Motor	8W-42
Blower Resistor Block	8W-42
Brake Lamp Switch	8W-30
Brake Pressure Switch	8W-34, 35
Camshaft Position Sensor	8W-30
Capacitors	8W-30
Cargo Lamps	8W-44
Center High Mounted Stop Lamp	8W-51
Central Timer Module	8W-45
Cigar Lighter	8W-41
Circuit Breakers (JB)	8W-12
Clockspring No. 1	8W-33, 41
Clockspring No. 2	8W-43
Clockspring	8W-43, 47
Cluster Illumination Lamps	8W-40
Clutch Interlock Switch Jumper	8W-21
Clutch Interlock Switch	8W-21
Coil On Plugs	8W-30
Combination Flasher	8W-11, 52
Controller Anti-Lock Brake	8W-34, 35
Crankshaft Position Sensor	8W-30
Data Link Connector	8W-30
Daytime Running Lamp Module	8W-50
Dome Lamp	8W-44
Door Ajar Switches	8W-45
Door Key Cylinder Switches	8W-45
Door Lock Motor/Ajar Switches	8W-45, 61
Door Window Motors	8W-60
Driver Unlock Relay	8W-61
Electric Brake	8W-54
Engine Coolant Temperature Sensor	8W-30
Engine Oil Pressure Sensor	8W-30
Engine Starter Motor Relay	8W-21
Engine Starter Motor	8W-21
Fog Lamp Indicator	8W-50
Fog Lamp Relay	8W-50
Fog Lamps	8W-50
Fuel Injectors	8W-30
Fuel Pump Module	8W-30
Fuel Pump Relay	8W-30
Fuse/Relay Block	8W-11
Fuses (F/RB)	8W-11
Fuses (JB)	8W-12
Fuses (PDC)	8W-10
Fusible Link	8W-10, 20
Generator	8W-20
Glove Box Lamp	8W-44
Grounds	8W-15
Headlamp Flasher Relay	8W-39
Headlamp Switch	8W-50
Headlamps	8W-50
Heater Control	8W-42
Hevac Relay	8W-42
Horn Relay	8W-41
Horns	8W-41
I/O Processor	8W-40
Idle Air Control Motor	8W-30
Ignition Coil	8W-30
Ignition Switch	8W-10
Indicators	8W-40
Input Speed Sensor	8W-31
Instrument Cluster	8W-40
Intake Air Temperature Sensor	8W-30
Joint Connectors	8W-10
Junction Block	8W-12
Key-In Switch	8W-44, 45
Leak Detection Pump	8W-30
License Lamps	8W-51
Line Pressure Sensor	8W-31
Manifold Absolute Pressure Sensor	8W-30
Map Lamps	8W-44, 49
Multi- Function Switch	8W-50
Output Speed Sensor	8W-31
Overdrive Switch	8W-30
Overhead Console	8W-49
Oxygen Sensor Heater Relays	8W-30
Oxygen Sensors	8W-30
Park Brake Switch	8W-40, 50
Park/Neutral Position Switch	8W-51
Park/Turn Signal Lamps	8W-50, 52
Passenger Airbag On/Off Switch	8W-43
Power Amplifier	8W-47
Power Distribution Center	8W-10
Power Lock/Window Switches	8W-60, 61
Power Mirror Switch	8W-62
Power Mirrors	8W-48, 62

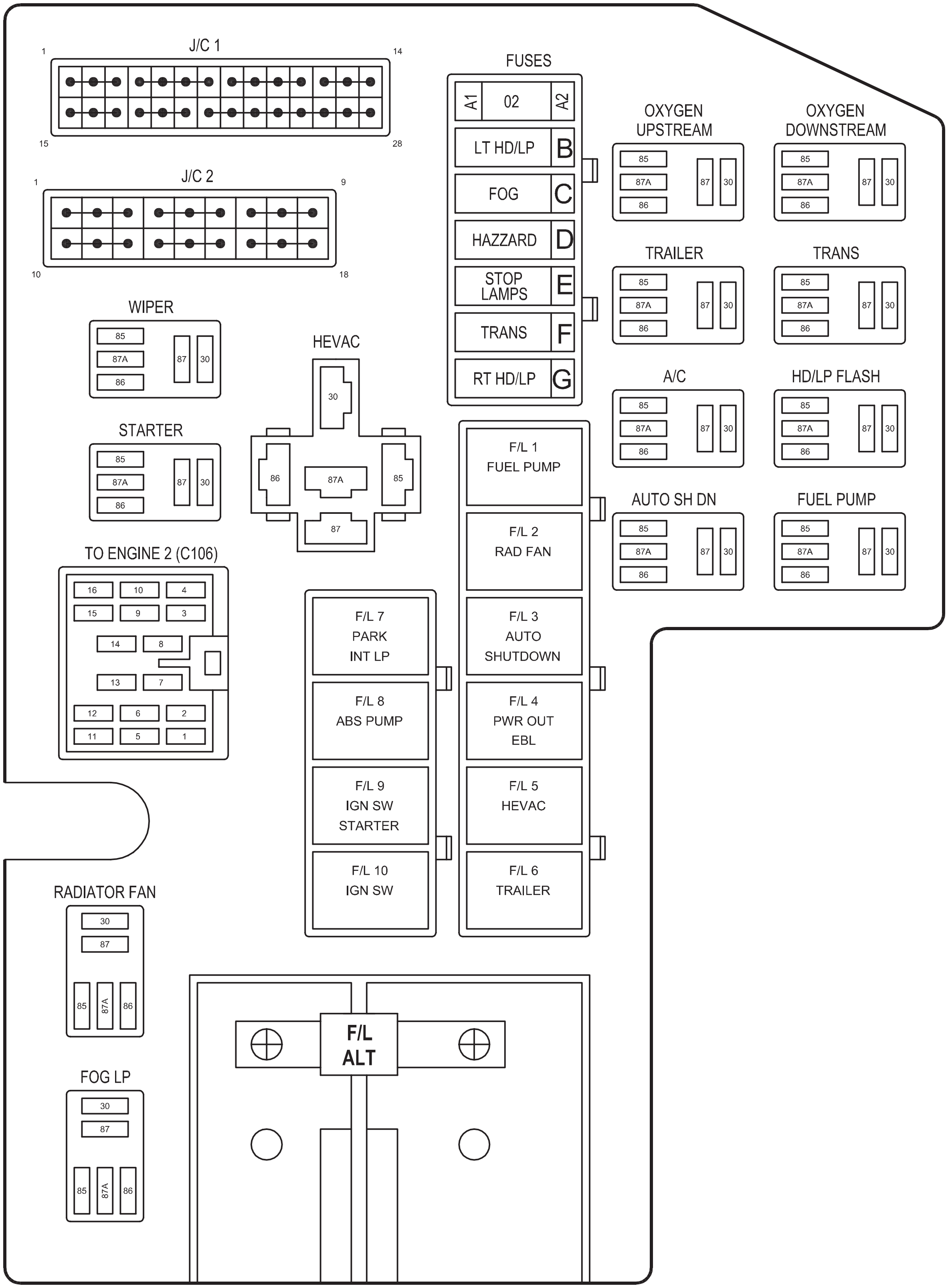
Component	Page
Power Outlet	8W-41
Power Seat Motors	8W-63
Power Seat Switch	8W-63
Power Steering Pressure Switch	8W-30
Powertrain Control Module	8W-20, 30
PRNDL	8W-31
Proportional Purge Solenoid	8W-30
Radiator Fan Motor	8W-42
Radiator Fan Relay	8W-42
Radio	8W-47
Rear Window Defogger Switch	8W-48
Rear Window Defogger	8W-48
Remote Radio Switches	8W-47
RKE Antenna	8W-61
Seat Belt Switch	8W-40
Shift Bezel Lamp	8W-44
Side Marker Lamps	8W-50
Speakers	8W-47
Speed Control Switches	8W-33
Splice Information	8W-70

Component	Page
Tail/Stop/Turn Signal Lamps	8W-51
Throttle Position Sensor	8W-30
Trailer Tow Connector	8W-54
Trailer Tow Relay	8W-54
Transmission Control Module	8W-31
Transmission Control Relay	8W-31
Transmission Solenoid Assembly	8W-31
Transmission Solenoid	8W-31
Turn Signal/Hazard Switch	8W-11, 52
Underhood Lamp/Switch	8W-44
Vehicle Speed Control Servo	8W-33
Vehicle Speed Control/Horn Switches	8W-33, 41
Voltmeter	8W-40
Washer Fluid Level Sensor	8W-40
Wheel Speed Sensors	8W-35
Window Motors	8W-60
Window Switches	8W-60
Windshield Washer Pump	8W-53
Wiper Motor	8W-53
Wiper Relay	8W-53
Wiper Switch	8W-53

8W-10 POWER DISTRIBUTION

Component	Page
A/C- Heater Control	8W-10-36
Airbag Control Module	8W-10-35
Ash Receiver Lamp	8W-10-36, 37
Automatic Day/Night Mirror	8W-10-33
Automatic Shut Down Relay	8W-10-18, 19, 20, 21, 33
Back-Up Lamp Switch	8W-10-33
Battery	8W-10-12
Battery Temperature Sensor	8W-10-33
Blower Motor	8W-10-25
Blower Motor Relay	8W-10-28
Brake Lamp Switch	8W-10-14, 17, 37
Capacitor No. 1	8W-10-20, 21
Capacitor No. 2	8W-10-22
Central Timer Module	8W-10-16, 35
Circuit Breaker 20 (JB)	8W-10-29
Circuit Breaker 21 (JB)	8W-10-26
Clockspring	8W-10-33
Clutch Interlock Switch	8W-10-31
Clutch Interlock Switch Jumper	8W-10-31
Coil On Plug No. 1	8W-10-20, 21
Coil On Plug No. 2	8W-10-22
Coil On Plug No. 3	8W-10-20
Coil On Plug No. 3	8W-10-21
Coil On Plug No. 4	8W-10-22
Coil On Plug No. 5	8W-10-20, 21
Coil On Plug No. 6	8W-10-22
Coil On Plug No. 7	8W-10-22
Coil On Plug No. 8	8W-10-22
Combination Flasher	8W-10-14, 37
Controller Anti-Lock Brake	8W-10-17, 35
Data Link Connector	8W-10-35, 36, 37
Daytime Running Lamp Module	8W-10-14
Driver Power Mirror	8W-10-24
Electric Brake	8W-10-17
Engine Starter Motor	8W-10-12, 31
Engine Starter Motor Relay	8W-10-31
Fog Lamp Relay	8W-10-14, 34
Fuel Injector No. 1	8W-10-18, 19, 20, 21
Fuel Injector No. 2	8W-10-18, 19, 22
Fuel Injector No. 3	8W-10-18, 19, 20, 21
Fuel Injector No. 4	8W-10-18, 19, 22
Fuel Injector No. 5	8W-10-19, 22
Fuel Injector No. 6	8W-10-19, 22
Fuel Injector No. 7	8W-10-19, 22
Fuel Injector No. 8	8W-10-19, 22
Fuel Pump Module	8W-10-16, 33
Fuel Pump Relay	8W-10-16, 33
Fuse 1 (PDC)	8W-10-13, 16
Fuse 2 (JB)	8W-10-29
Fuse 2 (PDC)	8W-10-13, 17
Fuse 3 (JB)	8W-10-29
Fuse 3 (PDC)	8W-10-13, 18, 19, 20, 21
Fuse 4 (JB)	8W-10-26
Fuse 4 (PDC)	8W-10-13, 24
Fuse 5 (JB)	8W-10-36
Fuse 5 (PDC)	8W-10-13, 25
Fuse 6 (JB)	8W-10-30
Fuse 6 (PDC)	8W-10-13, 25
Fuse 7 (JB)	8W-10-29
Fuse 7 (PDC)	8W-10-13, 26
Fuse 8 (JB)	8W-10-30
Fuse 8 (PDC)	8W-10-13, 17
Fuse 9 (JB)	8W-10-28, 33
Fuse 9 (PDC)	8W-10-13, 27
Fuse 10 (JB)	8W-10-30
Fuse 10 (PDC)	8W-10-13, 27
Fuse 11 (JB)	8W-10-28
Fuse 12 (JB)	8W-10-26, 36
Fuse 13 (JB)	8W-10-26
Fuse 14 (JB)	8W-10-26
Fuse 15 (JB)	8W-10-30
Fuse 17 (JB)	8W-10-28
Fuse 18 (JB)	8W-10-29
Fuse 19 (JB)	8W-10-28
Fuse A (F/RB)	8W-10-24
Fuse A (PDC)	8W-10-18, 19, 20, 21
Fuse B (F/RB)	8W-10-24
Fuse B (PDC)	8W-10-12, 14
Fuse C (PDC)	8W-10-12, 14
Fuse D (F/RB)	8W-10-28
Fuse D (PDC)	8W-10-12, 14
Fuse E (PDC)	8W-10-12, 14
Fuse F (PDC)	8W-10-12, 15
Fuse G (PDC)	8W-10-13, 15
Fuse/Relay Block	8W-10-24, 28
Fusible Link	8W-10-12
G200	8W-10-37
Generator	8W-10-12
Glove Box Lamp	8W-10-36, 37
Headlamp Switch	8W-10-32, 34, 37
Heater Control	8W-10-36
Hevac Relay	8W-10-25
Ignition Coil	8W-10-18, 19
Ignition Switch	8W-10-27, 28, 29, 30, 31
Instrument Cluster	8W-10-15, 32, 34, 35, 36, 37
Joint Connector No. 1	8W-10-32, 33, 34
Joint Connector No. 2	8W-10-16, 17, 18, 19, 20, 21, 32, 34
Joint Connector No. 3	8W-10-35
Joint Connector No. 4	8W-10-36, 37
Junction Block	8W-10-14, 26, 28, 29, 30, 32, 33, 34
Left Fog Lamp	8W-10-14, 34
Left Front Park/Turn Signal Lamp No. 1	8W-10-32, 34
Left Front Park/Turn Signal Lamp No. 2	8W-10-32, 34
Left Front Side Marker Lamp	8W-10-32
Left Headlamp	8W-10-14
Multi- Function Switch	8W-10-32
Overdrive Switch	8W-10-37
Overhead Console	8W-10-35
Oxygen Sensor 1/1 Upstream	8W-10-18, 19, 20, 23
Oxygen Sensor 1/2 Downstream	8W-10-18, 19, 23
Oxygen Sensor 2/1 Upstream	8W-10-23
Oxygen Sensor 2/2 Downstream	8W-10-20, 23
Oxygen Sensor Downstream Heater Relay	8W-10-23
Oxygen Sensor Upstream Heater Relay	8W-10-23
Park/Neutral Position Switch	8W-10-33
Passenger Power Mirror	8W-10-24
Power Distribution Center	8W-10-2, 12, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 27
Power Outlet	8W-10-24
Powertrain Control Module	8W-10-16, 17, 18, 19, 22, 33, 35
PRNDL	8W-10-15
Radiator Fan Motor	8W-10-17
Radiator Fan Relay	8W-10-17, 33
Radio	8W-10-35, 36
Rear Window Defogger	8W-10-24
Rear Window Defogger Switch	8W-10-24, 36
Right Fog Lamp	8W-10-14, 34
Right Front Park/Turn Signal Lamp No. 1	8W-10-32
Right Front Park/Turn Signal Lamp No. 2	8W-10-32
Right Front Side Marker Lamp	8W-10-32
Right Headlamp	8W-10-15
Trailer Tow Connector	8W-10-25
Trailer Tow Relay	8W-10-25, 32
Transmission Control Module	8W-10-15, 31, 35
Transmission Control Relay	8W-10-15
Transmission Solenoid Assembly	8W-10-15, 33
Turn Signal/Hazard Switch	8W-10-34
Wiper Motor	8W-10-16
Wiper Relay	8W-10-16

POWER DISTRIBUTION CENTER



FUSES

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
A	15A	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
B	15A	A301 18RD/TN	FUSED B(+)
C	20A	L39 18LB	FUSED B(+)
D	25A	L9 14BK/VT	FUSED B(+)
E	20A	F32 18PK/DB	FUSED B(+)
F	20A	F84 18YL/WT	FUSED B(+)
G	15A	A302 18RD/LG	FUSED B(+)
1	20A	A14 16RD/WT	FUSED B(+)
2	30A	A17 12RD/TN	FUSED B(+)
3	30A	A16 12GY	FUSED B(+)
4	20A	A4 12BK/PK	FUSED B(+)
5	40A	A111 12RD/LB	FUSED B(+)
6	40A	A6 14RD/TN ■■	FUSED B(+)
7	50A	A7 12RD/BK	FUSED B(+)
8	40A	A10 14RD/DG	FUSED B(+)
9	40A	A2 12PK/BK	FUSED B(+)
10	40A	A1 12RD	FUSED B(+)

A/C COMPRESSOR CLUTCH RELAY

CAVITY	CIRCUIT	FUNCTION
30	F31 18VT	FUSED B(+)
85	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
86	F24 18RD/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
87	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
87A	-	-

■■ TRAILER TOW

AUTOMATIC SHUT DOWN RELAY

CAVITY	CIRCUIT	FUNCTION
30	A16 12GY	FUSED B(+)
85	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
86	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
87	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
87A	-	-

ENGINE STARTER MOTOR RELAY

CAVITY	CIRCUIT	FUNCTION
30	A2 12PK/BK	FUSED B(+)
85	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
86	A41 14DB/YL	IGNITION SWITCH OUTPUT (START)
87	T40 12BR	ENGINE STARTER MOTOR RELAY OUTPUT
87A	-	-

FOG LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	L38 20LB/BK	FOG LAMPS CONTROL
85	L161 20LG/OR ■■	DAYTIME RUNNING LAMPS
	Z38 20BK/LG ■	GROUND
86	L39 18LB ■■	FUSED B(+)
	L3 18RD/OR ■	HIGH BEAM RELAY OUTPUT
87	Z38 20BK/LG ■	GROUND
87A	Z38 20BK/LG ■■	GROUND

FUEL PUMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	A14 16RD/WT	FUSED B(+)
85	K151 18LB/OR	FUEL PUMP RELAY CONTROL
86	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
87	A61 16DG/BK	FUEL PUMP RELAY OUTPUT
87A	-	-

■ EXCEPT DRL
■■ DRL

HEADLAMP FLASHER RELAY

CAVITY	CIRCUIT	FUNCTION
30	L4 18VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
85	G50 18RD	HEADLAMP FLASHER RELAY CONTROL
86	F31 18VT	FUSED B(+)
87	Z1 18BK	GROUND
87A	-	-

HEVAC RELAY

CAVITY	CIRCUIT	FUNCTION
30	A111 12RD/LB	FUSED B(+)
85	Z1 20BK	GROUND
86	F24 20RD/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
87	C1 12DG	BLOWER MOTOR FEED
87A	-	-

OXYGEN SENSOR DOWNSTREAM HEATER RELAY

CAVITY	CIRCUIT	FUNCTION
30	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
85	A141 18DG/BK	OXYEN SENSOR DOWNSTREAM HEATER RELAY CONTROL
86	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
87	F242 18DG/PK	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
87A	-	-

OXYGEN SENSOR UPSTREAM HEATER RELAY

CAVITY	CIRCUIT	FUNCTION
30	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
85	A145 18DG/WT	OXYGEN SENSOR UPSTREAM HEATER RELAY CONTROL
86	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
87	F342 18DG/RD	OXYGEN SENSOR UPSTREAM HEATER RELAY OUTPUT
87A	-	-

RADIATOR FAN RELAY

CAVITY	CIRCUIT	FUNCTION
30	A17 12RD/TN	FUSED B(+)
85	C27 18DB/PK ■	RADIATOR FAN RELAY CONTROL
85	C24 20DB/PK ■■	RADIATOR FAN RELAY CONTROL
86	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
87	C25 12LG ■	RADIATOR FAN RELAY OUTPUT
87	C23 12DG ■■	RADIATOR FAN RELAY OUTPUT
87A	-	-

TRAILER TOW RELAY

CAVITY	CIRCUIT	FUNCTION
30	A6 14RD/TN	FUSED B(+)
85	Z1 20BK	GROUND
86	L7 20BK/YL	HEADLAMP SWITCH OUPUT
87	L76 14BK/OR	TRAILER TOW RELAY OUTPUT
87A	-	-

TRANSMISSION CONTROL RELAY

CAVITY	CIRCUIT	FUNCTION
30	F84 18YL/WT	FUSED B(+)
85	K30 18PK ●●	TRANSMISSION CONTROL RELAY CONTROL
85	Z1 18BK ●	GROUND
86	T15 18LG ●	TRANSMISSION CONTROL RELAY CONTROL
86	K125 18WT/DB ●●	GENERATOR SOURCE
87	T16 16RD	TRANSMISSION CONTROL RELAY OUTPUT

WIPER RELAY

CAVITY	CIRCUIT	FUNCTION
30	V49 18RD/BK	DRIVER LOW SPEED WIPER MOTOR DRIVER
85	V18 18YL/DG	WIPER RELAY CONTROL
86	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87A	V5 18DG/YL	WIPER PARK SWITCH SENSE

■ 2.5L
■■ EXCEPT 2.5L

● 4.7L
●● 3.9L/5.9L

J008W-1

AN001006

C106 (ENGINE) — C106 (PDC)

CAVITY	CIRCUIT	FUNCTION	CAVITY	CIRCUIT
1	C24 20DB/PK ■■	GROUND	1	C24 20DB/PK ■■
2	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT	2	C3 18DB/BK
3	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE	3	T41 18BK/WT
4	K4 18BK/LB	SENSOR GROUND	4	K4 18BK/LB
5	G107 18BK/GY ■■■	4WD SENSE	5	G107 20BK/GY ■■■
6	K125 18WT/DB	GENERATOR SOURCE (+)	6	K125 18WT/DB
7	A142 14DG/OR ●■	AUTOMATIC SHUT DOWN RELAY OUTPUT	7	A142 14DG/OR
	A142 16DG/OR ▲	AUTOMATIC SHUT DOWN RELAY OUTPUT		
8	Z12 16BK/TN	GROUND	8	Z12 16BK/TN
9	F12 18DB/WT	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL	9	F12 18DB/WT
10	A81 18DG/RD	A/C SWITCH SENSE	10	A81 18DG/RD
11	C90 20LG/WT ●■	A/C SELECT SIGNAL	11	C90 20LG/WT
	C90 18LG ▲	A/C SELECT SIGNAL		
12	L10 20BR/LG ◆◆▲	BACK-UP LAMP FEED	12	L10 20BR/LG
	L10 18BR/LG ▲▲	BACK-UP LAMP FEED		
13	A14 16RD/WT	FUSED (B+)	13	A14 16RD/WT
14	A41 14DB/YL ▽	OXYGEN SENSOR 1/2 SIGNAL	14	A41 14DB/YL ▽
15	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)	15	F18 20LG/BK
16	L1 20VT/BK ◆◆▲	BACK-UP LAMP FEED	16	L1 20VT/BK
	L1 18VT/BK ▲▲	BACK-UP LAMP FEED		

■■■ 4WD
■■ EXCEPT 2.5L
■ 3.9L/5.9L
▽ A/T, 4.7L
● 2.5L
◆◆ M/T
▲ 4.7L
▲▲ A/T, EXCEPT 4.7L

JOINT CONNECTOR NO. 1 (IN PDC)

CAVITY	CIRCUIT	FUNCTION
1	L1 20VT/BK	BACK-UP LAMP FEED
2	L1 20VT/BK	BACK-UP LAMP FEED
3	L1 20VT/BK	BACK-UP LAMP FEED
4	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
5	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
7	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
8	L38 20LB/BK	FOG LAMP FEED
9	L38 20LB/BK	FOG LAMP FEED
10	L38 20LB/BK	FOG LAMP FEED
11	L38 20LB/BK	FOG LAMP FEED
12	L60 16TN	RIGHT TURN SIGNAL
13	L60 16TN	RIGHT TURN SIGNAL
14	L60 16TN	RIGHT TURN SIGNAL
15	K4 18BK/LB	SENSOR GROUND
16	K4 18BK/LB	SENSOR GROUND
17	K4 18BK/LB	SENSOR GROUND
18	K4 18BK/LB	SENSOR GROUND
19	K4 18BK/LB	SENSOR GROUND
20	K4 18BK/LB	SENSOR GROUND
21	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
22	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
23	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
24	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
25	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
26	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
27	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
28	L7 18BK/YL	HEADLAMP SWITCH OUTPUT

NOTE: ALL CIRCUITS ON SAME BUSBAR OF JOINT CONNECTOR ARE INTERCHANGABLE.

JOINT CONNECTOR NO. 2 (IN PDC)

CAVITY	CIRCUIT	FUNCTION
1	L61 16LG	LEFT TURN SIGNAL
2	L61 16LG	LEFT TURN SIGNAL
3	L61 16LG	LEFT TURN SIGNAL
4	L7 20BK/YL ●	HEADLAMP SWITCH OUTPUT
5	L7 20BK/YL ●	HEADLAMP SWITCH OUTPUT
6	L7 20BK/YL ●	HEADLAMP SWITCH OUTPUT
7	V5 18DG/YL	WIPER PARK SWITCH SENSE
8	V5 18DG/YL	WIPER PARK SWITCH SENSE
9	V5 18DG/YL	WIPER PARK SWITCH SENSE
10	A14 16RD/WT	FUSED B(+)
11	A14 16RD/WT	FUSED B(+)
12	A14 16RD/WT	FUSED B(+)
13	A142 14DG/OR ▲	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
13	A16 12GY ●●	FUSED B(+)
14	A142 14DG/OR ▲	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
14	A16 12GY ●●	FUSED B(+)
15	A142 14DG/OR ▲	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
15	A16 12GY ●●	FUSED B(+)
16	K29 20WT/PK	BRAKE SWITCH SENSE
17	K29 18WT/PK	BRAKE SWITCH SENSE
18	K29 18WT/PK	BRAKE SWITCH SENSE

NOTE: ALL CIRCUITS ON SAME BUSBAR OF JOINT CONNECTOR ARE INTERCHANGABLE.

● TRAILOR TOW
●● CALIFORNIA
▲ EXCEPT CALIFORNIA

AN001009 J008W-1

JOINT CONNECTOR NO. 3

CAVITY	CIRCUIT	FUNCTION
1	D1 20VT/BR ●	CCD BUS (+)
2	D1 20VT/BR	CCD BUS (+)
3	D1 20VT/BR	CCD BUS (+)
4	D2 20WT/BK ●	CCD BUS (-)
5	D2 20WT/BK	CCD BUS (-)
6	D2 20WT/BK	CCD BUS (-)
7	D2 18WT/BK	CCD BUS (-)
8	D1 20VT/BR ● ●	CCD BUS (+)
9	D1 20VT/BR ▲	CCD BUS (+)
10	NOT USED	NOT USED
11	D1 18VT/BR	CCD BUS (+)
12	D1 20VT/BR	CCD BUS (+)
13	D1 20VT/BR	CCD BUS (+)
14	D2 20WT/BK	CCD BUS (-)
15	D2 20WT/BK ▲	CCD BUS (-)
16	D2 20WT/BK	CCD BUS (-)
17	D2 20WT/BK ● ●	CCD BUS (-)
18	NOT USED	NOT USED
19	NOT USED	NOT USED
20	D1 20VT/BR	CCD BUS (+)
21	D1 20VT/BR	CCD BUS (+)
22	NOT USED	NOT USED

NOTE: ALL CIRCUITS ON SAME BUSBAR OF JOINT CONNECTOR ARE INTERCHANGABLE.

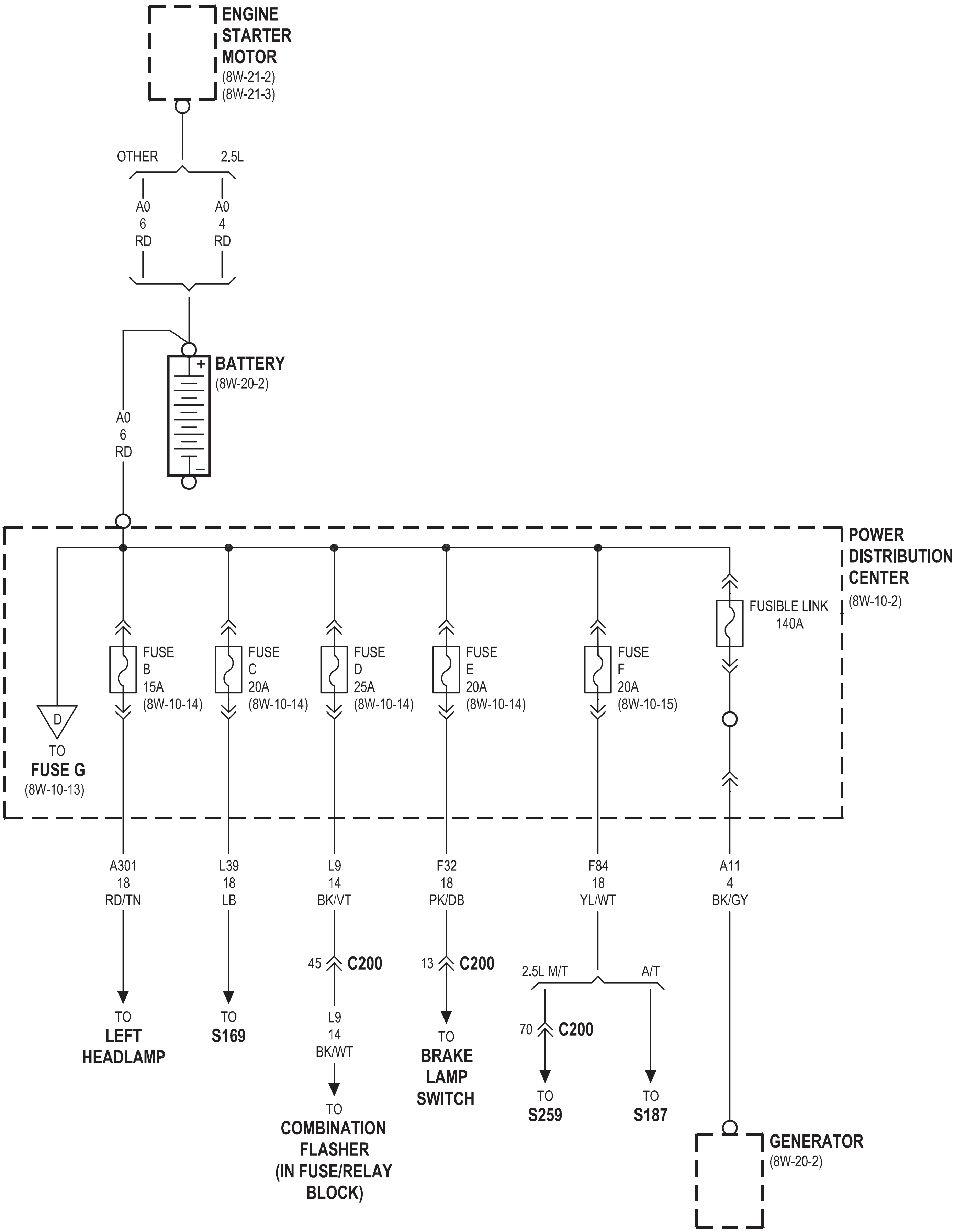
● POWER OPTIONS
● ● REMOTE RADIO
▲ EXCEPT BASE CTM

JOINT CONNECTOR NO. 4

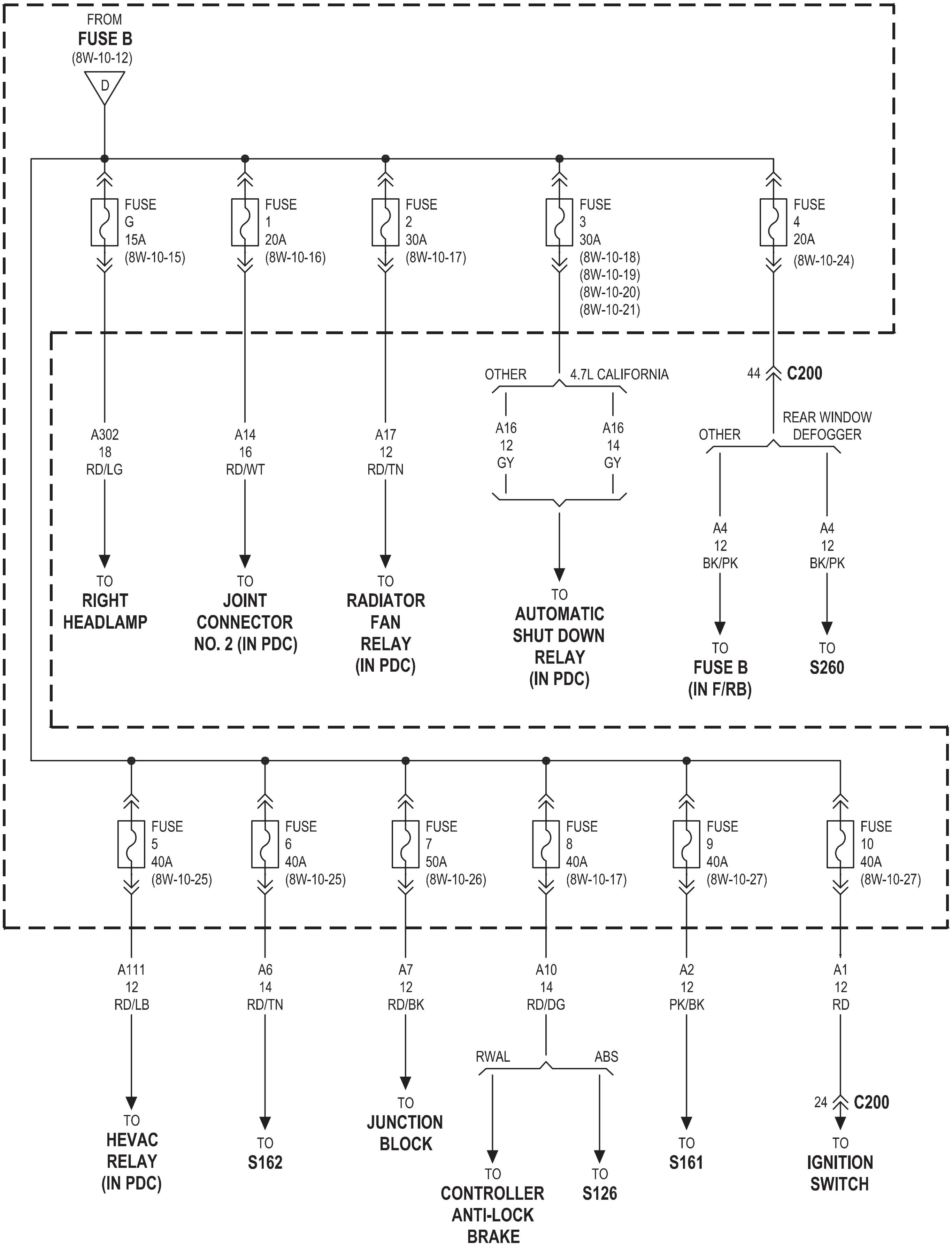
CAVITY	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	NOT USED	NOT USED
3	M1 18PK	FUSED B(+)
4	Z1 18BK	GROUND
5	Z1 20BK	GROUND
6	Z1 18BK	GROUND
7	Z1 20BK	GROUND
8	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
9	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
10	E2 20OR ▲	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
11	M1 18PK	FUSED B(+)
12	NOT USED	NOT USED
13	M1 18PK	FUSED B(+)
14	Z11 18BK/WT	GROUND
15	Z1 20BK	GROUND
16	NOT USED	NOT USED
17	Z1 20BK	GROUND
18	Z1 20BK	GROUND
19	Z1 20BK ▲	GROUND
20	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
21	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
22	E2 20OR ■	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL

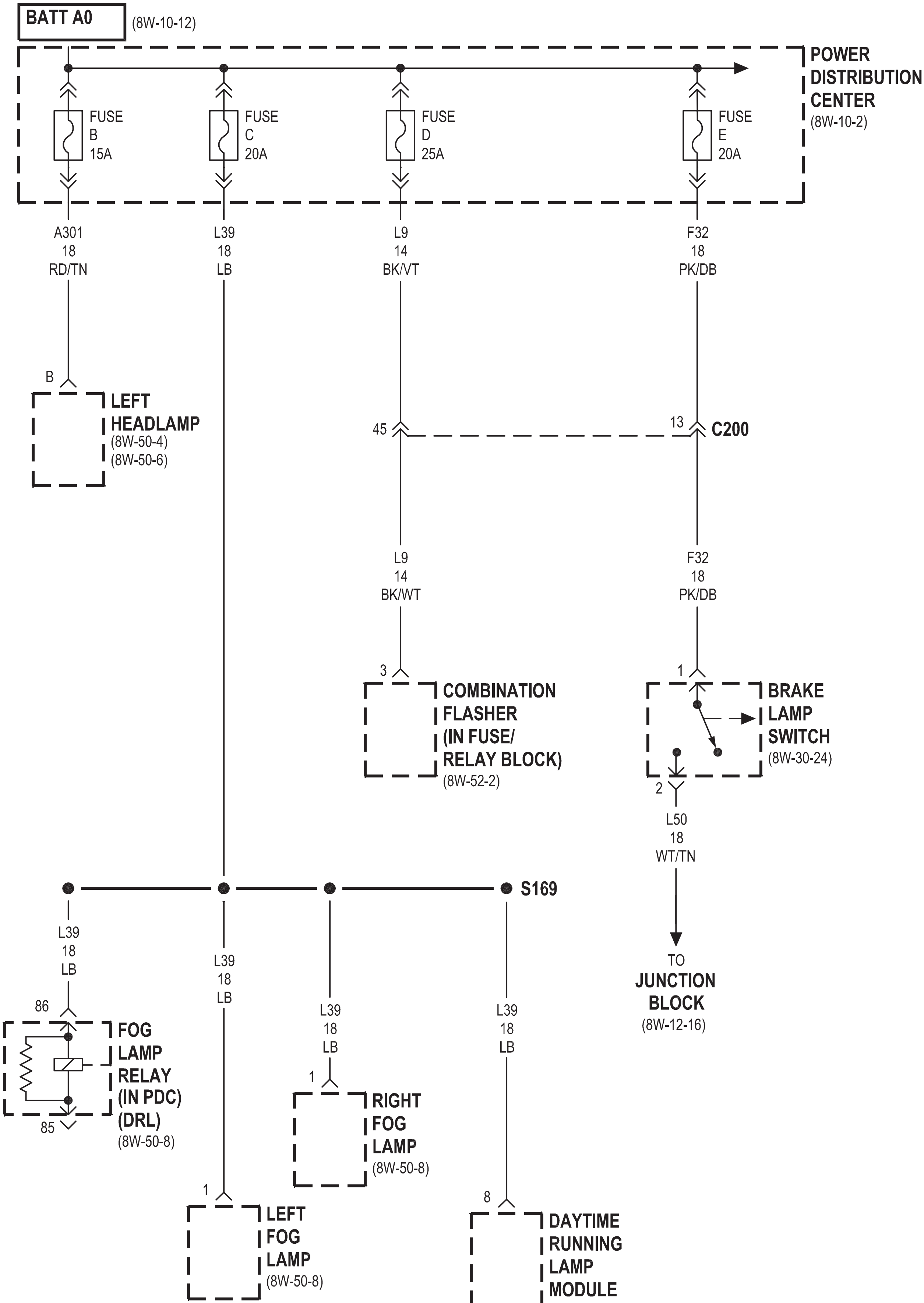
NOTE: ALL CIRCUITS ON SAME BUSBAR OF JOINT CONNECTOR ARE INTERCHANGABLE.

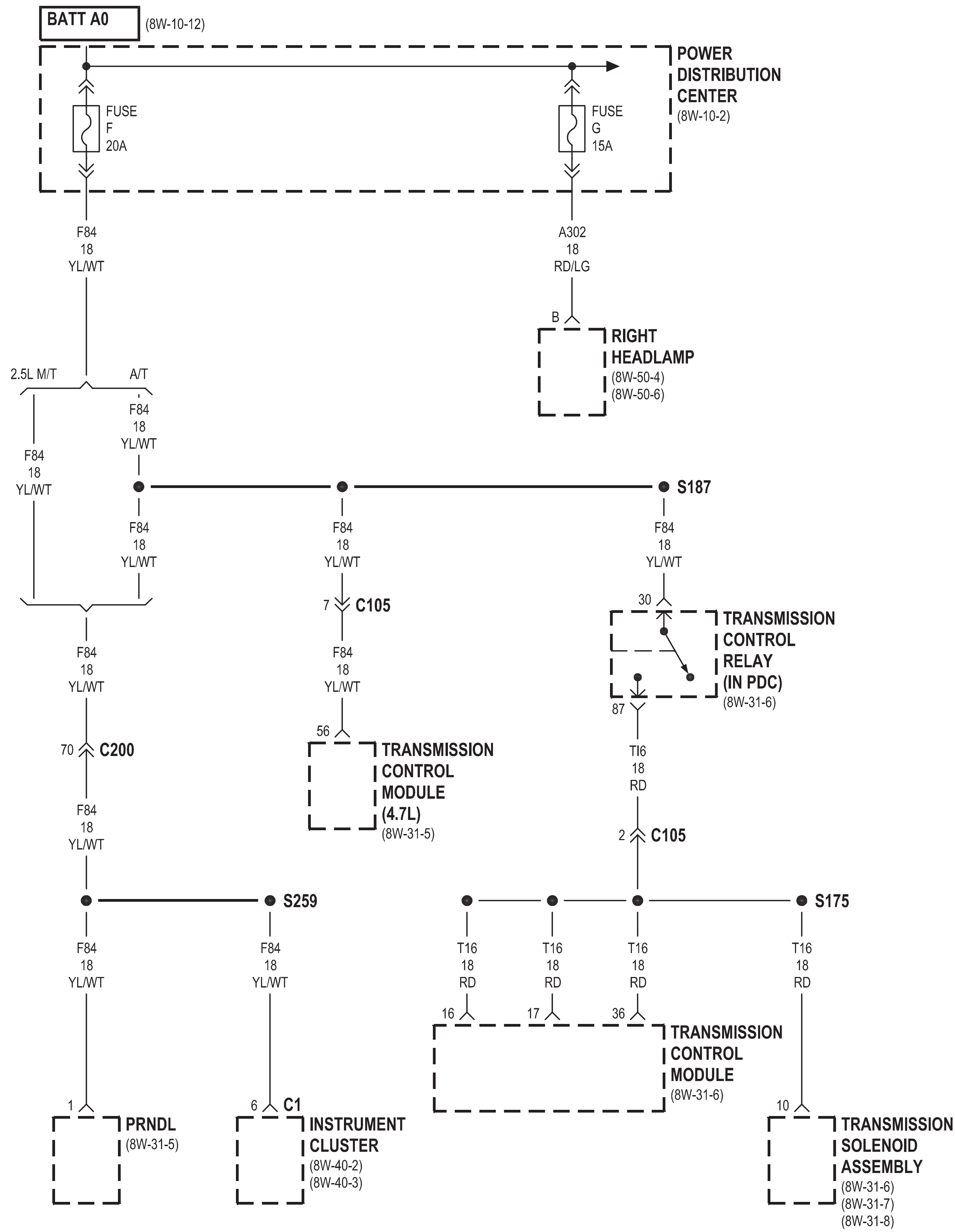
▲ LIGHT PACKAGE
■ REAR WINDOW DEFOGGER

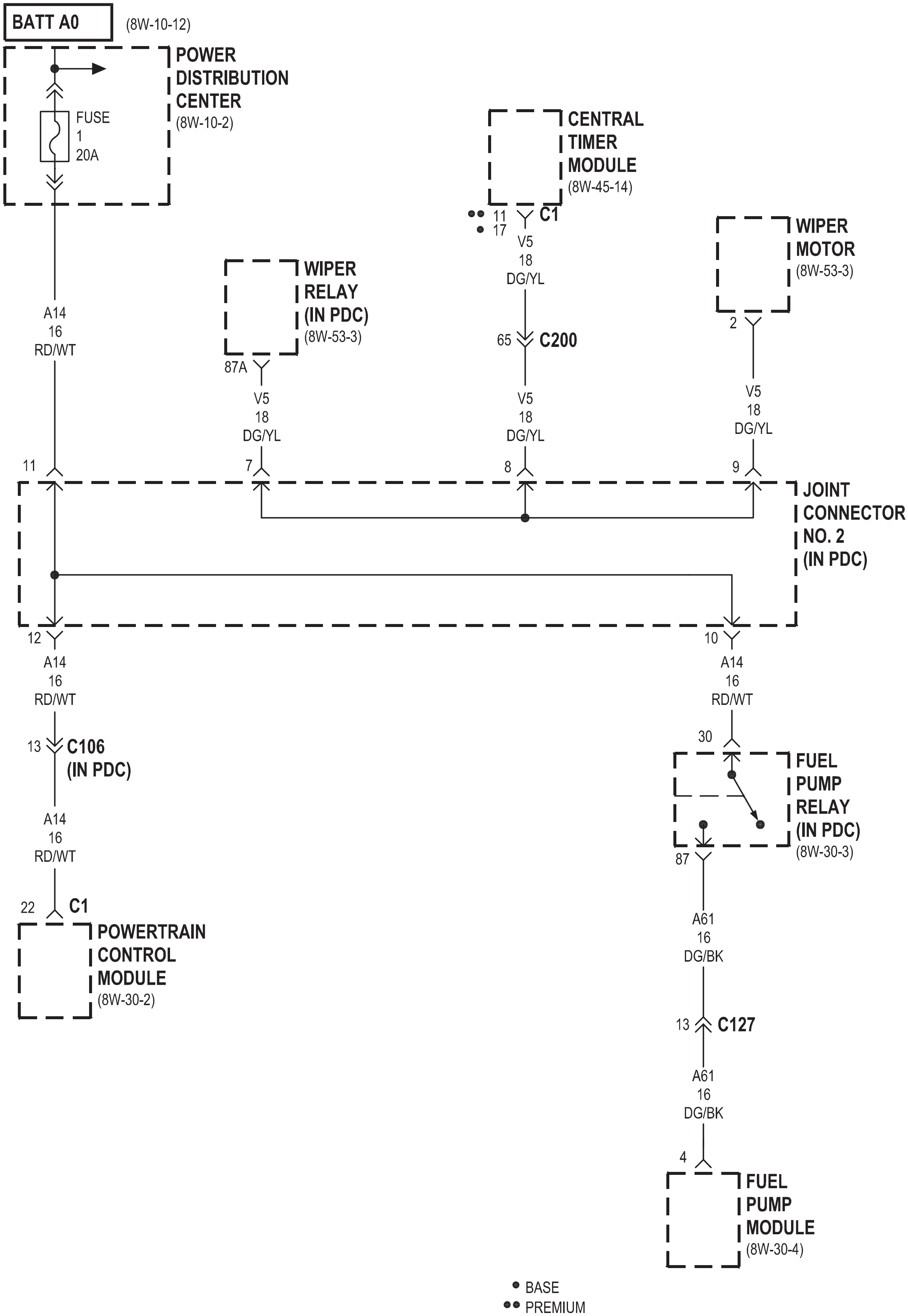


J008W-1 AN001012

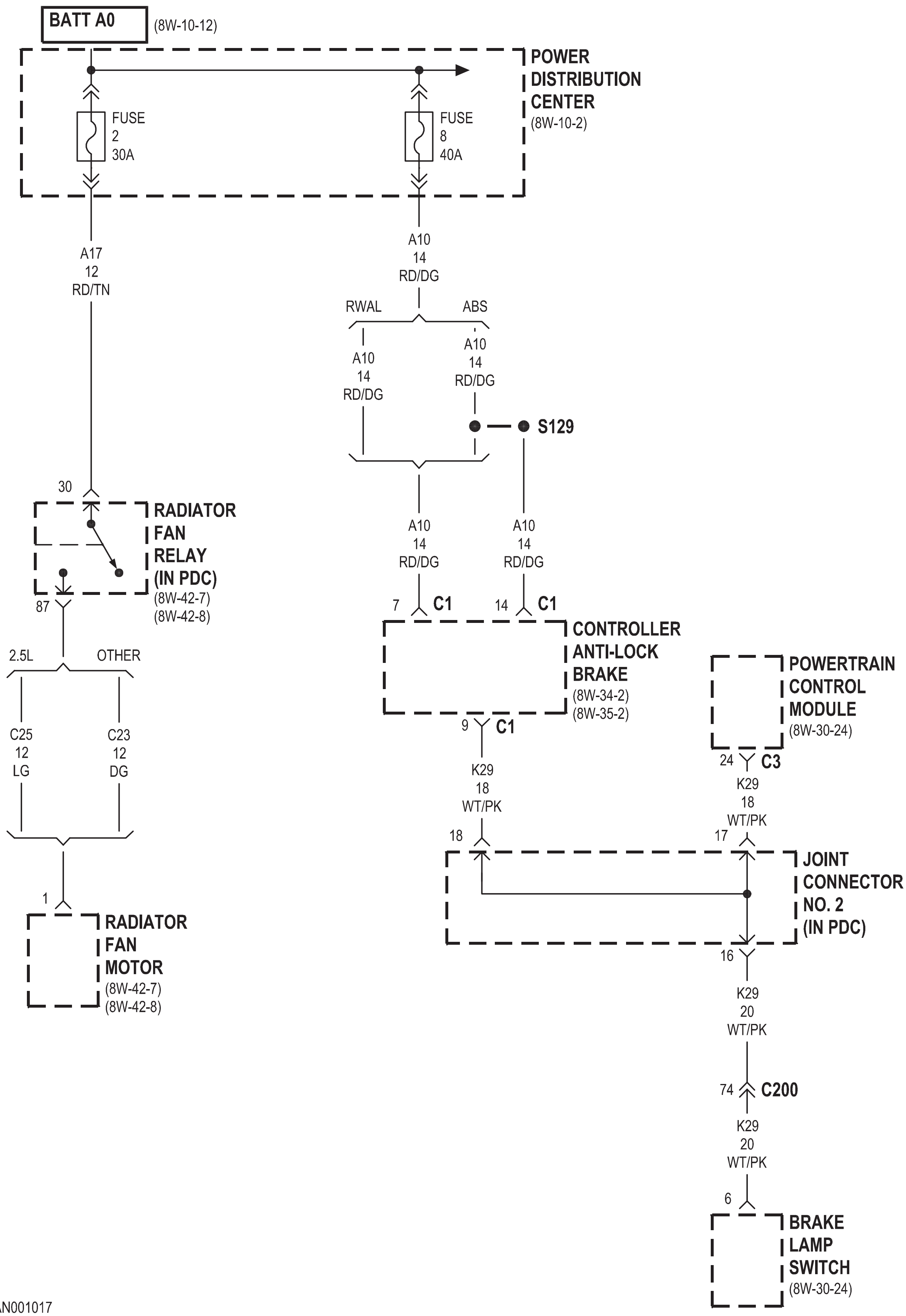

FROM
FUSE B
(8W-10-12)
D
FUSE
G
15A
(8W-10-15)
FUSE
1
20A
(8W-10-16)
FUSE
2
30A
(8W-10-17)
FUSE
3
30A
(8W-10-18)
(8W-10-19)
(8W-10-20)
(8W-10-21)
FUSE
4
20A
(8W-10-24)
OTHER
4.7L CALIFORNIA
44
C200
A302
18
RD/LG
A14
16
RD/WT
A17
12
RD/TN
A16
12
GY
A16
14
GY
OTHER
REAR WINDOW
DEFOGGER
A4
12
BK/PK
A4
12
BK/PK
TO
RIGHT
HEADLAMP
TO
JOINT
CONNECTOR
NO. 2 (IN PDC)
TO
RADIATOR
FAN
RELAY
(IN PDC)
TO
AUTOMATIC
SHUT DOWN
RELAY
(IN PDC)
TO
FUSE B
(IN F/RB)
TO
S260
FUSE
5
40A
(8W-10-25)
FUSE
6
40A
(8W-10-25)
FUSE
7
50A
(8W-10-26)
FUSE
8
40A
(8W-10-17)
FUSE
9
40A
(8W-10-27)
FUSE
10
40A
(8W-10-27)
A111
12
RD/LB
A6
14
RD/TN
A7
12
RD/BK
A10
14
RD/DG
A2
12
PK/BK
A1
12
RD
RWAL
ABS
24
C200
TO
HEVAC
RELAY
(IN PDC)
TO
S162
TO
JUNCTION
BLOCK
TO
CONTROLLER
ANTI-LOCK
BRAKE
TO
S126
TO
S161
TO
IGNITION
SWITCH


BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE B 15A
FUSE C 20A
FUSE D 25A
FUSE E 20A
A301 18 RD/TN
L39 18 LB
L9 14 BK/VT
F32 18 PK/DB
B
LEFT HEADLAMP
(8W-50-4)
(8W-50-6)
45
13
C200
L9 14 BK/WT
F32 18 PK/DB
3
COMBINATION FLASHER (IN FUSE/ RELAY BLOCK)
(8W-52-2)
1
BRAKE LAMP SWITCH
(8W-30-24)
2
L50 18 WT/TN
S169
TO JUNCTION BLOCK
(8W-12-16)
L39 18 LB
86
FOG LAMP RELAY (IN PDC) (DRL)
85
(8W-50-8)
L39 18 LB
L39 18 LB
1
RIGHT FOG LAMP
(8W-50-8)
L39 18 LB
1
LEFT FOG LAMP
(8W-50-8)
8
DAYTIME RUNNING LAMP MODULE
(8W-50-8)

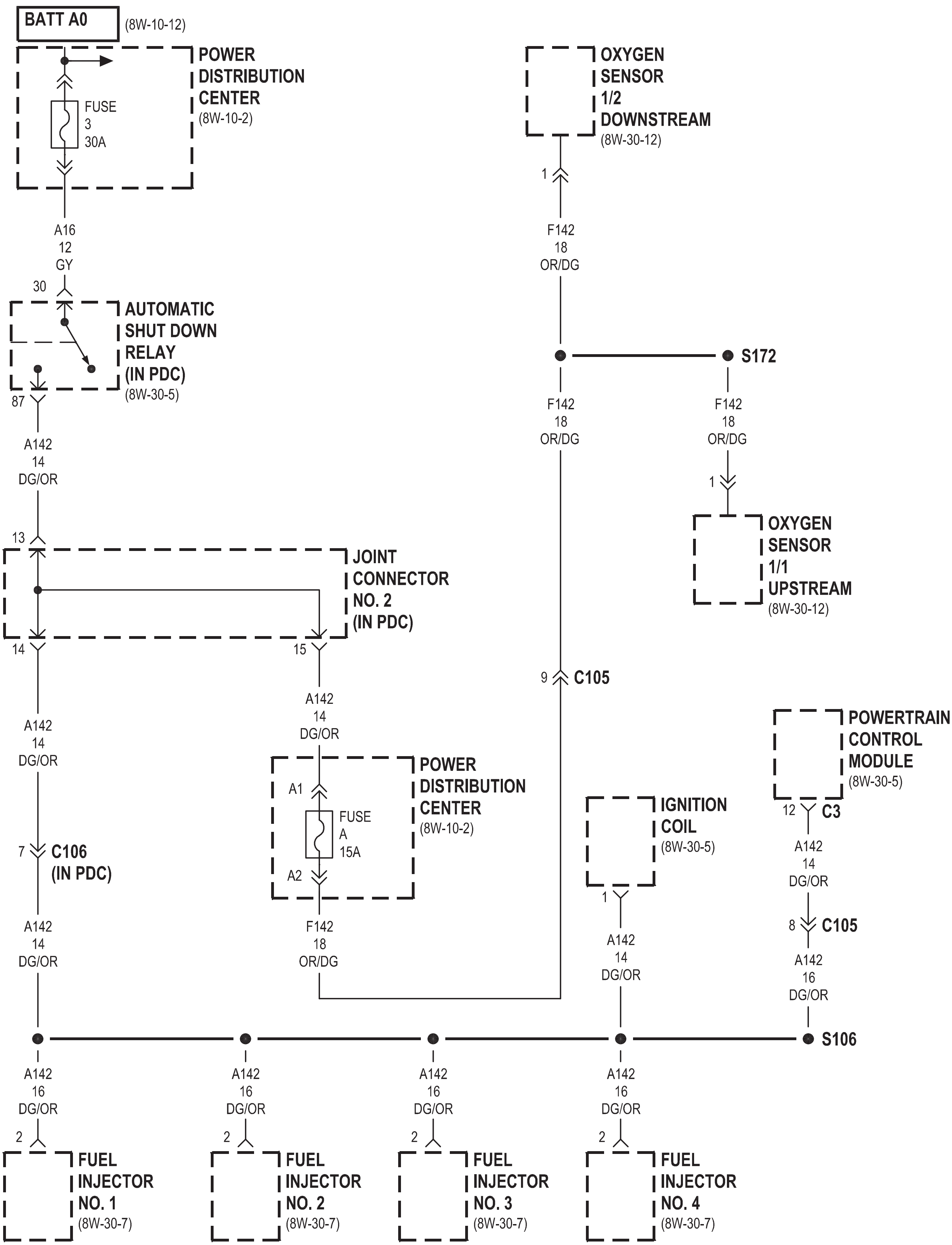

BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE F 20A
FUSE G 15A
F84 18 YL/WT
A302 18 RD/LG
B
RIGHT HEADLAMP
(8W-50-4)
(8W-50-6)
2.5L M/T
A/T
S187
7 C105
30
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-6)
87
TI6 18 RD
70 C200
56
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-5)
2 C105
S259
S175
T16 18 RD
16
17
36
TRANSMISSION CONTROL MODULE
(8W-31-6)
1
PRNDL
(8W-31-5)
6 C1
INSTRUMENT CLUSTER
(8W-40-2)
(8W-40-3)
10
TRANSMISSION SOLENOID ASSEMBLY
(8W-31-6)
(8W-31-7)
(8W-31-8)



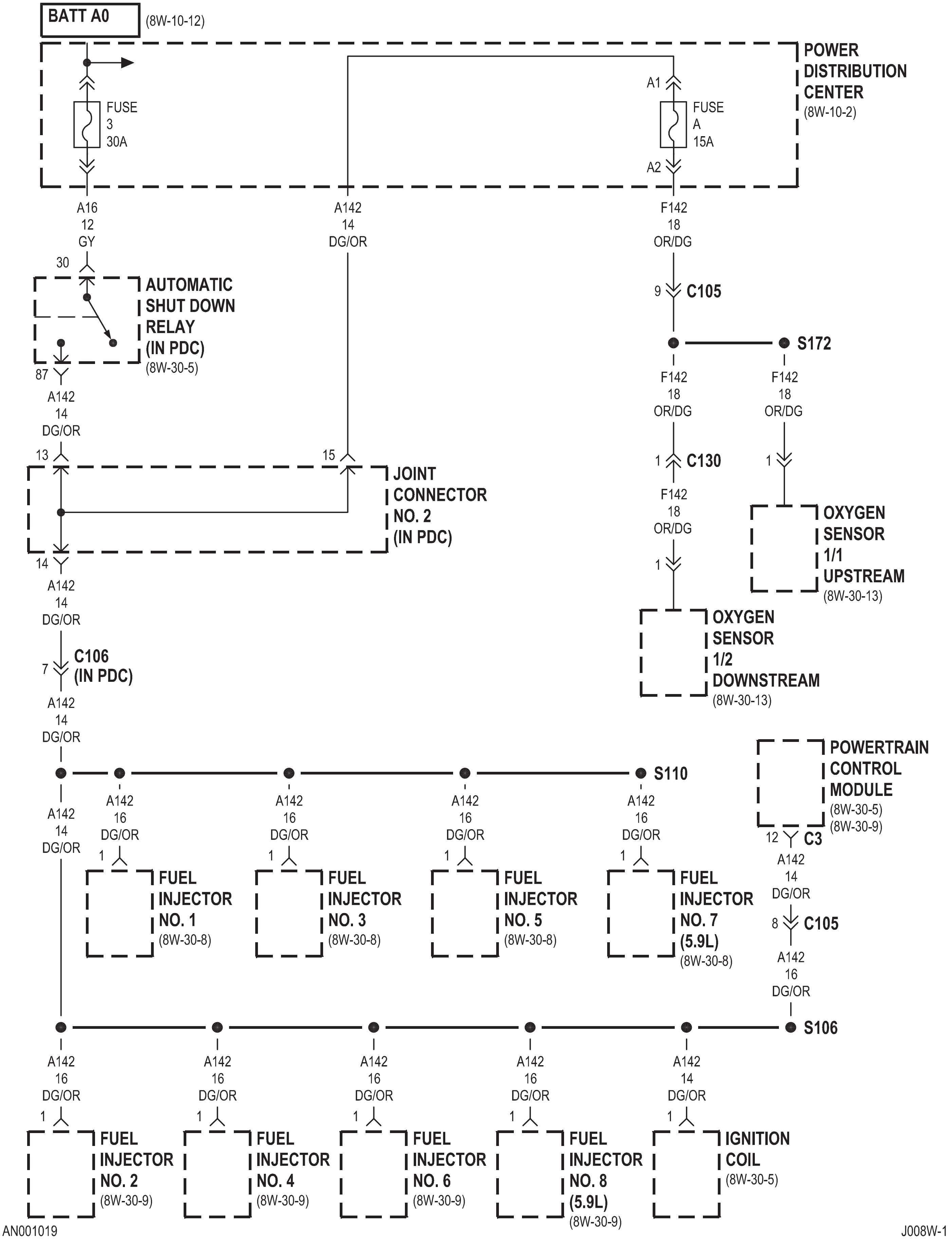
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 1 20A
A14 16 RD/WT
CENTRAL TIMER MODULE
(8W-45-14)
11
17
C1
V5 18 DG/YL
65 C200
WIPER RELAY (IN PDC)
(8W-53-3)
87A
V5 18 DG/YL
WIPER MOTOR
(8W-53-3)
2
V5 18 DG/YL
11
7
8
9
JOINT CONNECTOR NO. 2 (IN PDC)
12
10
A14 16 RD/WT
13 C106 (IN PDC)
A14 16 RD/WT
22 C1
POWERTRAIN CONTROL MODULE
(8W-30-2)
30
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
87
A61 16 DG/BK
13 C127
A61 16 DG/BK
4
FUEL PUMP MODULE
(8W-30-4)
BASE
PREMIUM


BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 2 30A
FUSE 8 40A
A17 12 RD/TN
A10 14 RD/DG
RWAL
ABS
A10 14 RD/DG
A10 14 RD/DG
S129
30
RADIATOR FAN RELAY (IN PDC)
(8W-42-7)
(8W-42-8)
87
2.5L
OTHER
C25 12 LG
C23 12 DG
1
RADIATOR FAN MOTOR
(8W-42-7)
(8W-42-8)
A10 14 RD/DG
A10 14 RD/DG
7 C1
14 C1
CONTROLLER ANTI-LOCK BRAKE
(8W-34-2)
(8W-35-2)
9 C1
K29 18 WT/PK
POWERTRAIN CONTROL MODULE
(8W-30-24)
24 C3
K29 18 WT/PK
18
17
JOINT CONNECTOR NO. 2 (IN PDC)
16
K29 20 WT/PK
74 C200
K29 20 WT/PK
6
BRAKE LAMP SWITCH
(8W-30-24)

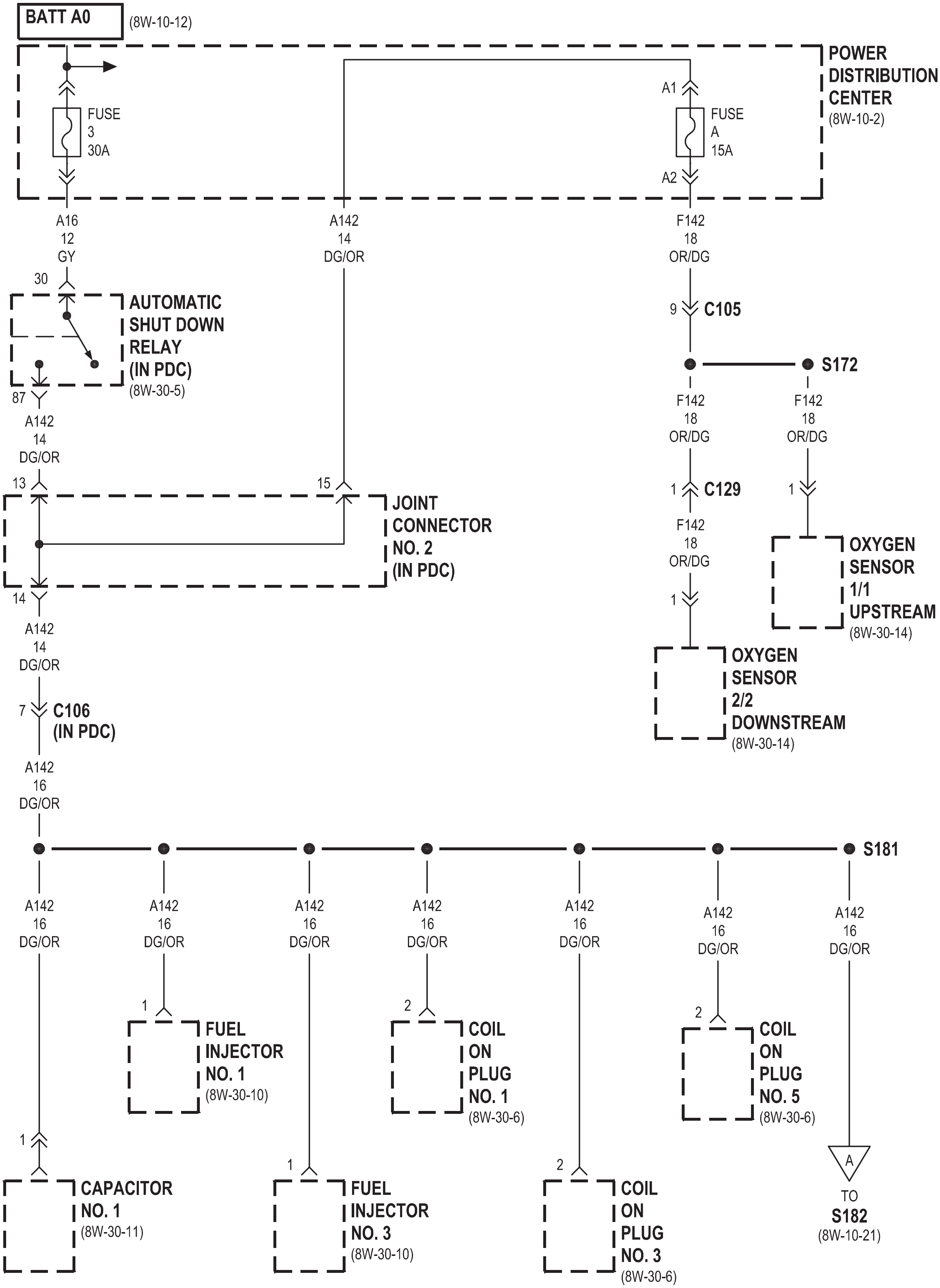
2.5L


BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 30A
A16 12 GY
30
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-5)
87
A142 14 DG/OR
13
JOINT CONNECTOR NO. 2 (IN PDC)
14
15
A142 14 DG/OR
A142 14 DG/OR
POWER DISTRIBUTION CENTER
(8W-10-2)
A1
FUSE A 15A
A2
F142 18 OR/DG
7
C106 (IN PDC)
A142 14 DG/OR
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-12)
1
F142 18 OR/DG
S172
F142 18 OR/DG
F142 18 OR/DG
1
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-12)
9
C105
POWERTRAIN CONTROL MODULE
(8W-30-5)
12
C3
A142 14 DG/OR
8
C105
A142 16 DG/OR
IGNITION COIL
(8W-30-5)
1
A142 14 DG/OR
S106
A142 16 DG/OR
A142 16 DG/OR
A142 16 DG/OR
A142 16 DG/OR
2
2
2
2
FUEL INJECTOR NO. 1
(8W-30-7)
FUEL INJECTOR NO. 2
(8W-30-7)
FUEL INJECTOR NO. 3
(8W-30-7)
FUEL INJECTOR NO. 4
(8W-30-7)

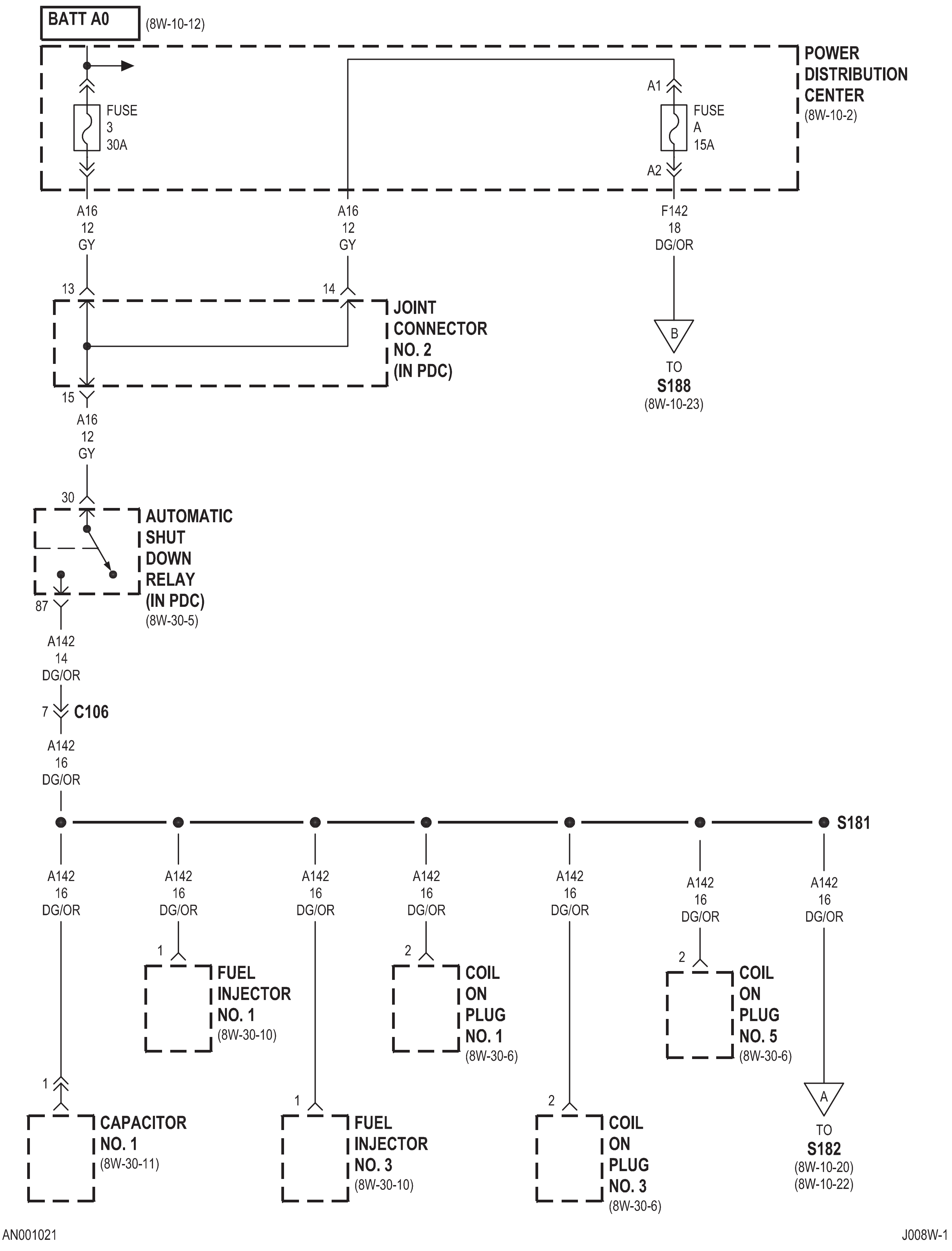
3.9L/5.9L

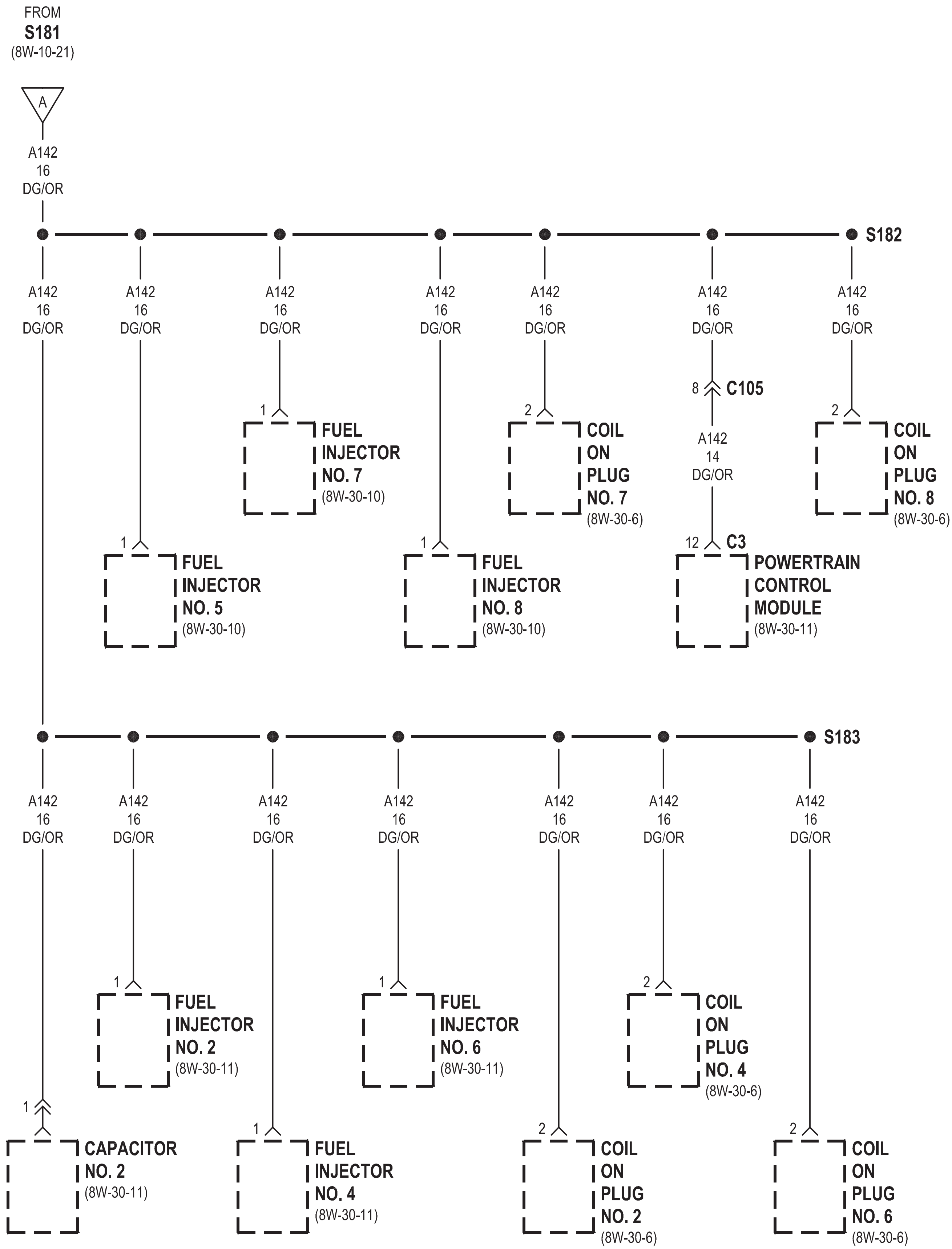


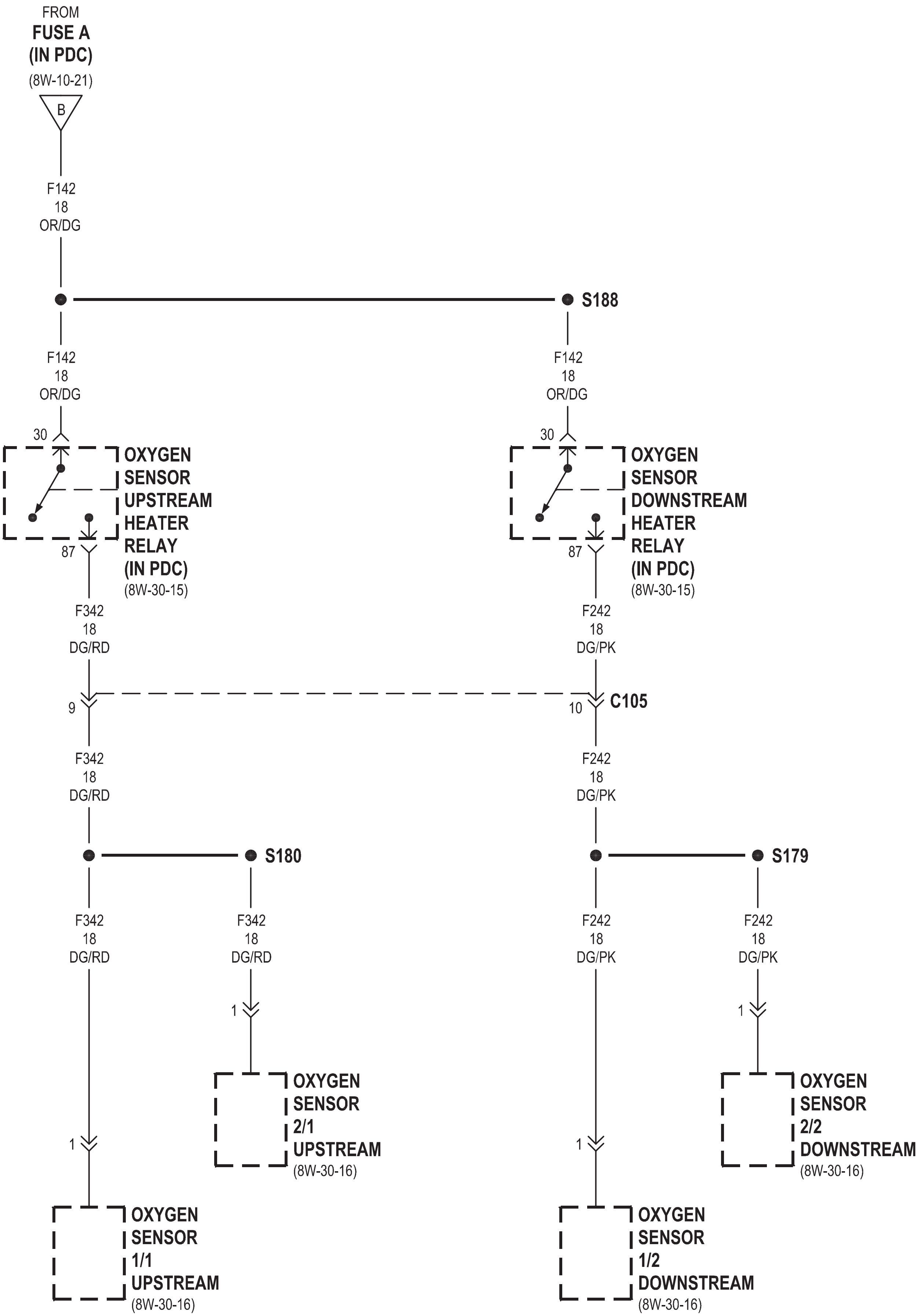
AN001019 J008W-1

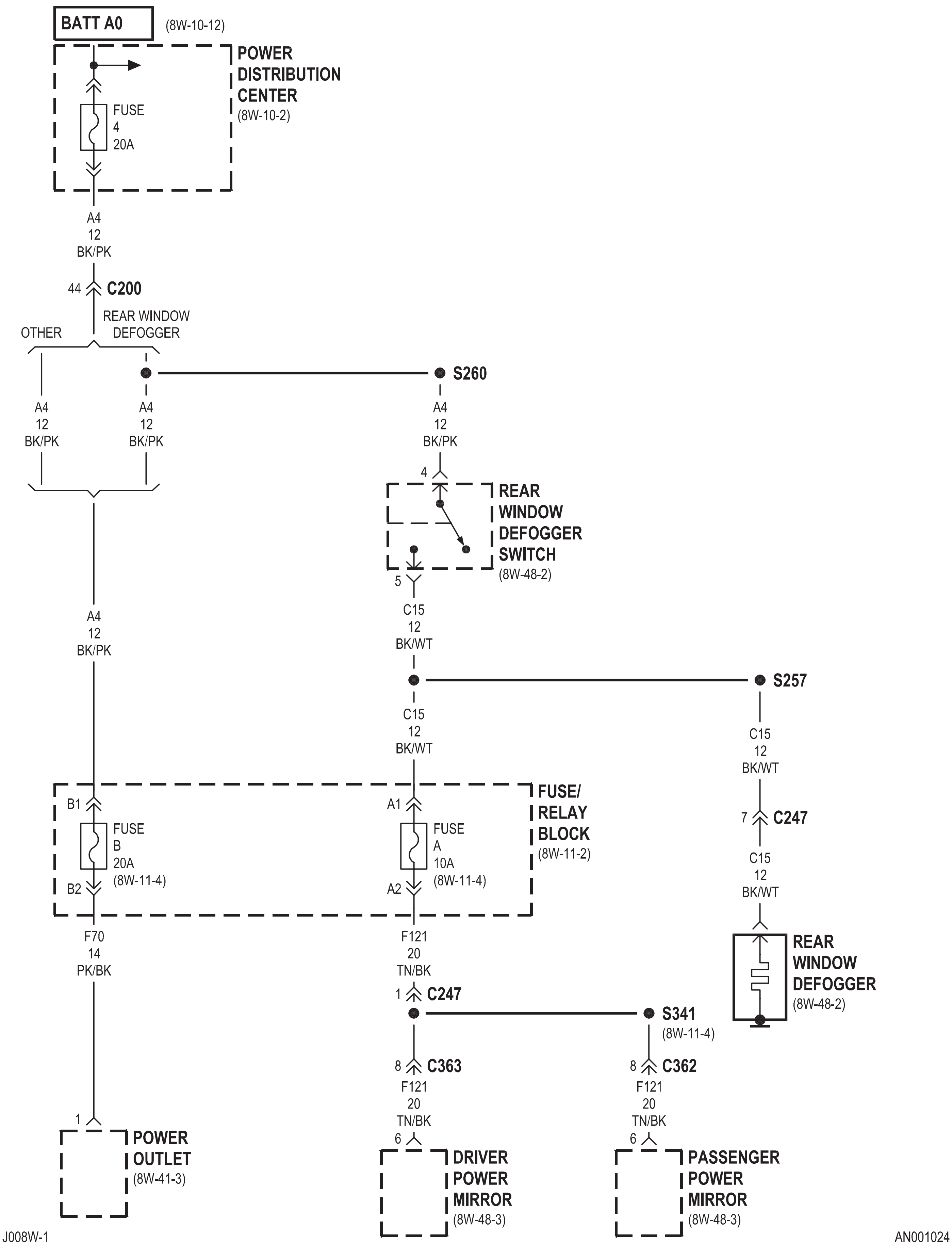

BATT A0
(8W-10-12)
FUSE
3
30A
A1
FUSE
A
15A
A2
POWER
DISTRIBUTION
CENTER
(8W-10-2)
A16
12
GY
A142
14
DG/OR
F142
18
OR/DG
30
AUTOMATIC
SHUT DOWN
RELAY
(IN PDC)
(8W-30-5)
87
9
C105
S172
F142
18
OR/DG
A142
14
DG/OR
13
15
1
C129
JOINT
CONNECTOR
NO. 2
(IN PDC)
OXYGEN
SENSOR
1/1
UPSTREAM
(8W-30-14)
14
OXYGEN
SENSOR
2/2
DOWNSTREAM
(8W-30-14)
7
C106
(IN PDC)
A142
16
DG/OR
S181
FUEL
INJECTOR
NO. 1
(8W-30-10)
COIL
ON
PLUG
NO. 1
(8W-30-6)
COIL
ON
PLUG
NO. 5
(8W-30-6)
CAPACITOR
NO. 1
(8W-30-11)
FUEL
INJECTOR
NO. 3
(8W-30-10)
COIL
ON
PLUG
NO. 3
(8W-30-6)
A
TO
S182
(8W-10-21)

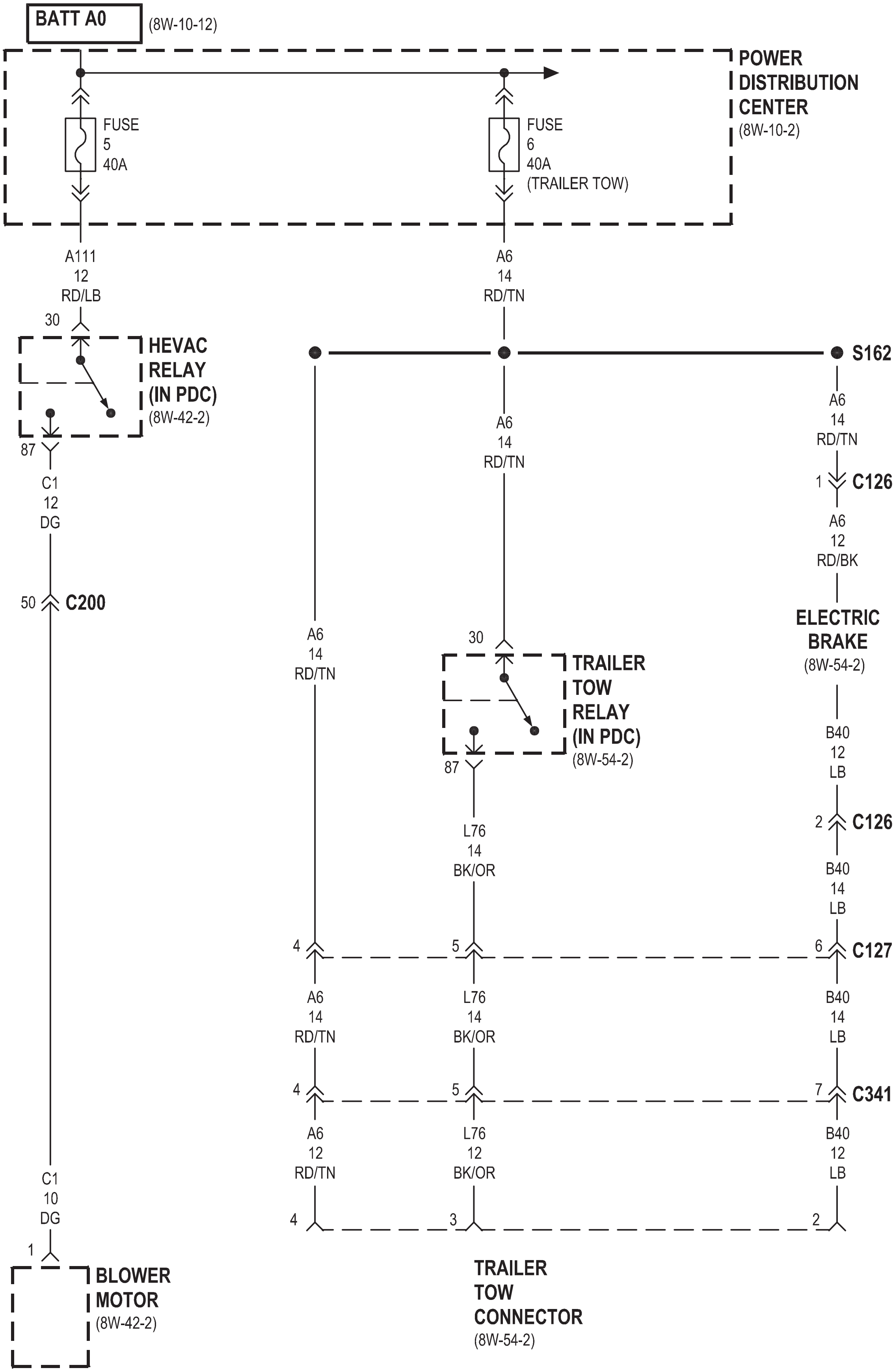
4.7L CALIFORNIA

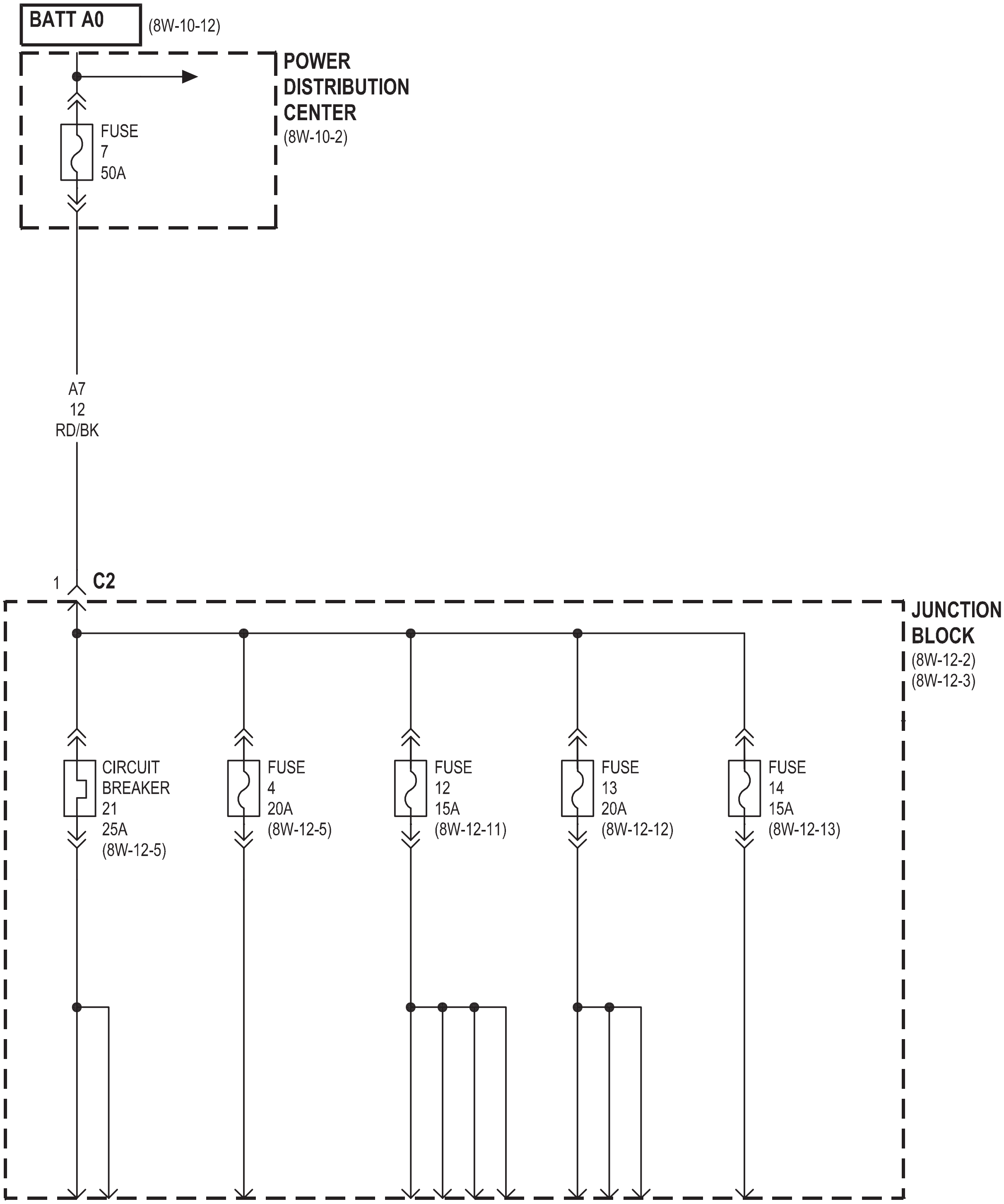


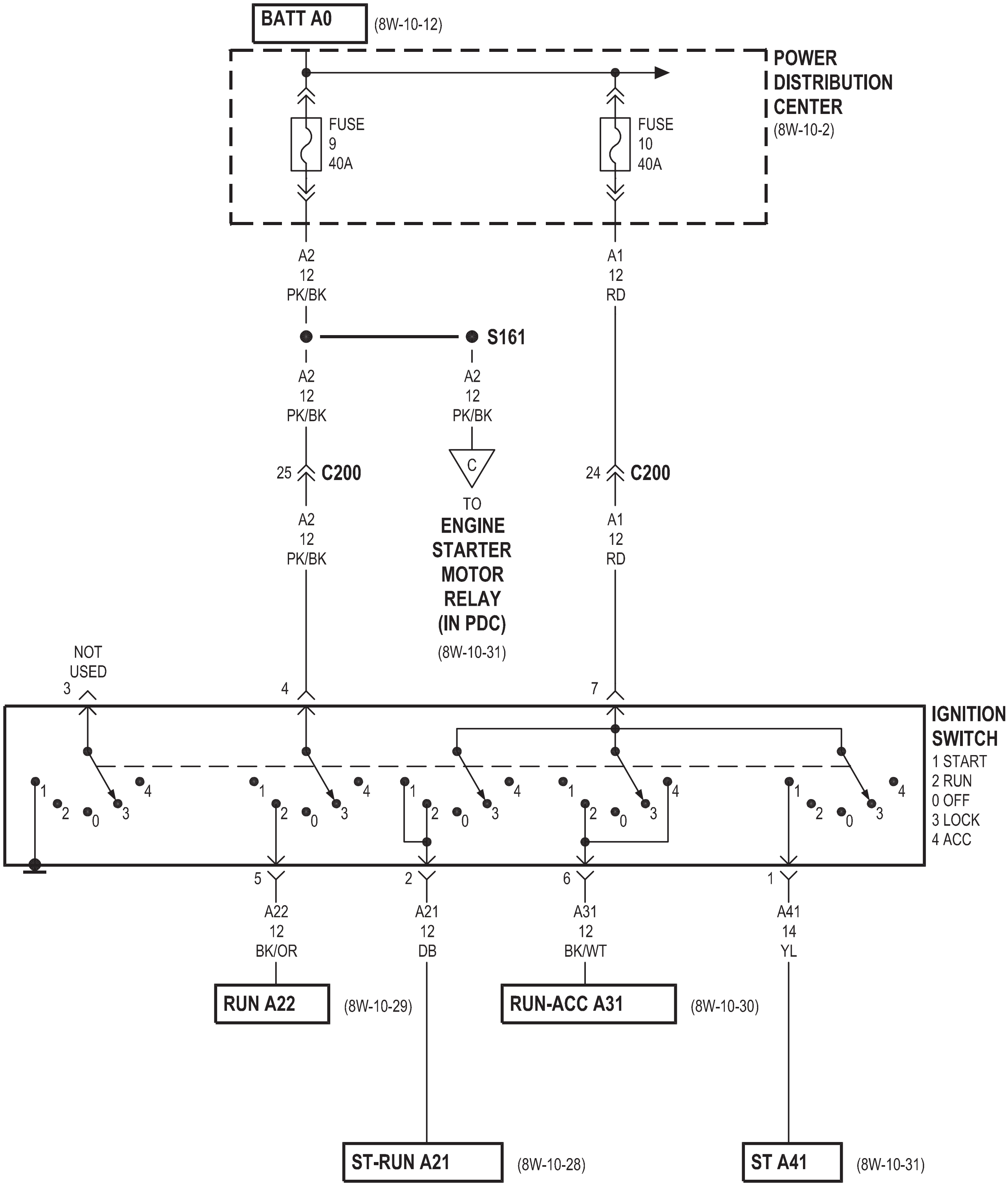

FROM
S181
(8W-10-21)
A
A142
16
DG/OR
S182
C105
POWERTRAIN CONTROL MODULE
(8W-30-11)
C3
FUEL INJECTOR NO. 7
(8W-30-10)
COIL ON PLUG NO. 7
(8W-30-6)
COIL ON PLUG NO. 8
(8W-30-6)
FUEL INJECTOR NO. 5
(8W-30-10)
FUEL INJECTOR NO. 8
(8W-30-10)
A142
14
DG/OR
S183
FUEL INJECTOR NO. 2
(8W-30-11)
FUEL INJECTOR NO. 6
(8W-30-11)
COIL ON PLUG NO. 4
(8W-30-6)
CAPACITOR NO. 2
(8W-30-11)
FUEL INJECTOR NO. 4
(8W-30-11)
COIL ON PLUG NO. 2
(8W-30-6)
COIL ON PLUG NO. 6
(8W-30-6)


FROM
FUSE A
(IN PDC)
(8W-10-21)
B
F142
18
OR/DG
S188
F142
18
OR/DG
F142
18
OR/DG
30
30
OXYGEN
SENSOR
UPSTREAM
HEATER
RELAY
(IN PDC)
(8W-30-15)
OXYGEN
SENSOR
DOWNSTREAM
HEATER
RELAY
(IN PDC)
(8W-30-15)
87
87
F342
18
DG/RD
F242
18
DG/PK
9
10
C105
F342
18
DG/RD
F242
18
DG/PK
S180
S179
F342
18
DG/RD
F342
18
DG/RD
F242
18
DG/PK
F242
18
DG/PK
1
1
1
1
OXYGEN
SENSOR
2/1
UPSTREAM
(8W-30-16)
OXYGEN
SENSOR
2/2
DOWNSTREAM
(8W-30-16)
OXYGEN
SENSOR
1/1
UPSTREAM
(8W-30-16)
OXYGEN
SENSOR
1/2
DOWNSTREAM
(8W-30-16)

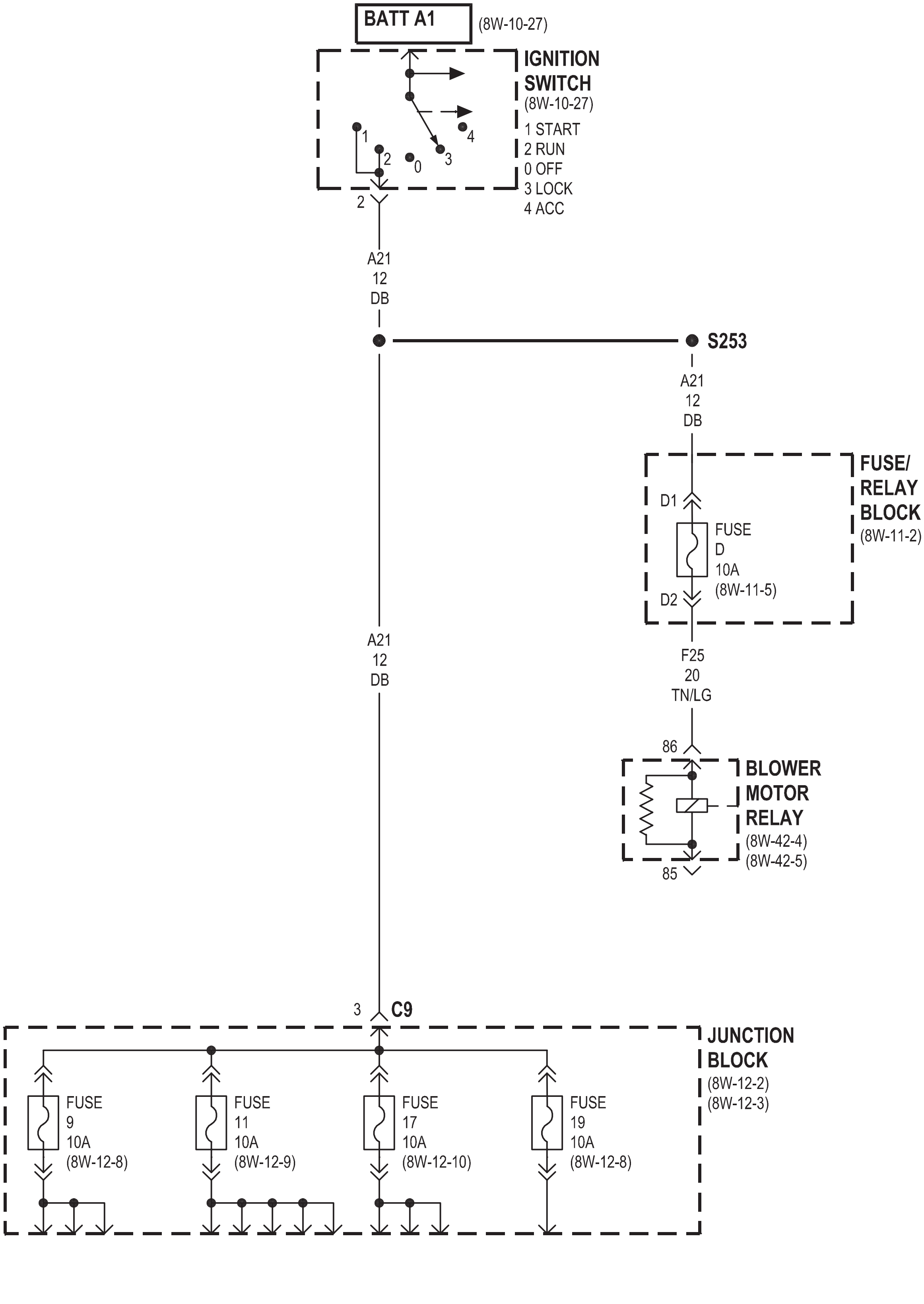

BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
4
20A
A4
12
BK/PK
44
C200
OTHER
REAR WINDOW
DEFOGGER
S260
A4
12
BK/PK
4
REAR
WINDOW
DEFOGGER
SWITCH
(8W-48-2)
5
C15
12
BK/WT
S257
FUSE/
RELAY
BLOCK
(8W-11-2)
B1
FUSE
B
20A
(8W-11-4)
B2
A1
FUSE
A
10A
(8W-11-4)
A2
7
C247
REAR
WINDOW
DEFOGGER
(8W-48-2)
F70
14
PK/BK
F121
20
TN/BK
1
C247
S341
(8W-11-4)
8
C363
8
C362
6
POWER
OUTLET
(8W-41-3)
DRIVER
POWER
MIRROR
(8W-48-3)
PASSENGER
POWER
MIRROR
(8W-48-3)

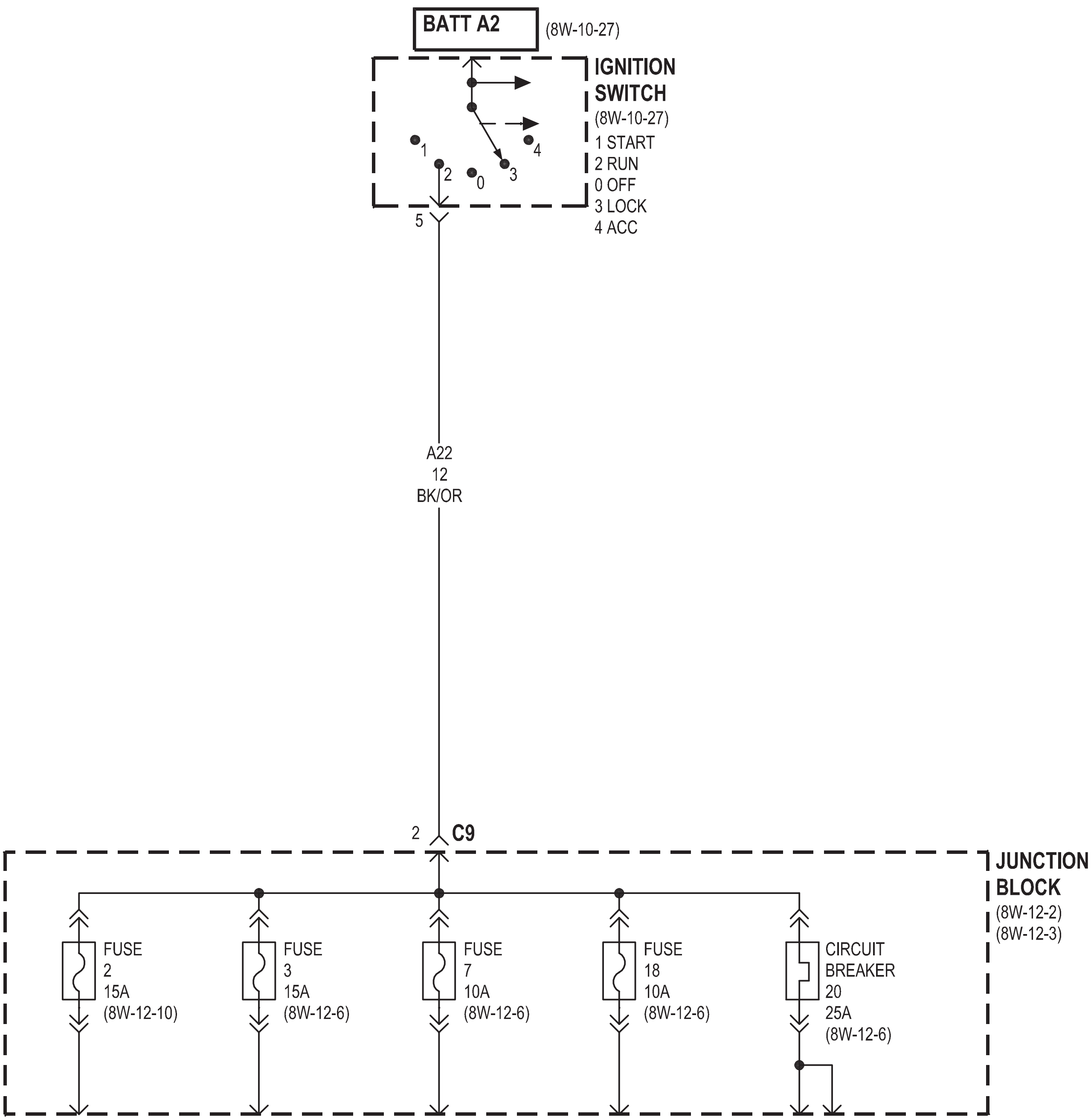

BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
5
40A
FUSE
6
40A
(TRAILER TOW)
A111
12
RD/LB
A6
14
RD/TN
30
HEVAC
RELAY
(IN PDC)
(8W-42-2)
87
S162
C1
12
DG
50
C200
A6
14
RD/TN
1
C126
A6
12
RD/BK
ELECTRIC
BRAKE
(8W-54-2)
30
TRAILER
TOW
RELAY
(IN PDC)
(8W-54-2)
87
B40
12
LB
L76
14
BK/OR
2
C126
B40
14
LB
4
5
6
C127
A6
14
RD/TN
L76
14
BK/OR
B40
14
LB
4
5
7
C341
A6
12
RD/TN
L76
12
BK/OR
B40
12
LB
C1
10
DG
4
3
2
1
BLOWER
MOTOR
(8W-42-2)
TRAILER
TOW
CONNECTOR
(8W-54-2)

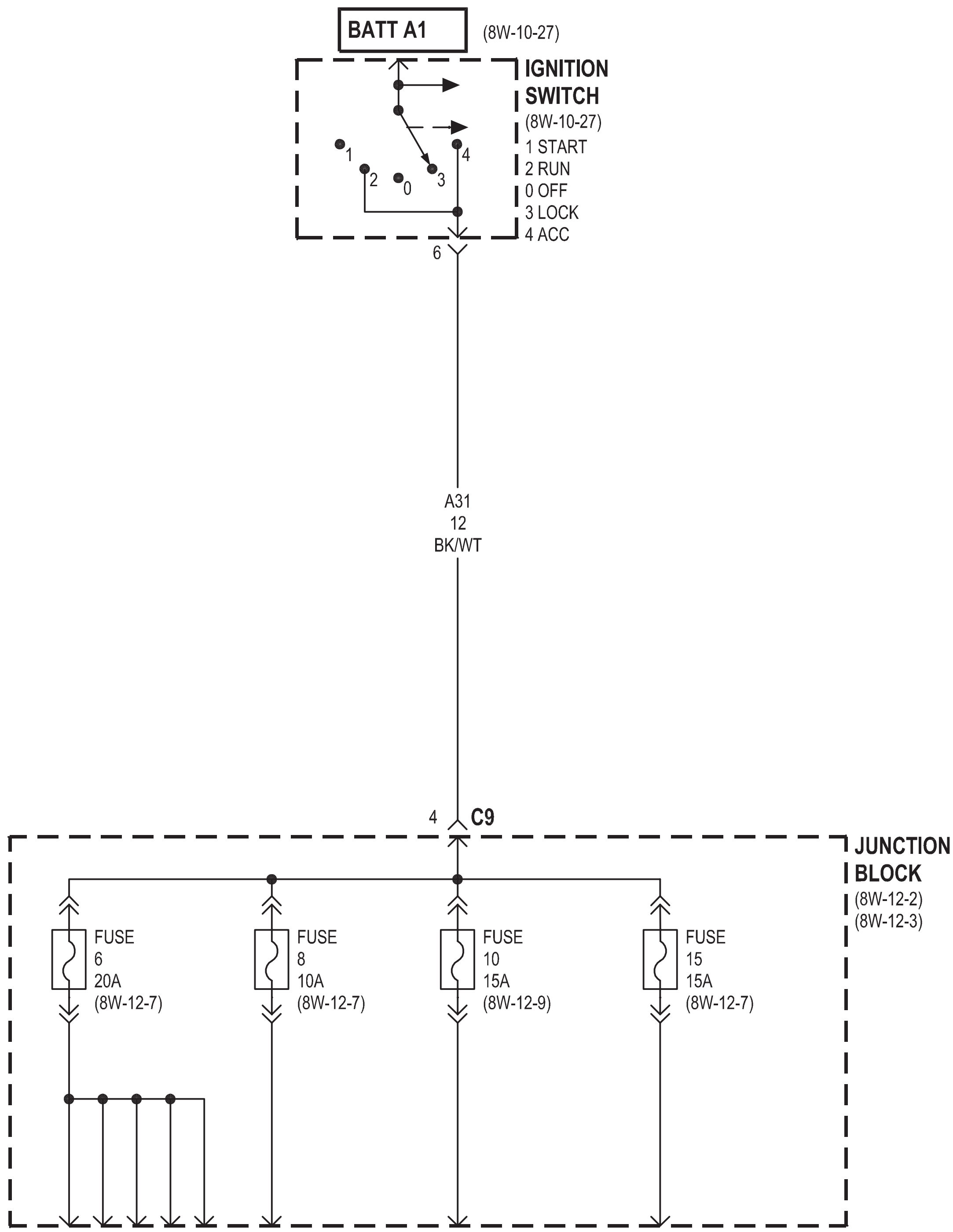

BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
7
50A
A7
12
RD/BK
1
C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT
BREAKER
21
25A
(8W-12-5)
FUSE
4
20A
(8W-12-5)
FUSE
12
15A
(8W-12-11)
FUSE
13
20A
(8W-12-12)
FUSE
14
15A
(8W-12-13)

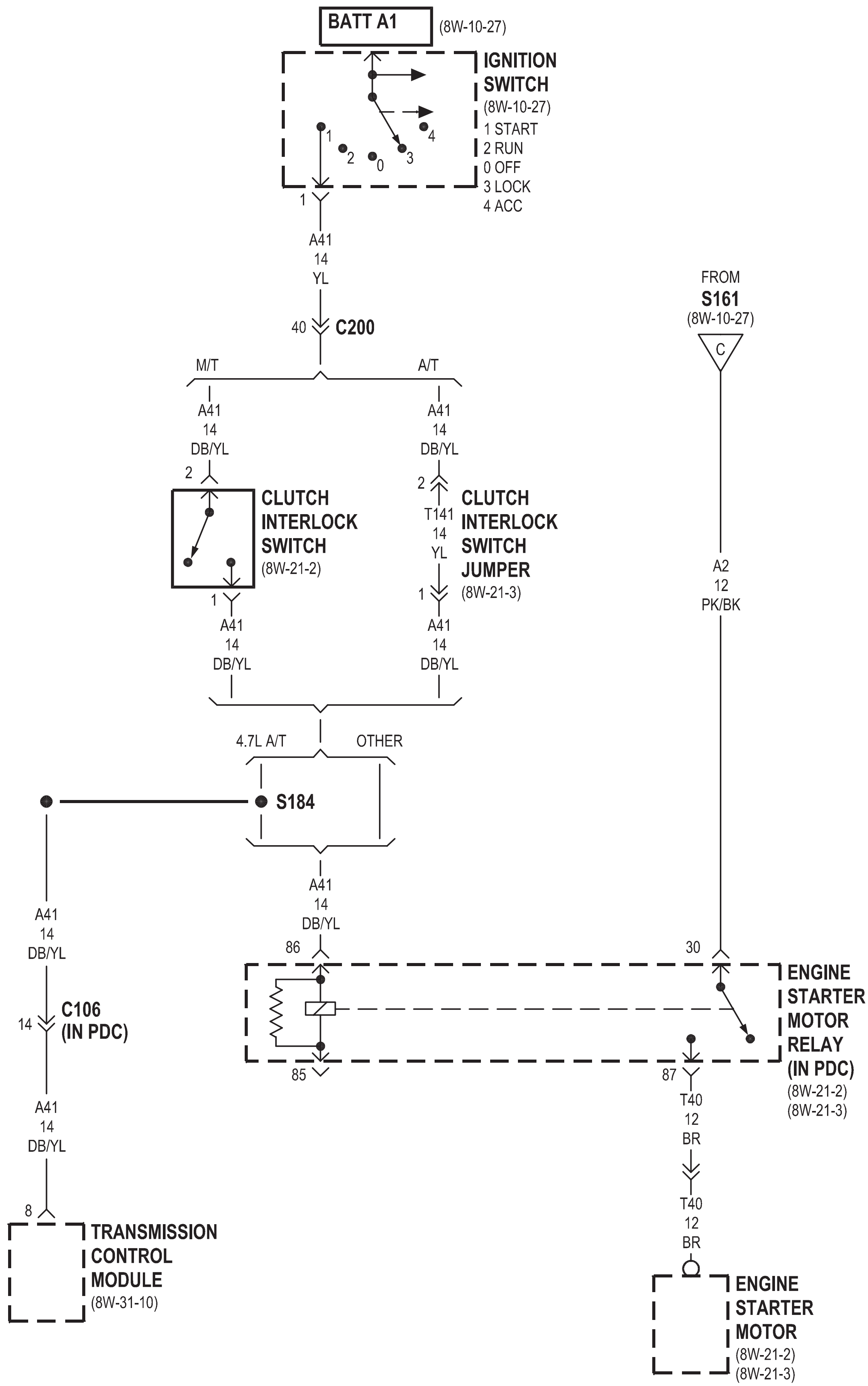


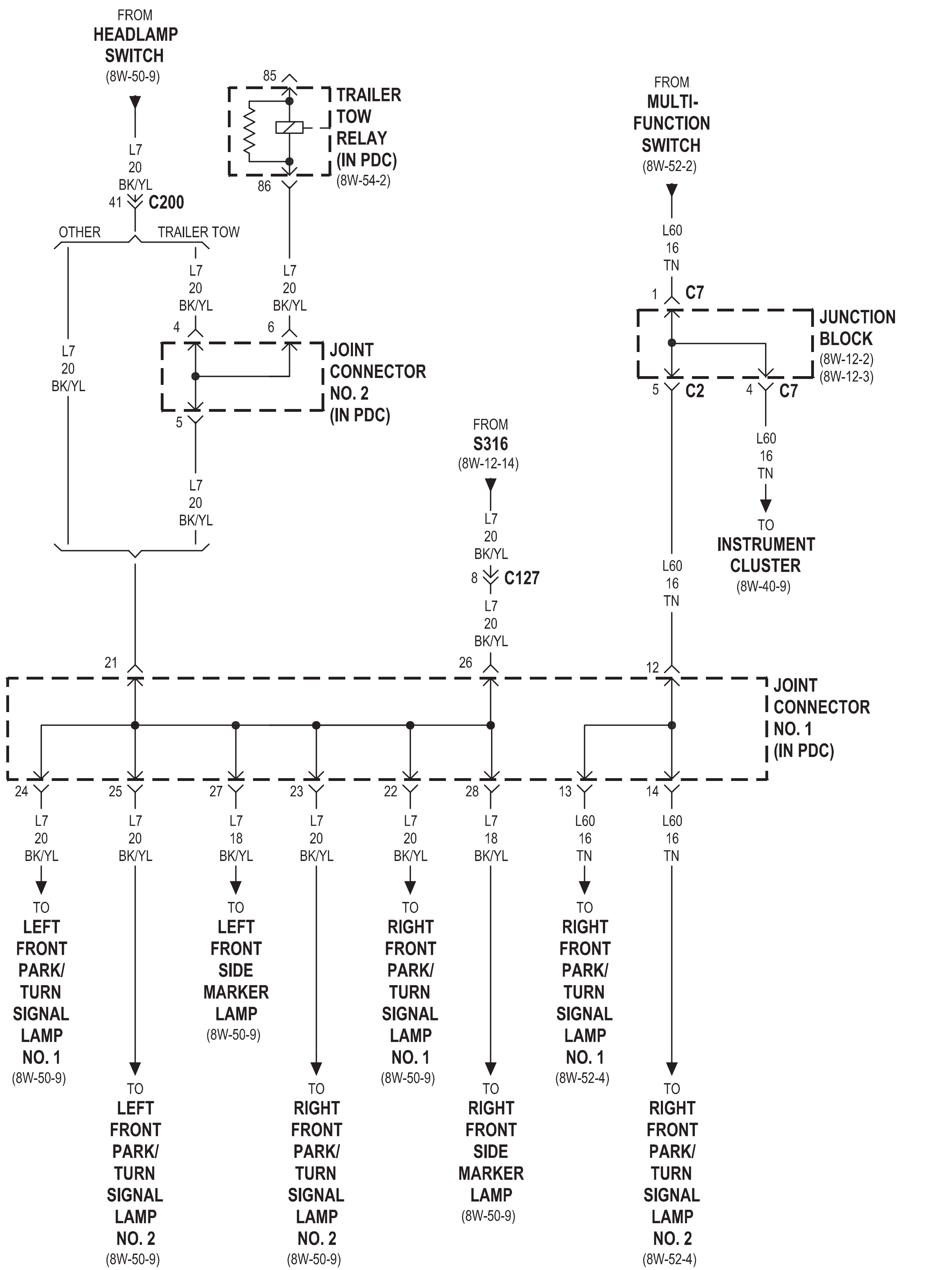
BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
9
40A
FUSE
10
40A
A2
12
PK/BK
A1
12
RD
S161
A2
12
PK/BK
A2
12
PK/BK
C
25
C200
24
C200
TO
ENGINE
STARTER
MOTOR
RELAY
(IN PDC)
(8W-10-31)
A2
12
PK/BK
A1
12
RD
NOT
USED
3
4
7
IGNITION
SWITCH
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
5
2
6
1
A22
12
BK/OR
A21
12
DB
A31
12
BK/WT
A41
14
YL
RUN A22
(8W-10-29)
RUN-ACC A31
(8W-10-30)
ST-RUN A21
(8W-10-28)
ST A41
(8W-10-31)


BATT A1
(8W-10-27)
IGNITION SWITCH
(8W-10-27)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
2
0
3
4
2
A21
12
DB
S253
A21
12
DB
FUSE/ RELAY BLOCK
(8W-11-2)
D1
FUSE
D
10A
(8W-11-5)
D2
A21
12
DB
F25
20
TN/LG
86
BLOWER MOTOR RELAY
(8W-42-4)
(8W-42-5)
85
3
C9
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
10A
(8W-12-8)
FUSE
11
10A
(8W-12-9)
FUSE
17
10A
(8W-12-10)
FUSE
19
10A
(8W-12-8)

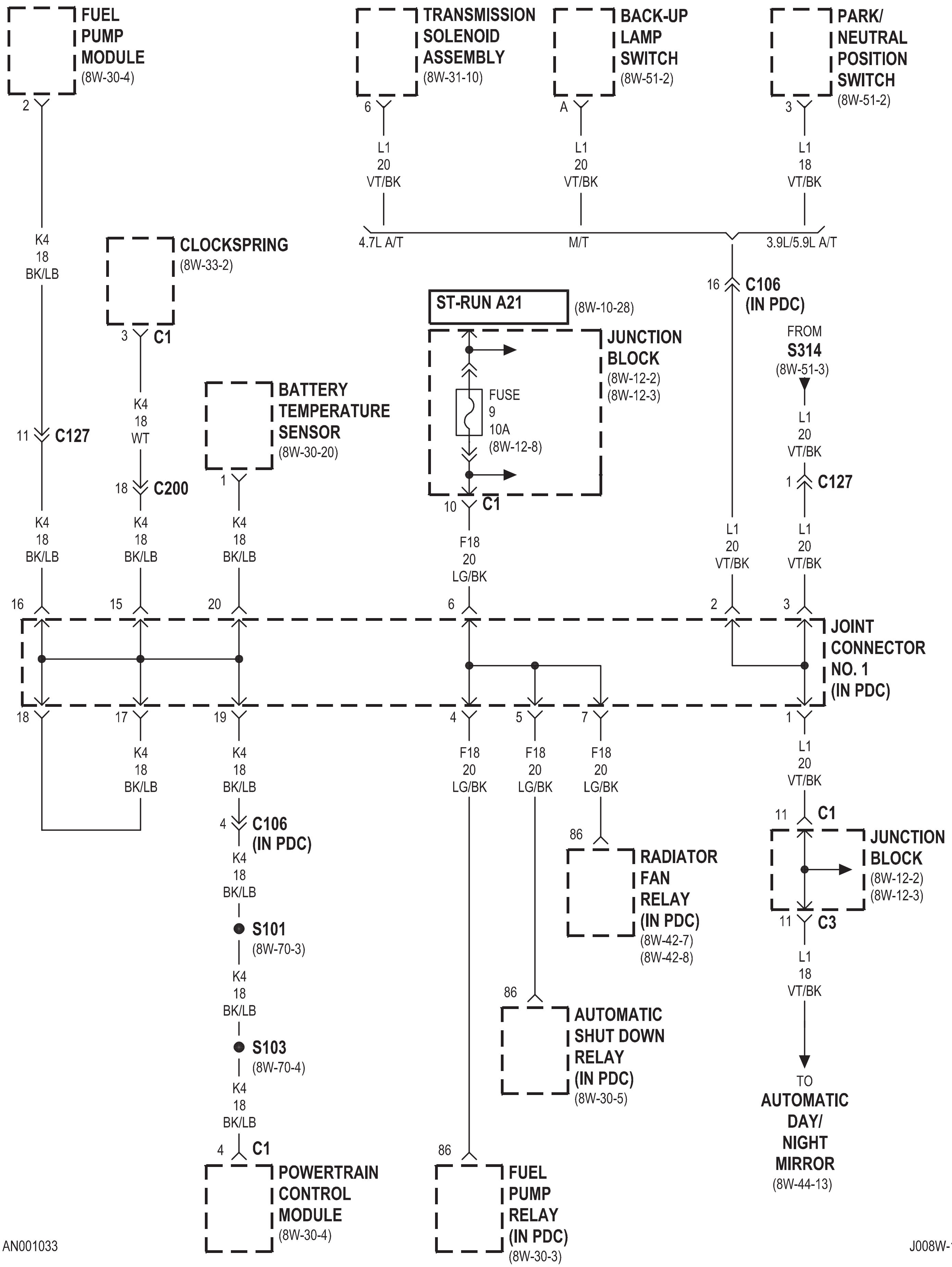

BATT A2
(8W-10-27)
IGNITION SWITCH
(8W-10-27)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
2
0
3
4
5
A22
12
BK/OR
2
C9
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 2 15A (8W-12-10)
FUSE 3 15A (8W-12-6)
FUSE 7 10A (8W-12-6)
FUSE 18 10A (8W-12-6)
CIRCUIT BREAKER 20 25A (8W-12-6)

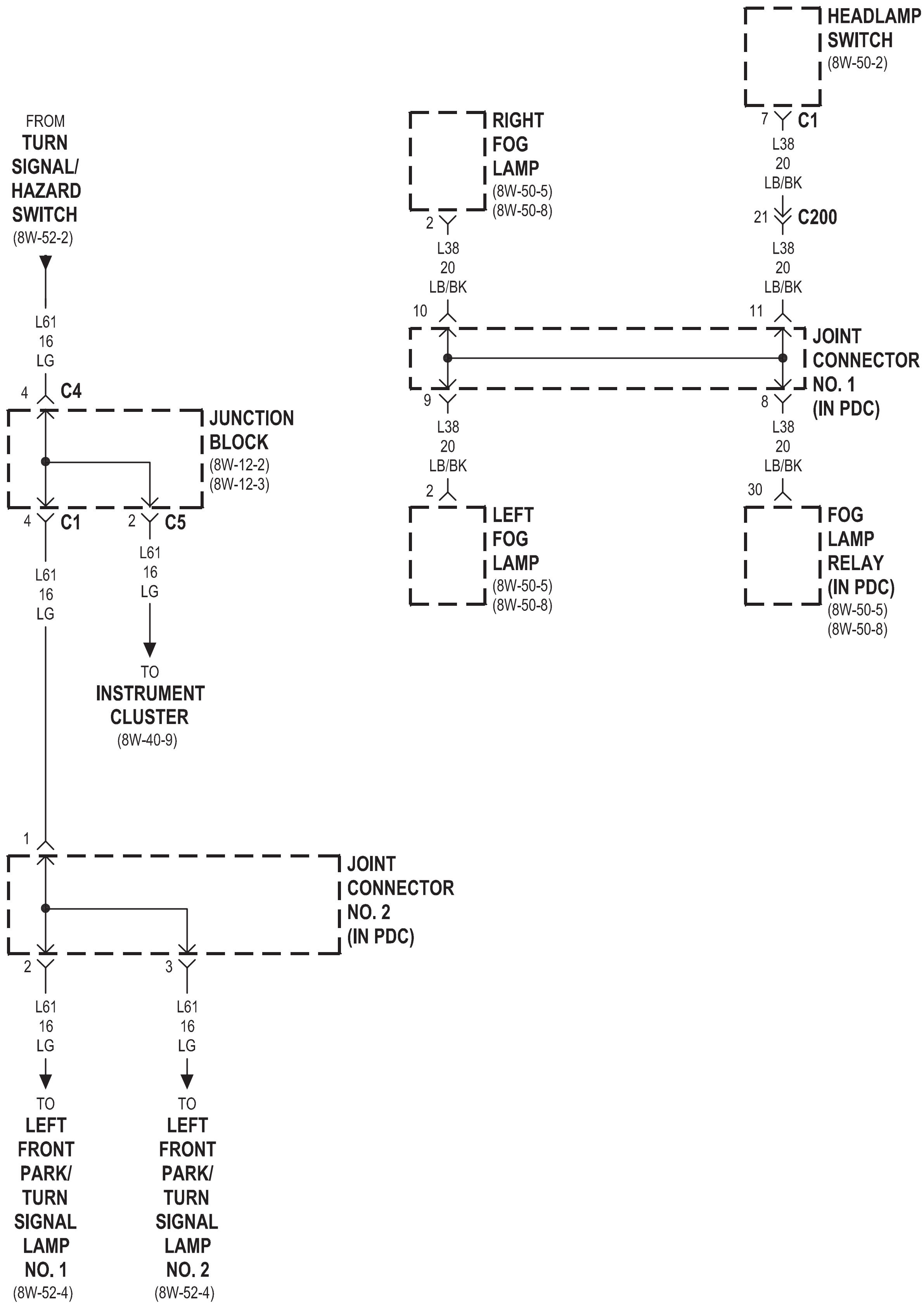

BATT A1
(8W-10-27)
IGNITION
SWITCH
(8W-10-27)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
2
0
3
4
6
A31
12
BK/WT
4
C9
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
20A
(8W-12-7)
FUSE
8
10A
(8W-12-7)
FUSE
10
15A
(8W-12-9)
FUSE
15
15A
(8W-12-7)

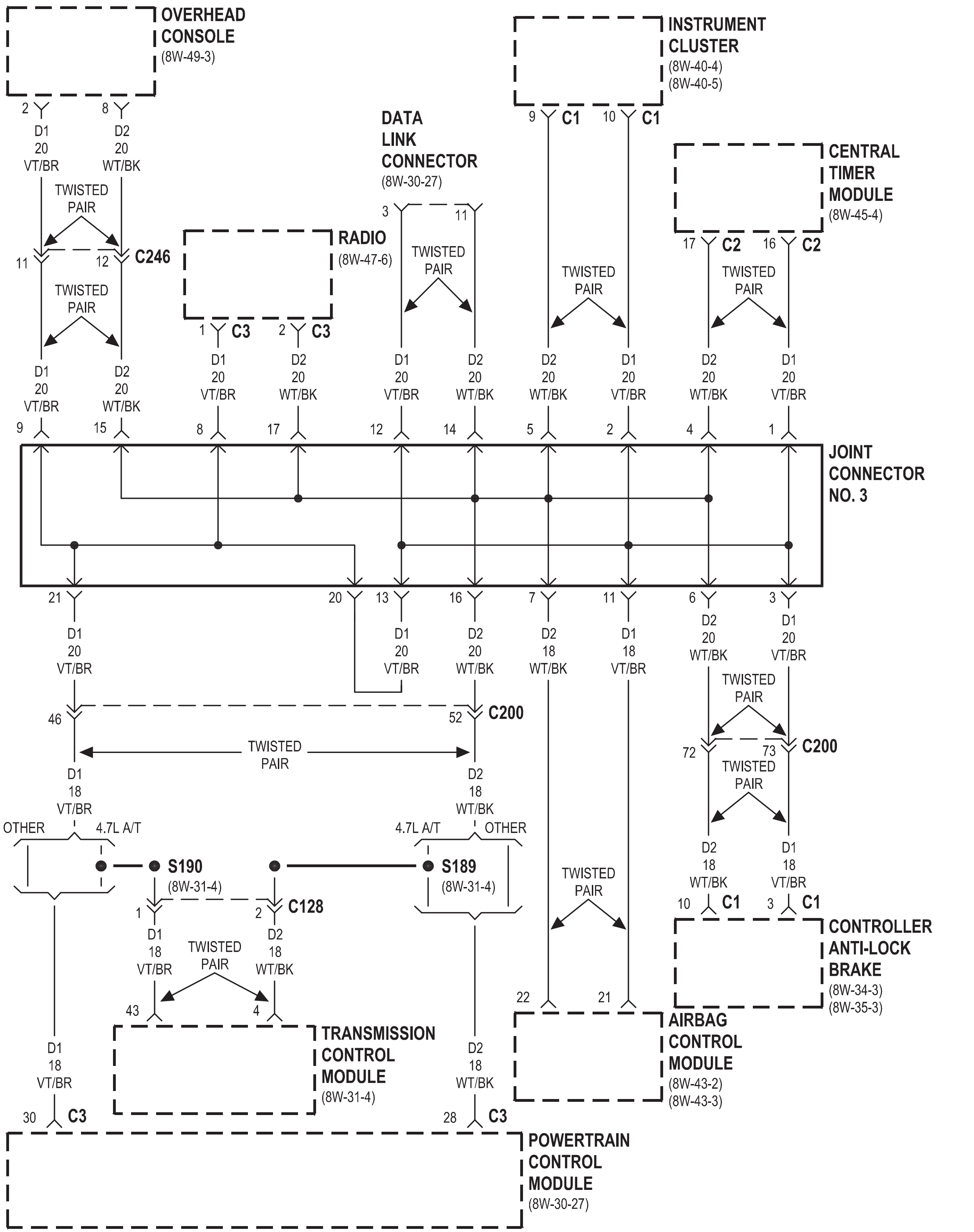

BATT A1
(8W-10-27)
IGNITION SWITCH
(8W-10-27)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
A41
14
YL
40
C200
M/T
A/T
A41
14
DB/YL
2
CLUTCH INTERLOCK SWITCH
(8W-21-2)
1
T141
14
YL
CLUTCH INTERLOCK SWITCH JUMPER
(8W-21-3)
4.7L A/T
OTHER
S184
FROM
S161
(8W-10-27)
C
A2
12
PK/BK
86
85
30
87
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
C106 (IN PDC)
14
8
TRANSMISSION CONTROL MODULE
(8W-31-10)
T40
12
BR
ENGINE STARTER MOTOR
(8W-21-2)
(8W-21-3)

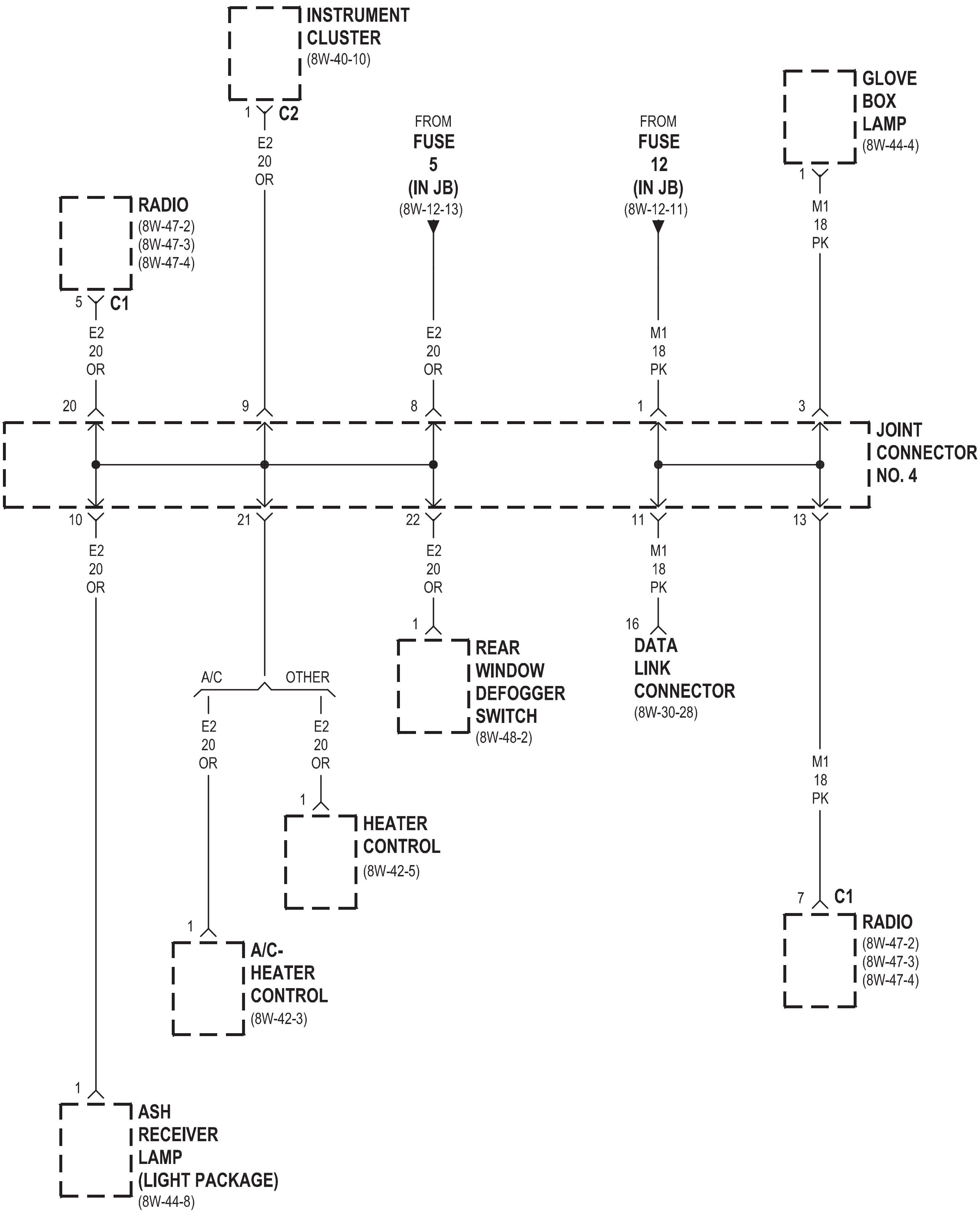


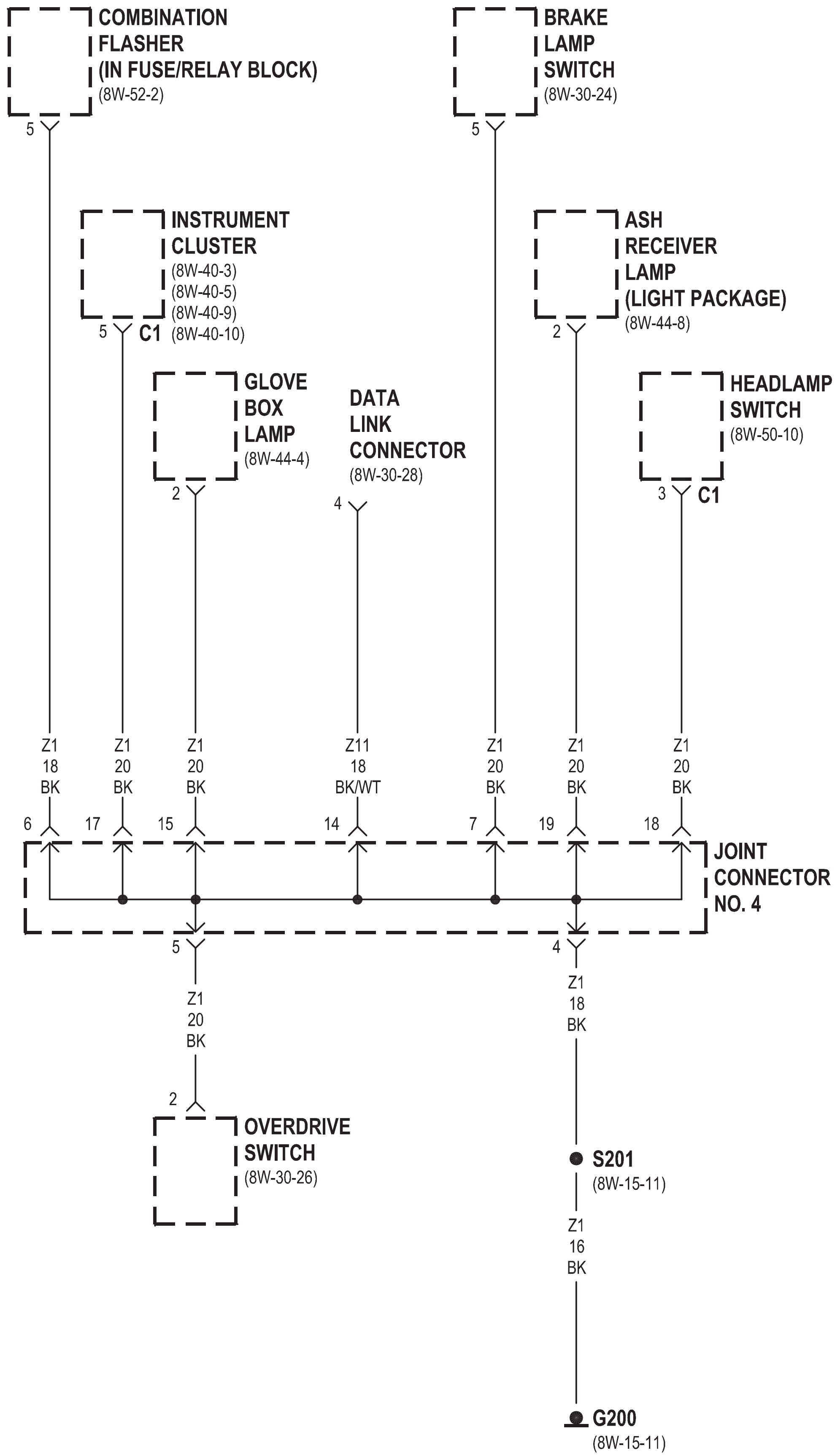
FROM
HEADLAMP SWITCH
(8W-50-9)
L7
20
BK/YL
41
C200
OTHER
TRAILER TOW
85
86
TRAILER TOW RELAY (IN PDC)
(8W-54-2)
L7
20
BK/YL
4
6
5
JOINT CONNECTOR NO. 2 (IN PDC)
FROM
MULTI-FUNCTION SWITCH
(8W-52-2)
L60
16
TN
1
C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
5
C2
4
C7
TO
INSTRUMENT CLUSTER
(8W-40-9)
FROM
S316
(8W-12-14)
8
C127
21
26
12
JOINT CONNECTOR NO. 1 (IN PDC)
24
25
27
23
22
28
13
14
L7
18
BK/YL
TO
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 1
(8W-50-9)
TO
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 2
(8W-50-9)
TO
LEFT FRONT SIDE MARKER LAMP
(8W-50-9)
TO
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 2
(8W-50-9)
TO
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 1
(8W-50-9)
TO
RIGHT FRONT SIDE MARKER LAMP
(8W-50-9)
TO
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 1
(8W-52-4)
TO
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 2
(8W-52-4)


FUEL PUMP MODULE
(8W-30-4)
2
K4
18
BK/LB
TRANSMISSION SOLENOID ASSEMBLY
(8W-31-10)
6
L1
20
VT/BK
BACK-UP LAMP SWITCH
(8W-51-2)
A
L1
20
VT/BK
PARK/ NEUTRAL POSITION SWITCH
(8W-51-2)
3
L1
18
VT/BK
4.7L A/T
M/T
3.9L/5.9L A/T
CLOCKSPRING
(8W-33-2)
3 C1
K4
18
WT
16 C106 (IN PDC)
ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
10A
(8W-12-8)
10 C1
F18
20
LG/BK
FROM S314
(8W-51-3)
L1
20
VT/BK
1 C127
BATTERY TEMPERATURE SENSOR
(8W-30-20)
1
11 C127
18 C200
K4
18
BK/LB
L1
20
VT/BK
16
15
20
6
2
3
JOINT CONNECTOR NO. 1 (IN PDC)
18
17
19
4
5
7
1
K4
18
BK/LB
F18
20
LG/BK
L1
20
VT/BK
4 C106 (IN PDC)
S101
(8W-70-3)
S103
(8W-70-4)
11 C1
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
11 C3
L1
18
VT/BK
86
RADIATOR FAN RELAY (IN PDC)
(8W-42-7)
(8W-42-8)
86
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-5)
TO AUTOMATIC DAY/ NIGHT MIRROR
(8W-44-13)
4 C1
POWERTRAIN CONTROL MODULE
(8W-30-4)
86
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
AN001033
J008W-1


HEADLAMP SWITCH
(8W-50-2)
7 C1
L38
20
LB/BK
21 C200
RIGHT FOG LAMP
(8W-50-5)
(8W-50-8)
2
L38
20
LB/BK
10
11
JOINT CONNECTOR NO. 1 (IN PDC)
9
8
2
LEFT FOG LAMP
(8W-50-5)
(8W-50-8)
30
FOG LAMP RELAY (IN PDC)
(8W-50-5)
(8W-50-8)
FROM
TURN SIGNAL/ HAZARD SWITCH
(8W-52-2)
L61
16
LG
4 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
4 C1
2 C5
TO
INSTRUMENT CLUSTER
(8W-40-9)
1
JOINT CONNECTOR NO. 2 (IN PDC)
2
3
TO
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 1
(8W-52-4)
TO
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 2
(8W-52-4)


OVERHEAD CONSOLE
(8W-49-3)
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
DATA LINK CONNECTOR
(8W-30-27)
CENTRAL TIMER MODULE
(8W-45-4)
RADIO
(8W-47-6)
C246
C1
C2
C3
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
D1 18 VT/BR
D2 18 WT/BK
JOINT CONNECTOR NO. 3
C200
OTHER
4.7L A/T
S190
(8W-31-4)
S189
(8W-31-4)
C128
CONTROLLER ANTI-LOCK BRAKE
(8W-34-3)
(8W-35-3)
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
TRANSMISSION CONTROL MODULE
(8W-31-4)
POWERTRAIN CONTROL MODULE
(8W-30-27)

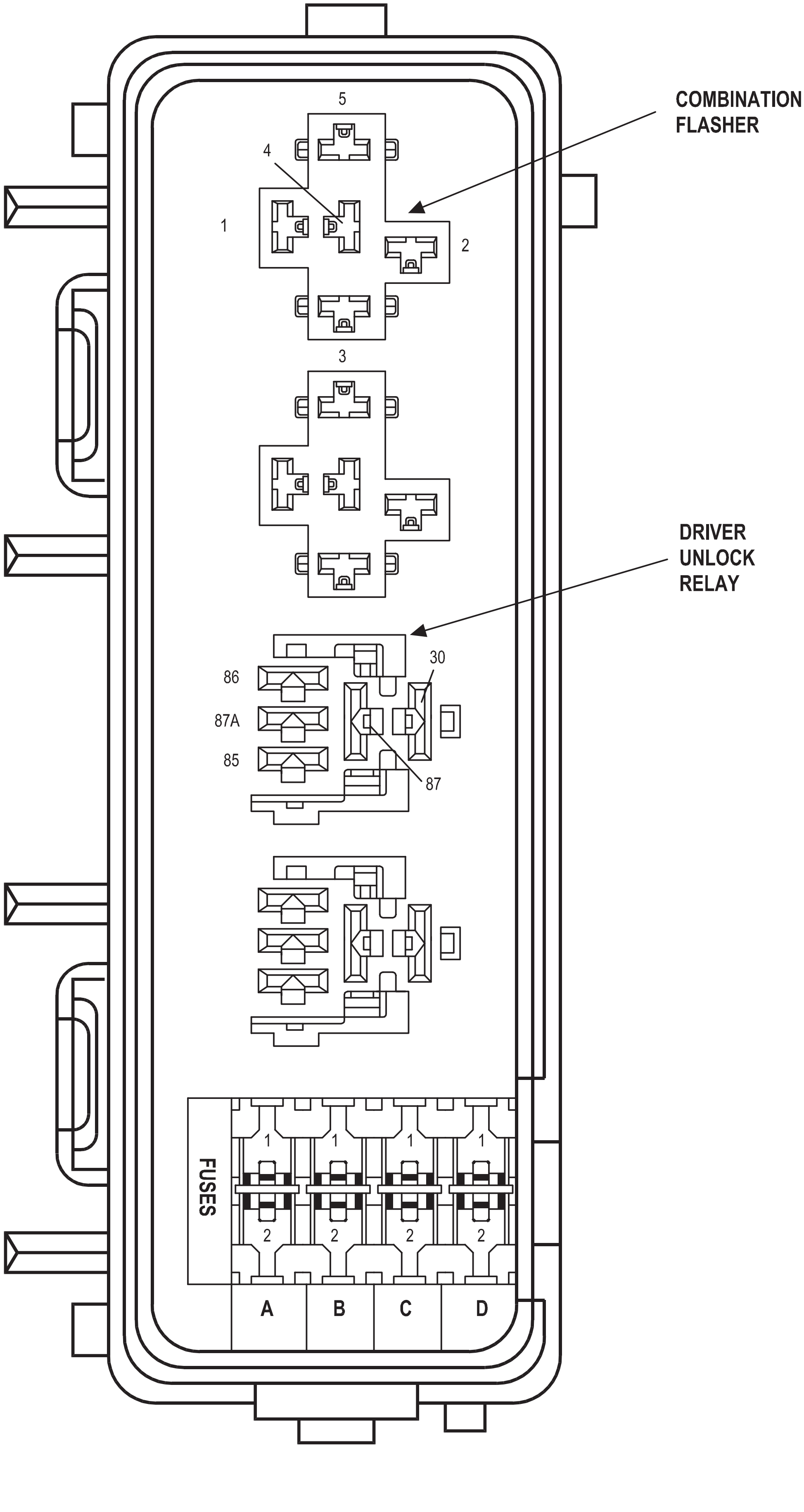

INSTRUMENT CLUSTER
(8W-40-10)
1 C2
E2 20 OR
FROM FUSE 5 (IN JB)
(8W-12-13)
FROM FUSE 12 (IN JB)
(8W-12-11)
GLOVE BOX LAMP
(8W-44-4)
1
M1 18 PK
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
5 C1
E2 20 OR
E2 20 OR
M1 18 PK
20
9
8
1
3
JOINT CONNECTOR NO. 4
10
21
22
11
13
E2 20 OR
E2 20 OR
M1 18 PK
1
16
REAR WINDOW DEFOGGER SWITCH
(8W-48-2)
DATA LINK CONNECTOR
(8W-30-28)
A/C
OTHER
E2 20 OR
E2 20 OR
M1 18 PK
1
HEATER CONTROL
(8W-42-5)
7 C1
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
1
A/C-HEATER CONTROL
(8W-42-3)
1
ASH RECEIVER LAMP (LIGHT PACKAGE)
(8W-44-8)


COMBINATION
FLASHER
(IN FUSE/RELAY BLOCK)
(8W-52-2)
5
BRAKE
LAMP
SWITCH
(8W-30-24)
5
INSTRUMENT
CLUSTER
(8W-40-3)
(8W-40-5)
(8W-40-9)
(8W-40-10)
5 C1
ASH
RECEIVER
LAMP
(LIGHT PACKAGE)
(8W-44-8)
2
GLOVE
BOX
LAMP
(8W-44-4)
2
DATA
LINK
CONNECTOR
(8W-30-28)
4
HEADLAMP
SWITCH
(8W-50-10)
3 C1
Z1 18 BK
Z1 20 BK
Z1 20 BK
Z11 18 BK/WT
Z1 20 BK
Z1 20 BK
Z1 20 BK
6
17
15
14
7
19
18
JOINT
CONNECTOR
NO. 4
5
4
Z1 20 BK
Z1 18 BK
2
OVERDRIVE
SWITCH
(8W-30-26)
S201
(8W-15-11)
Z1 16 BK
G200
(8W-15-11)

8W-11 FUSE/RELAY BLOCK

Component	Page
Blower Motor Relay	8W-11-5
Central Timer Module	8W-11-7
Combination Flasher	8W-11-6
Driver Door Lock Motor/Ajar Switch	8W-11-7
Driver Power Mirror	8W-11-4
Driver Unlock Relay	8W-11-7
Fuse 4 (PDC)	8W-11-4
Fuse 10 (JB)	8W-11-6
Fuse 10 (PDC)	8W-11-5
Fuse 13 (JB)	8W-11-7
Fuse A (F/RB)	8W-11-4
Fuse B (F/RB)	8W-11-4
Fuse D (F/RB)	8W-11-5
Fuse D (PDC)	8W-11-6
Fuse/Relay Block	8W-11-2, 4, 5
G200	8W-11-6
Ignition Switch	8W-11-5
Joint Connector No. 4	8W-11-6
Junction Block	8W-11-6, 7
Left Rear Door Lock Motor/Ajar Switch	8W-11-7
Passenger Door Lock Motor/Ajar Switch	8W-11-7
Passenger Power Mirror	8W-11-4
Power Distribution Center	8W-11-4, 5, 6
Power Outlet	8W-11-4
Rear Window Defogger	8W-11-4
Rear Window Defogger Switch	8W-11-4
Right Rear Door Lock Motor/Ajar Switch	8W-11-7
Turn Signal/Hazard Switch	8W-11-6

FUSE/ RELAY BLOCK



J008W-1 AN001102

FUSES

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
A ●	10A	F121 20TN/BK	FUSED REAR WINDOW DEFOGGER SWITCH OUTPUT
B	20A	F70 14PK/BK	FUSED B(+)
C	-	-	-
D	10A	F25 20TN/LG	FUSED IGNITION SWITCH OUTPUT (ST-RUN)

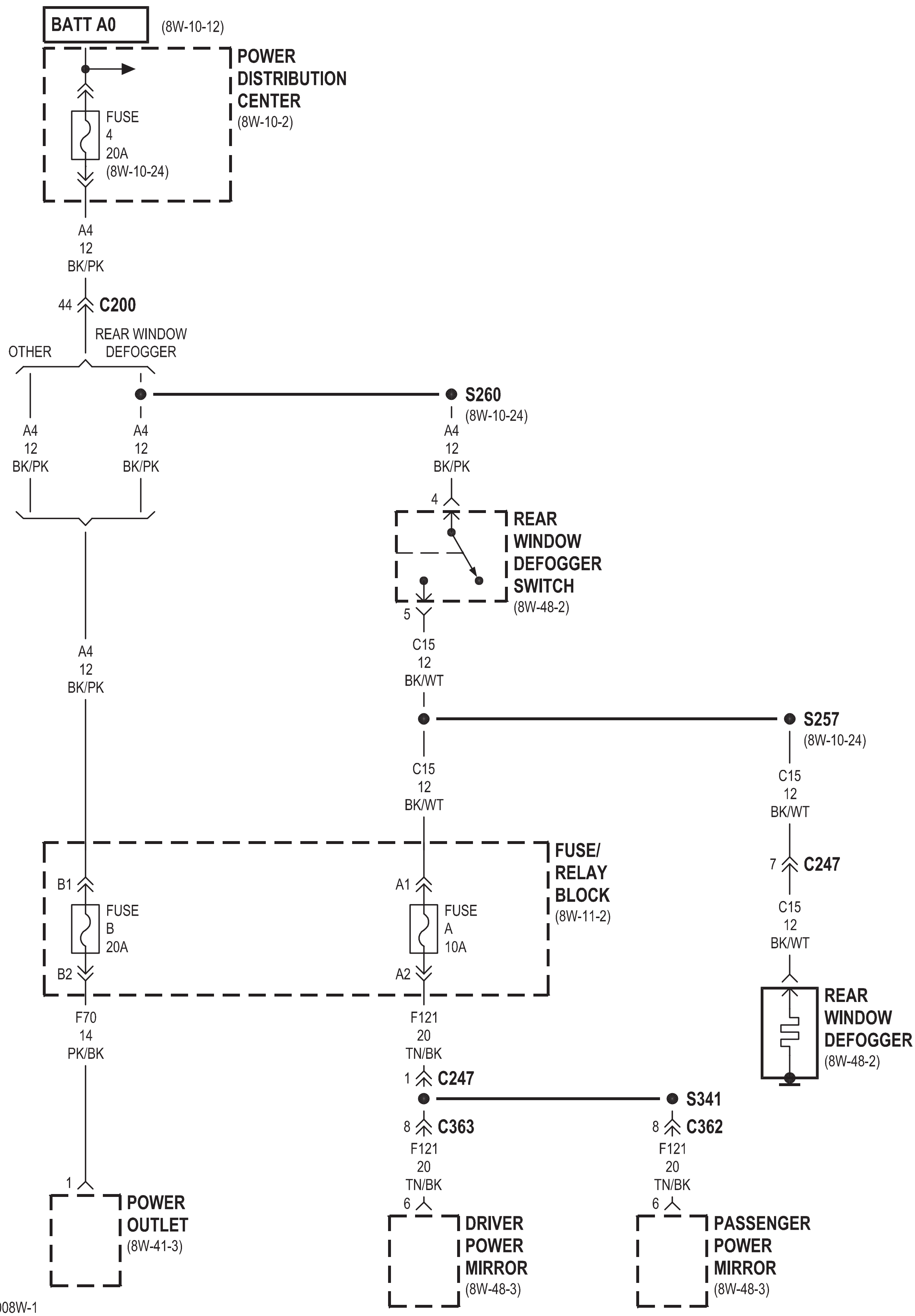
COMBINATION FLASHER

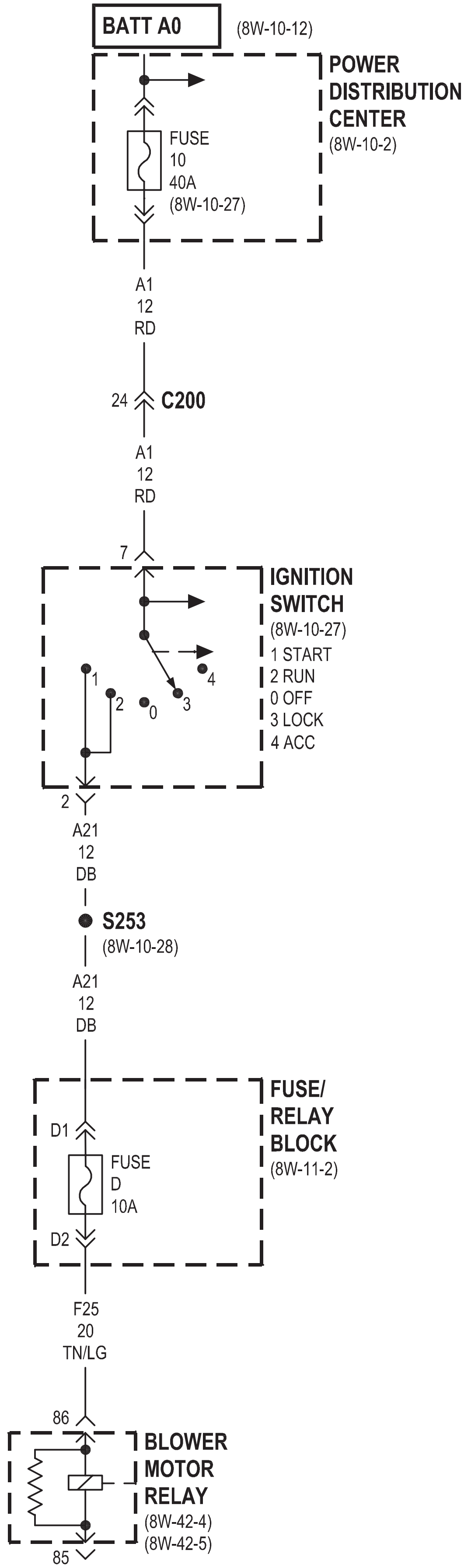
CAVITY	CIRCUIT	FUNCTION
1	L6 16RD/WT	FLASHER OUTPUT
2	L5 18BK/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
3	L9 14BK/WT	FUSED FLASHER FEED
4	L19 18PK	LOW BEAM RELAY OUTPUT
5	Z1 18BK	GROUND

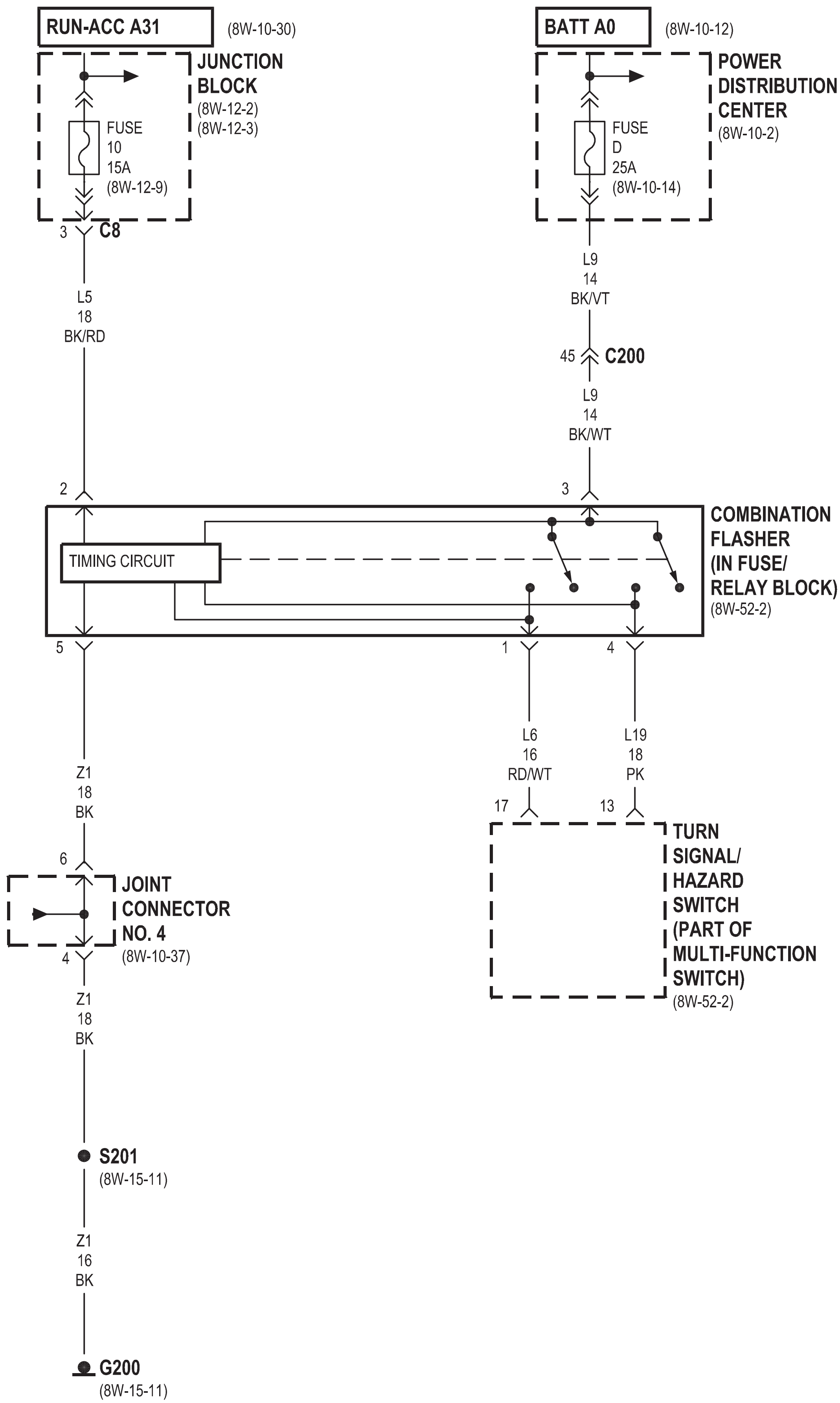
DRIVER UNLOCK RELAY

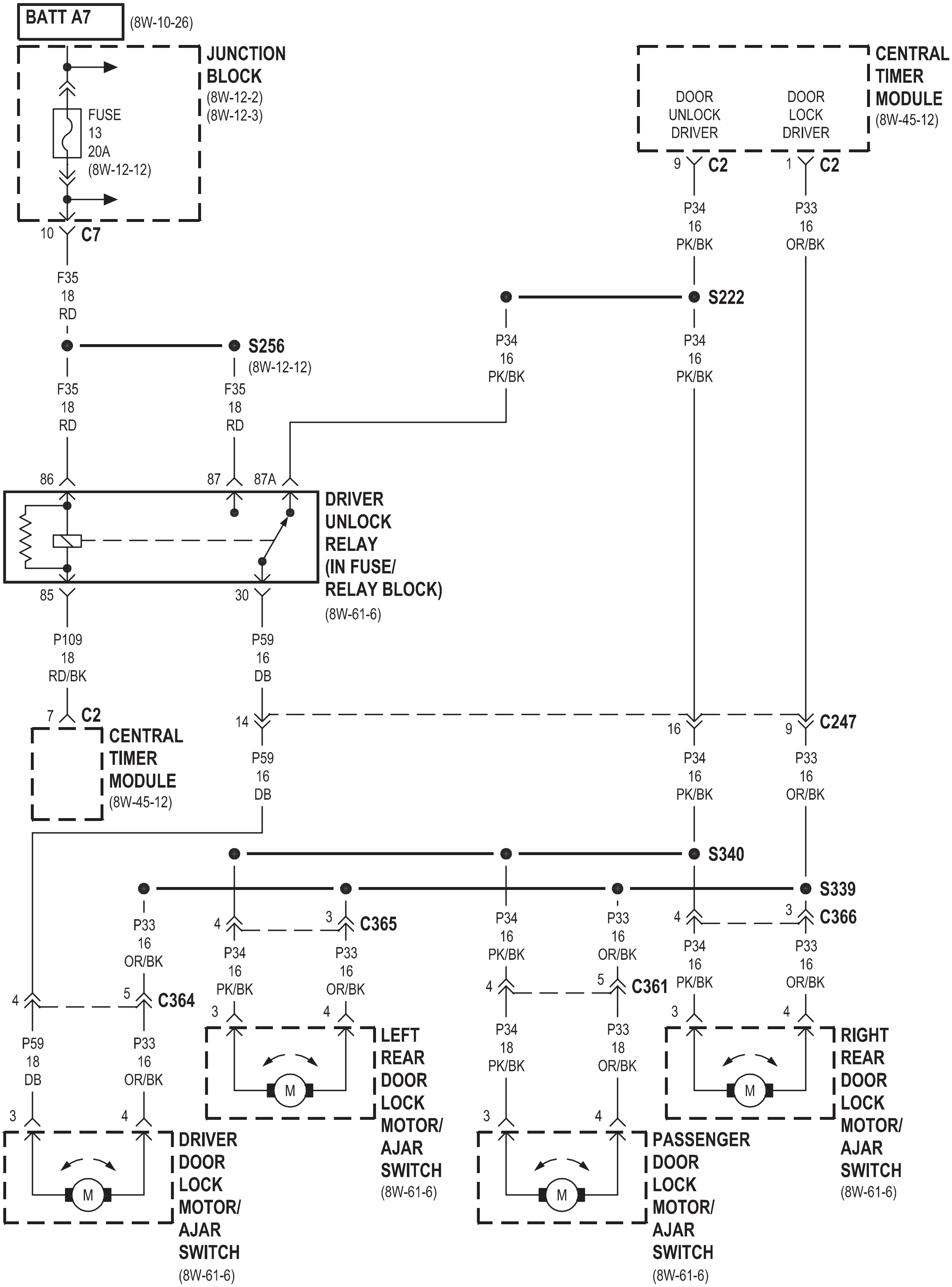
CAVITY	CIRCUIT	FUNCTION
30	P59 16DB	DOOR LOCK CONTROL
85	P109 18RD/BK	DOOR UNLOCK RELAY DRIVER
86	F35 18RD	FUSED B(+)
87	F35 18RD	FUSED B(+)
87A	P34 16PK/BK	UNLOCK RELAY OUTPUT

● HEATED MIRRORS


BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
4
20A
(8W-10-24)
A4
12
BK/PK
44
C200
OTHER
REAR WINDOW
DEFOGGER
A4
12
BK/PK
A4
12
BK/PK
S260
(8W-10-24)
A4
12
BK/PK
4
REAR
WINDOW
DEFOGGER
SWITCH
(8W-48-2)
5
C15
12
BK/WT
A4
12
BK/PK
S257
(8W-10-24)
C15
12
BK/WT
C15
12
BK/WT
7
C247
C15
12
BK/WT
FUSE/
RELAY
BLOCK
(8W-11-2)
B1
FUSE
B
20A
B2
A1
FUSE
A
10A
A2
REAR
WINDOW
DEFOGGER
(8W-48-2)
F70
14
PK/BK
F121
20
TN/BK
1
C247
S341
8
C363
8
C362
F121
20
TN/BK
F121
20
TN/BK
1
POWER
OUTLET
(8W-41-3)
6
DRIVER
POWER
MIRROR
(8W-48-3)
6
PASSENGER
POWER
MIRROR
(8W-48-3)


BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
10
40A
(8W-10-27)
A1
12
RD
24
C200
A1
12
RD
7
IGNITION
SWITCH
(8W-10-27)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
2
0
3
4
2
A21
12
DB
S253
(8W-10-28)
A21
12
DB
FUSE/
RELAY
BLOCK
(8W-11-2)
D1
FUSE
D
10A
D2
F25
20
TN/LG
86
BLOWER
MOTOR
RELAY
(8W-42-4)
(8W-42-5)
85

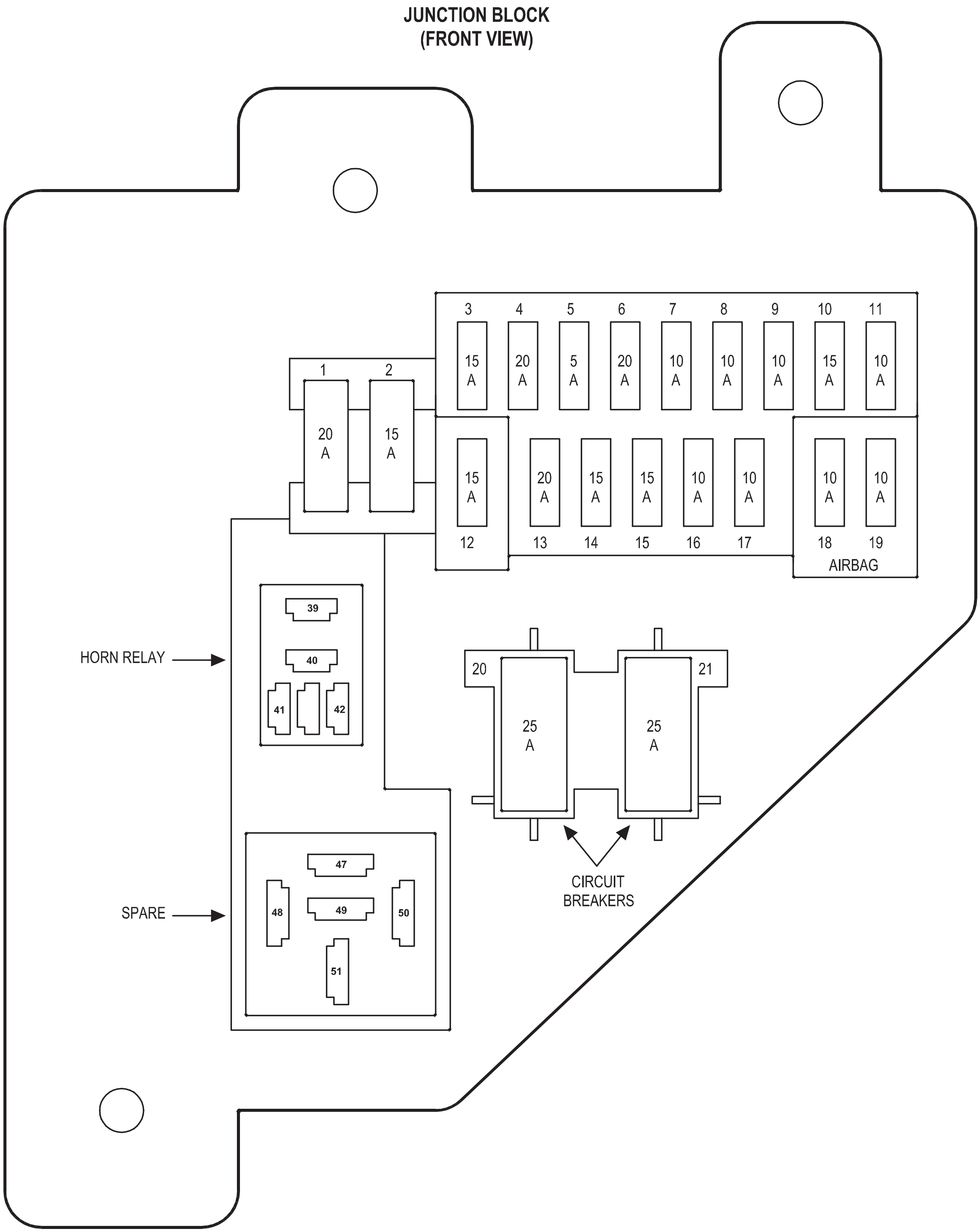

RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
10
15A
(8W-12-9)
3 C8
L5
18
BK/RD
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
D
25A
(8W-10-14)
L9
14
BK/VT
45 C200
L9
14
BK/WT
2
3
TIMING CIRCUIT
COMBINATION FLASHER (IN FUSE/ RELAY BLOCK)
(8W-52-2)
5
1
4
Z1
18
BK
L6
16
RD/WT
L19
18
PK
17
13
TURN SIGNAL/ HAZARD SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-52-2)
6
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)



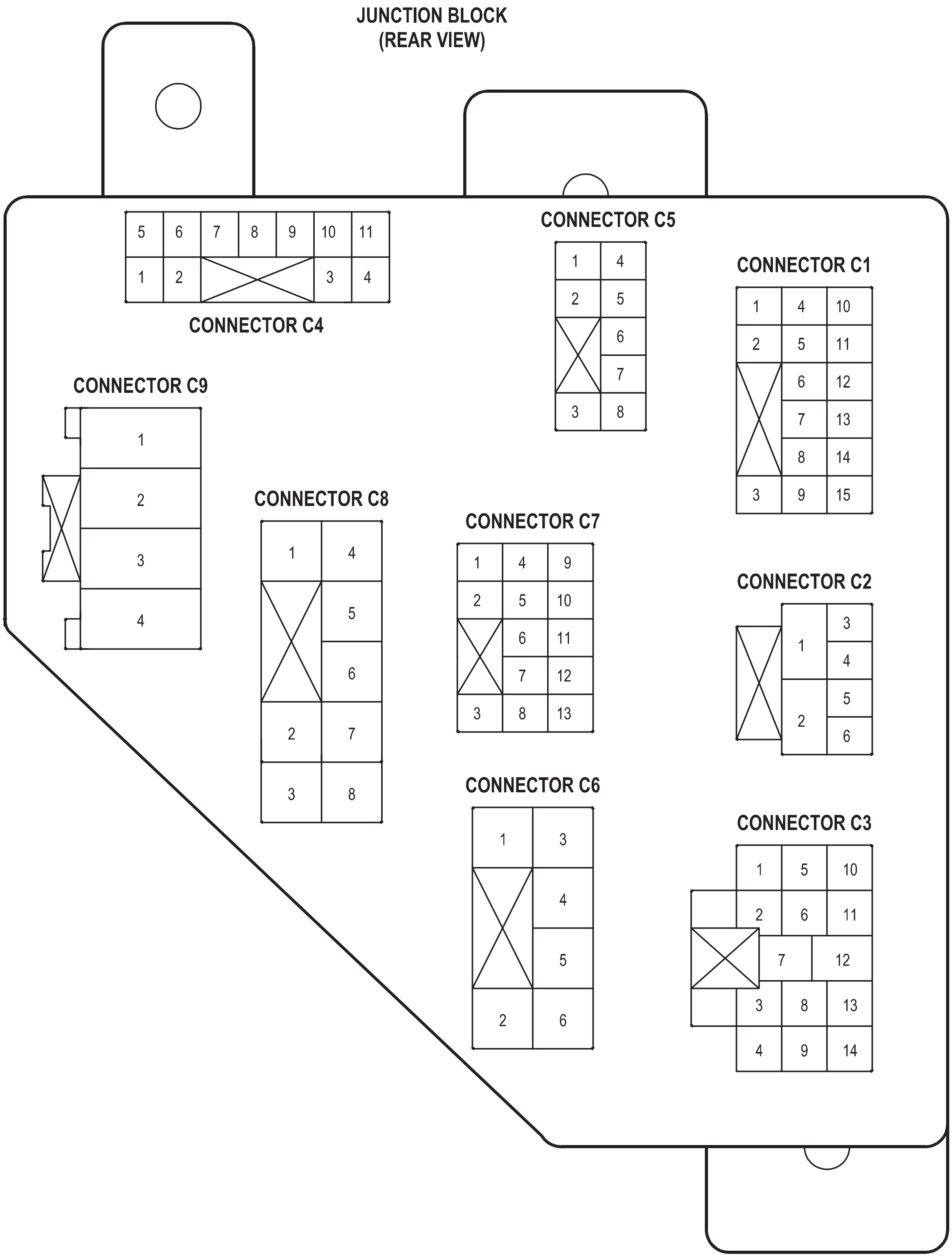
AN001107 J008W-1

8W-12 JUNCTION BLOCK

Component	Page
A/C Compressor Clutch	8W-12-5
A/C Compressor Clutch Relay	8W-12-5, 6
A/C- Heater Control	8W-12-13
Aftermarket CHMSL Connector	8W-12-16
Airbag Control Module	8W-12-6, 8
Ambient Temperature Sensor	8W-12-16
Ash Receiver Lamp	8W-12-13
Automatic Day/Night Mirror	8W-12-9, 10, 15
Automatic Shut Down Relay	8W-12-8
Back-Up Lamp Switch	8W-12-10
Base Console	8W-12-11, 15, 17
Brake Lamp Switch	8W-12-16
Cargo Lamp No. 1	8W-12-11, 16
Cargo Lamp No. 2	8W-12-11, 16
Center High Mounted Stop Lamp	8W-12-15, 16
Central Timer Module	8W-12-5, 7, 9, 12
Cigar Lighter	8W-12-7
Circuit Breaker 20 (JB)	8W-12-6
Circuit Breaker 21 (JB)	8W-12-5
Clockspring	8W-12-5
Combination Flasher	8W-12-9
Controller Anti-Lock Brake	8W-12-6
Data Link Connector	8W-12-11
Daytime Running Lamp Module	8W-12-10
Dome Lamp	8W-12-11, 15, 17
Driver Door Lock Motor/Ajar Switch	8W-12-12
Driver Power Lock/Window Switch	8W-12-6, 12
Driver Unlock Relay	8W-12-12
Electric Brake	8W-12-16
Fuel Pump Relay	8W-12-8
Fuse 1 (JB)	8W-12-5
Fuse 2 (JB)	8W-12-10
Fuse 3 (JB)	8W-12-6
Fuse 4 (JB)	8W-12-5
Fuse 5 (JB)	8W-12-13
Fuse 6 (JB)	8W-12-7
Fuse 7 (JB)	8W-12-6
Fuse 8 (JB)	8W-12-7
Fuse 9 (JB)	8W-12-8
Fuse 10 (JB)	8W-12-9
Fuse 11 (JB)	8W-12-9
Fuse 12 (JB)	8W-12-11
Fuse 13 (JB)	8W-12-12
Fuse 14 (JB)	8W-12-13
Fuse 15 (JB)	8W-12-7
Fuse 17 (JB)	8W-12-10
Fuse 18 (JB)	8W-12-6
Fuse 19 (JB)	8W-12-8
G200	8W-12-15
Glove Box Lamp	8W-12-11
Headlamp Flasher Relay	8W-12-5
Headlamp Switch	8W-12-13, 14, 16, 17
Heater Control	8W-12-13
Hevac Relay	8W-12-6
High Note Horn	8W-12-5
Horn Relay	8W-12-5
Instrument Cluster	8W-12-10, 13, 17
Joint Connector No. 1	8W-12-8, 10, 14, 17
Joint Connector No. 2	8W-12-14, 17
Joint Connector No. 4	8W-12-11, 13
Junction Block	8W-12-2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17
Left Front Park/Turn Signal Lamp No. 1	8W-12-14
Left Front Park/Turn Signal Lamp No. 2	8W-12-14
Left Front Side Marker Lamp	8W-12-14
Left License Lamp	8W-12-14
Left Tail/Stop/Turn Signal Lamp	8W-12-14
License Lamp	8W-12-14
Low Note Horn	8W-12-5
Overhead Console	8W-12-9, 11, 15, 16, 17
Oxygen Sensor Downstream Heater Relay	8W-12-9
Oxygen Sensor Upstream Heater Relay	8W-12-9
Park/Neutral Position Switch	8W-12-10
Passenger Airbag On/Off Switch	8W-12-8
Passenger Door Lock Switch	8W-12-10, 12, 15
Passenger Power Lock/Window Switch	8W-12-12, 15
Passenger Power Lock/Window Switch	8W-12-6
Passenger Power Mirror	8W-12-15
Power Amplifier	8W-12-5
Power Mirror Switch	8W-12-11
Power Seat Switch	8W-12-5
Powertrain Control Module	8W-12-8
Proportional Purge Solenoid	8W-12-9
Radiator Fan Relay	8W-12-8
Radio	8W-12-7, 11, 13
Rear Window Defogger Switch	8W-12-6, 13
Right Front Park/Turn Signal Lamp No. 1	8W-12-14
Right Front Park/Turn Signal Lamp No. 2	8W-12-14
Right Front Side Marker Lamp	8W-12-14
Right License Lamp	8W-12-14
Right Tail/Stop/Turn Signal Lamp	8W-12-14
Shift Bezel Lamp	8W-12-13, 15
Trailer Tow Relay	8W-12-14
Transmission Solenoid Assembly	8W-12-10
Turn Signal/Hazard Switch	8W-12-16, 17
Underhood Lamp/Switch	8W-12-11
Vehicle Speed Control/Horn Switches	8W-12-5
Wiper Motor	8W-12-7
Wiper Relay	8W-12-7
Wiper Switch	8W-12-7



JUNCTION BLOCK
(FRONT VIEW)
1
2
20 A
15 A
3
4
5
6
7
8
9
10
11
15 A
20 A
5 A
20 A
10 A
10 A
10 A
15 A
10 A
15 A
20 A
15 A
15 A
10 A
10 A
10 A
10 A
12
13
14
15
16
17
18
19
AIRBAG
39
40
41
42
HORN RELAY
20
21
25 A
25 A
CIRCUIT BREAKERS
47
48
49
50
51
SPARE

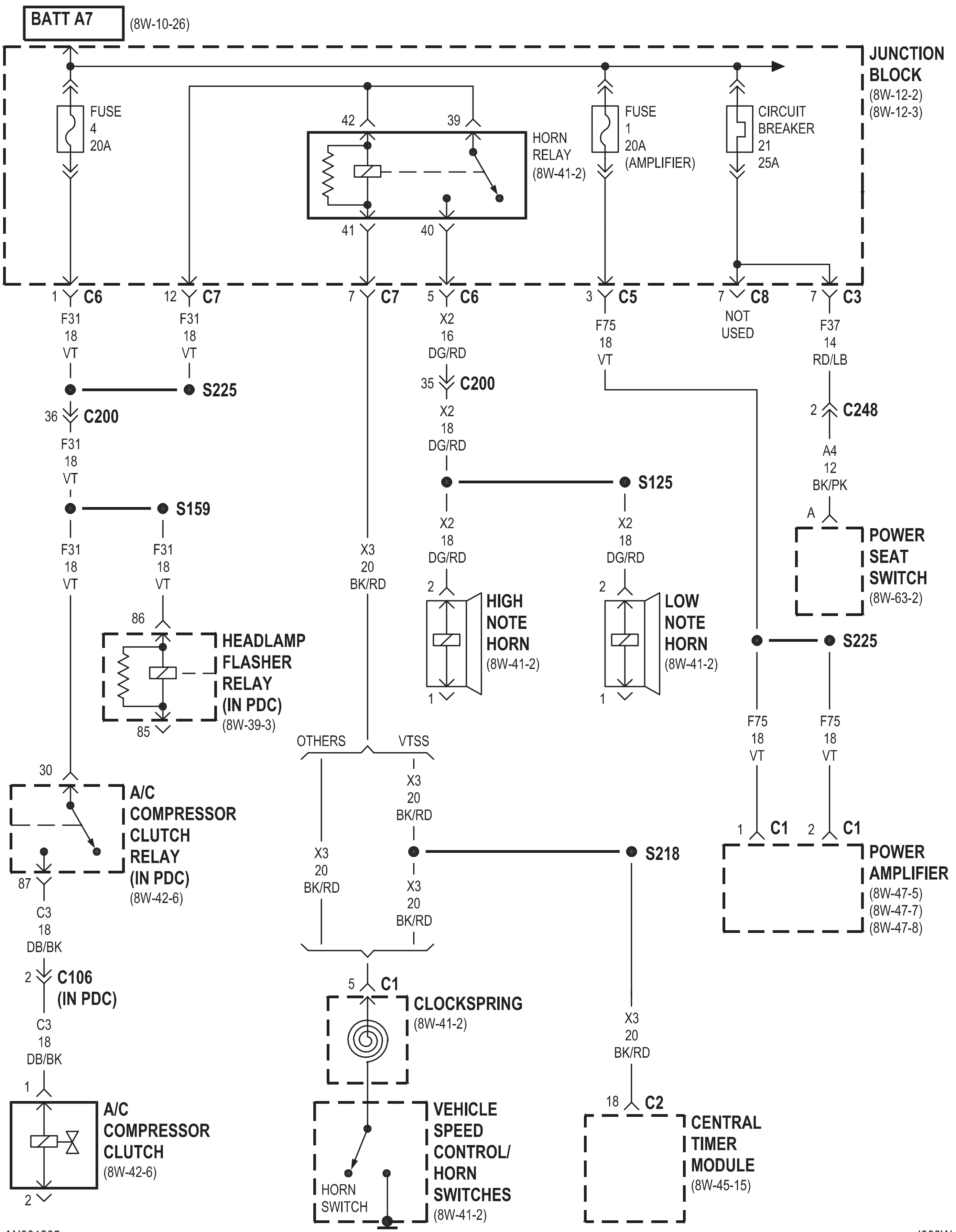

JUNCTION BLOCK
(REAR VIEW)
CONNECTOR C4
5 6 7 8 9 10 11
1 2 3 4
CONNECTOR C5
1 4
2 5
6
7
3 8
CONNECTOR C1
1 4 10
2 5 11
6 12
7 13
8 14
3 9 15
CONNECTOR C9
1
2
3
4
CONNECTOR C8
1 4
5
6
2 7
3 8
CONNECTOR C7
1 4 9
2 5 10
6 11
7 12
3 8 13
CONNECTOR C2
3
1
4
5
2
6
CONNECTOR C6
1 3
4
5
2 6
CONNECTOR C3
1 5 10
2 6 11
7 12
3 8 13
4 9 14

FUSES

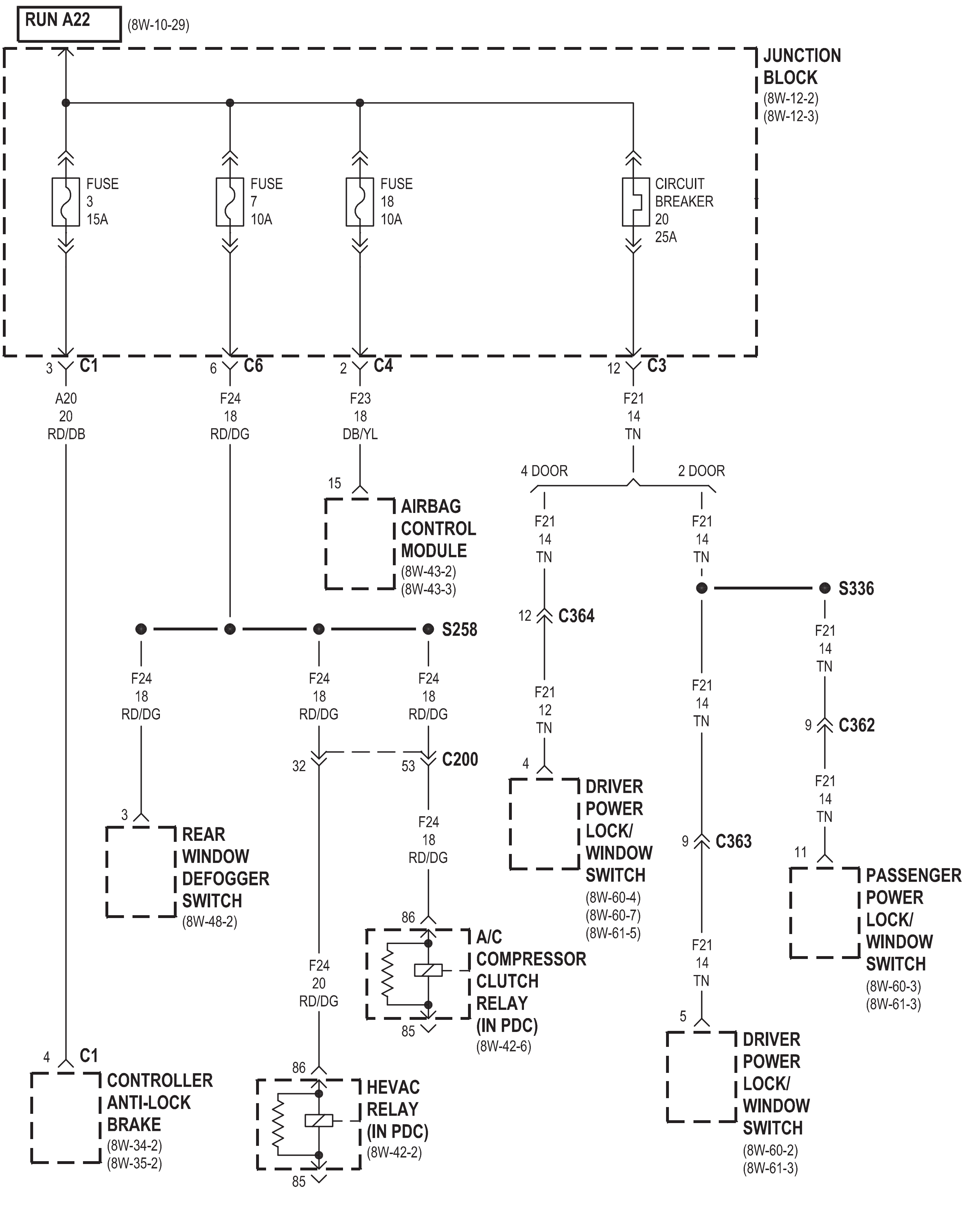
FUSE	AMPS	FUSED CIRCUIT	FUNCTION NAME
1	20A	F75 18VT	FUSED B(+)
2	15A	L10 18BR/LG	FUSED IGNITION SWITCH OUTPUT (RUN)
3	15A	A20 20RD/DB	FUSED IGNITION SWITCH OUTPUT (RUN)
4	20A	F31 18VT	FUSED B(+)
5	5A	E2 20OR	PANEL LAMPS FEED
6	20A	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
7	10A	F24 18RD/DG	FUSED IGNITION SWITCH OUTPUT (RUN)
8	10A	X12 16RD/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	10A	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
10	15A	L5 18BK/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
11	10A	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
12	15A	M1 18PK	FUSED B(+)
13	20A	F35 18RD	FUSED B(+)
14	15A	F33 18PK/RD	FUSED B(+)
15	15A	F30 16RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
16	10A	NOT USED	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
17	10A	F15 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
18	10A	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
19	10A	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
C.B. 20	25A	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
C.B. 21	25A	F37 14RD/LB	FUSED B(+)

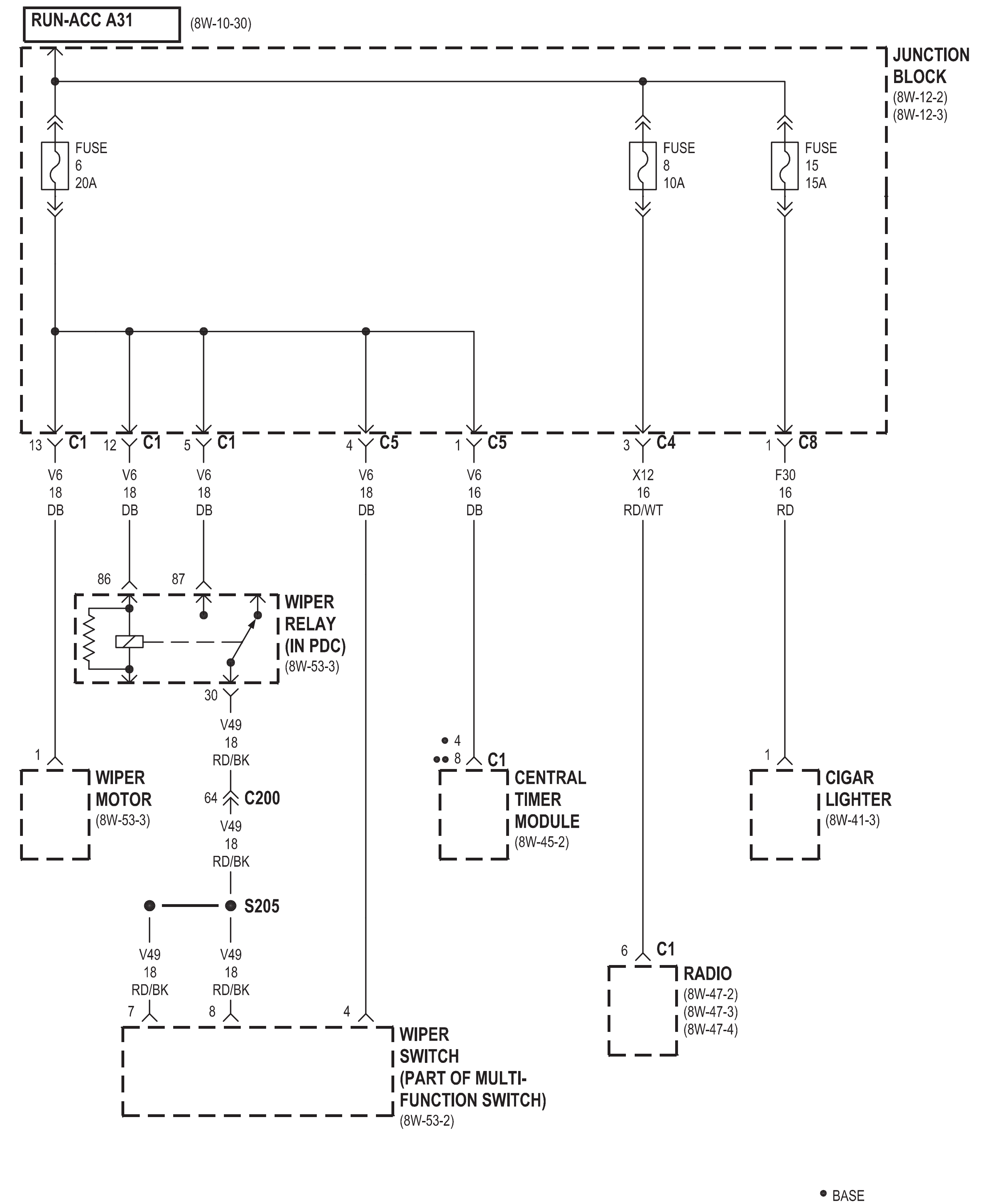
HORN RELAY

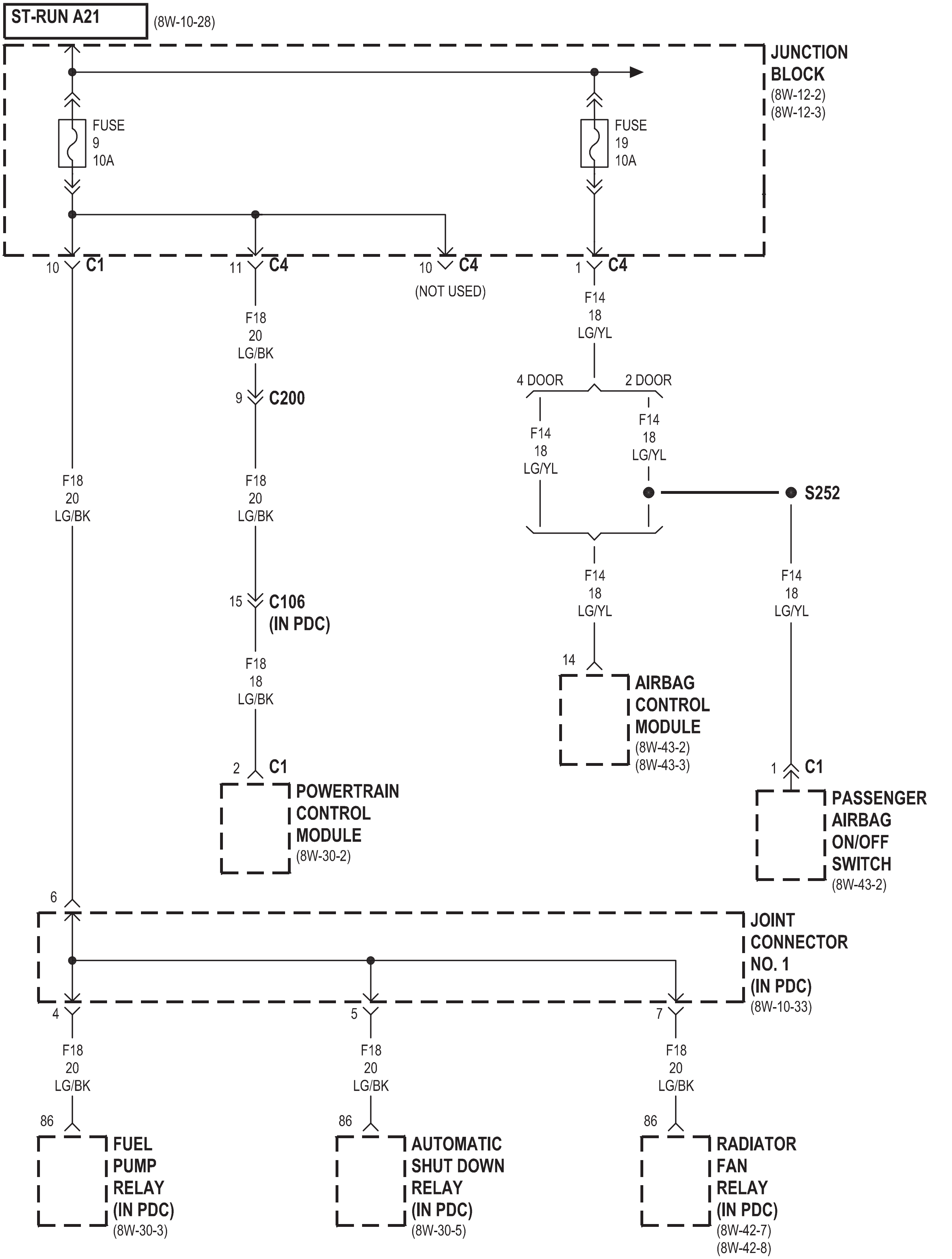
CAVITY	CIRCUIT	FUNCTION
39	F31 18VT	FUSED B(+)
40	X2 16 DG/RD	HORN RELAY OUTPUT
41	X3 20 BK/RD	HORN RELAY CONTROL
42	F31 18VT	FUSED B(+)

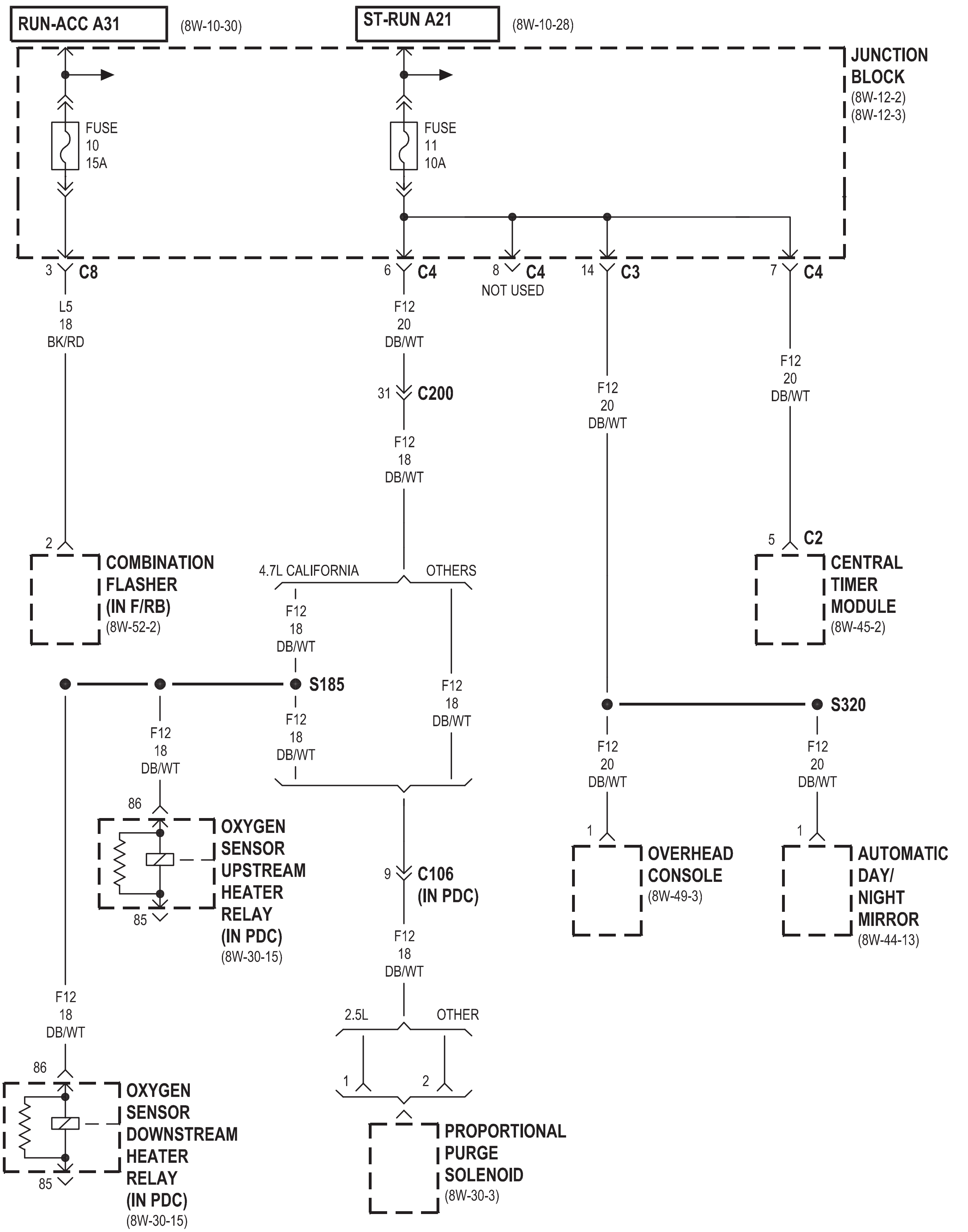


AN001205 J008W-1


RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 3 15A
FUSE 7 10A
FUSE 18 10A
CIRCUIT BREAKER 20 25A
3 C1
6 C6
2 C4
12 C3
A20 20 RD/DB
F24 18 RD/DG
F23 18 DB/YL
F21 14 TN
4 DOOR
2 DOOR
15
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
S258
F24 18 RD/DG
F24 18 RD/DG
F24 18 RD/DG
32
53
C200
3
REAR WINDOW DEFOGGER SWITCH
(8W-48-2)
F24 18 RD/DG
86
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-6)
85
F24 20 RD/DG
86
HEVAC RELAY (IN PDC)
(8W-42-2)
85
4 C1
CONTROLLER ANTI-LOCK BRAKE
(8W-34-2)
(8W-35-2)
F21 14 TN
12 C364
F21 12 TN
4
DRIVER POWER LOCK/ WINDOW SWITCH
(8W-60-4)
(8W-60-7)
(8W-61-5)
F21 14 TN
S336
F21 14 TN
F21 14 TN
9 C362
F21 14 TN
11
PASSENGER POWER LOCK/ WINDOW SWITCH
(8W-60-3)
(8W-61-3)
9 C363
F21 14 TN
5
DRIVER POWER LOCK/ WINDOW SWITCH
(8W-60-2)
(8W-61-3)

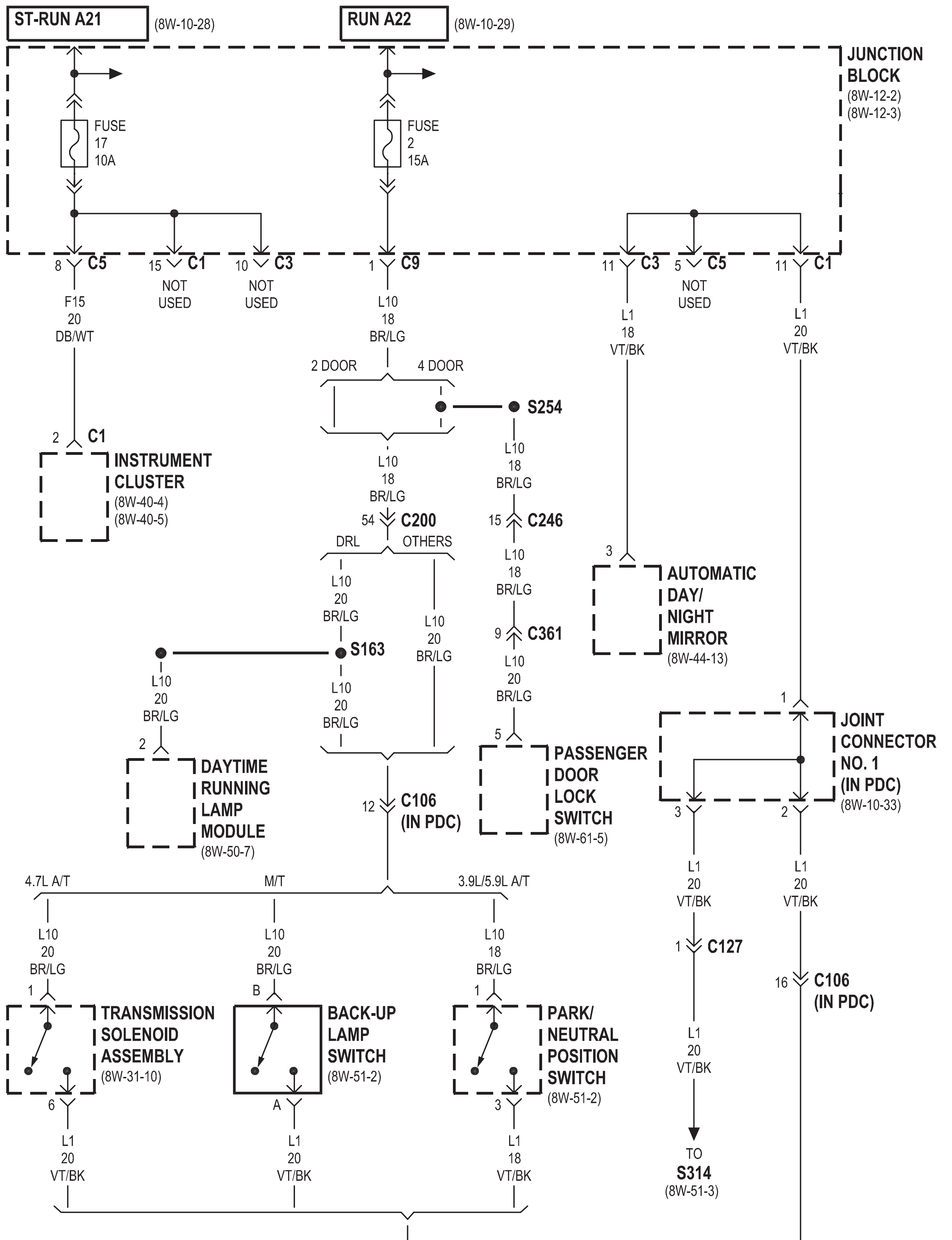

RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 20A
FUSE 8 10A
FUSE 15 15A
13 C1
12 C1
5 C1
4 C5
1 C5
3 C4
1 C8
V6 18 DB
V6 18 DB
V6 18 DB
V6 18 DB
V6 16 DB
X12 16 RD/WT
F30 16 RD
86
87
WIPER RELAY (IN PDC)
(8W-53-3)
30
V49 18 RD/BK
64 C200
V49 18 RD/BK
S205
V49 18 RD/BK
V49 18 RD/BK
7
8
4
WIPER SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-53-2)
1
WIPER MOTOR
(8W-53-3)
● 4
●● 8 C1
CENTRAL TIMER MODULE
(8W-45-2)
1
CIGAR LIGHTER
(8W-41-3)
6 C1
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
● BASE
●● PREMIUM

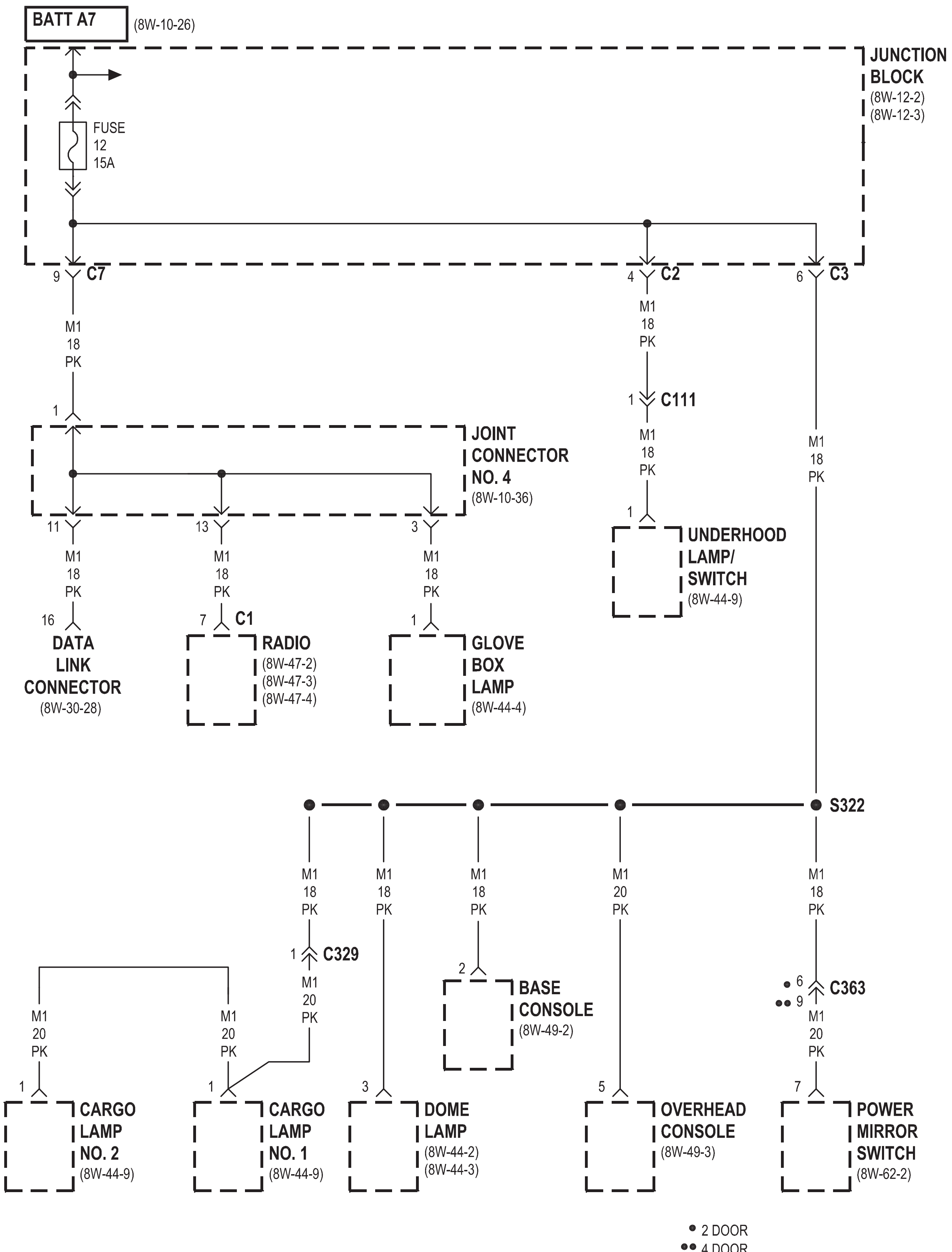

ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 9 10A
FUSE 19 10A
10 C1
11 C4
10 C4
(NOT USED)
1 C4
F14 18 LG/YL
4 DOOR
2 DOOR
F14 18 LG/YL
F14 18 LG/YL
S252
F14 18 LG/YL
F14 18 LG/YL
14
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
1 C1
PASSENGER AIRBAG ON/OFF SWITCH
(8W-43-2)
F18 20 LG/BK
9 C200
F18 20 LG/BK
15 C106 (IN PDC)
F18 18 LG/BK
2 C1
POWERTRAIN CONTROL MODULE
(8W-30-2)
F18 20 LG/BK
6
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
4
5
7
F18 20 LG/BK
F18 20 LG/BK
F18 20 LG/BK
86
86
86
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-5)
RADIATOR FAN RELAY (IN PDC)
(8W-42-7)
(8W-42-8)

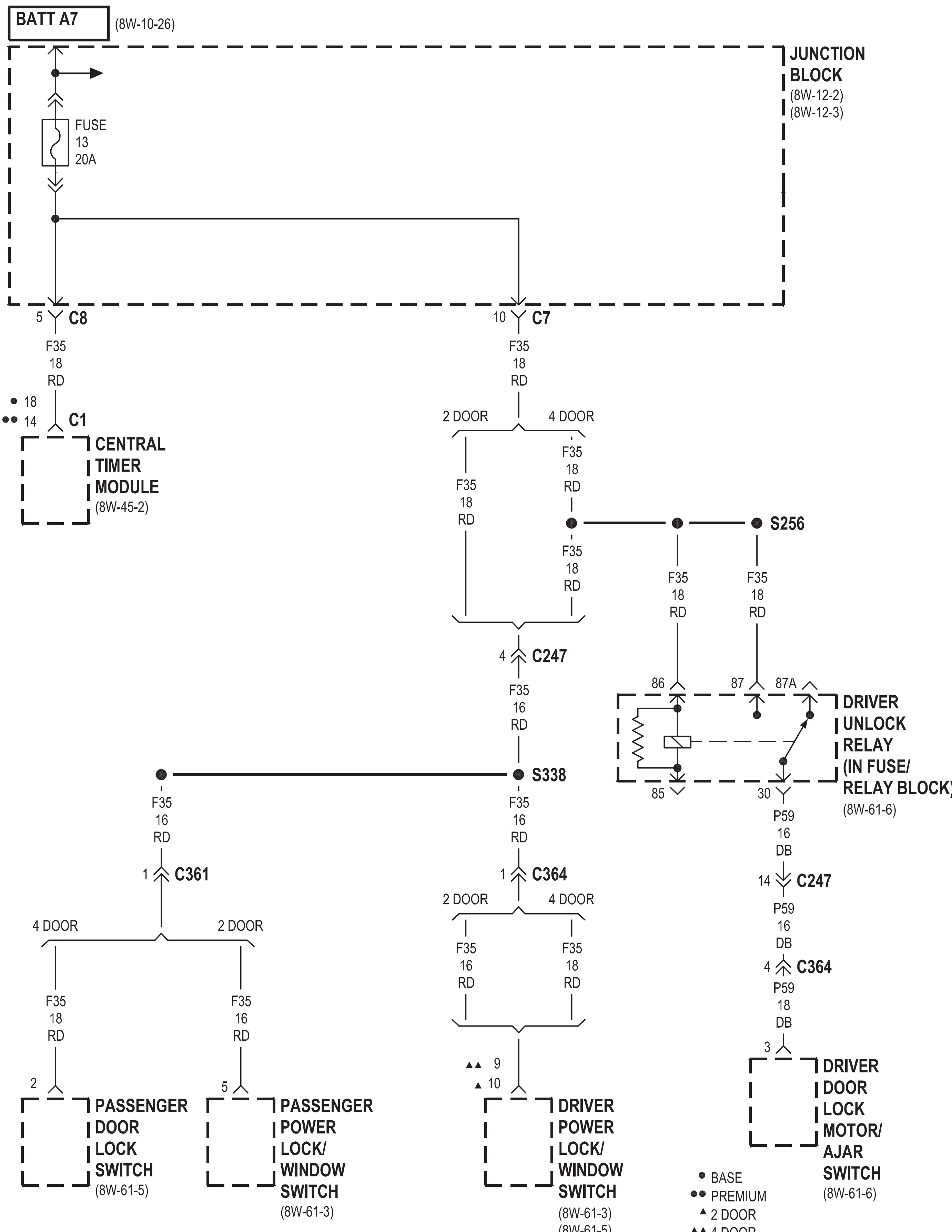


AN001209

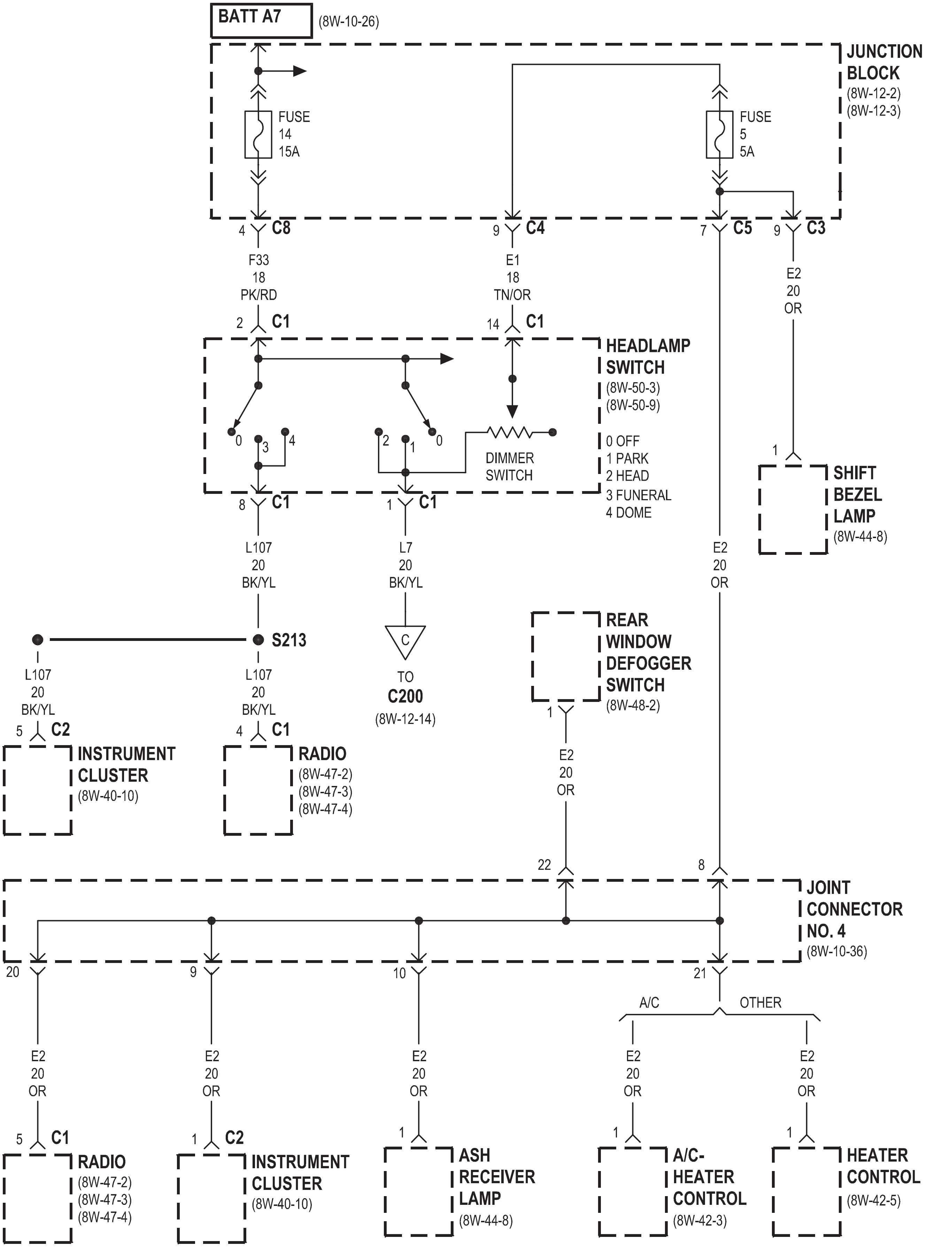
J008W-1

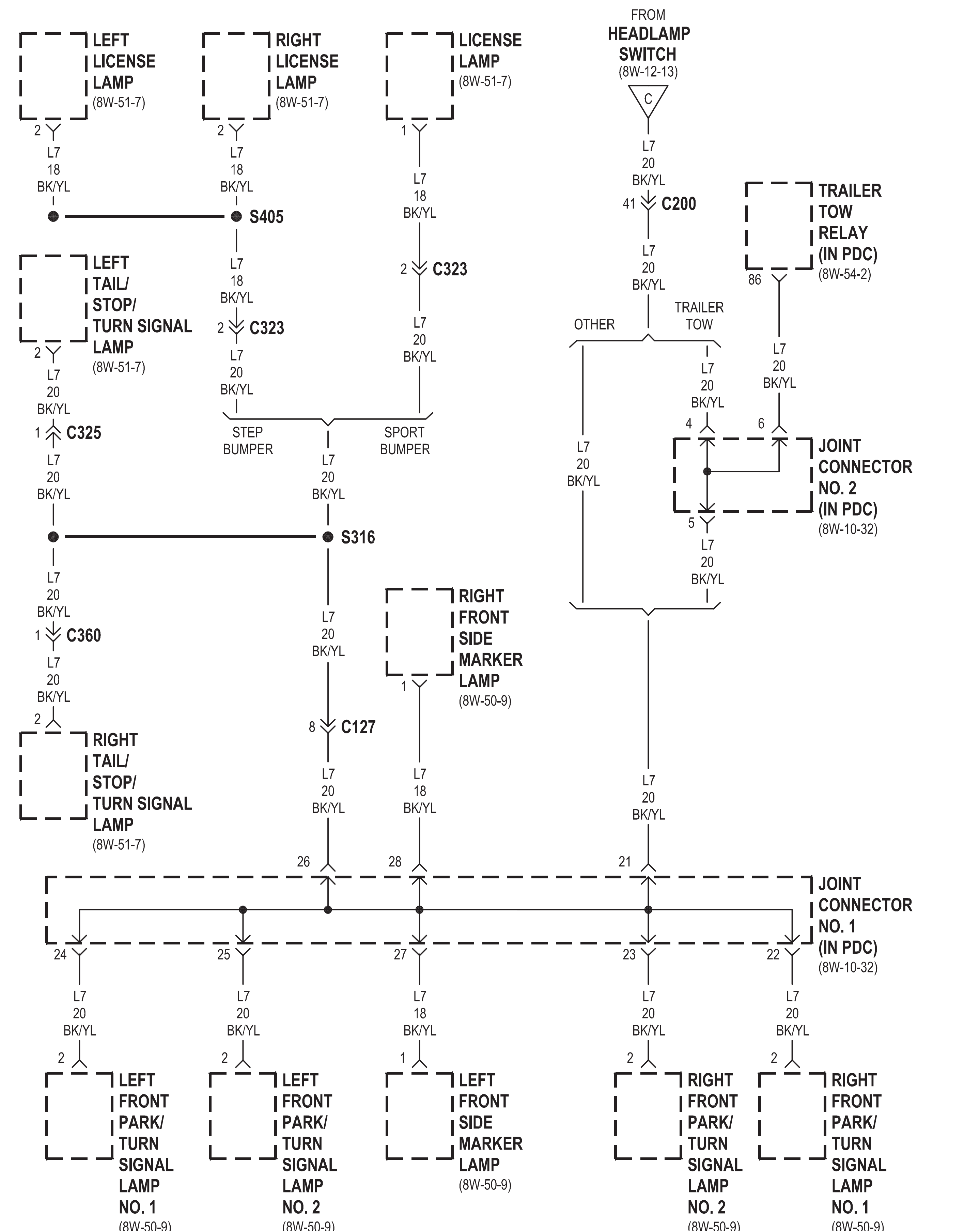

ST-RUN A21
(8W-10-28)
RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 17 10A
FUSE 2 15A
8 C5
15 C1 NOT USED
10 C3 NOT USED
1 C9
11 C3
5 C5 NOT USED
11 C1
F15 20 DB/WT
L10 18 BR/LG
L1 18 VT/BK
L1 20 VT/BK
2 DOOR
4 DOOR
S254
2 C1
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
54 C200
15 C246
DRL
OTHERS
L10 20 BR/LG
9 C361
S163
3
AUTOMATIC DAY/ NIGHT MIRROR
(8W-44-13)
5
PASSENGER DOOR LOCK SWITCH
(8W-61-5)
2
DAYTIME RUNNING LAMP MODULE
(8W-50-7)
12 C106 (IN PDC)
1
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
3
2
4.7L A/T
M/T
3.9L/5.9L A/T
L10 18 BR/LG
1 C127
16 C106 (IN PDC)
1
B
TRANSMISSION SOLENOID ASSEMBLY
(8W-31-10)
BACK-UP LAMP SWITCH
(8W-51-2)
PARK/ NEUTRAL POSITION SWITCH
(8W-51-2)
6
A
3
L1 20 VT/BK
L1 18 VT/BK
TO S314
(8W-51-3)

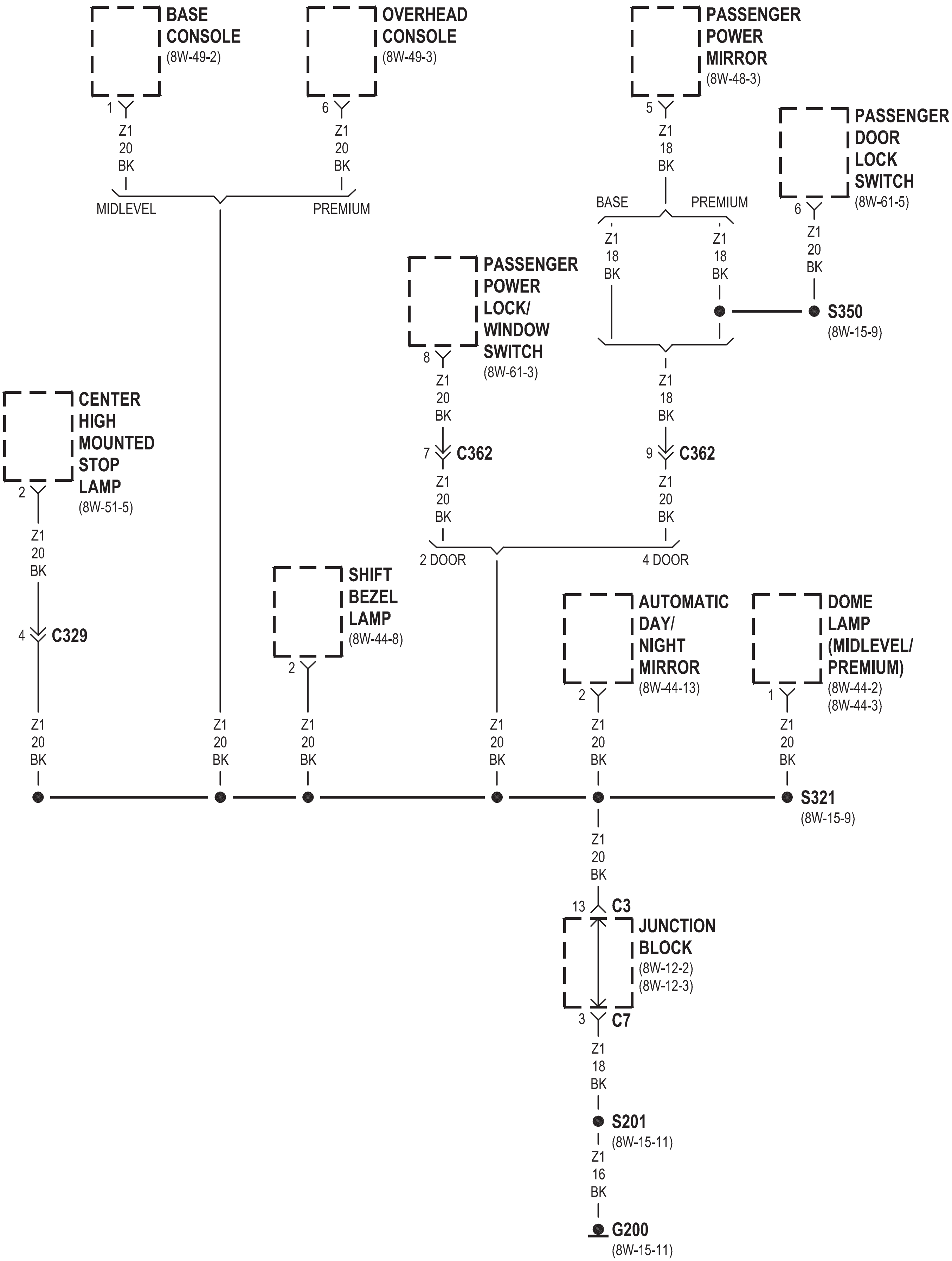

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
15A
9 C7
4 C2
6 C3
M1
18
PK
1 C111
1
JOINT CONNECTOR NO. 4
(8W-10-36)
11
13
3
16
DATA LINK CONNECTOR
(8W-30-28)
7 C1
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
1
GLOVE BOX LAMP
(8W-44-4)
UNDERHOOD LAMP/ SWITCH
(8W-44-9)
S322
M1
20
PK
1 C329
2
BASE CONSOLE
(8W-49-2)
6
9 C363
7
CARGO LAMP NO. 2
(8W-44-9)
CARGO LAMP NO. 1
(8W-44-9)
3
DOME LAMP
(8W-44-2)
(8W-44-3)
5
OVERHEAD CONSOLE
(8W-49-3)
POWER MIRROR SWITCH
(8W-62-2)
• 2 DOOR
•• 4 DOOR

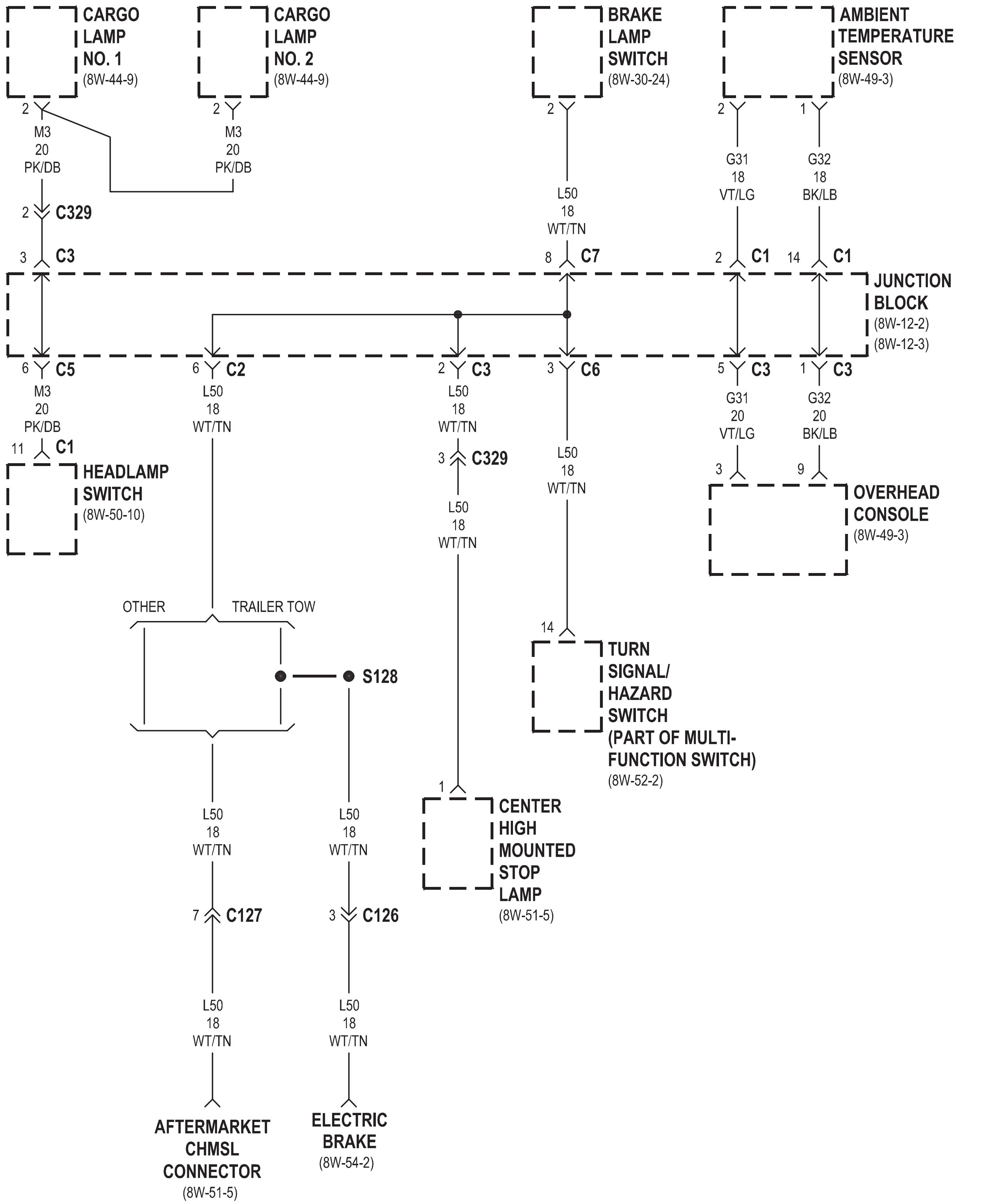


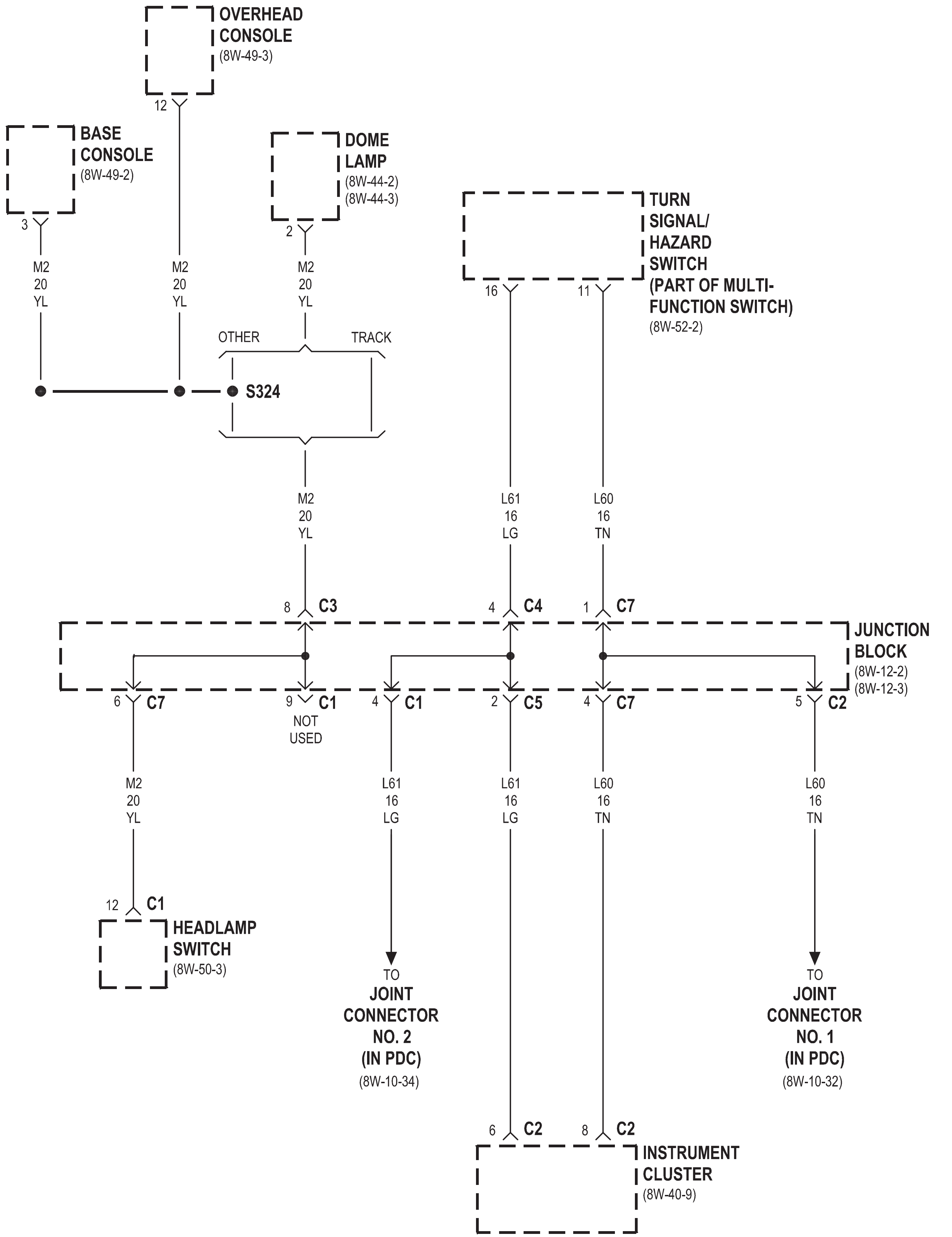
J008W-1 AN001212


BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 14 15A
FUSE 5 5A
4 C8
9 C4
7 C5
9 C3
F33 18 PK/RD
E1 18 TN/OR
E2 20 OR
2 C1
14 C1
HEADLAMP SWITCH
(8W-50-3)
(8W-50-9)
DIMMER SWITCH
0 OFF
1 PARK
2 HEAD
3 FUNERAL
4 DOME
8 C1
1 C1
1
SHIFT BEZEL LAMP
(8W-44-8)
L107 20 BK/YL
L7 20 BK/YL
E2 20 OR
S213
C
TO C200
(8W-12-14)
REAR WINDOW DEFOGGER SWITCH
(8W-48-2)
L107 20 BK/YL
L107 20 BK/YL
5 C2
4 C1
INSTRUMENT CLUSTER
(8W-40-10)
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
1
E2 20 OR
22
8
JOINT CONNECTOR NO. 4
(8W-10-36)
20
9
10
21
A/C
OTHER
E2 20 OR
E2 20 OR
E2 20 OR
E2 20 OR
E2 20 OR
5 C1
1 C2
1
1
1
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
INSTRUMENT CLUSTER
(8W-40-10)
ASH RECEIVER LAMP
(8W-44-8)
A/C-HEATER CONTROL
(8W-42-3)
HEATER CONTROL
(8W-42-5)


LEFT LICENSE LAMP (8W-51-7)
RIGHT LICENSE LAMP (8W-51-7)
LICENSE LAMP (8W-51-7)
FROM HEADLAMP SWITCH (8W-12-13)
C
L7 18 BK/YL
L7 20 BK/YL
S405
C323
C200
TRAILER TOW RELAY (IN PDC) (8W-54-2)
LEFT TAIL/ STOP/ TURN SIGNAL LAMP (8W-51-7)
OTHER
TRAILER TOW
STEP BUMPER
SPORT BUMPER
C325
JOINT CONNECTOR NO. 2 (IN PDC) (8W-10-32)
S316
C360
RIGHT FRONT SIDE MARKER LAMP (8W-50-9)
RIGHT TAIL/ STOP/ TURN SIGNAL LAMP (8W-51-7)
C127
L7 18 BK/YL
JOINT CONNECTOR NO. 1 (IN PDC) (8W-10-32)
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 1 (8W-50-9)
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 2 (8W-50-9)
LEFT FRONT SIDE MARKER LAMP (8W-50-9)
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 2 (8W-50-9)
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 1 (8W-50-9)

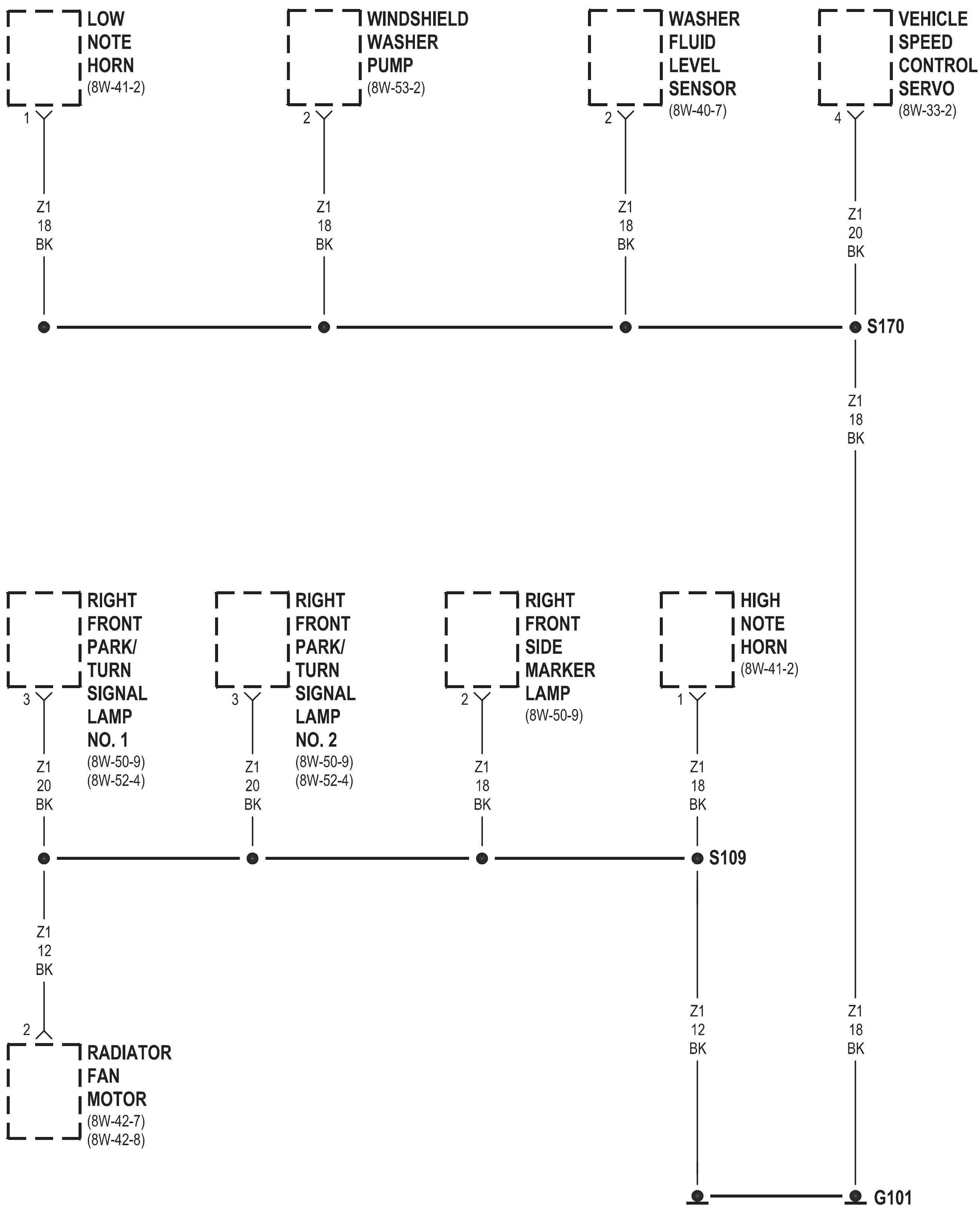

BASE CONSOLE (8W-49-2)
OVERHEAD CONSOLE (8W-49-3)
PASSENGER POWER MIRROR (8W-48-3)
PASSENGER DOOR LOCK SWITCH (8W-61-5)
MIDLEVEL
PREMIUM
BASE
PREMIUM
S350 (8W-15-9)
PASSENGER POWER LOCK/ WINDOW SWITCH (8W-61-3)
CENTER HIGH MOUNTED STOP LAMP (8W-51-5)
C362
C362
2 DOOR
4 DOOR
C329
SHIFT BEZEL LAMP (8W-44-8)
AUTOMATIC DAY/ NIGHT MIRROR (8W-44-13)
DOME LAMP (MIDLEVEL/ PREMIUM) (8W-44-2) (8W-44-3)
Z1 20 BK
Z1 18 BK
Z1 16 BK
S321 (8W-15-9)
C3
JUNCTION BLOCK (8W-12-2) (8W-12-3)
C7
S201 (8W-15-11)
G200 (8W-15-11)

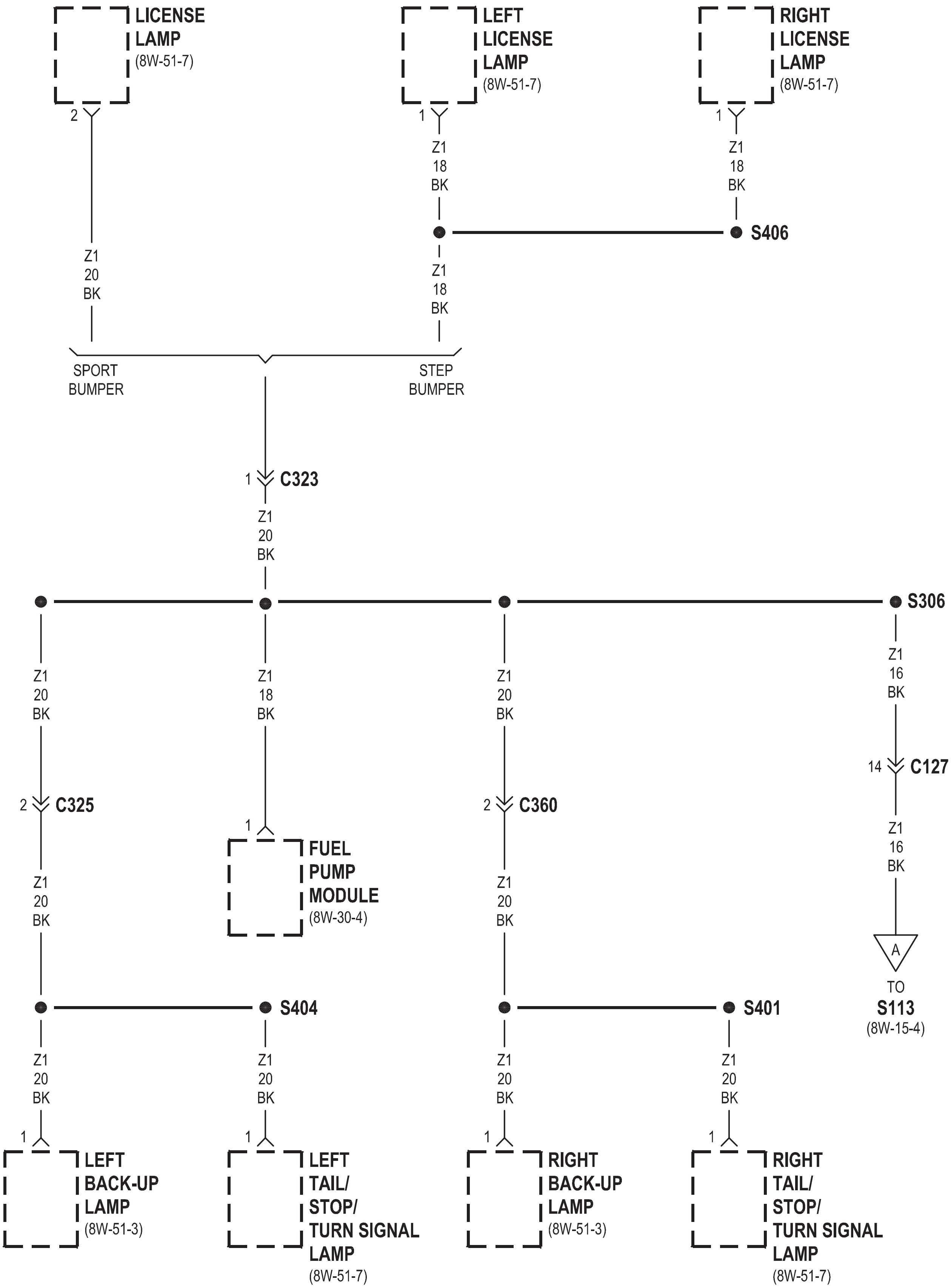

CARGO LAMP NO. 1 (8W-44-9)
CARGO LAMP NO. 2 (8W-44-9)
BRAKE LAMP SWITCH (8W-30-24)
AMBIENT TEMPERATURE SENSOR (8W-49-3)
M3 20 PK/DB
G31 18 VT/LG
G32 18 BK/LB
L50 18 WT/TN
C329
C3
C7
C1
JUNCTION BLOCK (8W-12-2) (8W-12-3)
C5
C2
C6
G31 20 VT/LG
G32 20 BK/LB
HEADLAMP SWITCH (8W-50-10)
OVERHEAD CONSOLE (8W-49-3)
OTHER
TRAILER TOW
S128
TURN SIGNAL/ HAZARD SWITCH (PART OF MULTI-FUNCTION SWITCH) (8W-52-2)
CENTER HIGH MOUNTED STOP LAMP (8W-51-5)
C127
C126
AFTERMARKET CHMSL CONNECTOR (8W-51-5)
ELECTRIC BRAKE (8W-54-2)


OVERHEAD
CONSOLE
(8W-49-3)
12
BASE
CONSOLE
(8W-49-2)
3
DOME
LAMP
(8W-44-2)
(8W-44-3)
2
TURN
SIGNAL/
HAZARD
SWITCH
(PART OF MULTI-
FUNCTION SWITCH)
(8W-52-2)
16
11
M2
20
YL
OTHER
TRACK
S324
L61
16
LG
L60
16
TN
8 C3
4 C4
1 C7
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6 C7
9 C1
NOT
USED
4 C1
2 C5
4 C7
5 C2
12 C1
HEADLAMP
SWITCH
(8W-50-3)
TO
JOINT
CONNECTOR
NO. 2
(IN PDC)
(8W-10-34)
TO
JOINT
CONNECTOR
NO. 1
(IN PDC)
(8W-10-32)
6 C2
8 C2
INSTRUMENT
CLUSTER
(8W-40-9)

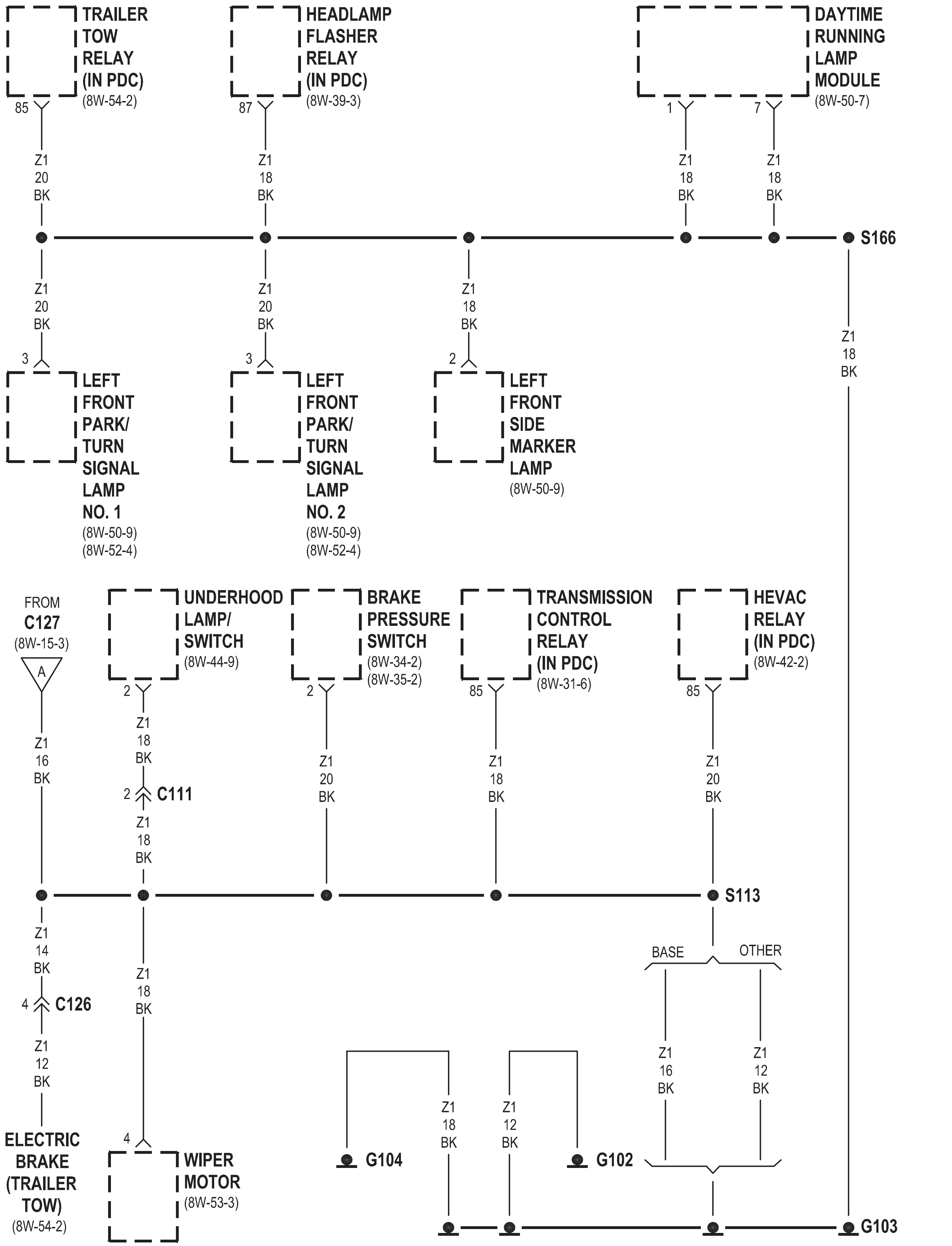
8W-15 GROUND DISTRIBUTION

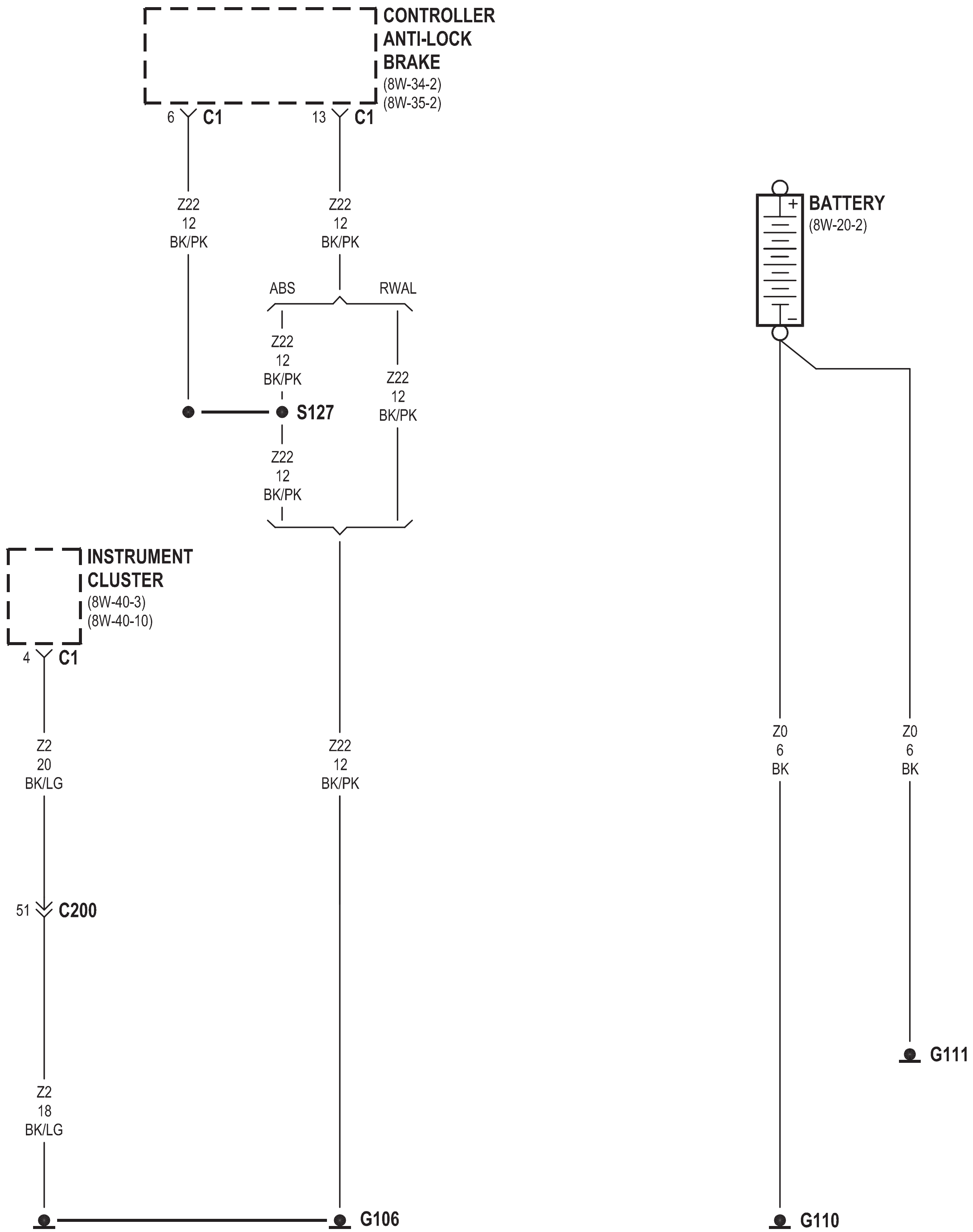
Component	Page
A/C Compressor Clutch	8W-15-6
A/C- Heater Control	8W-15-12, 14
Airbag Control Module	8W-15-11
Ash Receiver Lamp	8W-15-10
Automatic Day/Night Mirror	8W-15-9
Base Console	8W-15-9
Battery	8W-15-5
Brake Lamp Switch	8W-15-10
Brake Pressure Switch	8W-15-4
Center High Mounted Stop Lamp	8W-15-9
Central Timer Module	8W-15-12, 14
Cigar Lighter	8W-15-12, 14
Clockspring	8W-15-14
Combination Flasher	8W-15-10
Controller Anti-Lock Brake	8W-15-5
Data Link Connector	8W-15-7, 10
Daytime Running Lamp Module	8W-15-4
Dome Lamp	8W-15-9
Driver Door Ajar Switch	8W-15-12
Driver Door Key Cylinder Switch	8W-15-13
Driver Door Lock Motor/Ajar Switch	8W-15-13
Driver Power Lock/Window Switch	8W-15-8
Driver Power Mirror	8W-15-8
Electric Brake	8W-15-4
Engine Starter Motor Relay	8W-15-6
Fuel Pump Module	8W-15-3
G101	8W-15-2
G102	8W-15-4
G103	8W-15-4
G104	8W-15-4
G105	8W-15-6
G106	8W-15-5
G107	8W-15-7
G110	8W-15-5
G111	8W-15-5
G200	8W-15-11
G201	8W-15-11
G202	8W-15-12, 14
G203	8W-15-12, 14
G305	8W-15-10
Glove Box Lamp	8W-15-10
Headlamp Flasher Relay	8W-15-4
Headlamp Switch	8W-15-10, 11
Heater Control	8W-15-12, 14
Hevac Relay	8W-15-4
High Note Horn	8W-15-2
Instrument Cluster	8W-15-5, 10
Joint Connector No. 4	8W-15-10, 11
Junction Block	8W-15-11
Key-In Switch	8W-15-11
Left Back-Up Lamp	8W-15-3
Left Front Park/Turn Signal Lamp No. 1	8W-15-4
Left Front Park/Turn Signal Lamp No. 2	8W-15-4
Left Front Side Marker Lamp	8W-15-4
Left License Lamp	8W-15-3
Left Rear Door Ajar Switch	8W-15-12
Left Rear Door Lock Motor/Ajar Switch	8W-15-13
Left Tail/Stop/Turn Signal Lamp	8W-15-3
License Lamp	8W-15-3
Low Note Horn	8W-15-2
Multi- Function Switch	8W-15-11
Overdrive Switch	8W-15-10
Overhead Console	8W-15-9, 12, 13
Oxygen Sensor 1/1 Upstream	8W-15-6
Oxygen Sensor 1/2 Downstream	8W-15-6
Oxygen Sensor 2/1 Upstream	8W-15-6
Oxygen Sensor 2/2 Downstream	8W-15-6
Passenger Airbag On/Off Switch	8W-15-11
Passenger Door Ajar Switch	8W-15-12
Passenger Door Key Cylinder Switch	8W-15-13
Passenger Door Lock Motor/Ajar Switch	8W-15-13
Passenger Door Lock Switch	8W-15-9
Passenger Power Lock/Window Switch	8W-15-9
Passenger Power Mirror	8W-15-9
Power Amplifier	8W-15-14
Power Mirror Switch	8W-15-8
Power Outlet	8W-15-12, 14
Power Seat Switch	8W-15-11
Power Steering Pressure Switch	8W-15-6
Powertrain Control Module	8W-15-7
Radiator Fan Motor	8W-15-2
Radio	8W-15-6, 12, 14
Rear Window Defogger Switch	8W-15-11
Right Back-Up Lamp	8W-15-3
Right Front Park/Turn Signal Lamp No. 1	8W-15-2
Right Front Park/Turn Signal Lamp No. 2	8W-15-2
Right Front Side Marker Lamp	8W-15-2
Right License Lamp	8W-15-3
Right Rear Door Ajar Switch	8W-15-12
Right Rear Door Lock Motor/Ajar Switch	8W-15-13
Right Tail/Stop/Turn Signal Lamp	8W-15-3
Seat Belt Switch	8W-15-12, 13
Shift Bezel Lamp	8W-15-9
Trailer Tow Connector	8W-15-10
Trailer Tow Relay	8W-15-4
Transmission Control Module	8W-15-7
Transmission Control Relay	8W-15-4
Underhood Lamp/Switch	8W-15-4
Vehicle Speed Control Servo	8W-15-2
Washer Fluid Level Sensor	8W-15-2
Windshield Washer Pump	8W-15-2
Wiper Motor	8W-15-4

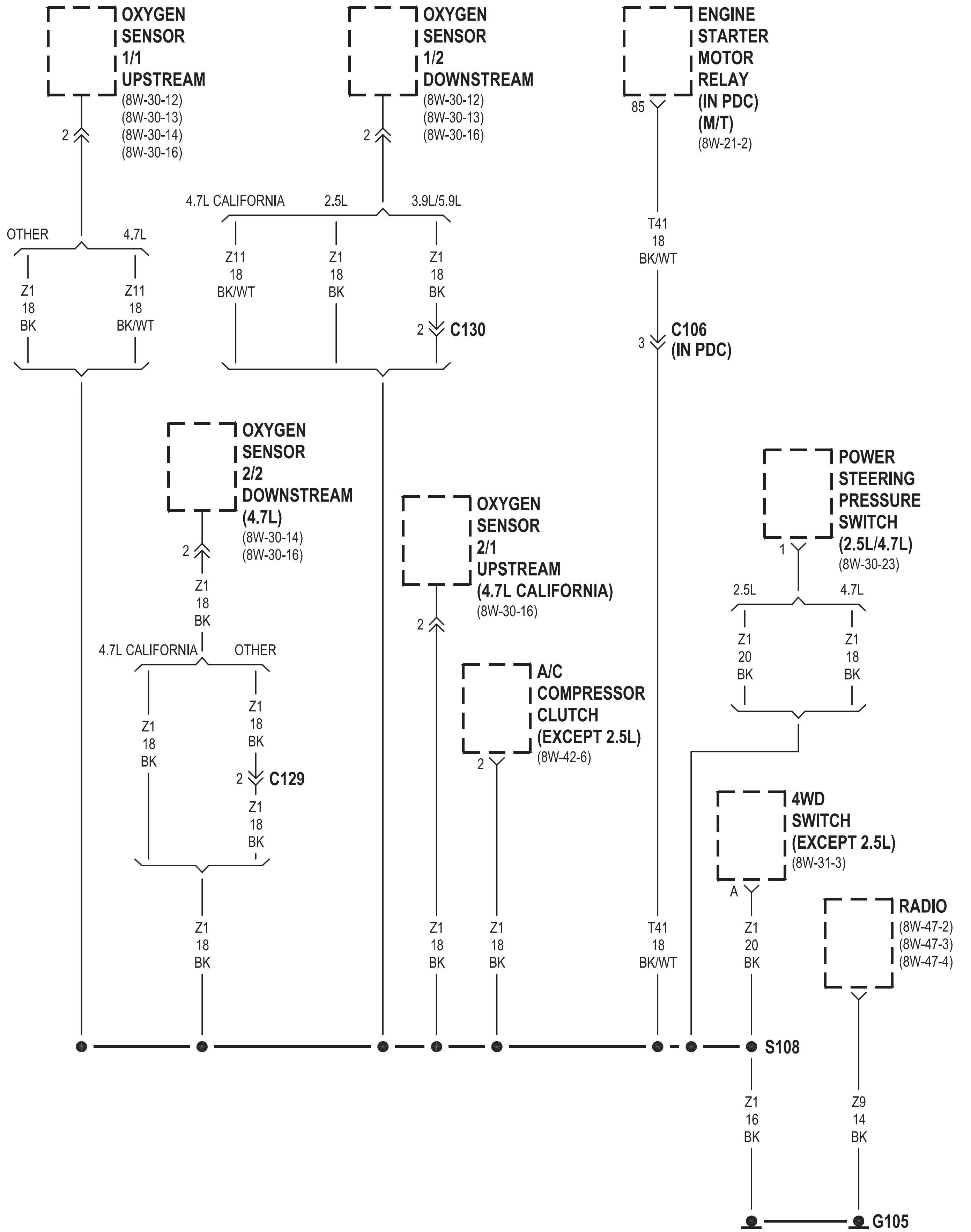

LOW NOTE HORN
(8W-41-2)
1
WINDSHIELD WASHER PUMP
(8W-53-2)
2
WASHER FLUID LEVEL SENSOR
(8W-40-7)
2
VEHICLE SPEED CONTROL SERVO
(8W-33-2)
4
Z1 18 BK
Z1 18 BK
Z1 18 BK
Z1 20 BK
S170
Z1 18 BK
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 1
(8W-50-9)
(8W-52-4)
3
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 2
(8W-50-9)
(8W-52-4)
3
RIGHT FRONT SIDE MARKER LAMP
(8W-50-9)
2
HIGH NOTE HORN
(8W-41-2)
1
Z1 20 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
S109
Z1 12 BK
2
RADIATOR FAN MOTOR
(8W-42-7)
(8W-42-8)
Z1 12 BK
Z1 18 BK
G101

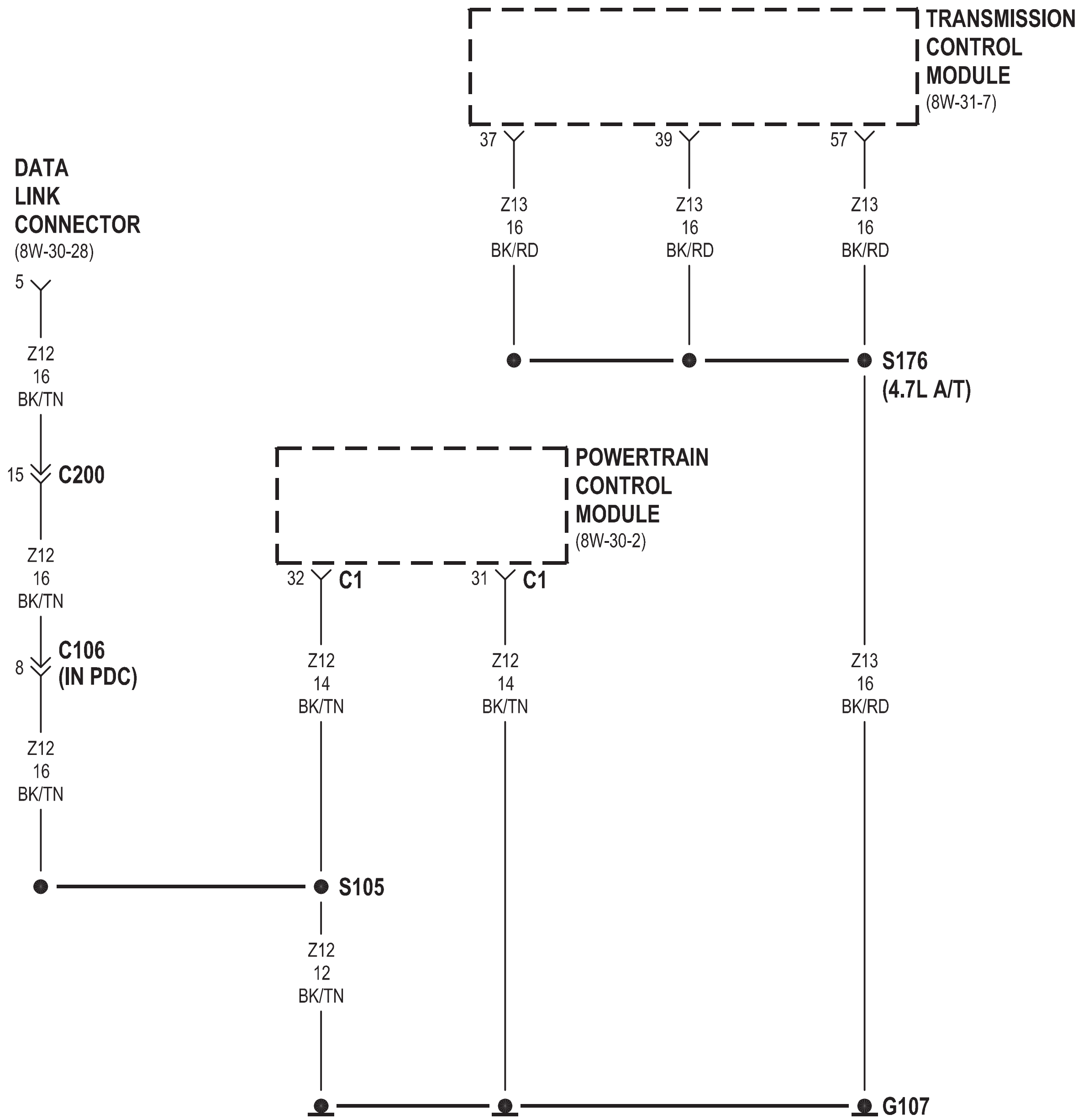


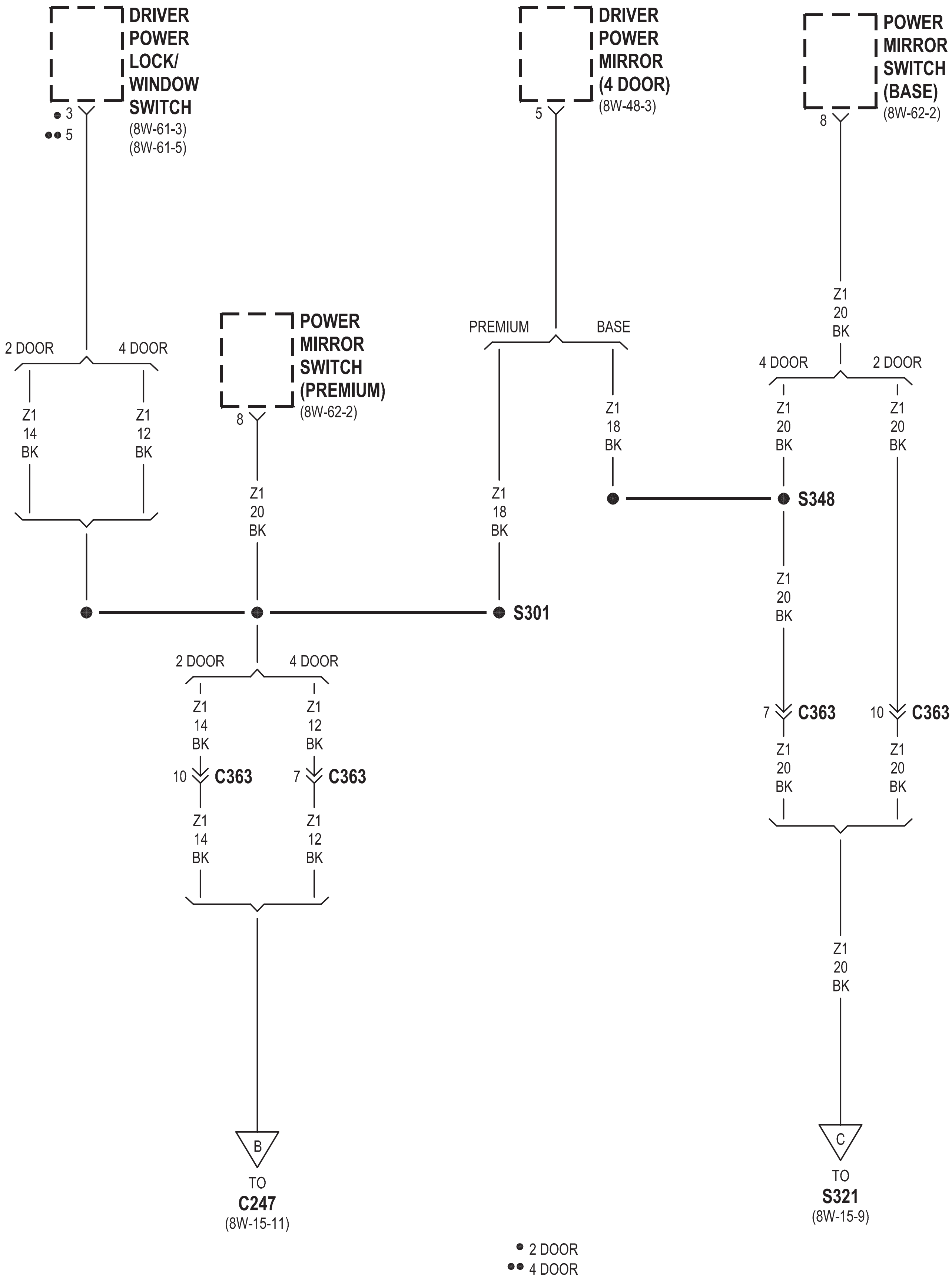
LICENSE
LAMP
(8W-51-7)
2
LEFT
LICENSE
LAMP
(8W-51-7)
1
RIGHT
LICENSE
LAMP
(8W-51-7)
1
Z1
18
BK
Z1
18
BK
S406
Z1
20
BK
Z1
18
BK
SPORT
BUMPER
STEP
BUMPER
1
C323
Z1
20
BK
S306
Z1
20
BK
Z1
18
BK
Z1
20
BK
Z1
16
BK
14
C127
2
C325
1
FUEL
PUMP
MODULE
(8W-30-4)
2
C360
Z1
16
BK
A
TO
S113
(8W-15-4)
S404
S401
1
LEFT
BACK-UP
LAMP
(8W-51-3)
1
LEFT
TAIL/
STOP/
TURN SIGNAL
LAMP
(8W-51-7)
1
RIGHT
BACK-UP
LAMP
(8W-51-3)
1
RIGHT
TAIL/
STOP/
TURN SIGNAL
LAMP
(8W-51-7)


TRAILER TOW RELAY (IN PDC)
(8W-54-2)
85
HEADLAMP FLASHER RELAY (IN PDC)
(8W-39-3)
87
DAYTIME RUNNING LAMP MODULE
(8W-50-7)
1
7
Z1 20 BK
Z1 18 BK
Z1 18 BK
Z1 18 BK
S166
Z1 20 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
3
3
2
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 1
(8W-50-9)
(8W-52-4)
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 2
(8W-50-9)
(8W-52-4)
LEFT FRONT SIDE MARKER LAMP
(8W-50-9)
FROM C127
(8W-15-3)
A
UNDERHOOD LAMP/ SWITCH
(8W-44-9)
BRAKE PRESSURE SWITCH
(8W-34-2)
(8W-35-2)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-6)
HEVAC RELAY (IN PDC)
(8W-42-2)
2
2
85
85
Z1 16 BK
Z1 18 BK
2 C111
Z1 18 BK
Z1 20 BK
Z1 18 BK
Z1 20 BK
S113
Z1 14 BK
4 C126
Z1 12 BK
Z1 18 BK
BASE
OTHER
Z1 16 BK
Z1 12 BK
Z1 18 BK
Z1 12 BK
G104
G102
ELECTRIC BRAKE (TRAILER TOW)
(8W-54-2)
4
WIPER MOTOR
(8W-53-3)
G103

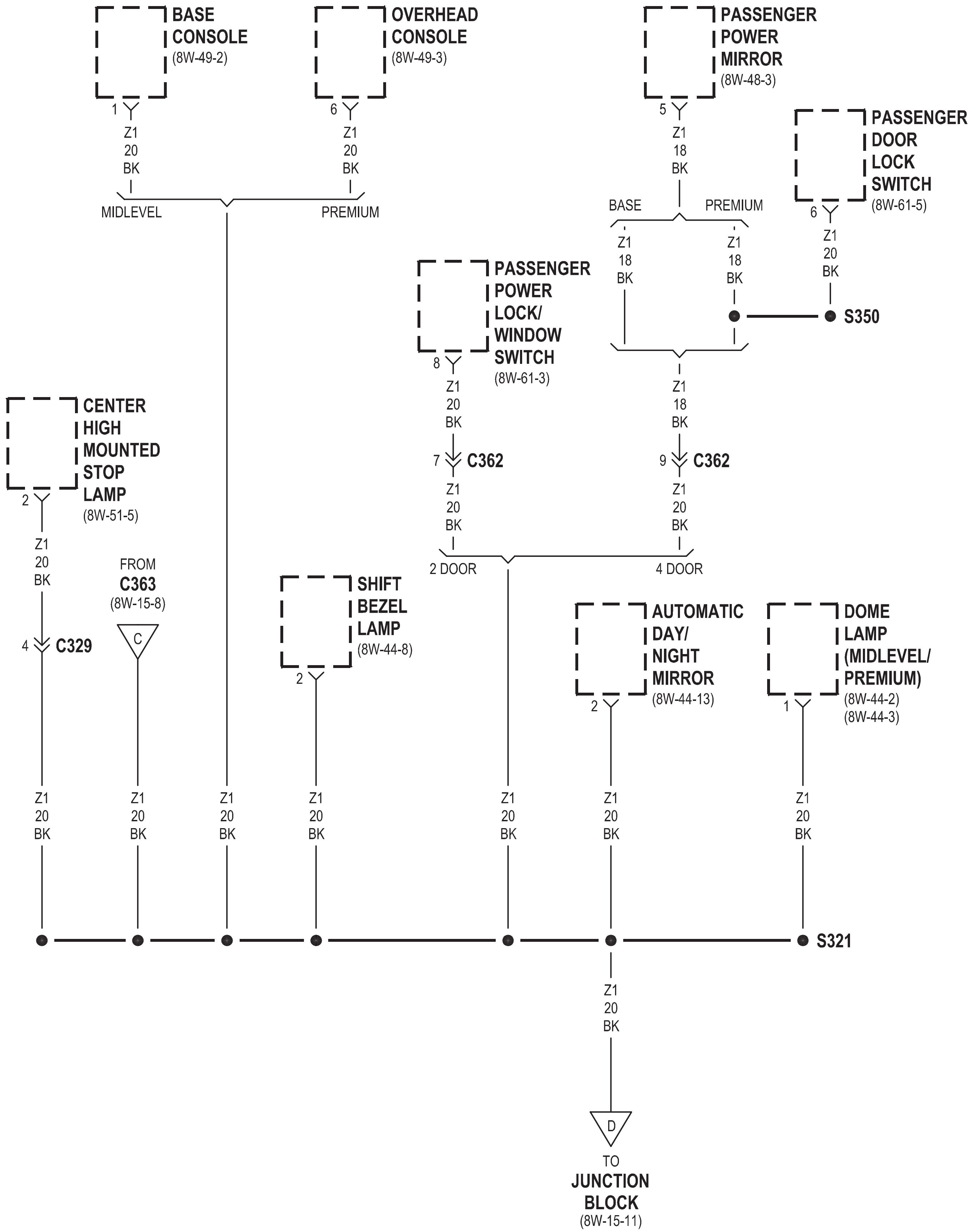

CONTROLLER
ANTI-LOCK
BRAKE
(8W-34-2)
(8W-35-2)
6 C1
13 C1
Z22
12
BK/PK
ABS
RWAL
S127
INSTRUMENT
CLUSTER
(8W-40-3)
(8W-40-10)
4 C1
Z2
20
BK/LG
51 C200
Z2
18
BK/LG
G106
BATTERY
(8W-20-2)
Z0
6
BK
G111
G110

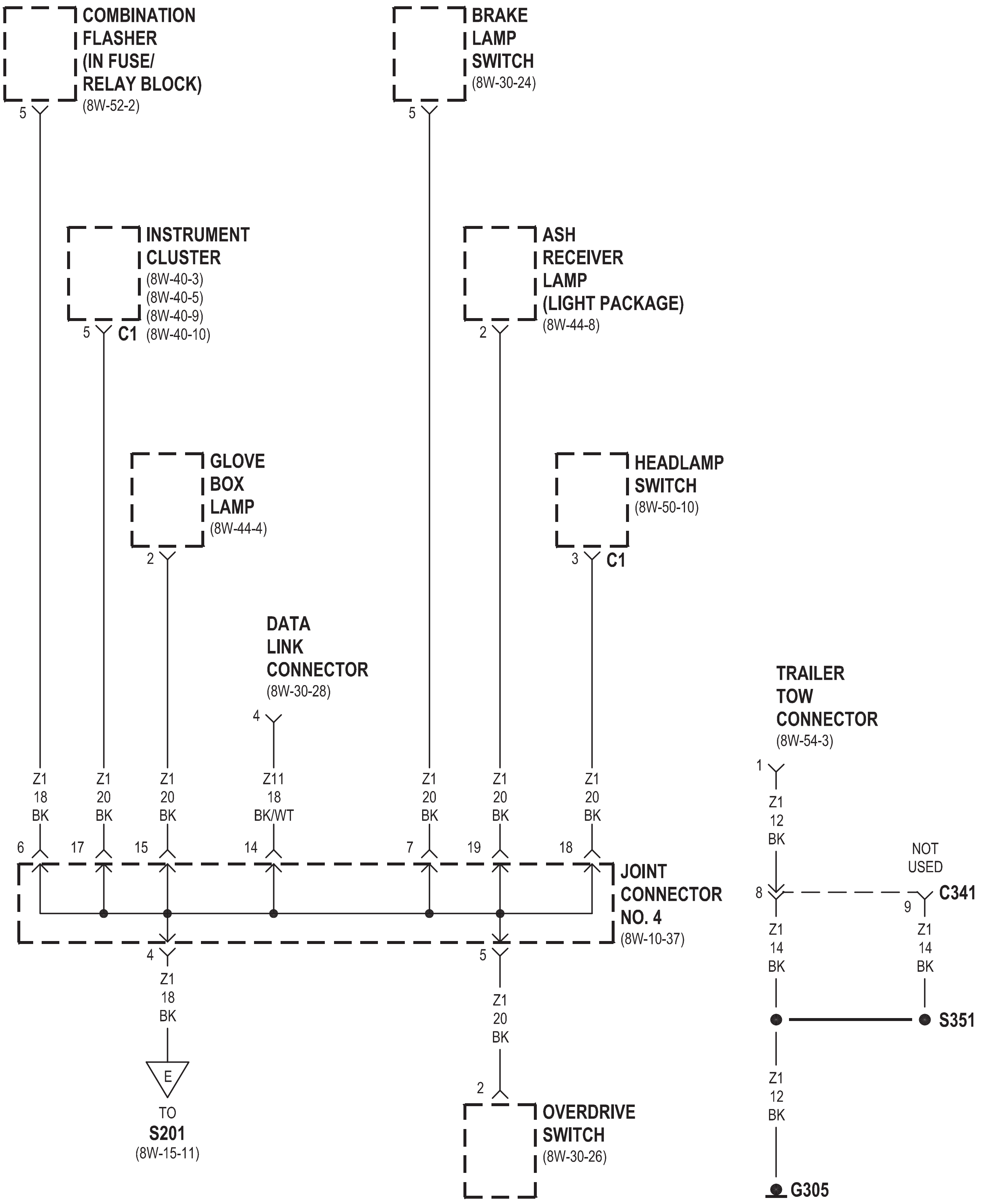

OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-12)
(8W-30-13)
(8W-30-14)
(8W-30-16)
2
OTHER
4.7L
Z1 18 BK
Z11 18 BK/WT
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-12)
(8W-30-13)
(8W-30-16)
2
4.7L CALIFORNIA
2.5L
3.9L/5.9L
Z11 18 BK/WT
Z1 18 BK
Z1 18 BK
2
C130
ENGINE STARTER MOTOR RELAY (IN PDC) (M/T)
(8W-21-2)
85
T41 18 BK/WT
3
C106 (IN PDC)
OXYGEN SENSOR 2/2 DOWNSTREAM (4.7L)
(8W-30-14)
(8W-30-16)
2
Z1 18 BK
4.7L CALIFORNIA
OTHER
Z1 18 BK
Z1 18 BK
2
C129
Z1 18 BK
Z1 18 BK
OXYGEN SENSOR 2/1 UPSTREAM (4.7L CALIFORNIA)
(8W-30-16)
2
Z1 18 BK
A/C COMPRESSOR CLUTCH (EXCEPT 2.5L)
(8W-42-6)
2
Z1 18 BK
T41 18 BK/WT
POWER STEERING PRESSURE SWITCH (2.5L/4.7L)
(8W-30-23)
1
2.5L
4.7L
Z1 20 BK
Z1 18 BK
4WD SWITCH (EXCEPT 2.5L)
(8W-31-3)
A
Z1 20 BK
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
S108
Z1 16 BK
Z9 14 BK
G105

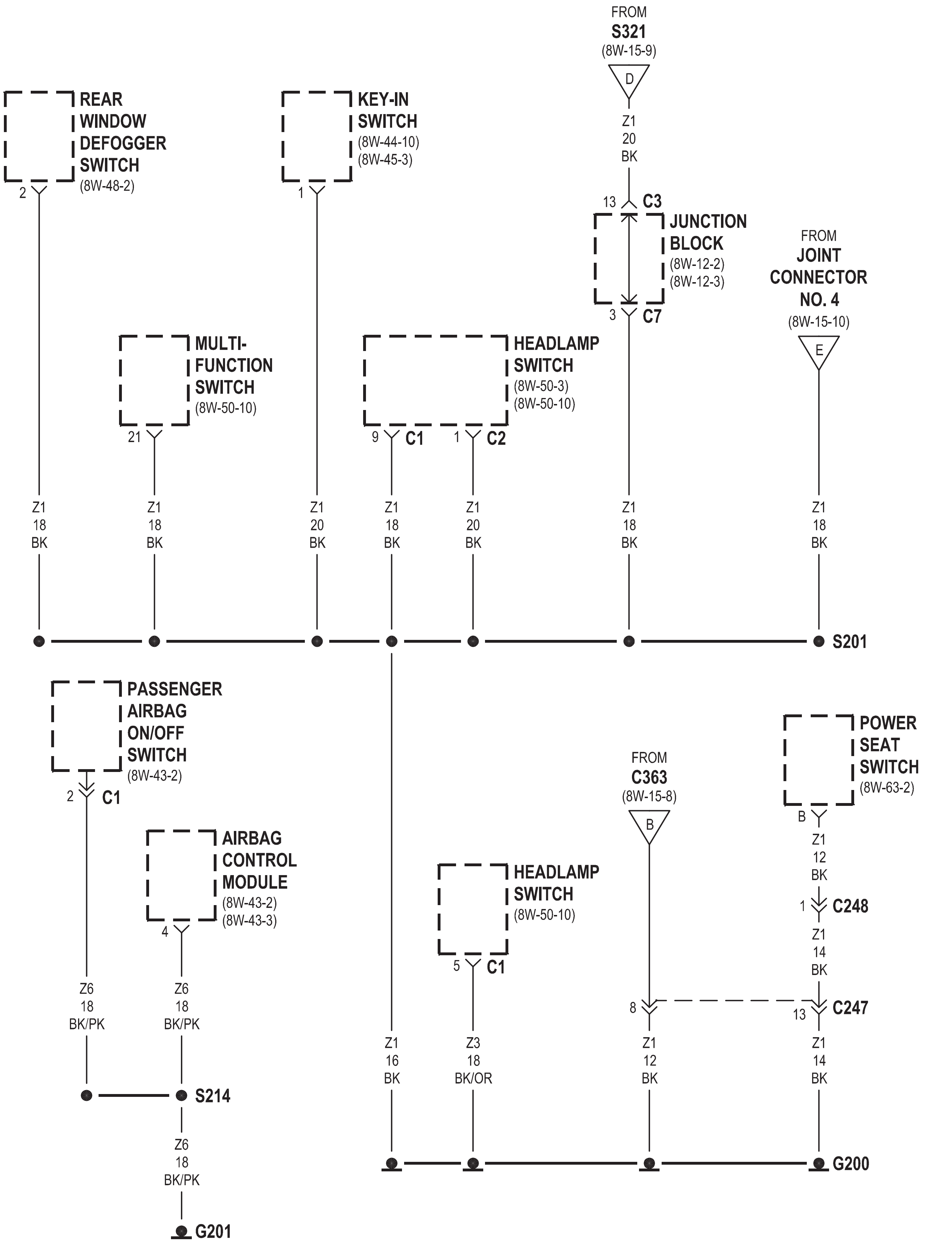

TRANSMISSION CONTROL MODULE
(8W-31-7)
37
39
57
Z13 16 BK/RD
Z13 16 BK/RD
Z13 16 BK/RD
DATA LINK CONNECTOR
(8W-30-28)
5
Z12 16 BK/TN
S176 (4.7L A/T)
15
C200
Z12 16 BK/TN
POWERTRAIN CONTROL MODULE
(8W-30-2)
32
C1
31
C1
8
C106 (IN PDC)
Z12 14 BK/TN
Z12 14 BK/TN
Z13 16 BK/RD
Z12 16 BK/TN
S105
Z12 12 BK/TN
G107



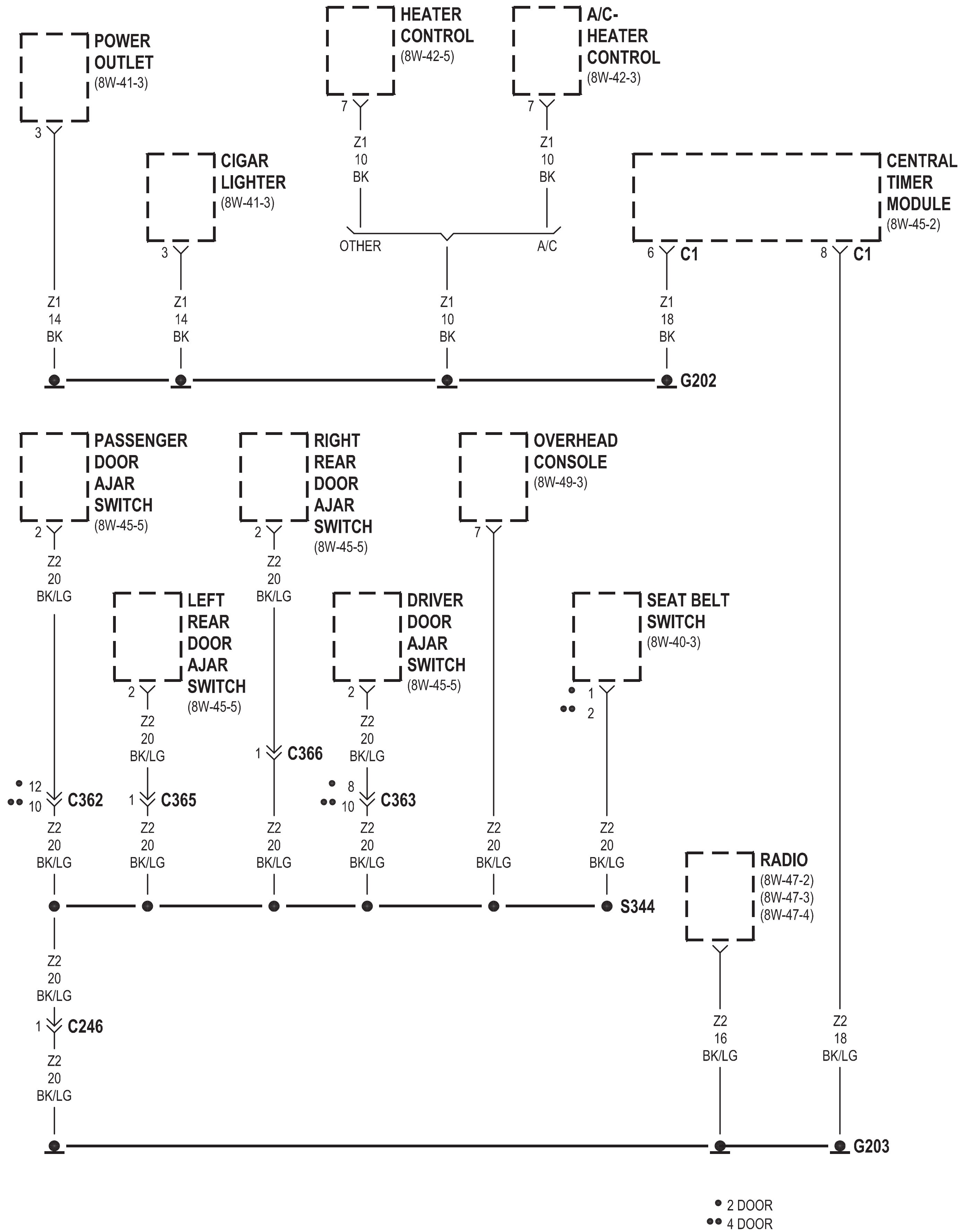
DRIVER POWER LOCK/ WINDOW SWITCH
(8W-61-3)
(8W-61-5)
● 3
●● 5
DRIVER POWER MIRROR (4 DOOR)
(8W-48-3)
5
POWER MIRROR SWITCH (BASE)
(8W-62-2)
8
POWER MIRROR SWITCH (PREMIUM)
(8W-62-2)
8
2 DOOR
4 DOOR
PREMIUM
BASE
Z1 14 BK
Z1 12 BK
Z1 20 BK
Z1 18 BK
S301
S348
C363
10
7
TO C247
(8W-15-11)
TO S321
(8W-15-9)
B
C
● 2 DOOR
●● 4 DOOR


BASE CONSOLE
(8W-49-2)
OVERHEAD CONSOLE
(8W-49-3)
PASSENGER POWER MIRROR
(8W-48-3)
PASSENGER DOOR LOCK SWITCH
(8W-61-5)
Z1
20
BK
MIDLEVEL
PREMIUM
BASE
PREMIUM
Z1
18
BK
S350
PASSENGER POWER LOCK/ WINDOW SWITCH
(8W-61-3)
C362
2 DOOR
4 DOOR
CENTER HIGH MOUNTED STOP LAMP
(8W-51-5)
FROM
C363
(8W-15-8)
C
C329
SHIFT BEZEL LAMP
(8W-44-8)
AUTOMATIC DAY/ NIGHT MIRROR
(8W-44-13)
DOME LAMP (MIDLEVEL/ PREMIUM)
(8W-44-2)
(8W-44-3)
S321
D
TO
JUNCTION BLOCK
(8W-15-11)

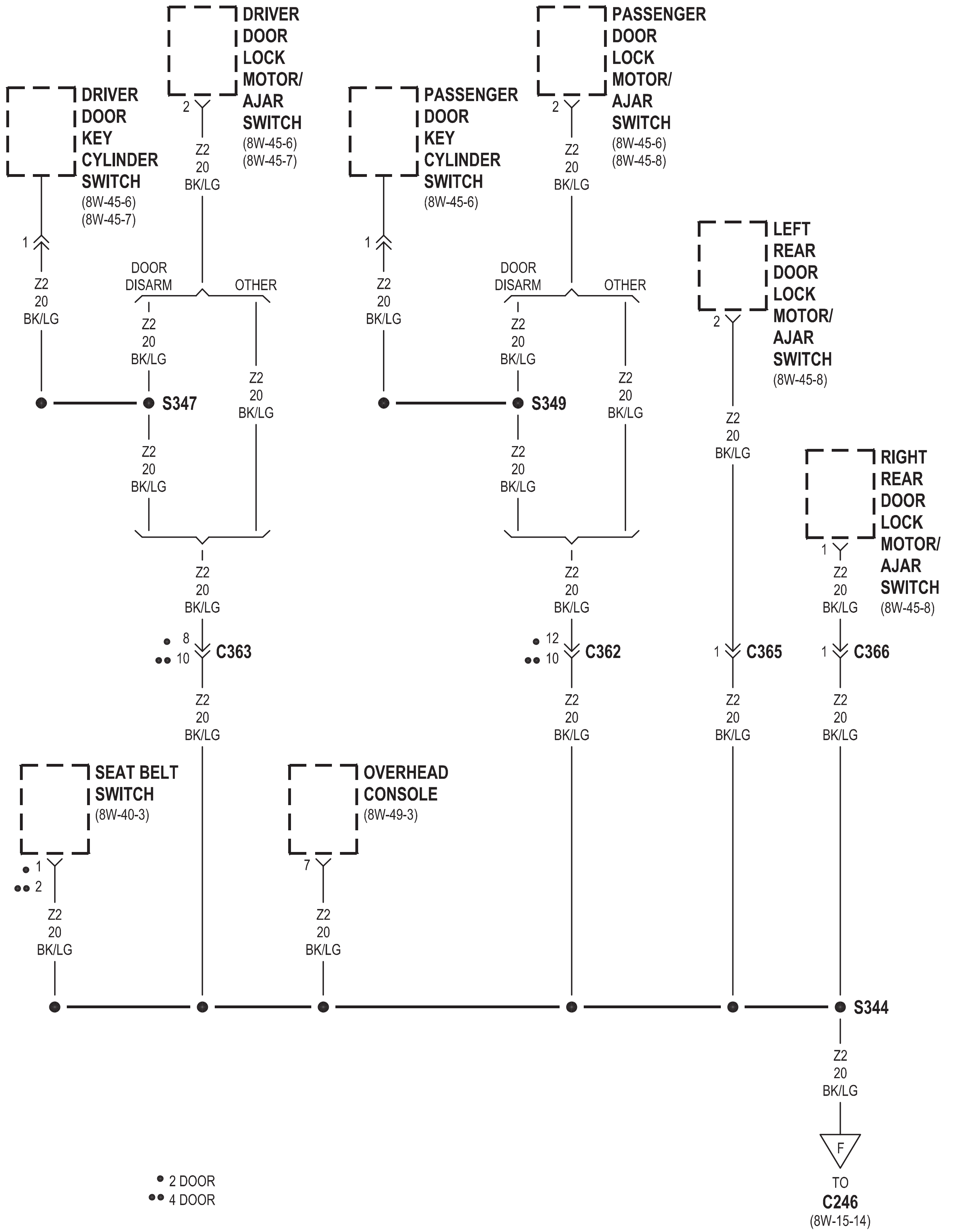

COMBINATION FLASHER (IN FUSE/ RELAY BLOCK) (8W-52-2)
BRAKE LAMP SWITCH (8W-30-24)
INSTRUMENT CLUSTER (8W-40-3) (8W-40-5) (8W-40-9) (8W-40-10)
C1
ASH RECEIVER LAMP (LIGHT PACKAGE) (8W-44-8)
GLOVE BOX LAMP (8W-44-4)
HEADLAMP SWITCH (8W-50-10)
C1
DATA LINK CONNECTOR (8W-30-28)
TRAILER TOW CONNECTOR (8W-54-3)
Z1 18 BK
Z1 20 BK
Z11 18 BK/WT
Z1 12 BK
NOT USED
C341
JOINT CONNECTOR NO. 4 (8W-10-37)
Z1 14 BK
S351
E
TO S201 (8W-15-11)
OVERDRIVE SWITCH (8W-30-26)
G305

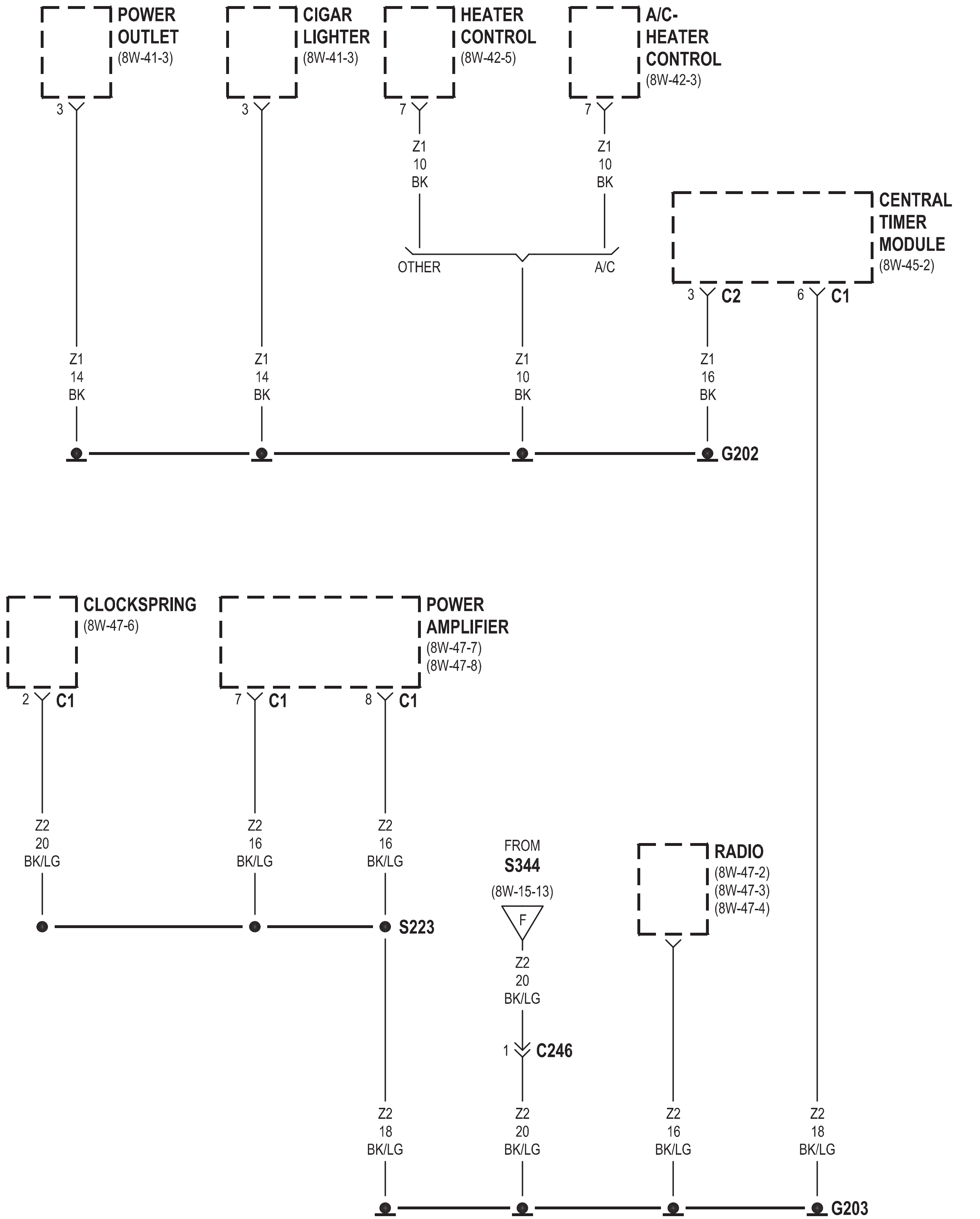

FROM
S321
(8W-15-9)
D
REAR WINDOW DEFOGGER SWITCH
(8W-48-2)
KEY-IN SWITCH
(8W-44-10)
(8W-45-3)
Z1 20 BK
13 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
3 C7
FROM
JOINT CONNECTOR NO. 4
(8W-15-10)
E
MULTI-FUNCTION SWITCH
(8W-50-10)
HEADLAMP SWITCH
(8W-50-3)
(8W-50-10)
2
1
21
9 C1
1 C2
Z1 18 BK
Z1 18 BK
Z1 20 BK
Z1 18 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
S201
PASSENGER AIRBAG ON/OFF SWITCH
(8W-43-2)
2 C1
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
4
FROM
C363
(8W-15-8)
B
POWER SEAT SWITCH
(8W-63-2)
B
Z1 12 BK
1 C248
Z1 14 BK
HEADLAMP SWITCH
(8W-50-10)
5 C1
8
13 C247
Z6 18 BK/PK
Z6 18 BK/PK
Z1 16 BK
Z3 18 BK/OR
Z1 12 BK
Z1 14 BK
S214
Z6 18 BK/PK
G201
G200

BASE



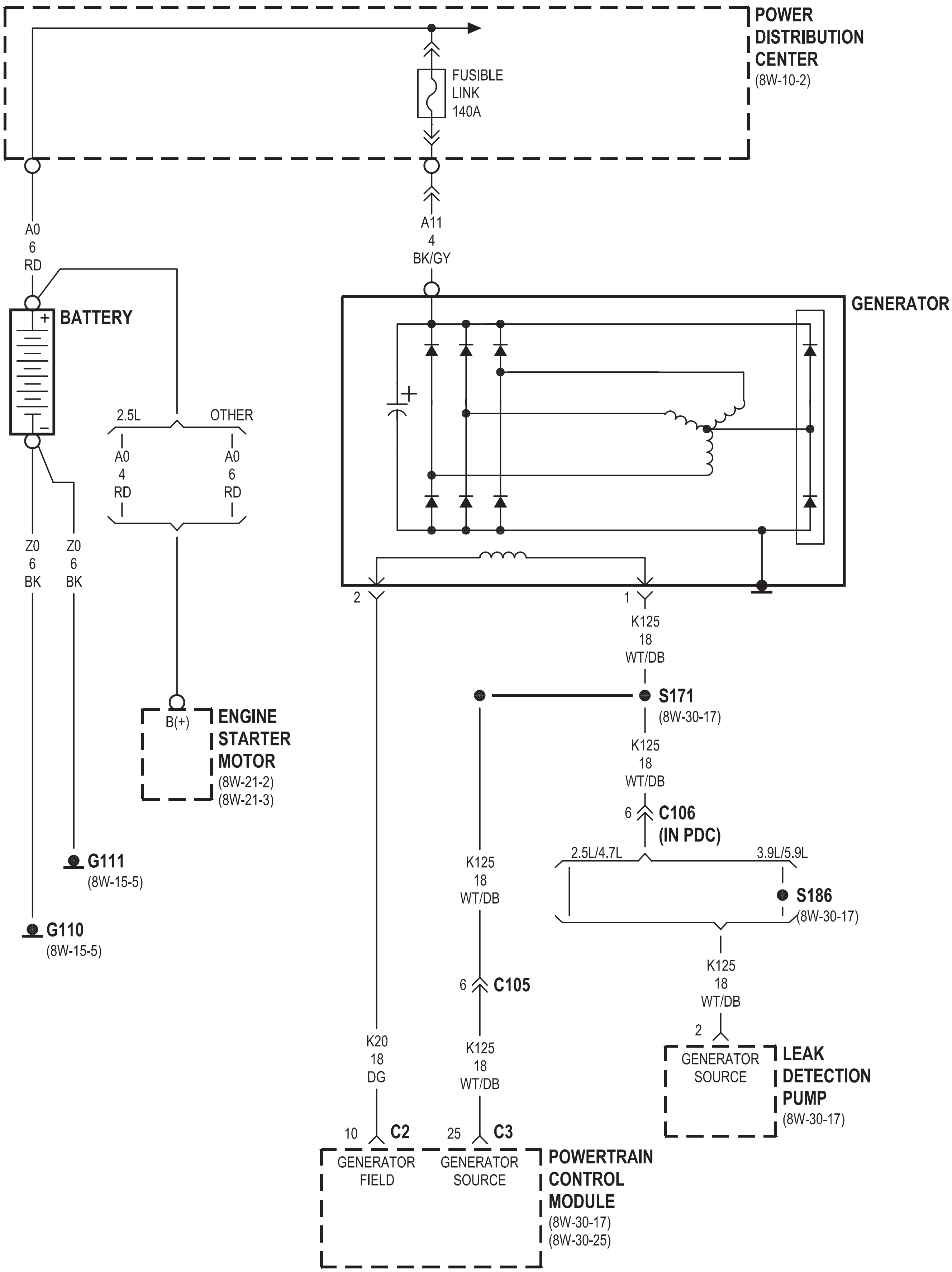
POWER OUTLET (8W-41-3)
3
Z1 14 BK
CIGAR LIGHTER (8W-41-3)
3
Z1 14 BK
HEATER CONTROL (8W-42-5)
7
Z1 10 BK
A/C-HEATER CONTROL (8W-42-3)
7
Z1 10 BK
OTHER
A/C
Z1 10 BK
CENTRAL TIMER MODULE (8W-45-2)
6 C1
Z1 18 BK
8 C1
G202
PASSENGER DOOR AJAR SWITCH (8W-45-5)
2
Z2 20 BK/LG
RIGHT REAR DOOR AJAR SWITCH (8W-45-5)
2
Z2 20 BK/LG
OVERHEAD CONSOLE (8W-49-3)
7
LEFT REAR DOOR AJAR SWITCH (8W-45-5)
2
Z2 20 BK/LG
DRIVER DOOR AJAR SWITCH (8W-45-5)
2
Z2 20 BK/LG
SEAT BELT SWITCH (8W-40-3)
1
2
1 C366
12
10 C362
1 C365
8
10 C363
Z2 20 BK/LG
S344
RADIO (8W-47-2) (8W-47-3) (8W-47-4)
1 C246
Z2 16 BK/LG
Z2 18 BK/LG
G203
2 DOOR
4 DOOR

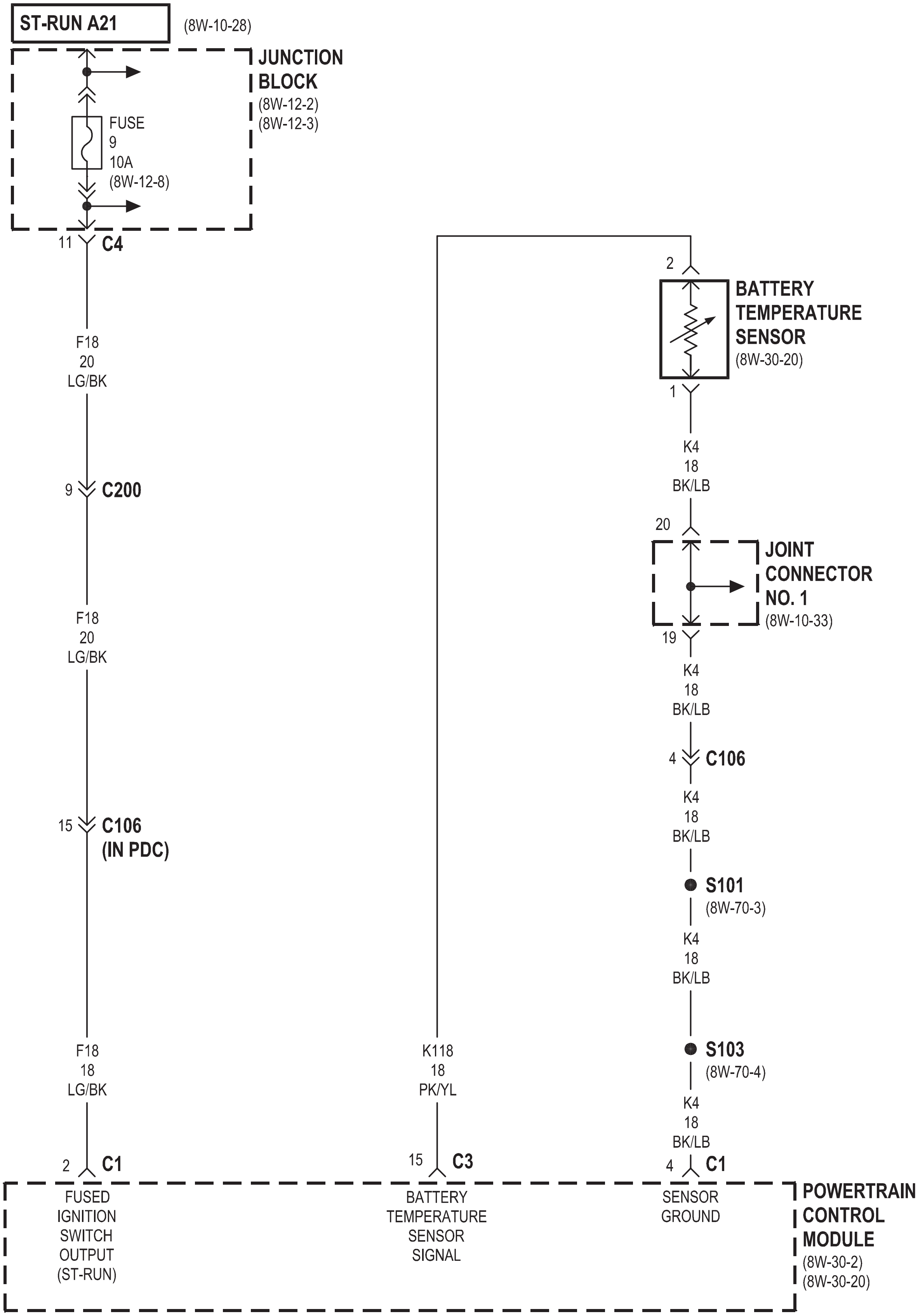

DRIVER DOOR KEY CYLINDER SWITCH (8W-45-6) (8W-45-7)
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH (8W-45-6) (8W-45-7)
PASSENGER DOOR KEY CYLINDER SWITCH (8W-45-6)
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH (8W-45-6) (8W-45-8)
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH (8W-45-8)
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH (8W-45-8)
DOOR DISARM
OTHER
Z2 20 BK/LG
S347
S349
C363
C362
C365
C366
SEAT BELT SWITCH (8W-40-3)
OVERHEAD CONSOLE (8W-49-3)
S344
F
TO C246 (8W-15-14)
● 2 DOOR
●● 4 DOOR


POWER
OUTLET
(8W-41-3)
CIGAR
LIGHTER
(8W-41-3)
HEATER
CONTROL
(8W-42-5)
A/C-
HEATER
CONTROL
(8W-42-3)
3
3
7
7
Z1
10
BK
Z1
10
BK
CENTRAL
TIMER
MODULE
(8W-45-2)
OTHER
A/C
3 C2
6 C1
Z1
14
BK
Z1
14
BK
Z1
10
BK
Z1
16
BK
G202
CLOCKSPRING
(8W-47-6)
POWER
AMPLIFIER
(8W-47-7)
(8W-47-8)
2 C1
7 C1
8 C1
Z2
20
BK/LG
Z2
16
BK/LG
Z2
16
BK/LG
FROM
S344
(8W-15-13)
F
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
S223
Z2
20
BK/LG
1 C246
Z2
18
BK/LG
Z2
20
BK/LG
Z2
16
BK/LG
Z2
18
BK/LG
G203

8W-20 CHARGING SYSTEM

Component	Page
Battery	8W-20-2
Battery Temperature Sensor	8W-20-3
Engine Starter Motor	8W-20-2
Fuse 9 (JB)	8W-20-3
Fusible Link	8W-20-2
G110	8W-20-2
G111	8W-20-2
Generator	8W-20-2
Joint Connector No. 1	8W-20-3
Junction Block	8W-20-3
Leak Detection Pump	8W-20-2
Power Distribution Center	8W-20-2
Powertrain Control Module	8W-20-2, 3

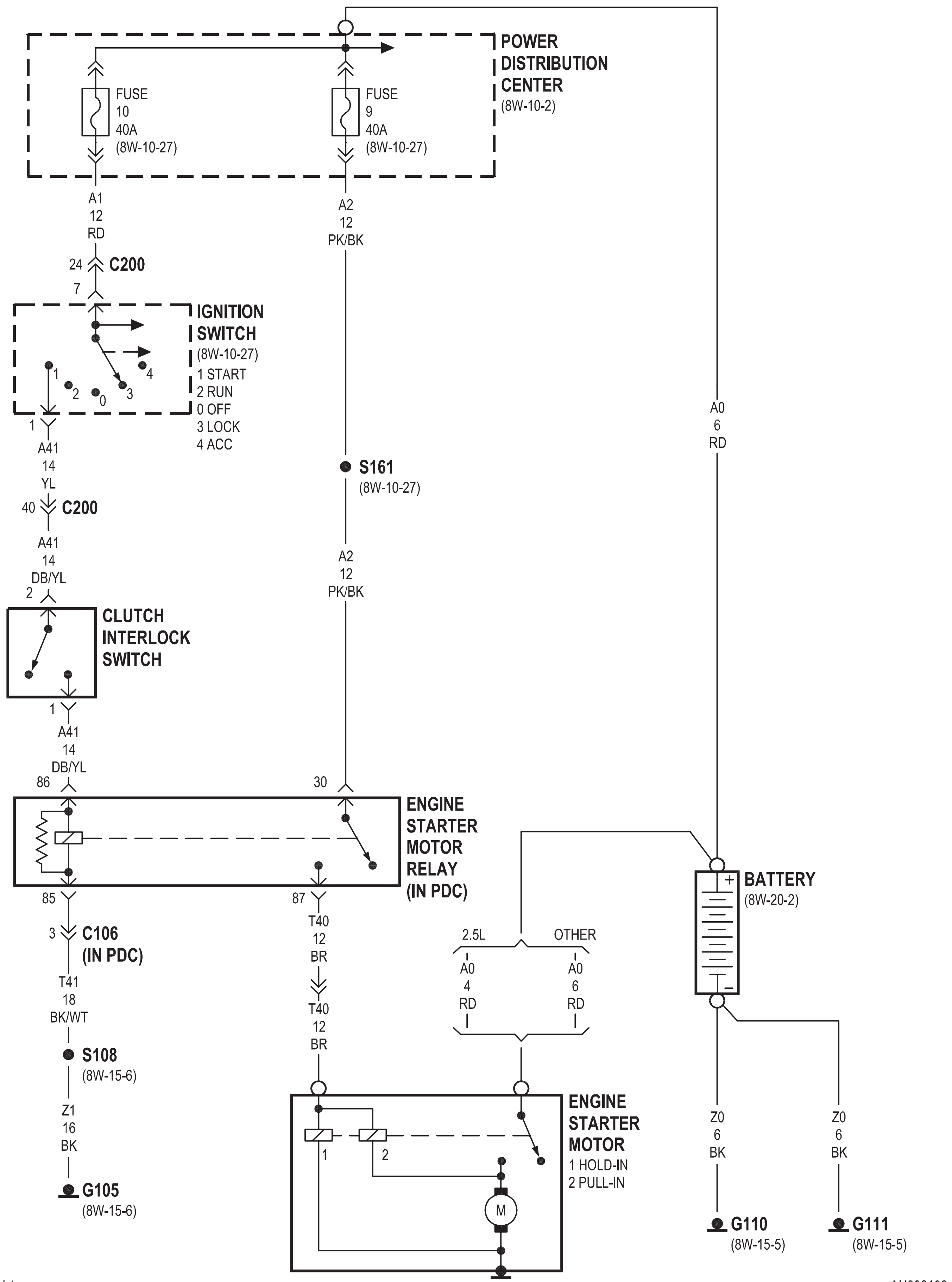

POWER DISTRIBUTION CENTER
(8W-10-2)
FUSIBLE LINK 140A
A0 6 RD
A11 4 BK/GY
BATTERY
GENERATOR
2.5L
OTHER
A0 4 RD
A0 6 RD
Z0 6 BK
Z0 6 BK
2
1
K125 18 WT/DB
S171
(8W-30-17)
K125 18 WT/DB
B(+)
ENGINE STARTER MOTOR
(8W-21-2)
(8W-21-3)
6
C106 (IN PDC)
2.5L/4.7L
3.9L/5.9L
G111
(8W-15-5)
K125 18 WT/DB
S186
(8W-30-17)
G110
(8W-15-5)
K125 18 WT/DB
6
C105
2
GENERATOR SOURCE
LEAK DETECTION PUMP
(8W-30-17)
K20 18 DG
K125 18 WT/DB
10
C2
25
C3
GENERATOR FIELD
GENERATOR SOURCE
POWERTRAIN CONTROL MODULE
(8W-30-17)
(8W-30-25)


ST-RUN A21
(8W-10-28)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
10A
(8W-12-8)
11
C4
F18
20
LG/BK
9
C200
F18
20
LG/BK
15
C106
(IN PDC)
F18
18
LG/BK
2
C1
FUSED
IGNITION
SWITCH
OUTPUT
(ST-RUN)
K118
18
PK/YL
15
C3
BATTERY
TEMPERATURE
SENSOR
SIGNAL
2
BATTERY
TEMPERATURE
SENSOR
(8W-30-20)
1
K4
18
BK/LB
20
JOINT
CONNECTOR
NO. 1
(8W-10-33)
19
K4
18
BK/LB
4
C106
K4
18
BK/LB
S101
(8W-70-3)
K4
18
BK/LB
S103
(8W-70-4)
K4
18
BK/LB
4
C1
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE
(8W-30-2)
(8W-30-20)

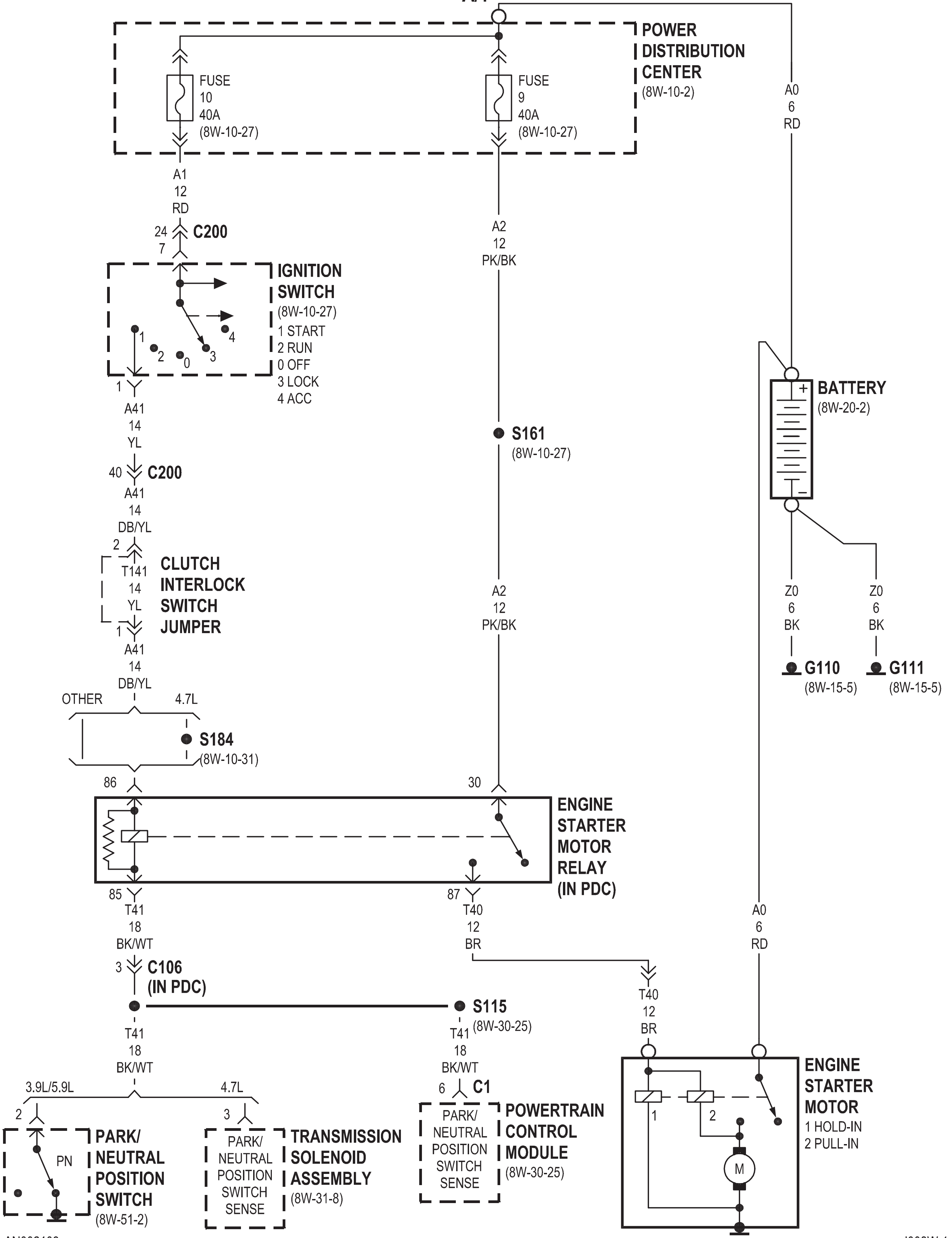
8W-21 STARTING SYSTEM

Component	Page
Battery	8W-21-2, 3
Clutch Interlock Switch	8W-21-2
Clutch Interlock Switch Jumper	8W-21-3
Engine Starter Motor	8W-21-2, 3
Engine Starter Motor Relay	8W-21-2, 3
Fuse 9 (PDC)	8W-21-2, 3
Fuse 10 (PDC)	8W-21-2, 3
G105	8W-21-2
G110	8W-21-2, 3
G111	8W-21-2, 3
Ignition Switch	8W-21-2, 3
Park/Neutral Position Switch	8W-21-3
Power Distribution Center	8W-21-2, 3
Powertrain Control Module	8W-21-3
Transmission Solenoid Assembly	8W-21-3

M/T


POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
10
40A
(8W-10-27)
FUSE
9
40A
(8W-10-27)
A1
12
RD
24
C200
7
IGNITION
SWITCH
(8W-10-27)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
A41
14
YL
40
C200
A41
14
DB/YL
2
CLUTCH
INTERLOCK
SWITCH
1
A41
14
DB/YL
86
A2
12
PK/BK
S161
(8W-10-27)
A2
12
PK/BK
30
ENGINE
STARTER
MOTOR
RELAY
(IN PDC)
85
3
C106
(IN PDC)
T41
18
BK/WT
S108
(8W-15-6)
Z1
16
BK
G105
(8W-15-6)
87
T40
12
BR
T40
12
BR
A0
6
RD
2.5L
OTHER
A0
4
RD
A0
6
RD
BATTERY
(8W-20-2)
ENGINE
STARTER
MOTOR
1 HOLD-IN
2 PULL-IN
M
Z0
6
BK
G110
(8W-15-5)
Z0
6
BK
G111
(8W-15-5)

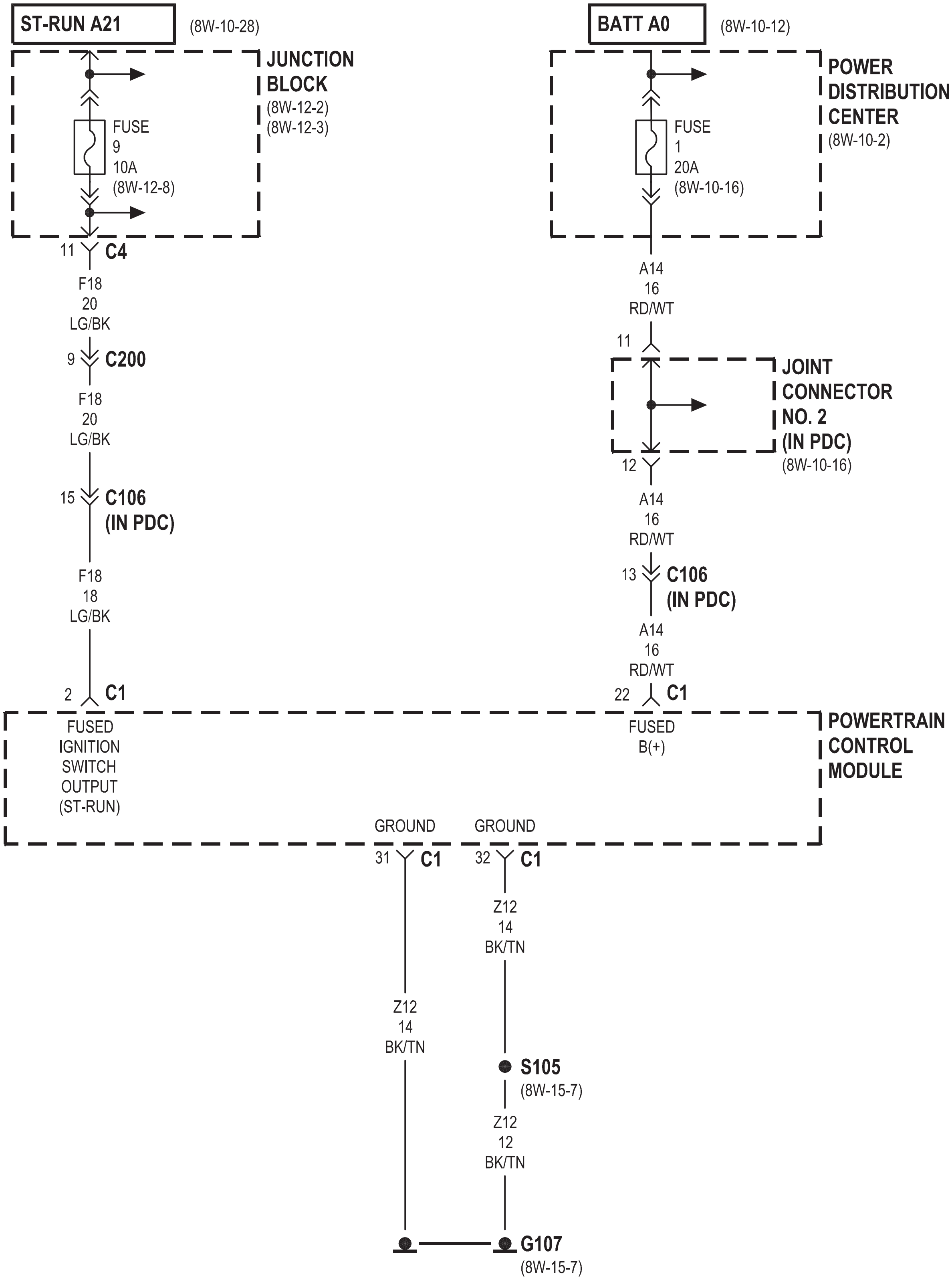
A/T

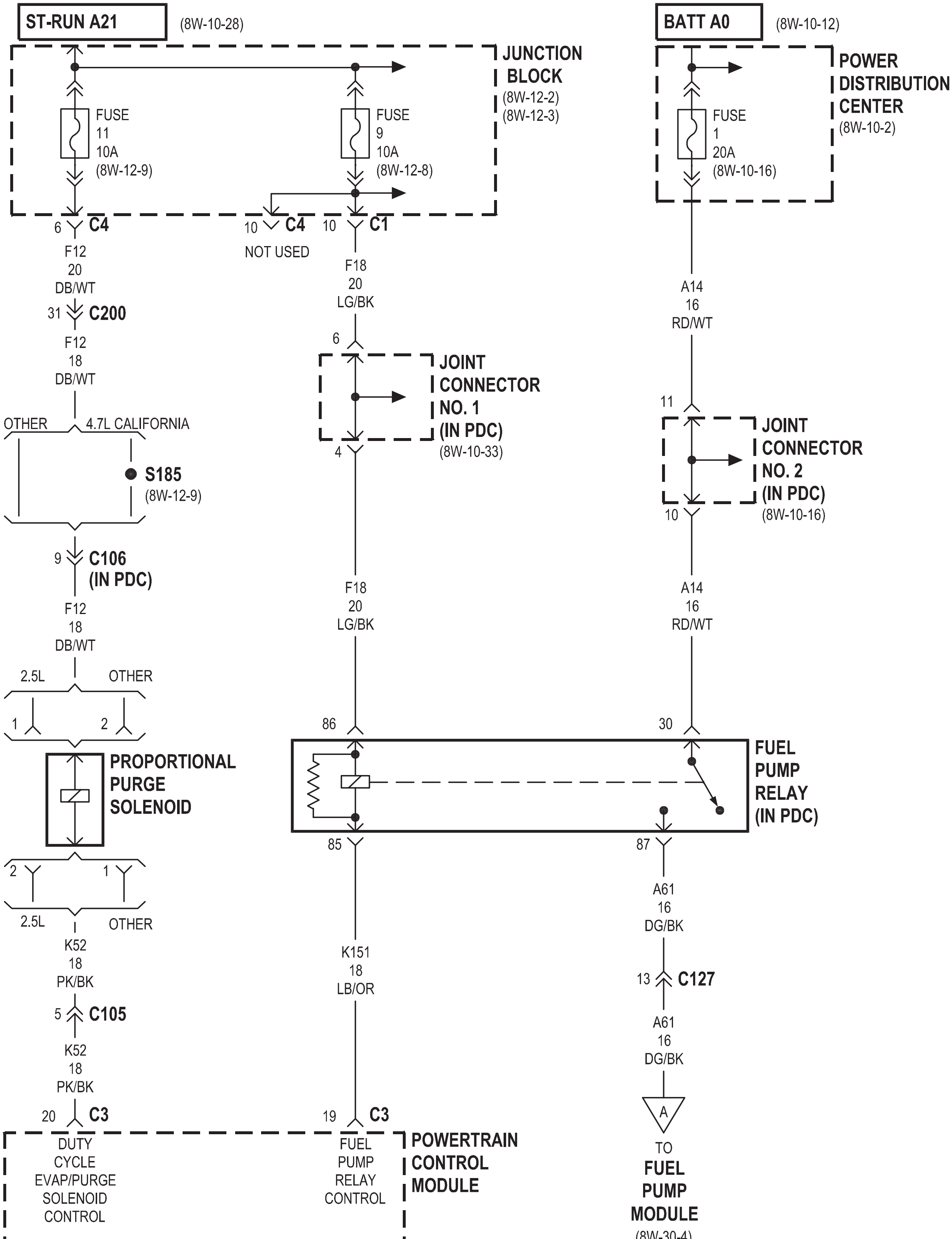


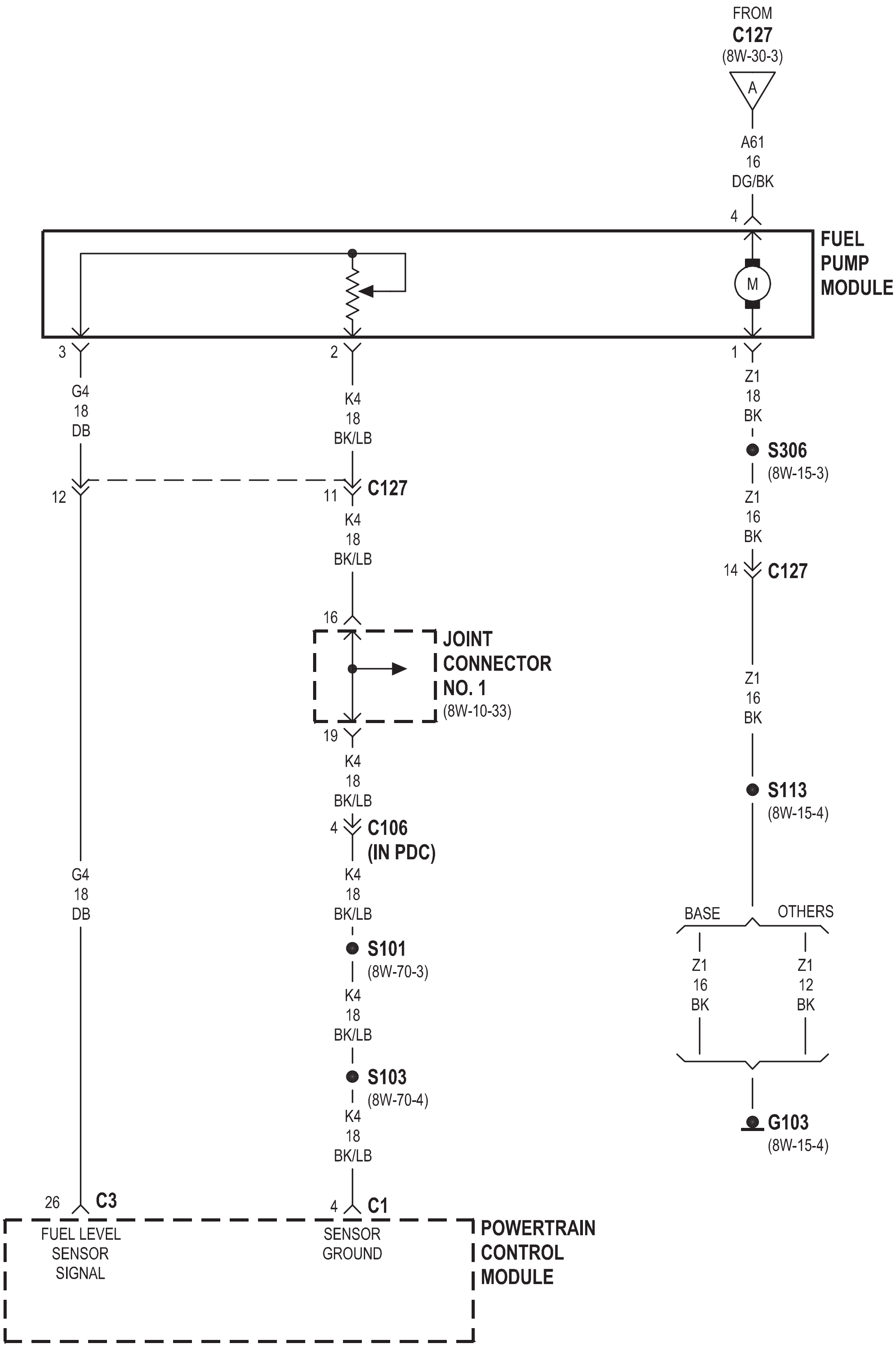
AN002103 J008W-1

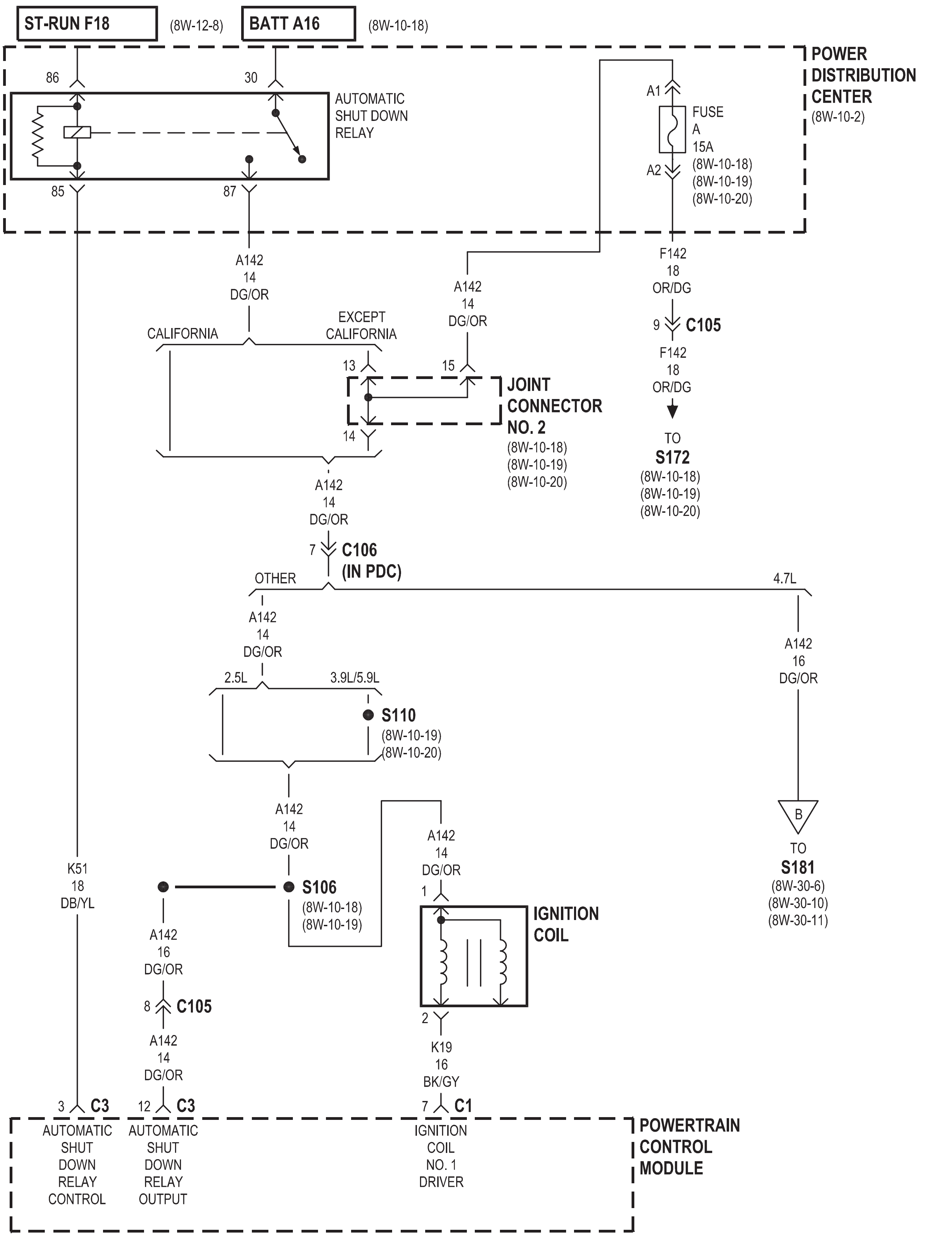
8W-30 FUEL/IGNITION SYSTEMS

Component	Page
A/C Compressor Clutch Relay	8W-30-22
A/C High Pressure Switch	8W-30-23
A/C Low Pressure Switch	8W-30-23
A/C- Heater Control	8W-30-23
Airbag Control Module	8W-30-27
Automatic Shut Down Relay	8W-30-5, 7, 8, 9, 12, 13, 14
Battery Temperature Sensor	8W-30-20
Brake Lamp Switch	8W-30-24
Camshaft Position Sensor	8W-30-18
Capacitor No. 1	8W-30-11
Capacitor No. 2	8W-30-11
Central Timer Module	8W-30-27
Clockspring	8W-30-26
Coil On Plug No. 1	8W-30-6
Coil On Plug No. 2	8W-30-6
Coil On Plug No. 3	8W-30-6
Coil On Plug No. 4	8W-30-6
Coil On Plug No. 5	8W-30-6
Coil On Plug No. 6	8W-30-6
Coil On Plug No. 7	8W-30-6
Coil On Plug No. 8	8W-30-6
Controller Anti-Lock Brake	8W-30-20, 24, 27
Crankshaft Position Sensor	8W-30-18
Data Link Connector	8W-30-22, 27, 28
Engine Coolant Temperature Sensor	8W-30-21
Engine Oil Pressure Sensor	8W-30-20
Engine Starter Motor Relay	8W-30-25
Fuel Injector No. 1	8W-30-7, 8, 10
Fuel Injector No. 2	8W-30-7, 9, 11
Fuel Injector No. 3	8W-30-7, 8, 10
Fuel Injector No. 4	8W-30-7, 9, 11
Fuel Injector No. 5	8W-30-8, 10
Fuel Injector No. 6	8W-30-9, 11
Fuel Injector No. 7	8W-30-8, 10
Fuel Injector No. 8	8W-30-9, 10
Fuel Pump Module	8W-30-4
Fuel Pump Relay	8W-30-3
Fuse 1 (PDC)	8W-30-2, 3
Fuse 3 (PDC)	8W-30-15
Fuse 7 (JB)	8W-30-22
Fuse 9 (JB)	8W-30-2, 3, 22
Fuse 11 (JB)	8W-30-3, 15
Fuse 12 (JB)	8W-30-28
Fuse A (PDC)	8W-30-5, 12, 13, 14, 15
Fuse E (PDC)	8W-30-24
G103	8W-30-4
G105	8W-30-12, 13, 14, 16, 23
G107	8W-30-2, 28
G200	8W-30-24, 26, 28
Generator	8W-30-17
Idle Air Control Motor	8W-30-21
Ignition Coil	8W-30-5
Instrument Cluster	8W-30-27
Intake Air Temperature Sensor	8W-30-21
Joint Connector No. 1	8W-30-3, 4, 20, 22, 26
Joint Connector No. 2	8W-30-2, 3, 5, 7, 8, 9, 12, 13, 14, 15, 24
Joint Connector No. 3	8W-30-27
Joint Connector No. 4	8W-30-24, 26, 28
Junction Block	8W-30-2, 3, 15, 22, 24, 28
Leak Detection Pump	8W-30-17
Manifold Absolute Pressure Sensor	8W-30-19
Output Speed Sensor	8W-30-25
Overdrive Switch	8W-30-26
Overhead Console	8W-30-27
Oxygen Sensor 1/1 Upstream	8W-30-12, 13, 14, 16
Oxygen Sensor 1/2 Downstream	8W-30-12, 13, 16
Oxygen Sensor 2/1 Upstream	8W-30-16
Oxygen Sensor 2/2 Downstream	8W-30-14, 16
Oxygen Sensor Downstream Heater Relay	8W-30-15
Oxygen Sensor Upstream Heater Relay	8W-30-15
Park/Neutral Position Switch	8W-30-25
Power Distribution Center	8W-30-2, 3, 5, 7, 8, 9, 12, 13, 14, 15, 25
Power Steering Pressure Switch	8W-30-23
Powertrain Control Module	8W-30-2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 29, 20, 21, 22, 23, 24, 25, 26, 27, 28
Proportional Purge Solenoid	8W-30-3
Radiator Fan Relay	8W-30-22
Radio	8W-30-27
Throttle Position Sensor	8W-30-19
Transmission Control Module	8W-30-18, 19, 20, 26, 27, 28
Transmission Control Relay	8W-30-17, 25
Transmission Solenoid	8W-30-25
Vehicle Speed Control Servo	8W-30-24, 26
Vehicle Speed Control/Horn Switches	8W-30-26

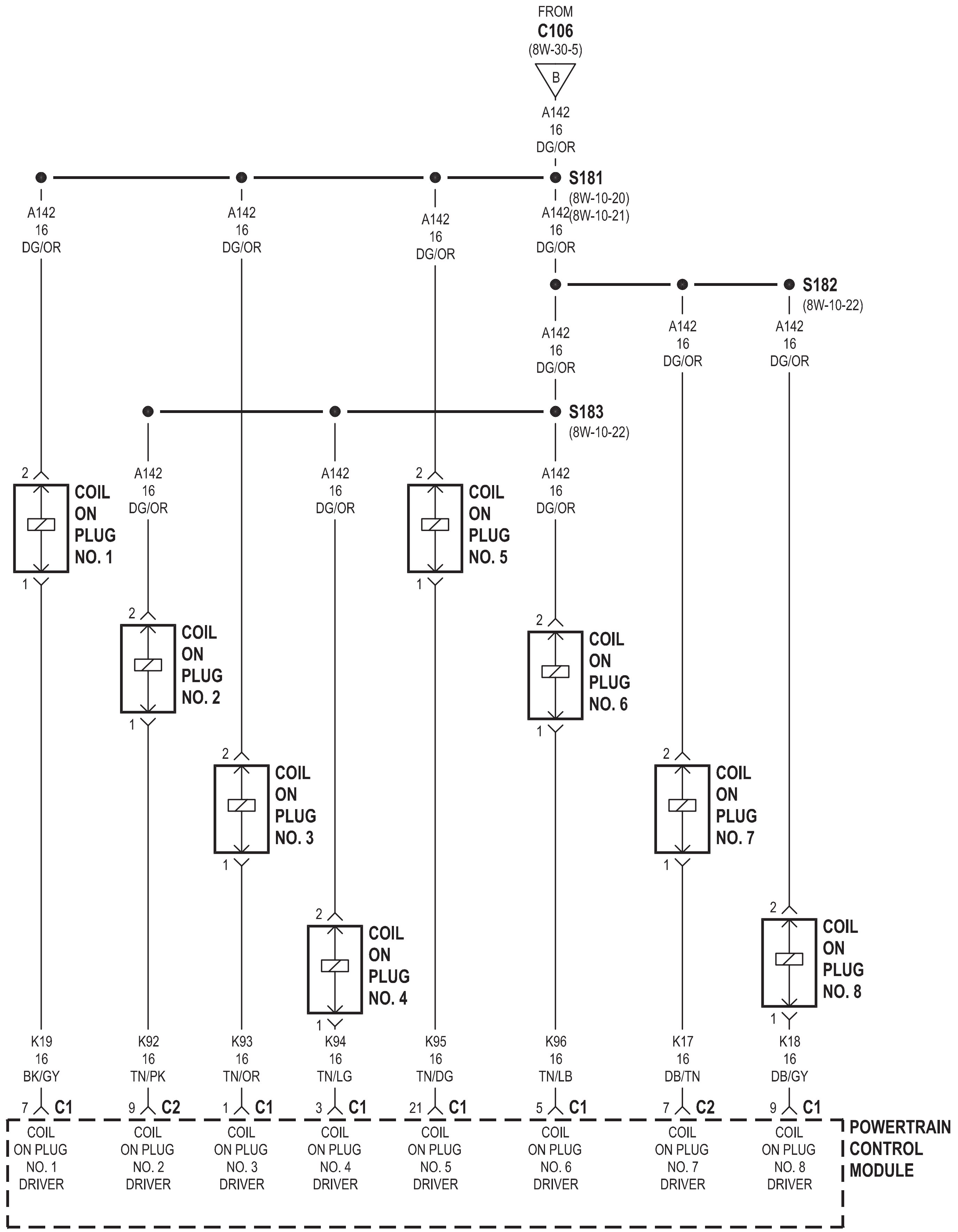

ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
10A
(8W-12-8)
11 C4
F18
20
LG/BK
9 C200
F18
20
LG/BK
15 C106 (IN PDC)
F18
18
LG/BK
2 C1
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
1
20A
(8W-10-16)
A14
16
RD/WT
11
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-16)
12
A14
16
RD/WT
13 C106 (IN PDC)
A14
16
RD/WT
22 C1
POWERTRAIN CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
FUSED B(+)
GROUND
GROUND
31 C1
32 C1
Z12
14
BK/TN
Z12
14
BK/TN
S105
(8W-15-7)
Z12
12
BK/TN
G107
(8W-15-7)

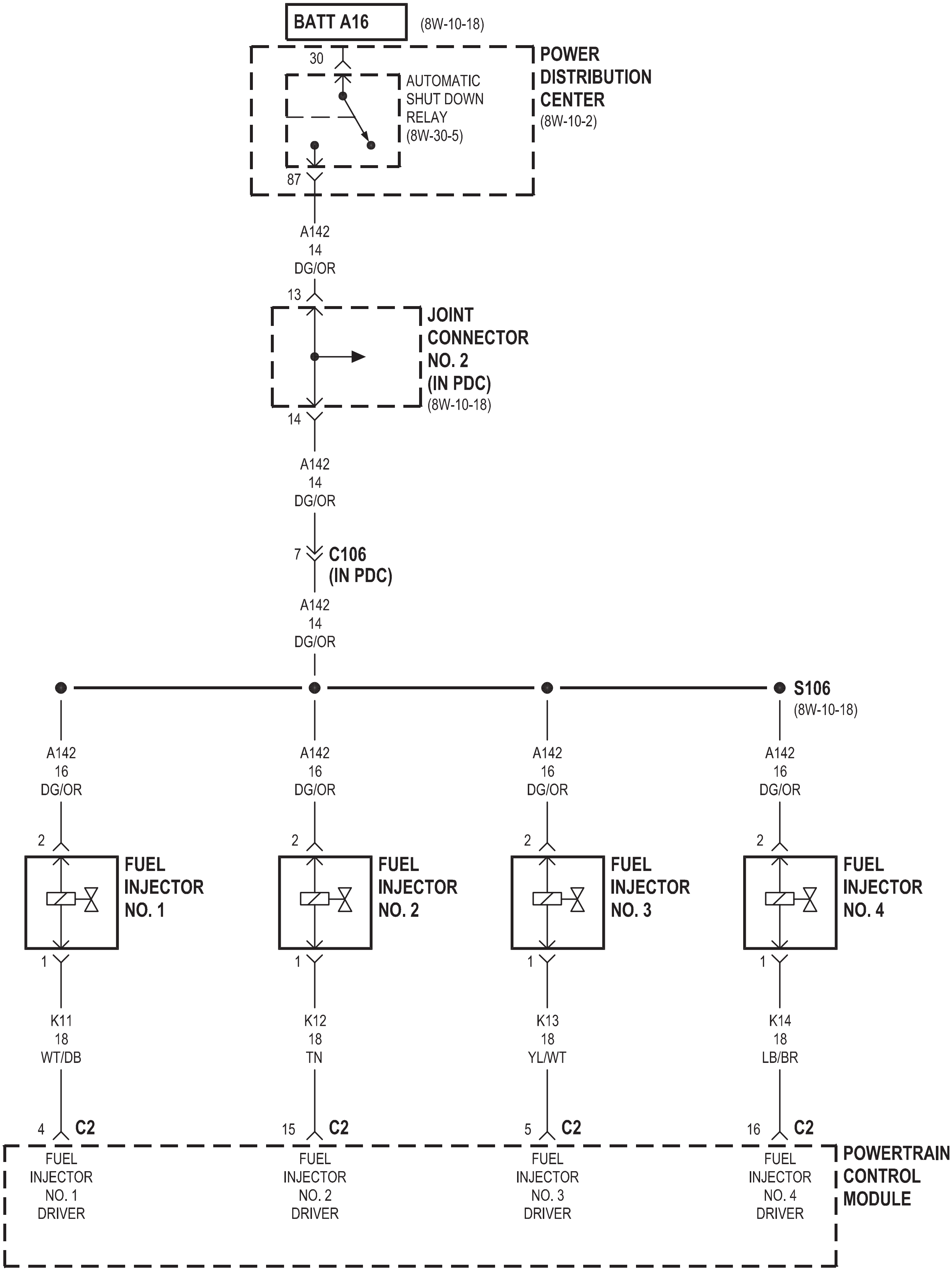

ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 11 10A (8W-12-9)
FUSE 9 10A (8W-12-8)
6 C4
10 C4
NOT USED
10 C1
F12 20 DB/WT
31 C200
F12 18 DB/WT
OTHER
4.7L CALIFORNIA
S185
(8W-12-9)
9 C106 (IN PDC)
F12 18 DB/WT
2.5L
OTHER
1
2
PROPORTIONAL PURGE SOLENOID
2
1
2.5L
OTHER
K52 18 PK/BK
5 C105
K52 18 PK/BK
20 C3
F18 20 LG/BK
6
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
4
F18 20 LG/BK
86
85
K151 18 LB/OR
19 C3
POWERTRAIN CONTROL MODULE
DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
FUEL PUMP RELAY CONTROL
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 1 20A (8W-10-16)
A14 16 RD/WT
11
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-16)
10
A14 16 RD/WT
30
FUEL PUMP RELAY (IN PDC)
87
A61 16 DG/BK
13 C127
A61 16 DG/BK
A
TO FUEL PUMP MODULE
(8W-30-4)


FROM
C127
(8W-30-3)
A
A61
16
DG/BK
4
FUEL
PUMP
MODULE
M
3
2
1
G4
18
DB
K4
18
BK/LB
Z1
18
BK
S306
(8W-15-3)
12
11
C127
Z1
16
BK
K4
18
BK/LB
14
C127
16
JOINT
CONNECTOR
NO. 1
(8W-10-33)
Z1
16
BK
19
K4
18
BK/LB
S113
(8W-15-4)
4
C106
(IN PDC)
G4
18
DB
K4
18
BK/LB
BASE
OTHERS
S101
(8W-70-3)
Z1
16
BK
Z1
12
BK
K4
18
BK/LB
S103
(8W-70-4)
G103
(8W-15-4)
K4
18
BK/LB
26
C3
4
C1
FUEL LEVEL
SENSOR
SIGNAL
SENSOR
GROUND
POWERTRAIN
CONTROL
MODULE

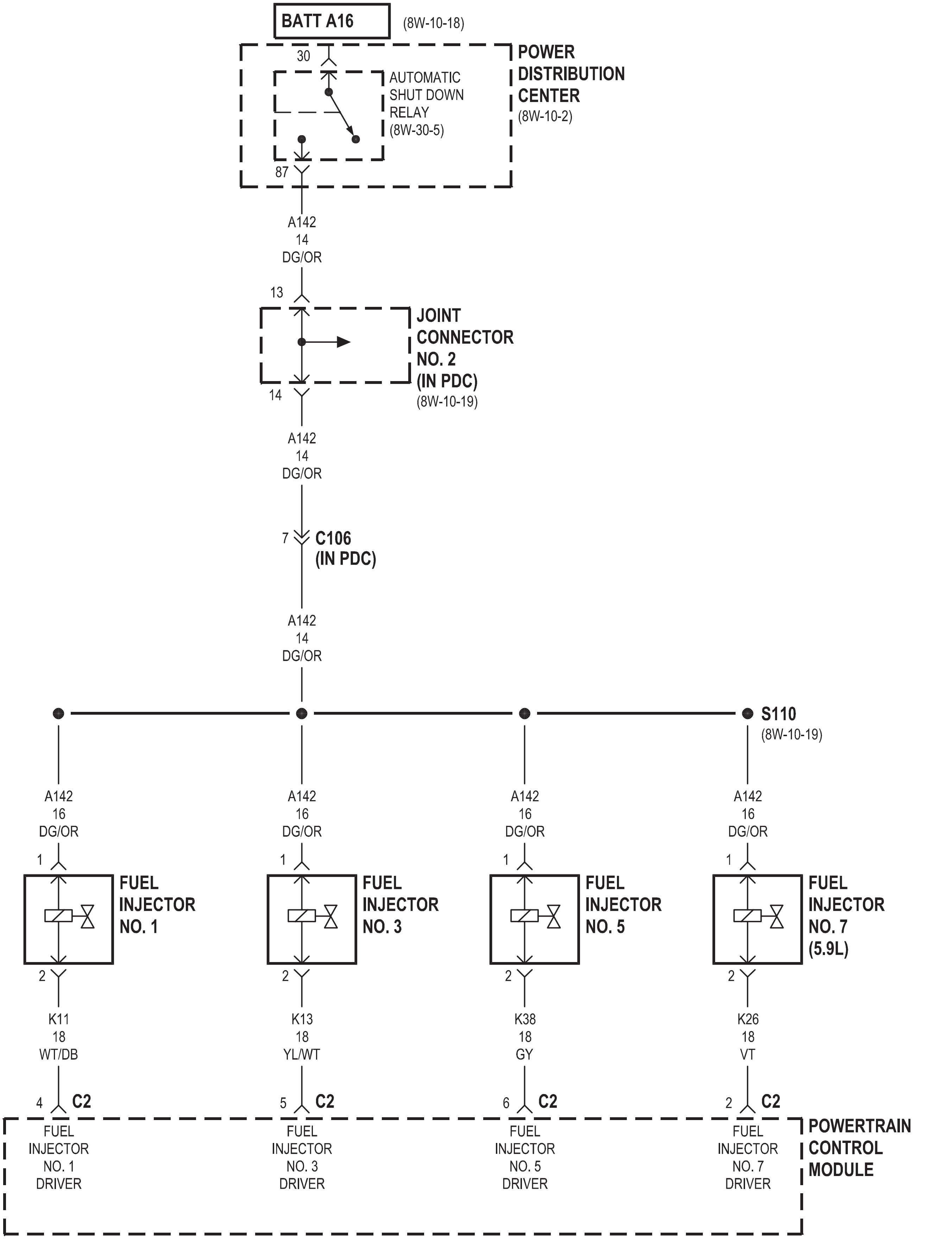

ST-RUN F18
(8W-12-8)
BATT A16
(8W-10-18)
POWER DISTRIBUTION CENTER
(8W-10-2)
86
30
AUTOMATIC SHUT DOWN RELAY
85
87
A1
FUSE A 15A
(8W-10-18)
(8W-10-19)
(8W-10-20)
A2
A142 14 DG/OR
CALIFORNIA
EXCEPT CALIFORNIA
A142 14 DG/OR
F142 18 OR/DG
9 C105
F142 18 OR/DG
13
15
JOINT CONNECTOR NO. 2
(8W-10-18)
(8W-10-19)
(8W-10-20)
14
TO S172
(8W-10-18)
(8W-10-19)
(8W-10-20)
A142 14 DG/OR
7 C106 (IN PDC)
OTHER
4.7L
A142 14 DG/OR
A142 16 DG/OR
2.5L
3.9L/5.9L
S110
(8W-10-19)
(8W-10-20)
A142 14 DG/OR
A142 14 DG/OR
K51 18 DB/YL
S106
(8W-10-18)
(8W-10-19)
1
IGNITION COIL
B
TO S181
(8W-30-6)
(8W-30-10)
(8W-30-11)
A142 16 DG/OR
8 C105
A142 14 DG/OR
2
K19 16 BK/GY
3 C3
12 C3
7 C1
AUTOMATIC SHUT DOWN RELAY CONTROL
AUTOMATIC SHUT DOWN RELAY OUTPUT
IGNITION COIL NO. 1 DRIVER
POWERTRAIN CONTROL MODULE

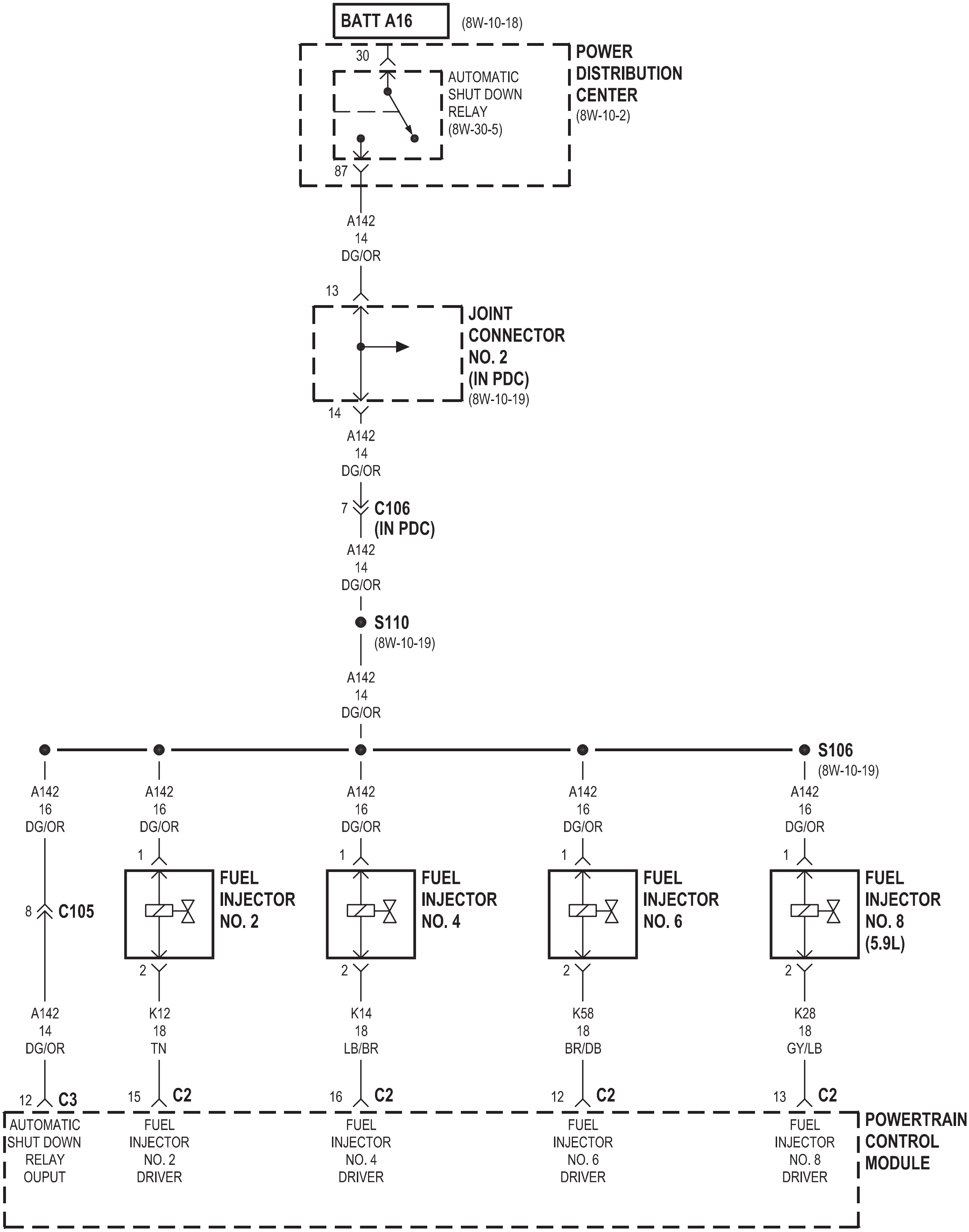
4.7L

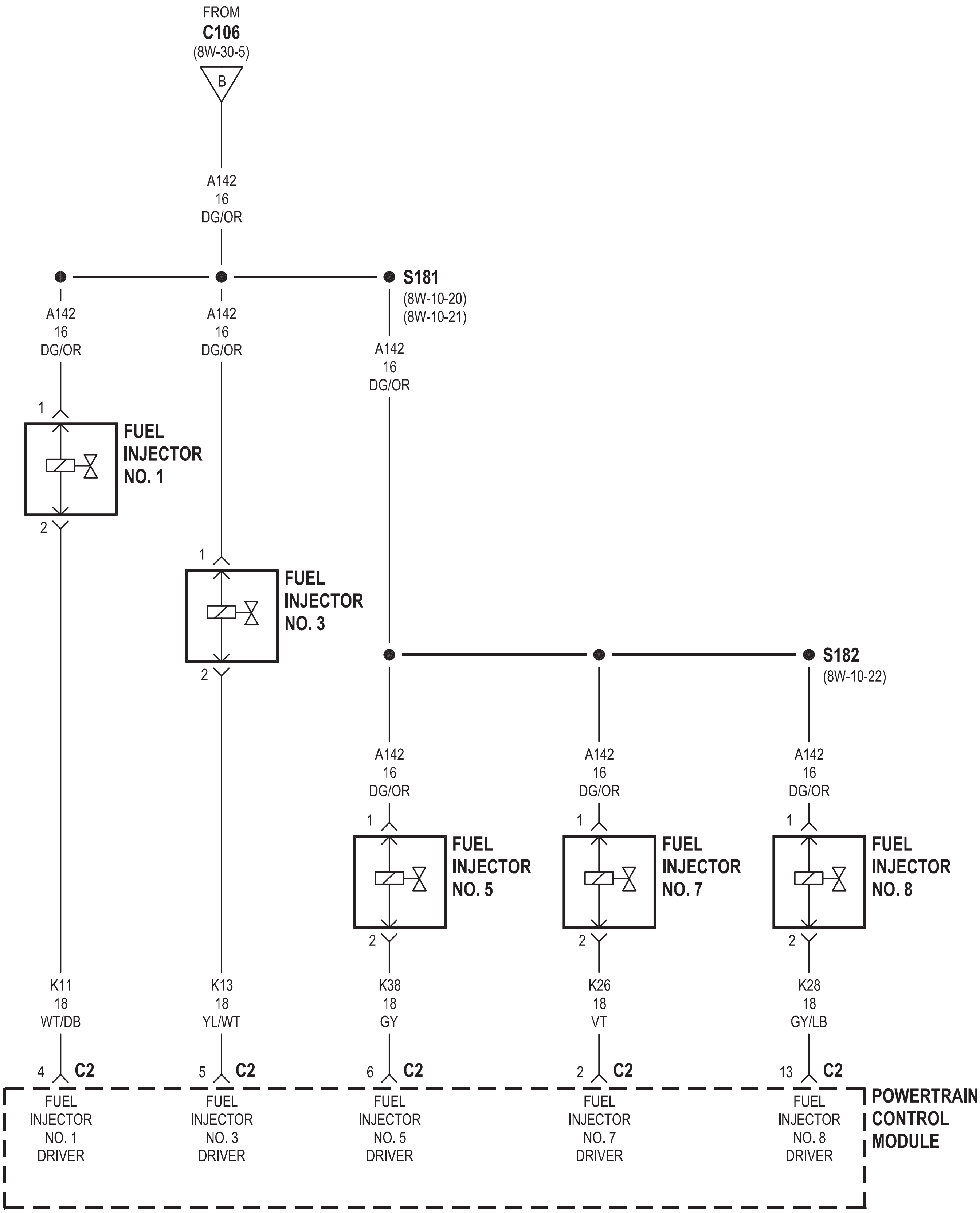

FROM
C106
(8W-30-5)
B
A142
16
DG/OR
S181
(8W-10-20)
(8W-10-21)
S182
(8W-10-22)
S183
(8W-10-22)
COIL ON PLUG NO. 1
COIL ON PLUG NO. 2
COIL ON PLUG NO. 3
COIL ON PLUG NO. 4
COIL ON PLUG NO. 5
COIL ON PLUG NO. 6
COIL ON PLUG NO. 7
COIL ON PLUG NO. 8
K19 16 BK/GY
K92 16 TN/PK
K93 16 TN/OR
K94 16 TN/LG
K95 16 TN/DG
K96 16 TN/LB
K17 16 DB/TN
K18 16 DB/GY
7 C1
9 C2
1 C1
3 C1
21 C1
5 C1
7 C2
9 C1
COIL ON PLUG NO. 1 DRIVER
COIL ON PLUG NO. 2 DRIVER
COIL ON PLUG NO. 3 DRIVER
COIL ON PLUG NO. 4 DRIVER
COIL ON PLUG NO. 5 DRIVER
COIL ON PLUG NO. 6 DRIVER
COIL ON PLUG NO. 7 DRIVER
COIL ON PLUG NO. 8 DRIVER
POWERTRAIN CONTROL MODULE

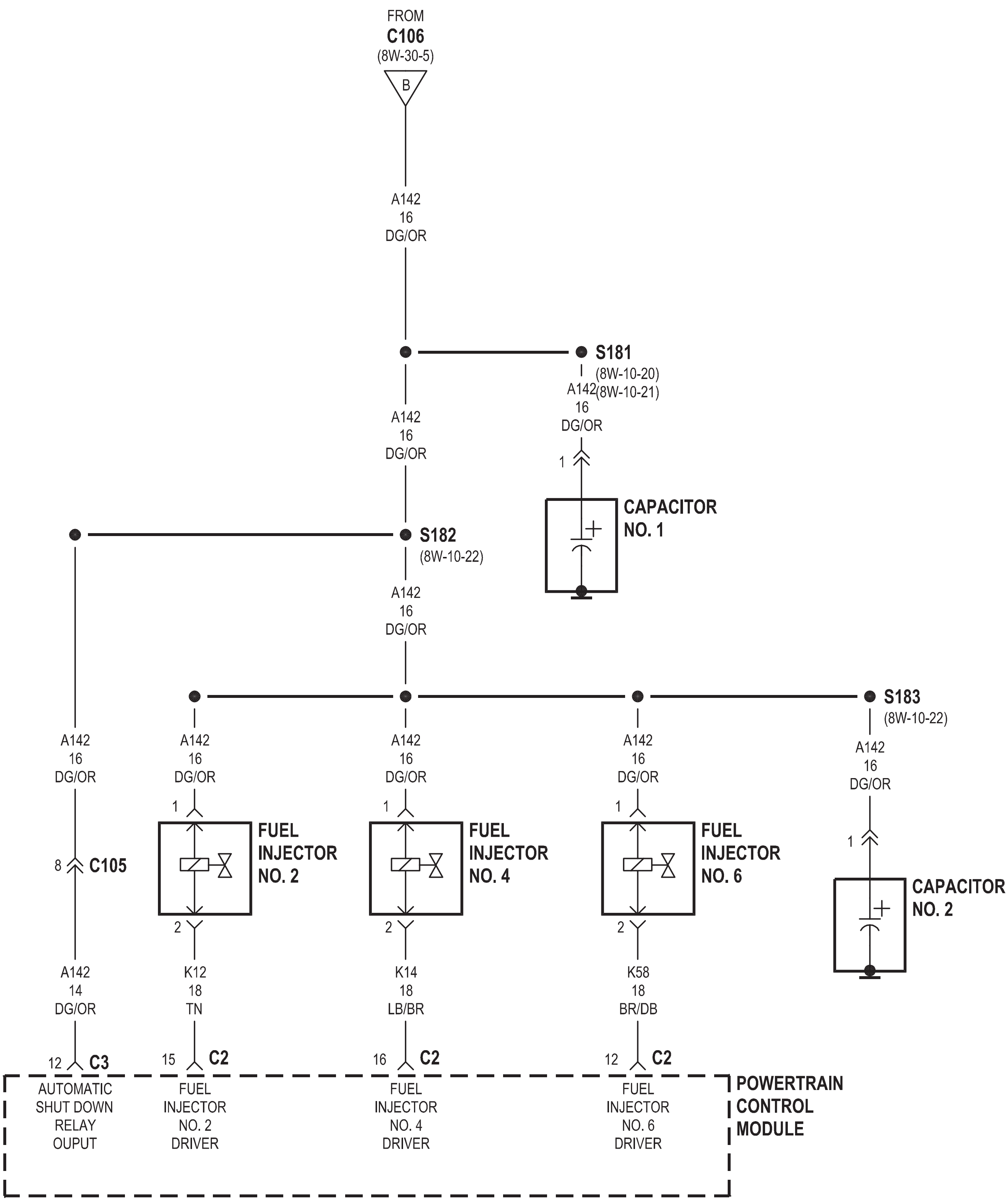

BATT A16
(8W-10-18)
30
AUTOMATIC
SHUT DOWN
RELAY
(8W-30-5)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
87
A142
14
DG/OR
13
JOINT
CONNECTOR
NO. 2
(IN PDC)
(8W-10-18)
14
A142
14
DG/OR
7
C106
(IN PDC)
A142
14
DG/OR
S106
(8W-10-18)
A142
16
DG/OR
2
FUEL
INJECTOR
NO. 1
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 3
FUEL
INJECTOR
NO. 4
1
K11
18
WT/DB
K12
18
TN
K13
18
YL/WT
K14
18
LB/BR
4
C2
15
C2
5
C2
16
C2
FUEL
INJECTOR
NO. 1
DRIVER
FUEL
INJECTOR
NO. 2
DRIVER
FUEL
INJECTOR
NO. 3
DRIVER
FUEL
INJECTOR
NO. 4
DRIVER
POWERTRAIN
CONTROL
MODULE

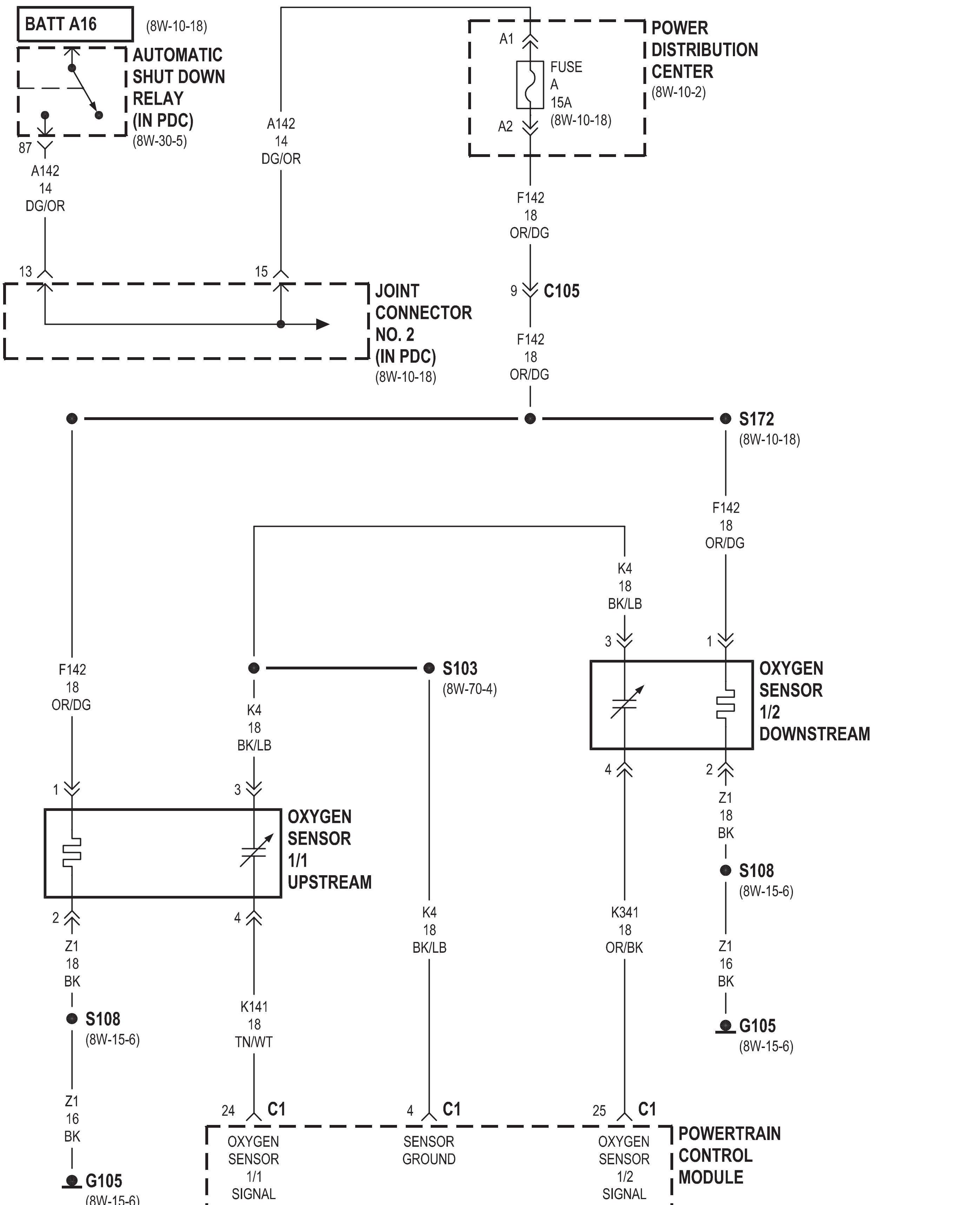
3.9L/5.9L

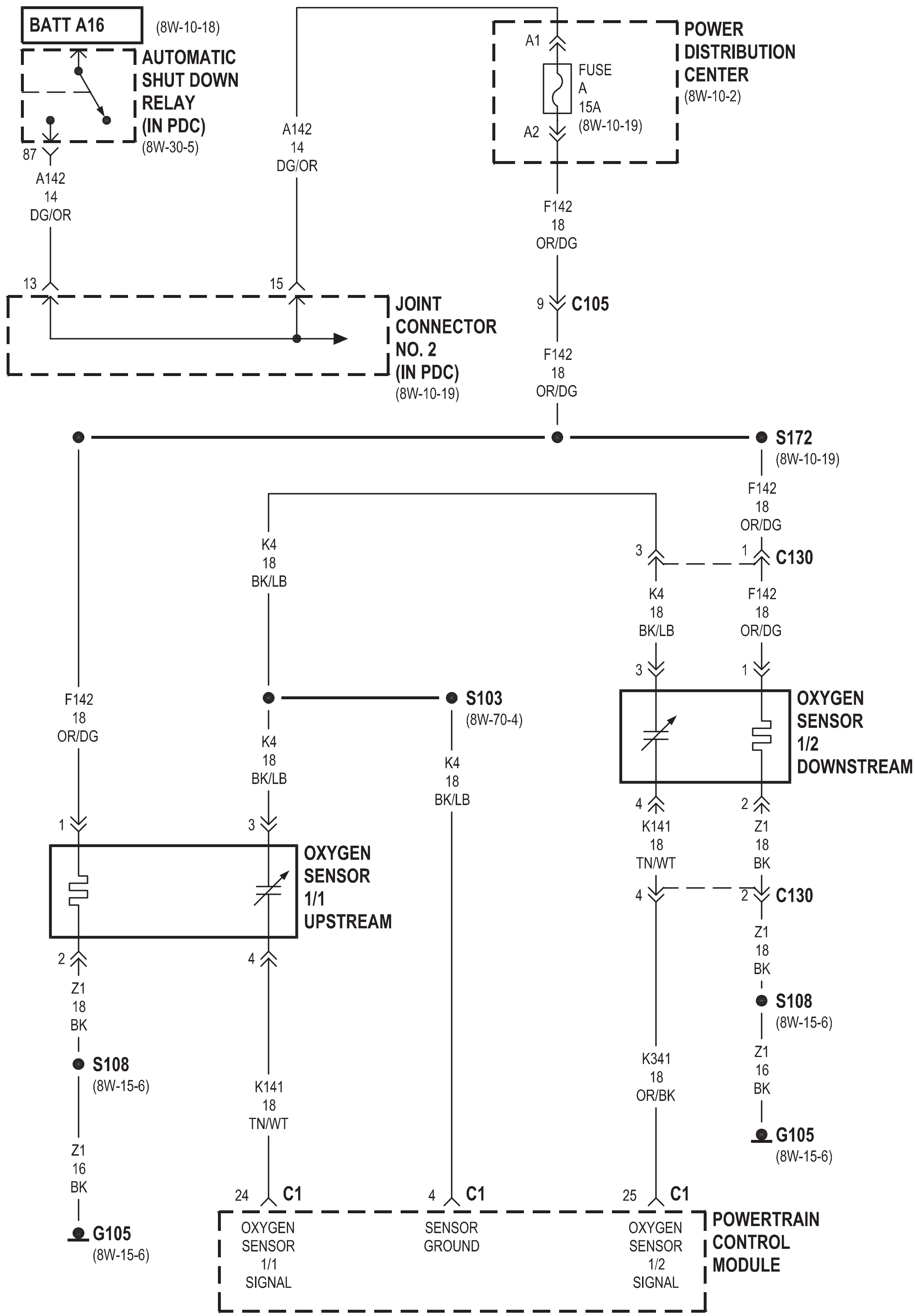

BATT A16
(8W-10-18)
30
AUTOMATIC
SHUT DOWN
RELAY
(8W-30-5)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
87
A142
14
DG/OR
13
JOINT
CONNECTOR
NO. 2
(IN PDC)
(8W-10-19)
14
A142
14
DG/OR
7
C106
(IN PDC)
A142
14
DG/OR
S110
(8W-10-19)
A142
16
DG/OR
1
FUEL
INJECTOR
NO. 1
2
K11
18
WT/DB
4
C2
FUEL
INJECTOR
NO. 1
DRIVER
A142
16
DG/OR
1
FUEL
INJECTOR
NO. 3
2
K13
18
YL/WT
5
C2
FUEL
INJECTOR
NO. 3
DRIVER
A142
16
DG/OR
1
FUEL
INJECTOR
NO. 5
2
K38
18
GY
6
C2
FUEL
INJECTOR
NO. 5
DRIVER
A142
16
DG/OR
1
FUEL
INJECTOR
NO. 7
(5.9L)
2
K26
18
VT
2
C2
FUEL
INJECTOR
NO. 7
DRIVER
POWERTRAIN
CONTROL
MODULE


BATT A16
(8W-10-18)
30
AUTOMATIC
SHUT DOWN
RELAY
(8W-30-5)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
87
A142
14
DG/OR
13
JOINT
CONNECTOR
NO. 2
(IN PDC)
(8W-10-19)
14
A142
14
DG/OR
7
C106
(IN PDC)
A142
14
DG/OR
S110
(8W-10-19)
A142
14
DG/OR
S106
(8W-10-19)
A142
16
DG/OR
8
C105
A142
14
DG/OR
12
C3
1
FUEL
INJECTOR
NO. 2
2
K12
18
TN
15
C2
FUEL
INJECTOR
NO. 4
K14
18
LB/BR
16
C2
FUEL
INJECTOR
NO. 6
K58
18
BR/DB
12
C2
FUEL
INJECTOR
NO. 8
(5.9L)
K28
18
GY/LB
13
C2
AUTOMATIC
SHUT DOWN
RELAY
OUPUT
FUEL
INJECTOR
NO. 2
DRIVER
FUEL
INJECTOR
NO. 4
DRIVER
FUEL
INJECTOR
NO. 6
DRIVER
FUEL
INJECTOR
NO. 8
DRIVER
POWERTRAIN
CONTROL
MODULE


FROM
C106
(8W-30-5)
B
A142
16
DG/OR
S181
(8W-10-20)
(8W-10-21)
A142
16
DG/OR
A142
16
DG/OR
A142
16
DG/OR
1
FUEL
INJECTOR
NO. 1
2
1
FUEL
INJECTOR
NO. 3
2
S182
(8W-10-22)
A142
16
DG/OR
A142
16
DG/OR
A142
16
DG/OR
1
FUEL
INJECTOR
NO. 5
2
1
FUEL
INJECTOR
NO. 7
2
1
FUEL
INJECTOR
NO. 8
2
K11
18
WT/DB
K13
18
YL/WT
K38
18
GY
K26
18
VT
K28
18
GY/LB
4 C2
5 C2
6 C2
2 C2
13 C2
FUEL
INJECTOR
NO. 1
DRIVER
FUEL
INJECTOR
NO. 3
DRIVER
FUEL
INJECTOR
NO. 5
DRIVER
FUEL
INJECTOR
NO. 7
DRIVER
FUEL
INJECTOR
NO. 8
DRIVER
POWERTRAIN
CONTROL
MODULE

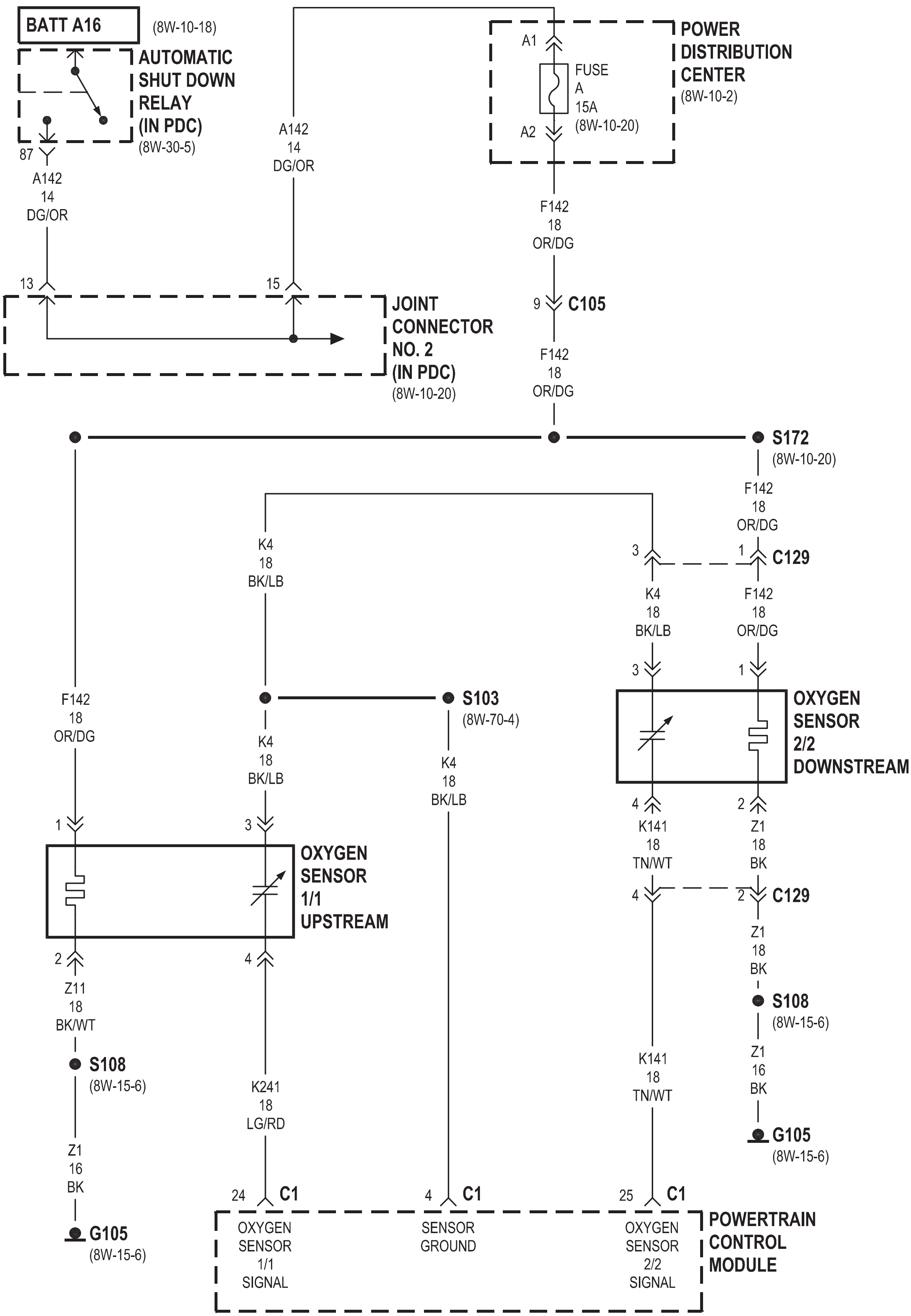

FROM
C106
(8W-30-5)
B
A142
16
DG/OR
S181
(8W-10-20)
(8W-10-21)
A142
16
DG/OR
1
CAPACITOR
NO. 1
S182
(8W-10-22)
A142
16
DG/OR
S183
(8W-10-22)
A142
16
DG/OR
8
C105
1
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 4
FUEL
INJECTOR
NO. 6
CAPACITOR
NO. 2
2
A142
14
DG/OR
K12
18
TN
K14
18
LB/BR
K58
18
BR/DB
12
C3
15
C2
16
C2
12
C2
AUTOMATIC
SHUT DOWN
RELAY
OUPUT
FUEL
INJECTOR
NO. 2
DRIVER
FUEL
INJECTOR
NO. 4
DRIVER
FUEL
INJECTOR
NO. 6
DRIVER
POWERTRAIN
CONTROL
MODULE


BATT A16
(8W-10-18)
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-5)
87
A142
14
DG/OR
A142
14
DG/OR
A1
FUSE
A
15A
(8W-10-18)
A2
POWER DISTRIBUTION CENTER
(8W-10-2)
F142
18
OR/DG
13
15
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-18)
9
C105
F142
18
OR/DG
S172
(8W-10-18)
F142
18
OR/DG
K4
18
BK/LB
3
1
OXYGEN SENSOR 1/2 DOWNSTREAM
4
2
Z1
18
BK
S108
(8W-15-6)
Z1
16
BK
G105
(8W-15-6)
F142
18
OR/DG
S103
(8W-70-4)
K4
18
BK/LB
1
3
OXYGEN SENSOR 1/1 UPSTREAM
2
4
Z1
18
BK
S108
(8W-15-6)
Z1
16
BK
G105
(8W-15-6)
K141
18
TN/WT
K4
18
BK/LB
K341
18
OR/BK
24
C1
4
C1
25
C1
OXYGEN SENSOR 1/1 SIGNAL
SENSOR GROUND
OXYGEN SENSOR 1/2 SIGNAL
POWERTRAIN CONTROL MODULE

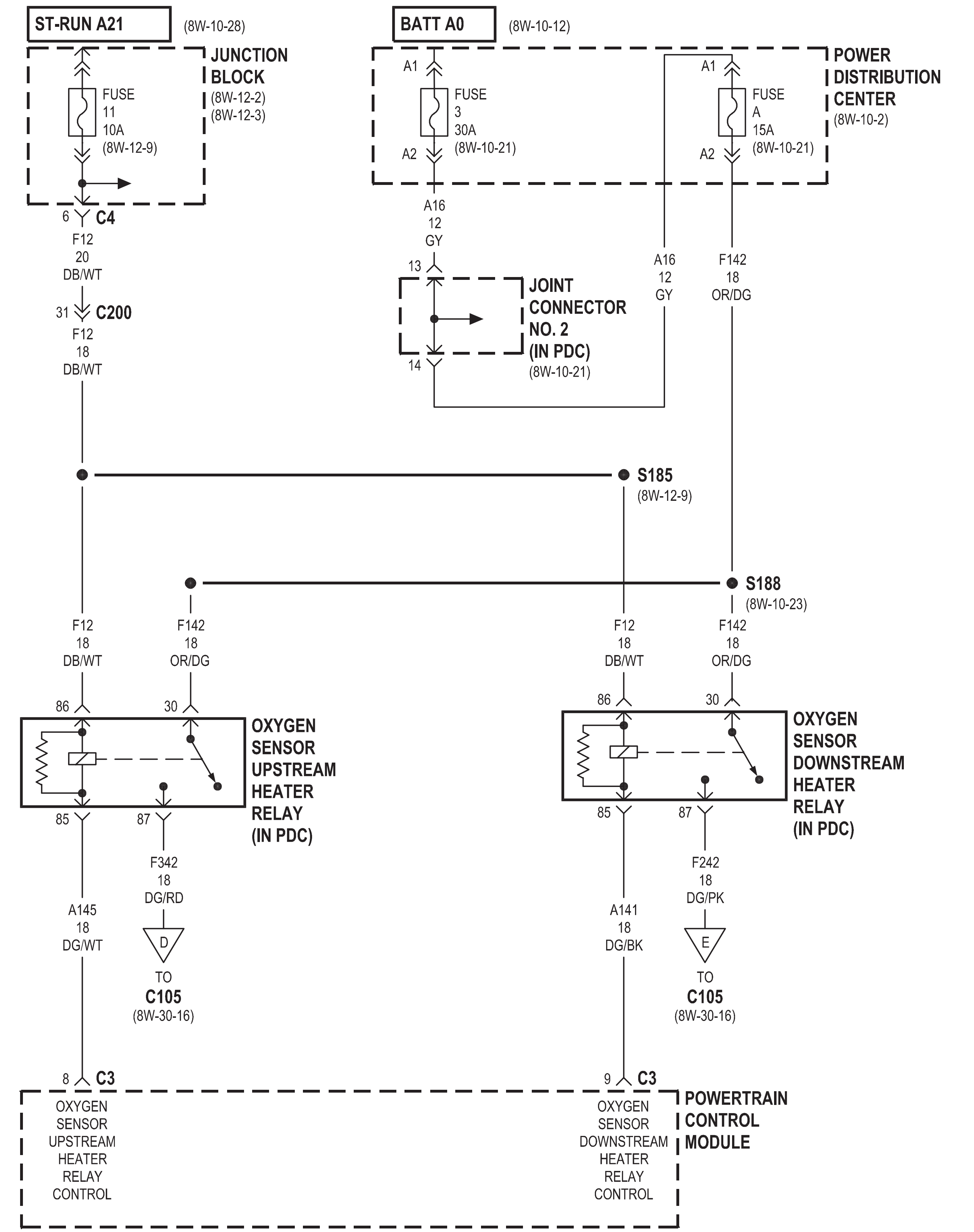


AN003013 J008W-1

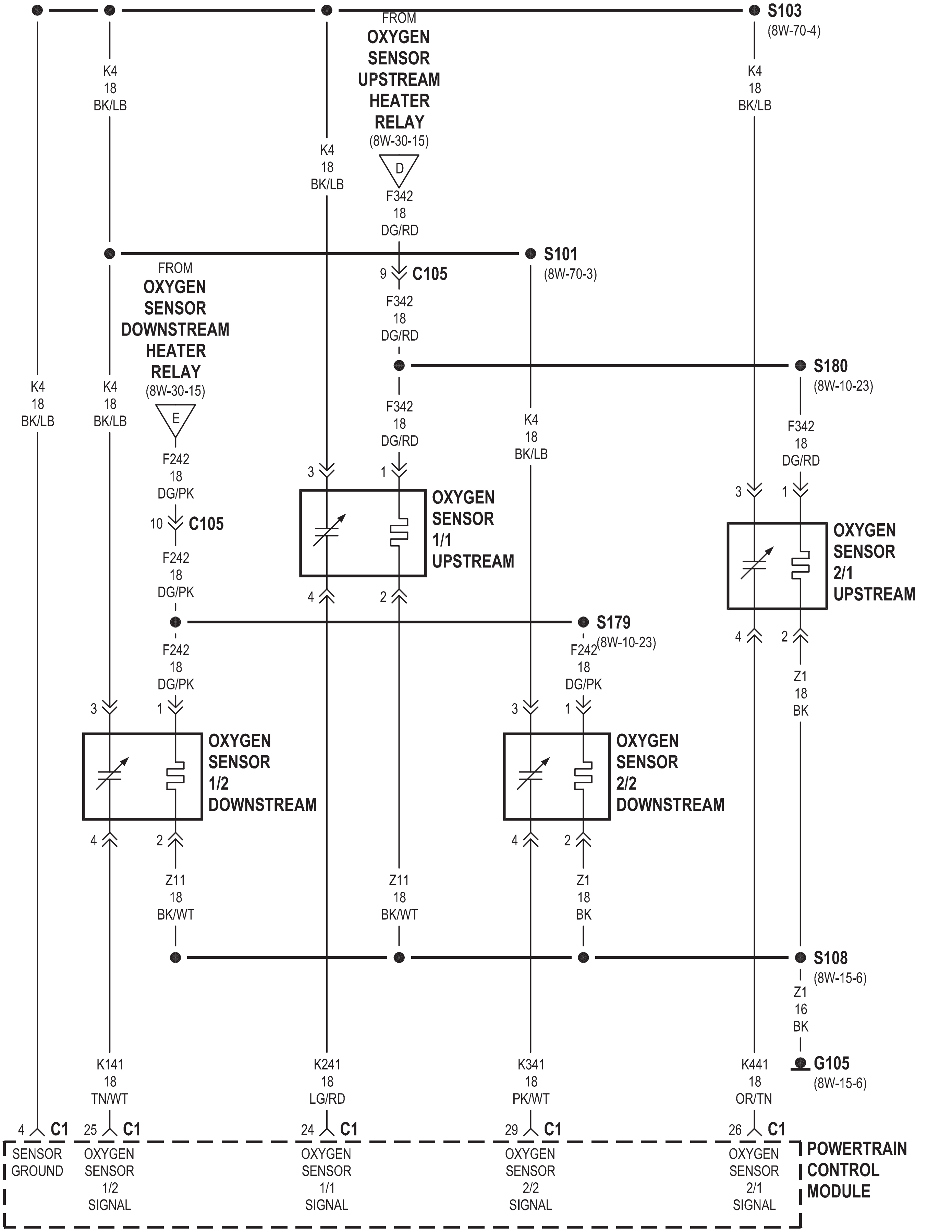
4.7L EXCEPT CALIFORNIA



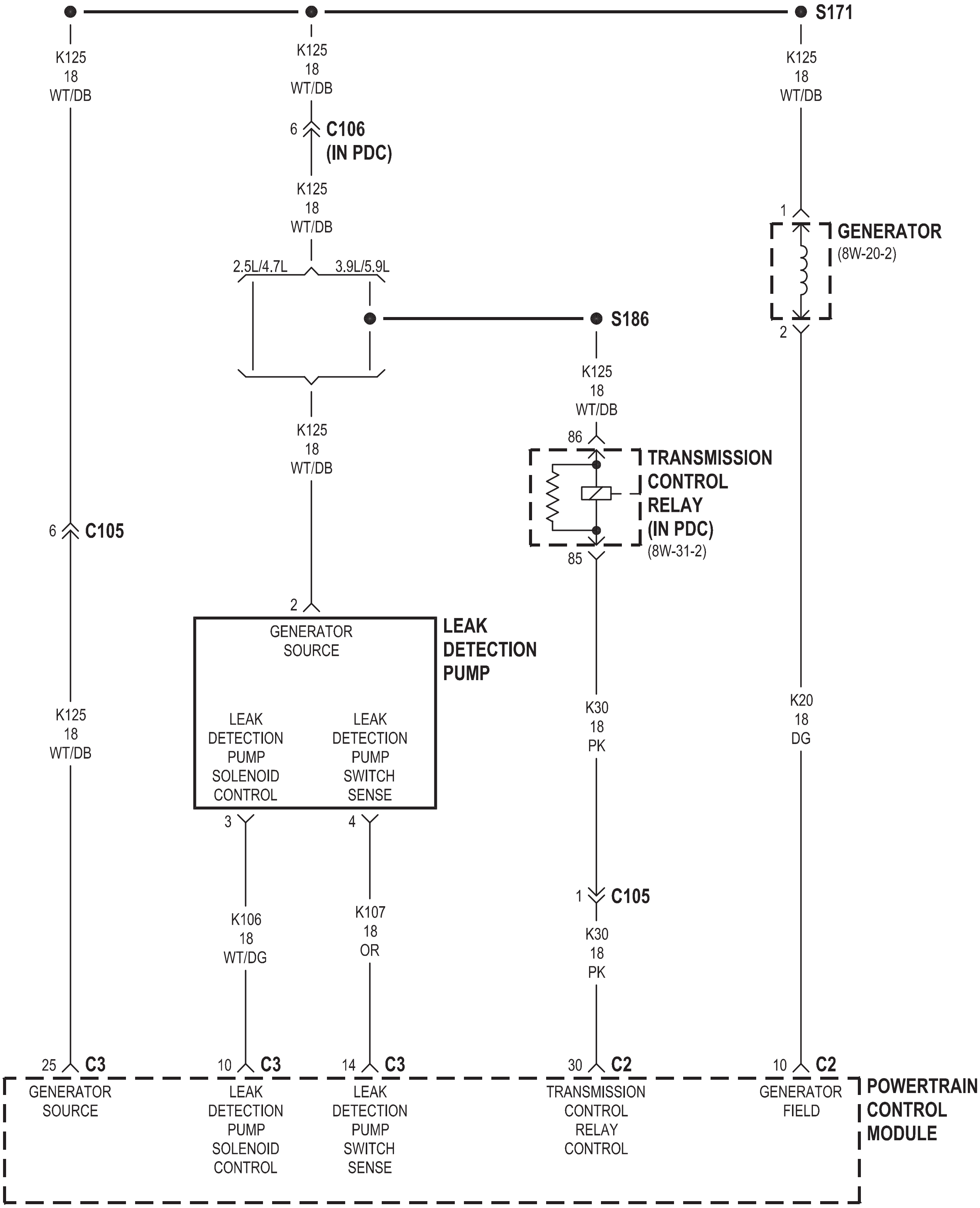
4.7L CALIFORNIA

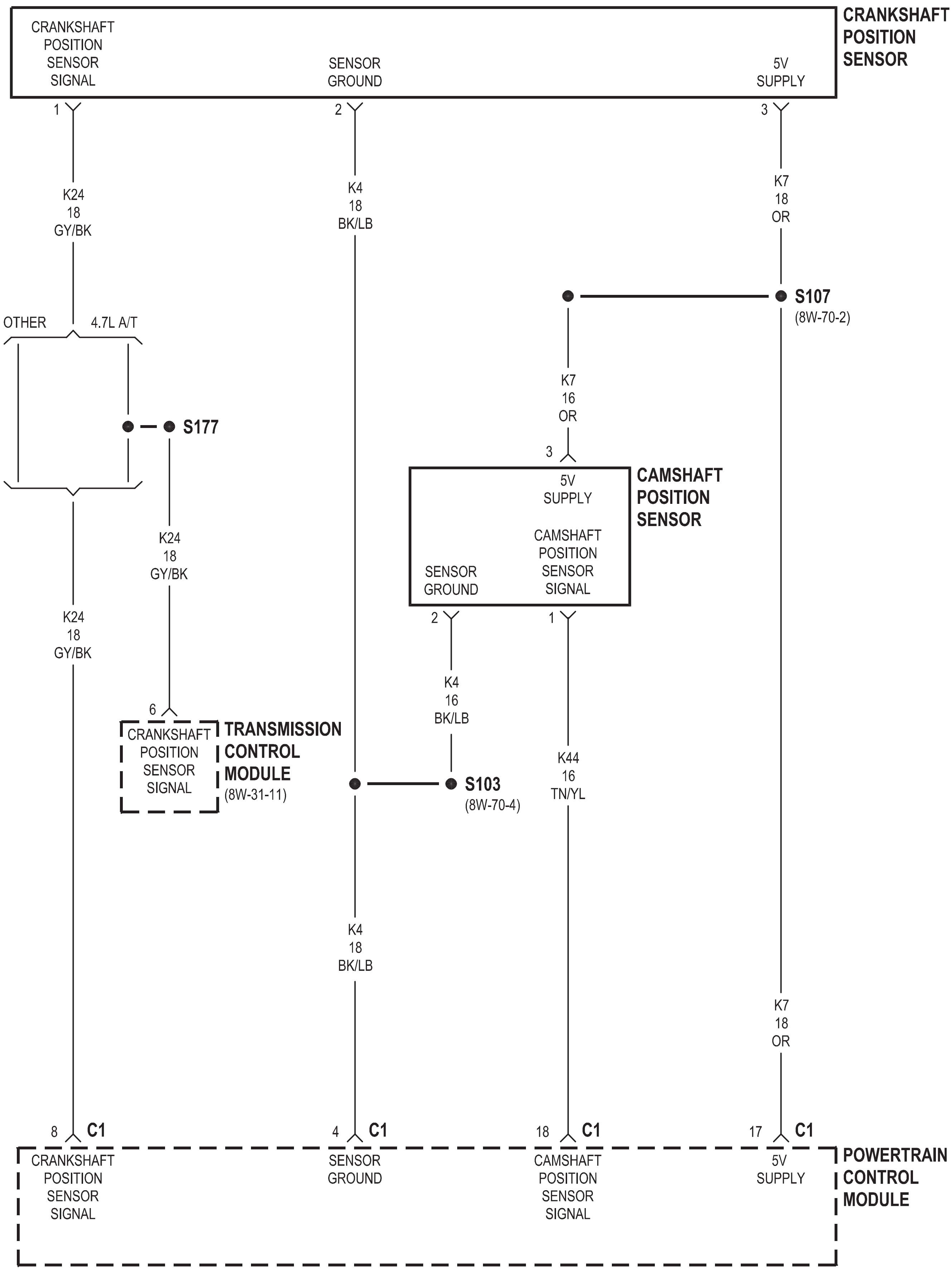


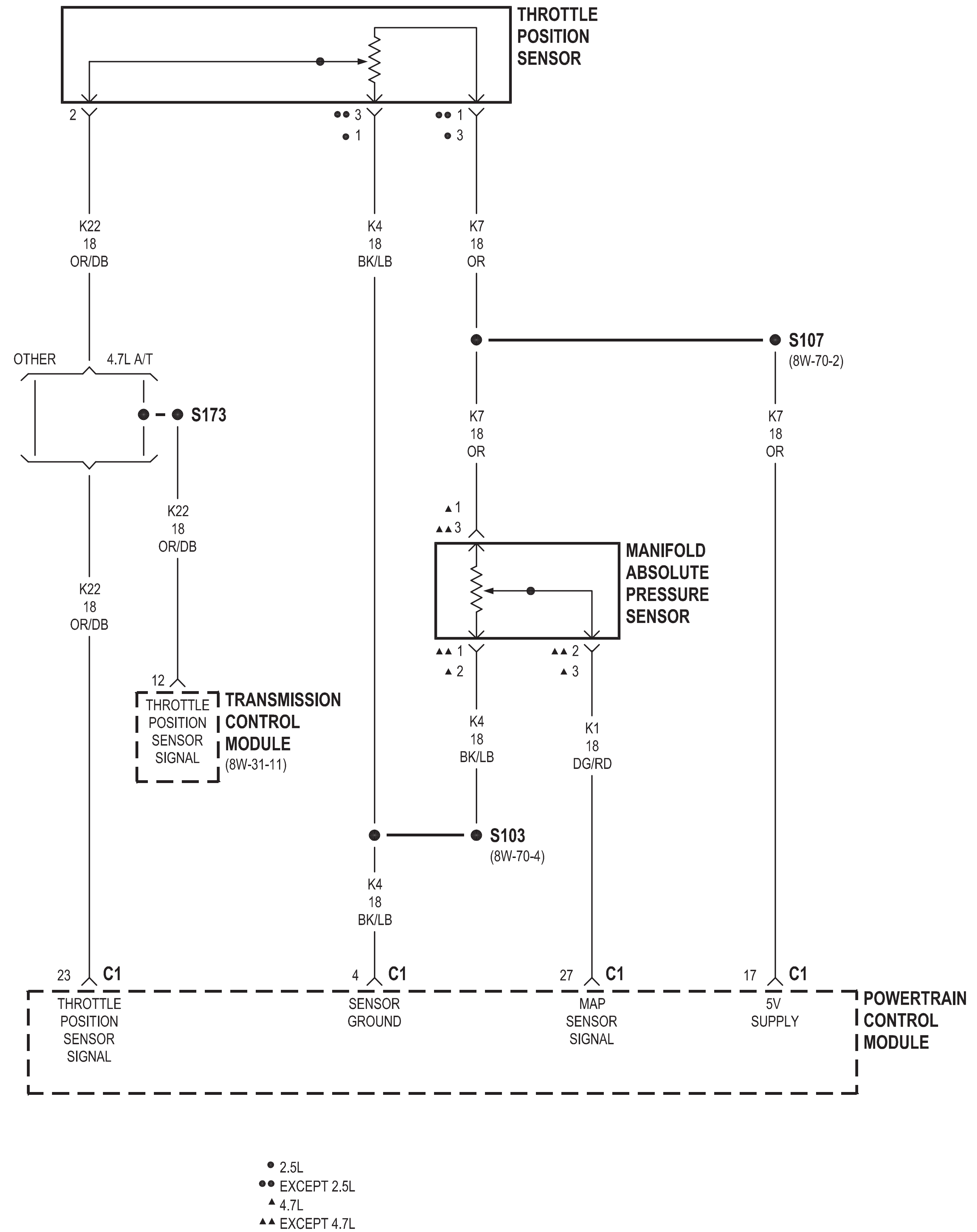
4.7L CALIFORNIA

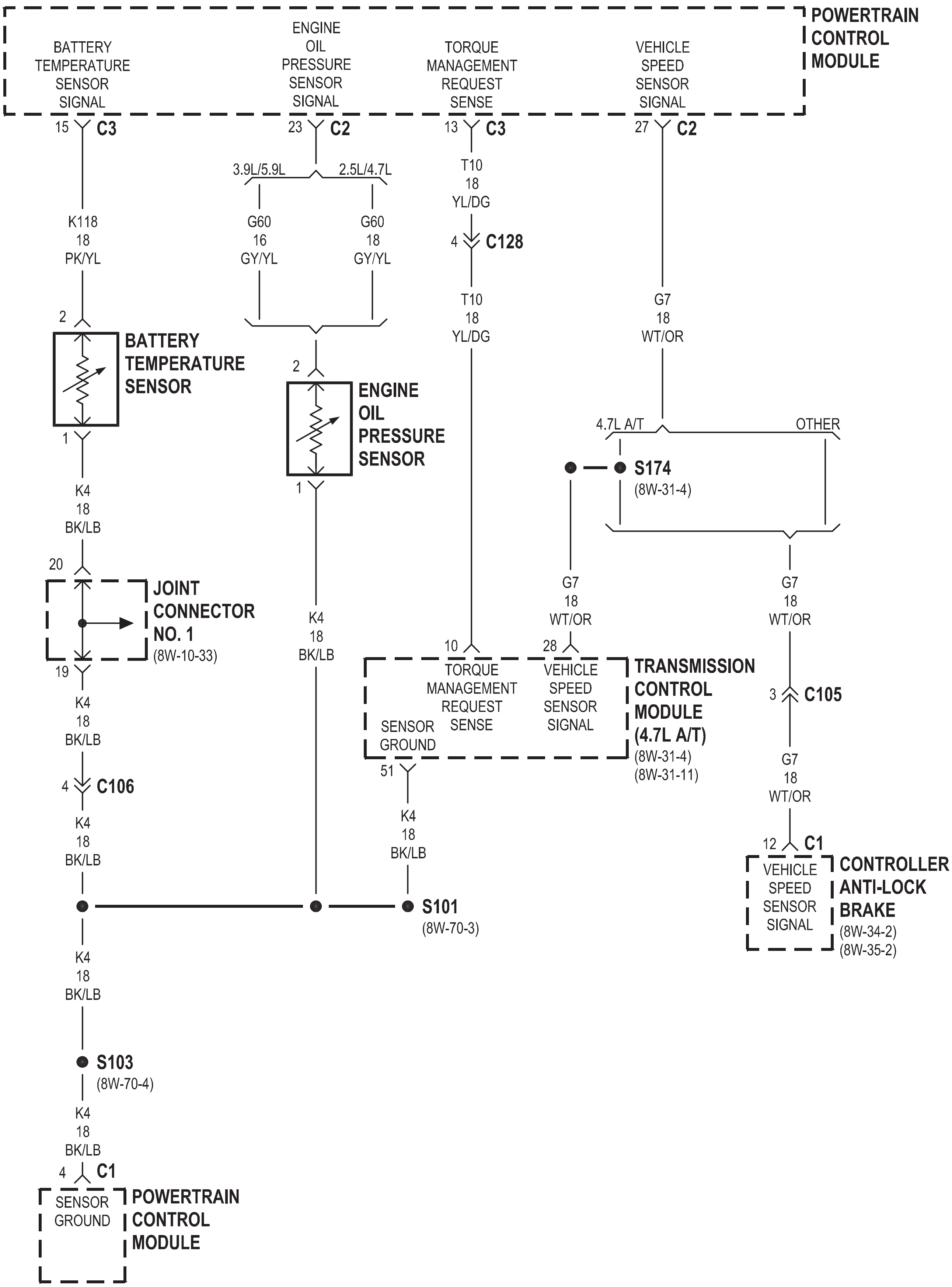


J008W-1 AN003016

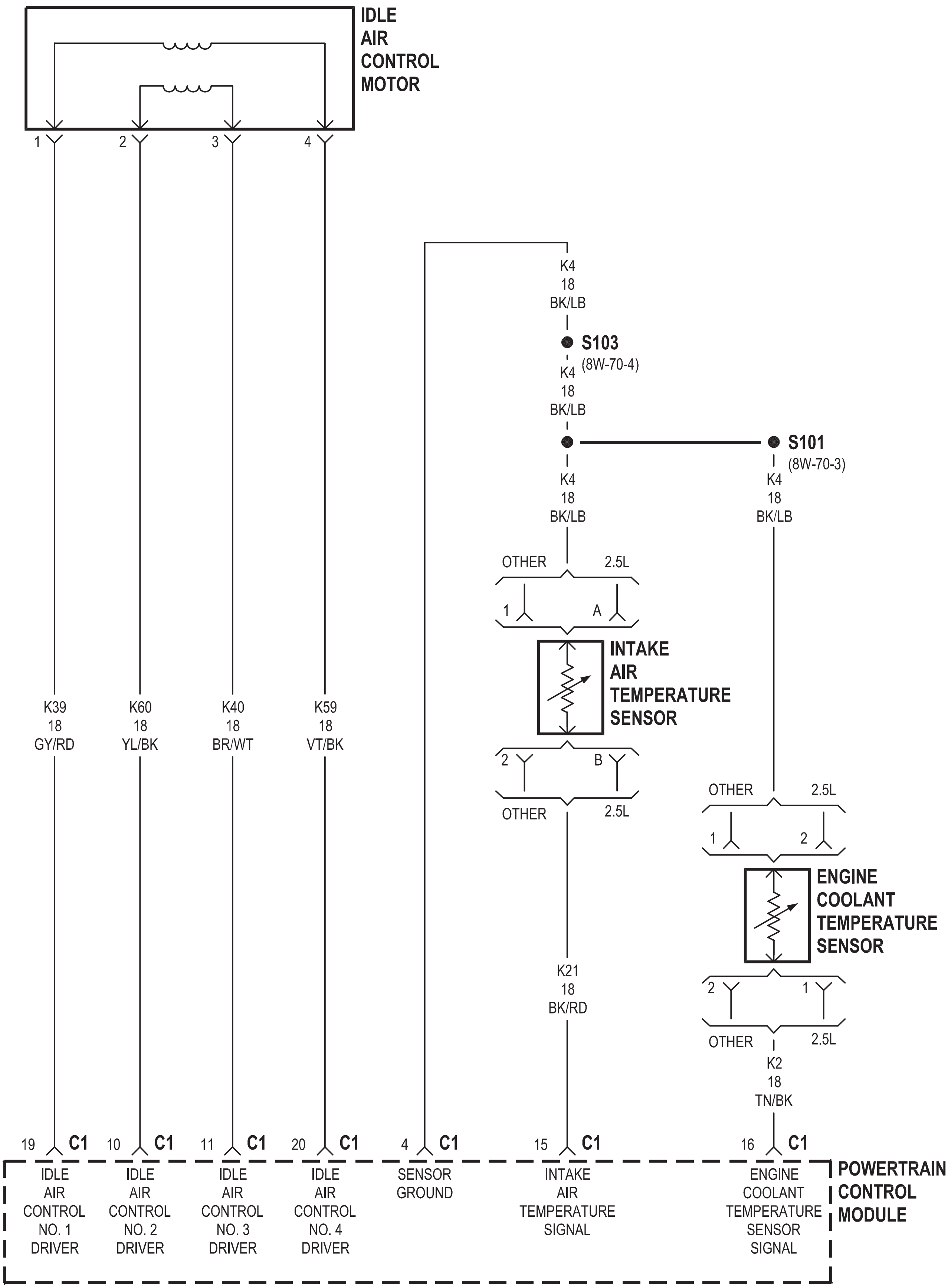

S171
K125
18
WT/DB
C106
(IN PDC)
2.5L/4.7L
3.9L/5.9L
S186
GENERATOR
(8W-20-2)
TRANSMISSION
CONTROL
RELAY
(IN PDC)
(8W-31-2)
C105
LEAK
DETECTION
PUMP
GENERATOR
SOURCE
LEAK
DETECTION
PUMP
SOLENOID
CONTROL
LEAK
DETECTION
PUMP
SWITCH
SENSE
K30
18
PK
K20
18
DG
K106
18
WT/DG
K107
18
OR
C3
C2
POWERTRAIN
CONTROL
MODULE
TRANSMISSION
CONTROL
RELAY
CONTROL
GENERATOR
FIELD

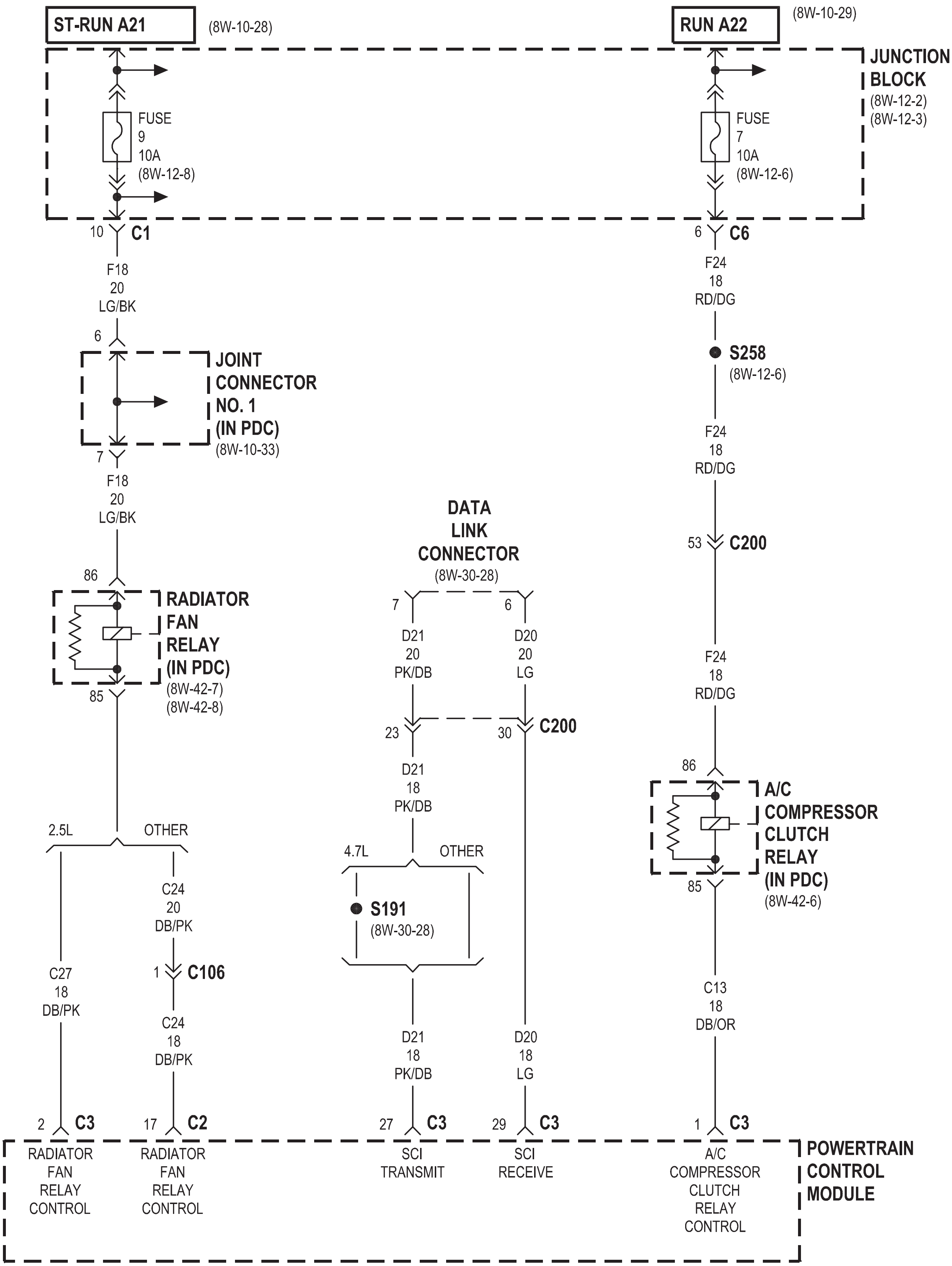

CRANKSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
5V SUPPLY
1
2
3
K24 18 GY/BK
K4 18 BK/LB
K7 18 OR
S107
(8W-70-2)
OTHER
4.7L A/T
S177
K7 16 OR
3
CAMSHAFT POSITION SENSOR
5V SUPPLY
CAMSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
K24 18 GY/BK
K24 18 GY/BK
2
1
K4 16 BK/LB
6
CRANKSHAFT POSITION SENSOR SIGNAL
TRANSMISSION CONTROL MODULE
(8W-31-11)
S103
(8W-70-4)
K44 16 TN/YL
K4 18 BK/LB
K7 18 OR
8 C1
4 C1
18 C1
17 C1
CRANKSHAFT POSITION SENSOR SIGNAL
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
5V SUPPLY
POWERTRAIN CONTROL MODULE


THROTTLE POSITION SENSOR
2
●● 3
● 1
●● 1
● 3
K22 18 OR/DB
K4 18 BK/LB
K7 18 OR
S107
(8W-70-2)
OTHER
4.7L A/T
S173
K7 18 OR
K7 18 OR
K22 18 OR/DB
K22 18 OR/DB
▲ 1
▲▲ 3
MANIFOLD ABSOLUTE PRESSURE SENSOR
▲▲ 1
▲ 2
▲▲ 2
▲ 3
12
THROTTLE POSITION SENSOR SIGNAL
TRANSMISSION CONTROL MODULE
(8W-31-11)
K4 18 BK/LB
K1 18 DG/RD
S103
(8W-70-4)
K4 18 BK/LB
23 C1
4 C1
27 C1
17 C1
THROTTLE POSITION SENSOR SIGNAL
SENSOR GROUND
MAP SENSOR SIGNAL
5V SUPPLY
POWERTRAIN CONTROL MODULE
● 2.5L
●● EXCEPT 2.5L
▲ 4.7L
▲▲ EXCEPT 4.7L

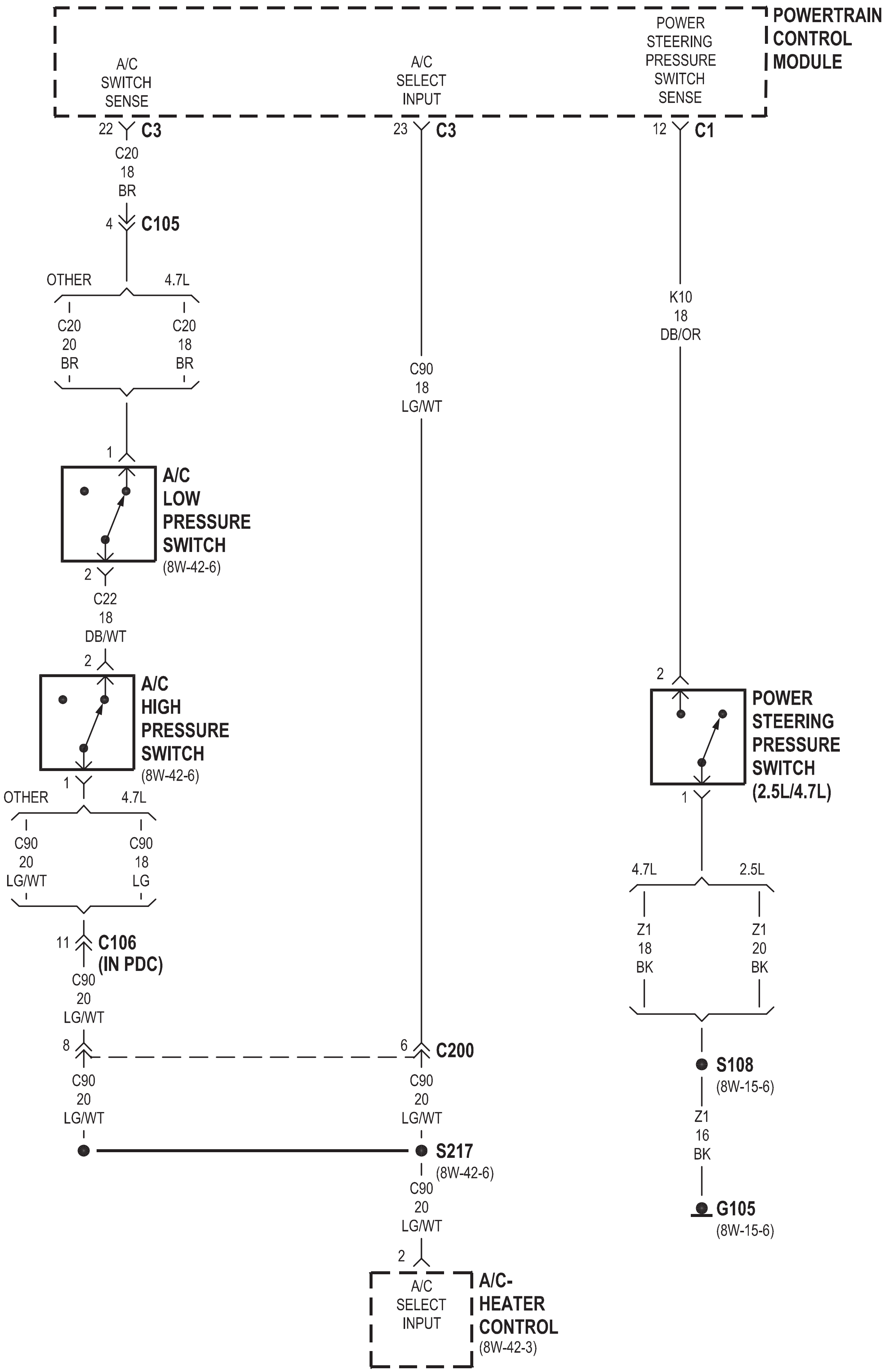


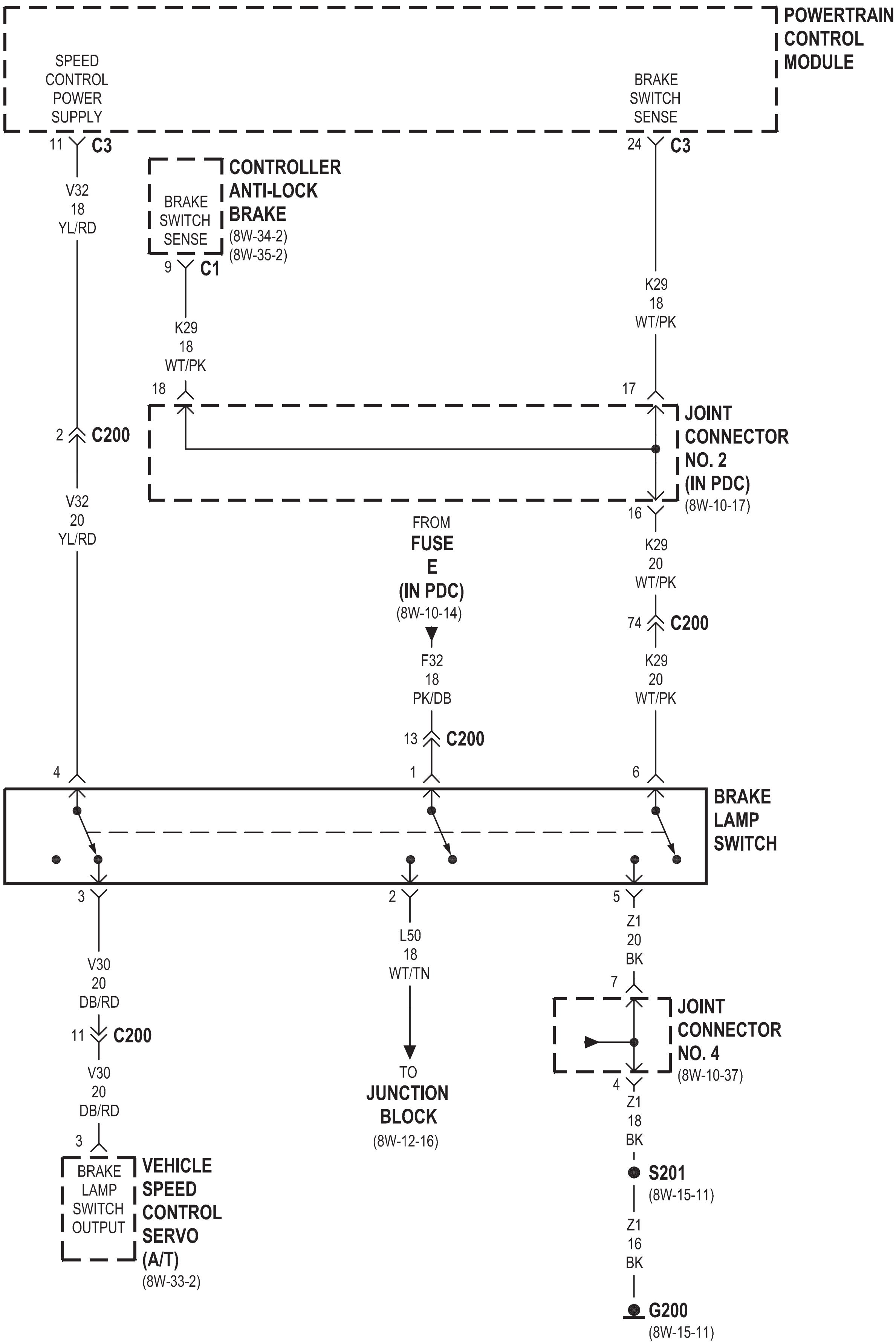
J008W-1 AN003020


IDLE AIR CONTROL MOTOR
1
2
3
4
K39 18 GY/RD
K60 18 YL/BK
K40 18 BR/WT
K59 18 VT/BK
K4 18 BK/LB
S103 (8W-70-4)
K4 18 BK/LB
S101 (8W-70-3)
K4 18 BK/LB
K4 18 BK/LB
OTHER
2.5L
1
A
INTAKE AIR TEMPERATURE SENSOR
2
B
OTHER
2.5L
K21 18 BK/RD
OTHER
2.5L
1
2
ENGINE COOLANT TEMPERATURE SENSOR
2
1
OTHER
2.5L
K2 18 TN/BK
19 C1
10 C1
11 C1
20 C1
4 C1
15 C1
16 C1
IDLE AIR CONTROL NO. 1 DRIVER
IDLE AIR CONTROL NO. 2 DRIVER
IDLE AIR CONTROL NO. 3 DRIVER
IDLE AIR CONTROL NO. 4 DRIVER
SENSOR GROUND
INTAKE AIR TEMPERATURE SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

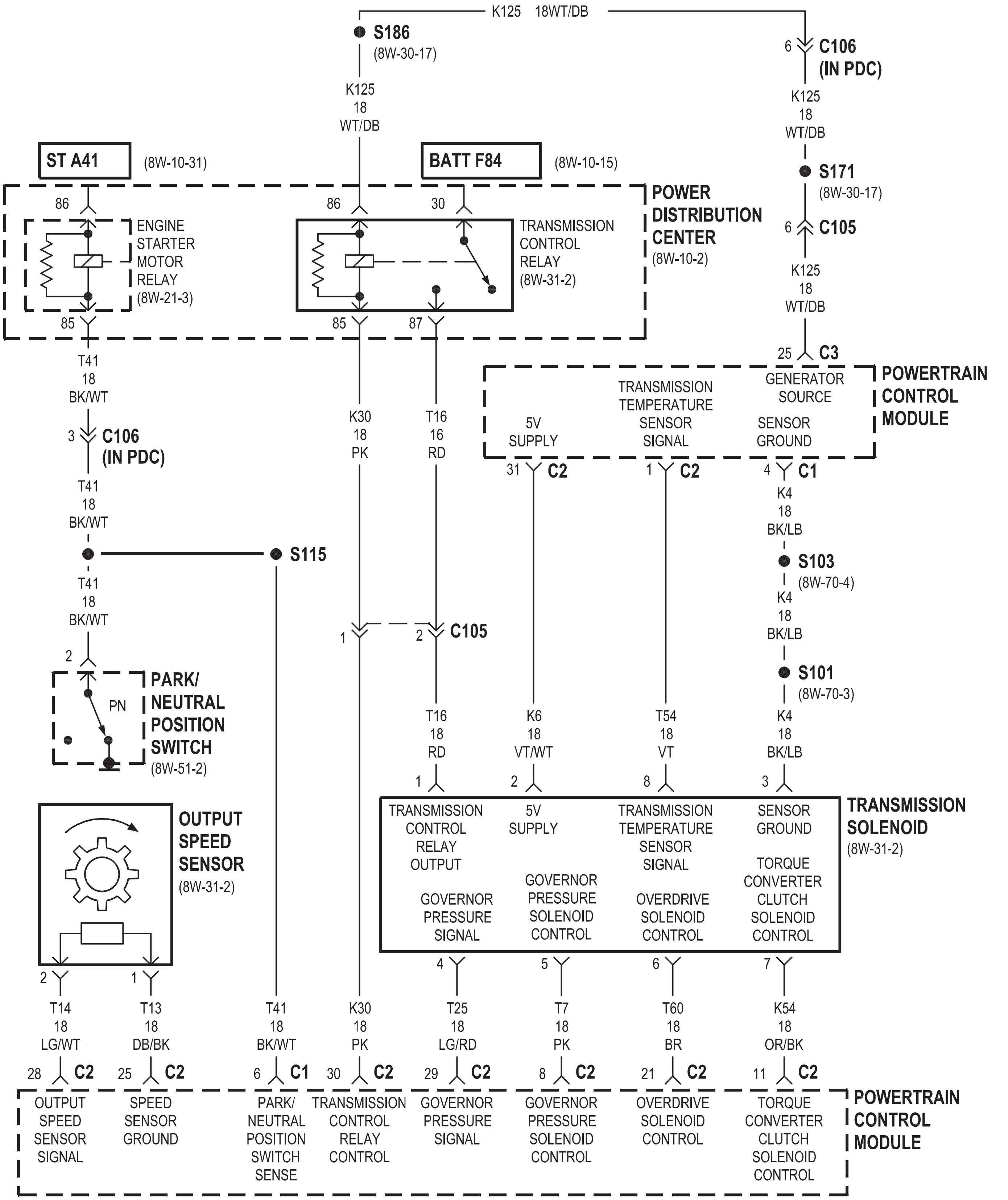


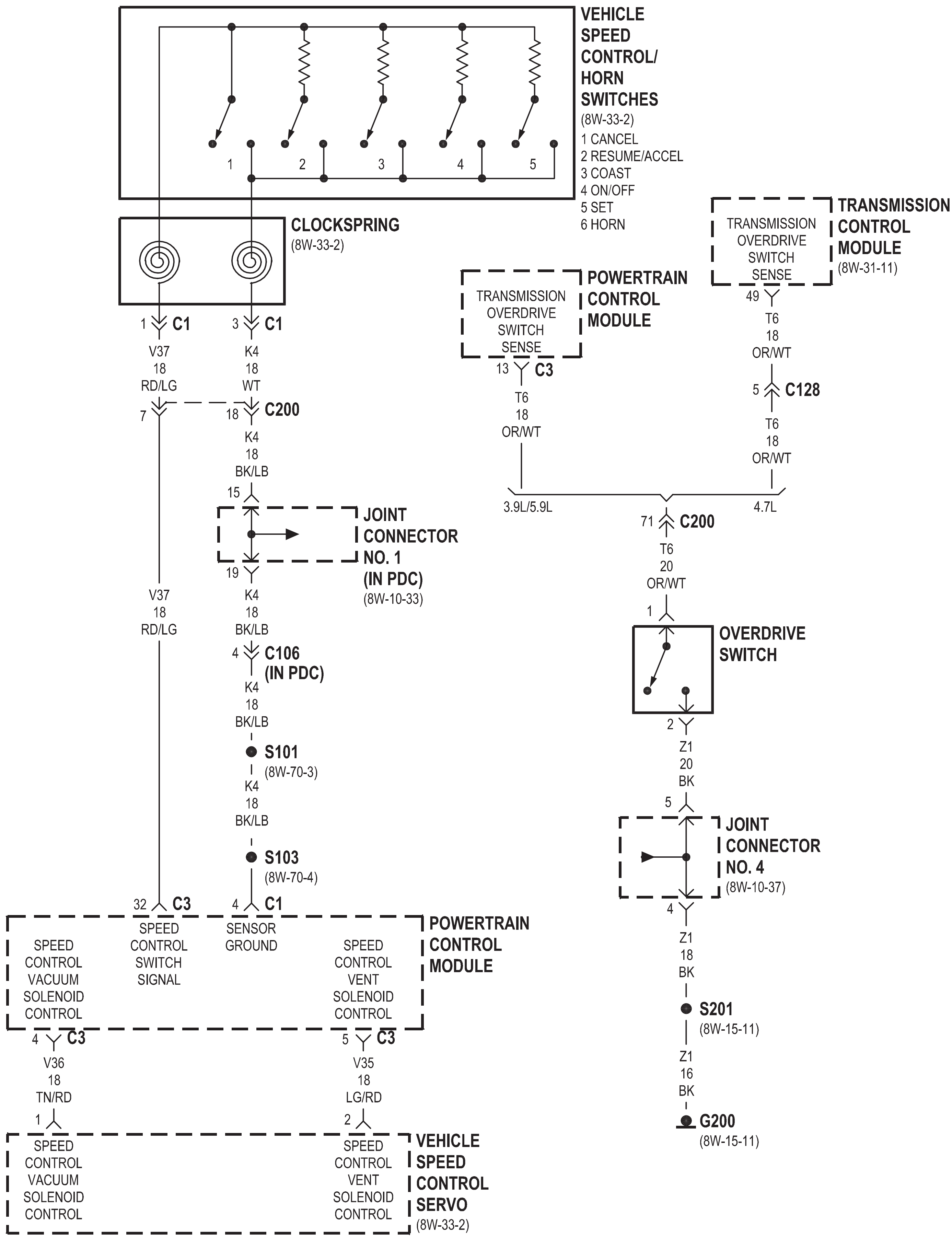
J008W-1 AN003022

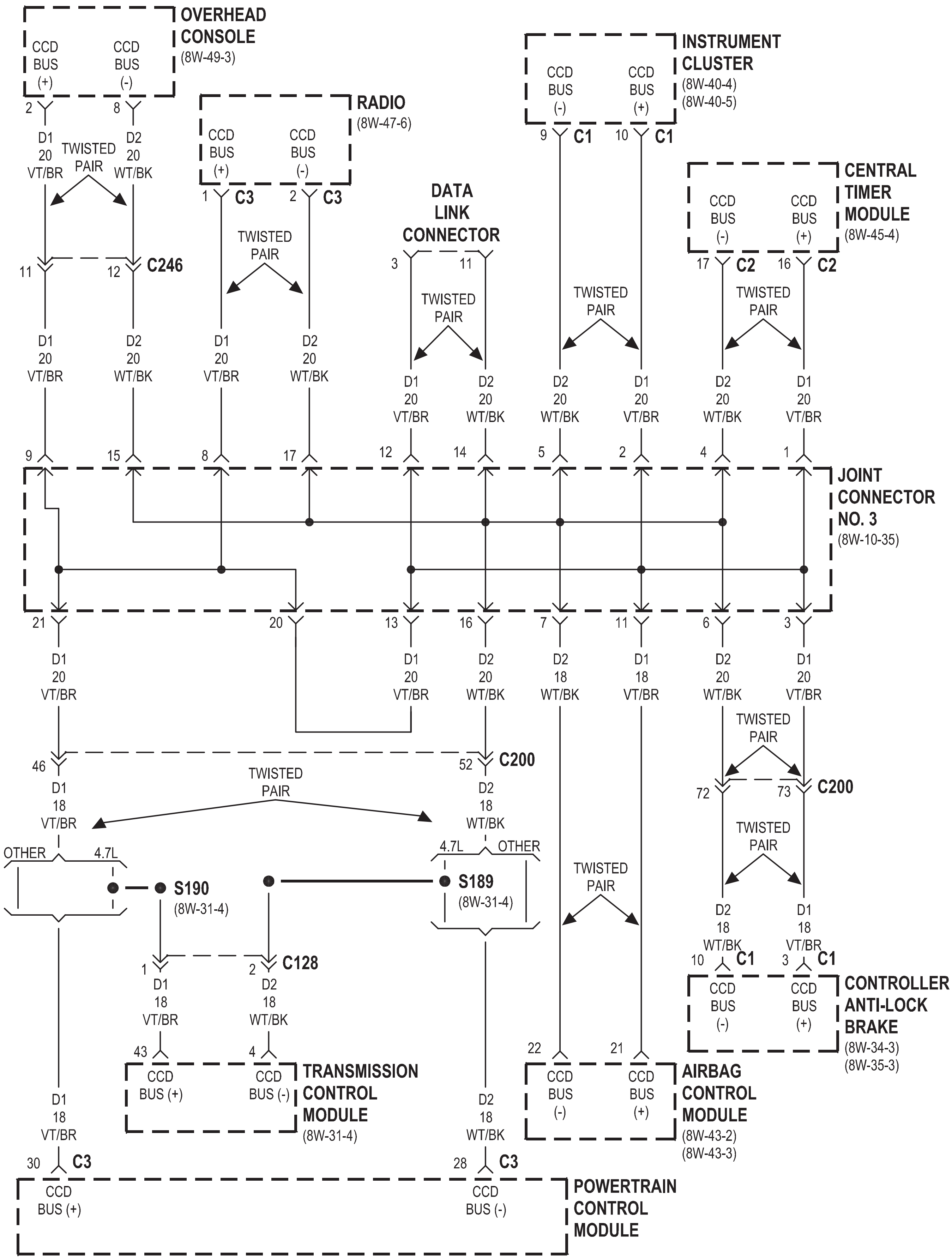

POWERTRAIN CONTROL MODULE
A/C SWITCH SENSE
A/C SELECT INPUT
POWER STEERING PRESSURE SWITCH SENSE
22 C3
23 C3
12 C1
C20 18 BR
4 C105
OTHER
4.7L
C20 20 BR
C20 18 BR
K10 18 DB/OR
C90 18 LG/WT
1
A/C LOW PRESSURE SWITCH (8W-42-6)
2
C22 18 DB/WT
2
A/C HIGH PRESSURE SWITCH (8W-42-6)
1
OTHER
4.7L
C90 20 LG/WT
C90 18 LG
11 C106 (IN PDC)
C90 20 LG/WT
8
6 C200
C90 20 LG/WT
C90 20 LG/WT
S217 (8W-42-6)
C90 20 LG/WT
2
A/C SELECT INPUT
A/C-HEATER CONTROL (8W-42-3)
2
POWER STEERING PRESSURE SWITCH (2.5L/4.7L)
1
4.7L
2.5L
Z1 18 BK
Z1 20 BK
S108 (8W-15-6)
Z1 16 BK
G105 (8W-15-6)

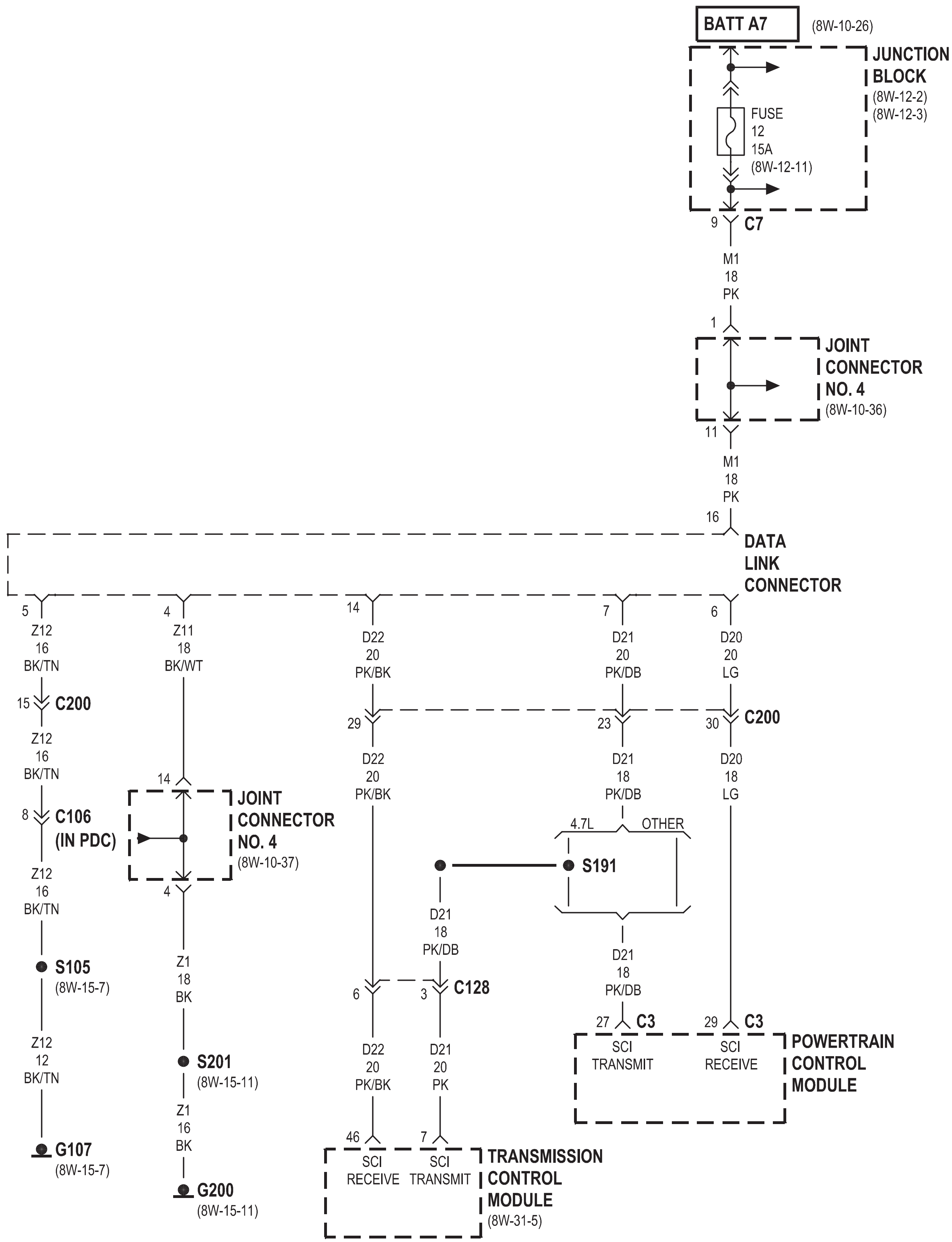


J008W-1 AN003024


K125 18WT/DB
S186
(8W-30-17)
K125
18
WT/DB
6 C106
(IN PDC)
ST A41
(8W-10-31)
BATT F84
(8W-10-15)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
86
86
30
ENGINE
STARTER
MOTOR
RELAY
(8W-21-3)
TRANSMISSION
CONTROL
RELAY
(8W-31-2)
85
85
87
S171
(8W-30-17)
6 C105
K125
18
WT/DB
25 C3
T41
18
BK/WT
3 C106
(IN PDC)
K30
18
PK
T16
16
RD
POWERTRAIN
CONTROL
MODULE
TRANSMISSION
TEMPERATURE
SENSOR
SIGNAL
GENERATOR
SOURCE
SENSOR
GROUND
5V
SUPPLY
31 C2
1 C2
4 C1
K4
18
BK/LB
S103
(8W-70-4)
S115
S101
(8W-70-3)
1
2 C105
PARK/
NEUTRAL
POSITION
SWITCH
(8W-51-2)
PN
T16
18
RD
K6
18
VT/WT
T54
18
VT
TRANSMISSION
SOLENOID
(8W-31-2)
TRANSMISSION
CONTROL
RELAY
OUTPUT
GOVERNOR
PRESSURE
SIGNAL
GOVERNOR
PRESSURE
SOLENOID
CONTROL
OVERDRIVE
SOLENOID
CONTROL
TORQUE
CONVERTER
CLUTCH
SOLENOID
CONTROL
OUTPUT
SPEED
SENSOR
(8W-31-2)
T14
18
LG/WT
T13
18
DB/BK
T25
18
LG/RD
T7
18
PK
T60
18
BR
K54
18
OR/BK
28 C2
25 C2
6 C1
30 C2
29 C2
8 C2
21 C2
11 C2
OUTPUT
SPEED
SENSOR
SIGNAL
SPEED
SENSOR
GROUND
PARK/
NEUTRAL
POSITION
SWITCH
SENSE
TRANSMISSION
CONTROL
RELAY
CONTROL


VEHICLE SPEED CONTROL/ HORN SWITCHES
(8W-33-2)
1 CANCEL
2 RESUME/ACCEL
3 COAST
4 ON/OFF
5 SET
6 HORN
1
2
3
4
5
CLOCKSPRING
(8W-33-2)
1 C1
3 C1
V37
18
RD/LG
K4
18
WT
7
18 C200
K4
18
BK/LB
15
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
19
V37
18
RD/LG
K4
18
BK/LB
4 C106 (IN PDC)
K4
18
BK/LB
S101
(8W-70-3)
K4
18
BK/LB
S103
(8W-70-4)
32 C3
4 C1
POWERTRAIN CONTROL MODULE
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL SWITCH SIGNAL
SENSOR GROUND
SPEED CONTROL VENT SOLENOID CONTROL
4 C3
5 C3
V36
18
TN/RD
V35
18
LG/RD
1
2
VEHICLE SPEED CONTROL SERVO
(8W-33-2)
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
POWERTRAIN CONTROL MODULE
TRANSMISSION OVERDRIVE SWITCH SENSE
13 C3
T6
18
OR/WT
TRANSMISSION CONTROL MODULE
(8W-31-11)
TRANSMISSION OVERDRIVE SWITCH SENSE
49
T6
18
OR/WT
5 C128
T6
18
OR/WT
3.9L/5.9L
4.7L
71 C200
T6
20
OR/WT
1
OVERDRIVE SWITCH
2
Z1
20
BK
5
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)


OVERHEAD CONSOLE
(8W-49-3)
CCD BUS (+)
CCD BUS (-)
RADIO
(8W-47-6)
CCD BUS (+)
CCD BUS (-)
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
CCD BUS (-)
CCD BUS (+)
CENTRAL TIMER MODULE
(8W-45-4)
CCD BUS (-)
CCD BUS (+)
DATA LINK CONNECTOR
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
C246
C1
C2
C3
JOINT CONNECTOR NO. 3
(8W-10-35)
C200
D1 18 VT/BR
D2 18 WT/BK
OTHER
4.7L
S190
(8W-31-4)
S189
(8W-31-4)
C128
TRANSMISSION CONTROL MODULE
(8W-31-4)
CCD BUS (+)
CCD BUS (-)
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
CONTROLLER ANTI-LOCK BRAKE
(8W-34-3)
(8W-35-3)
POWERTRAIN CONTROL MODULE
CCD BUS (+)
CCD BUS (-)

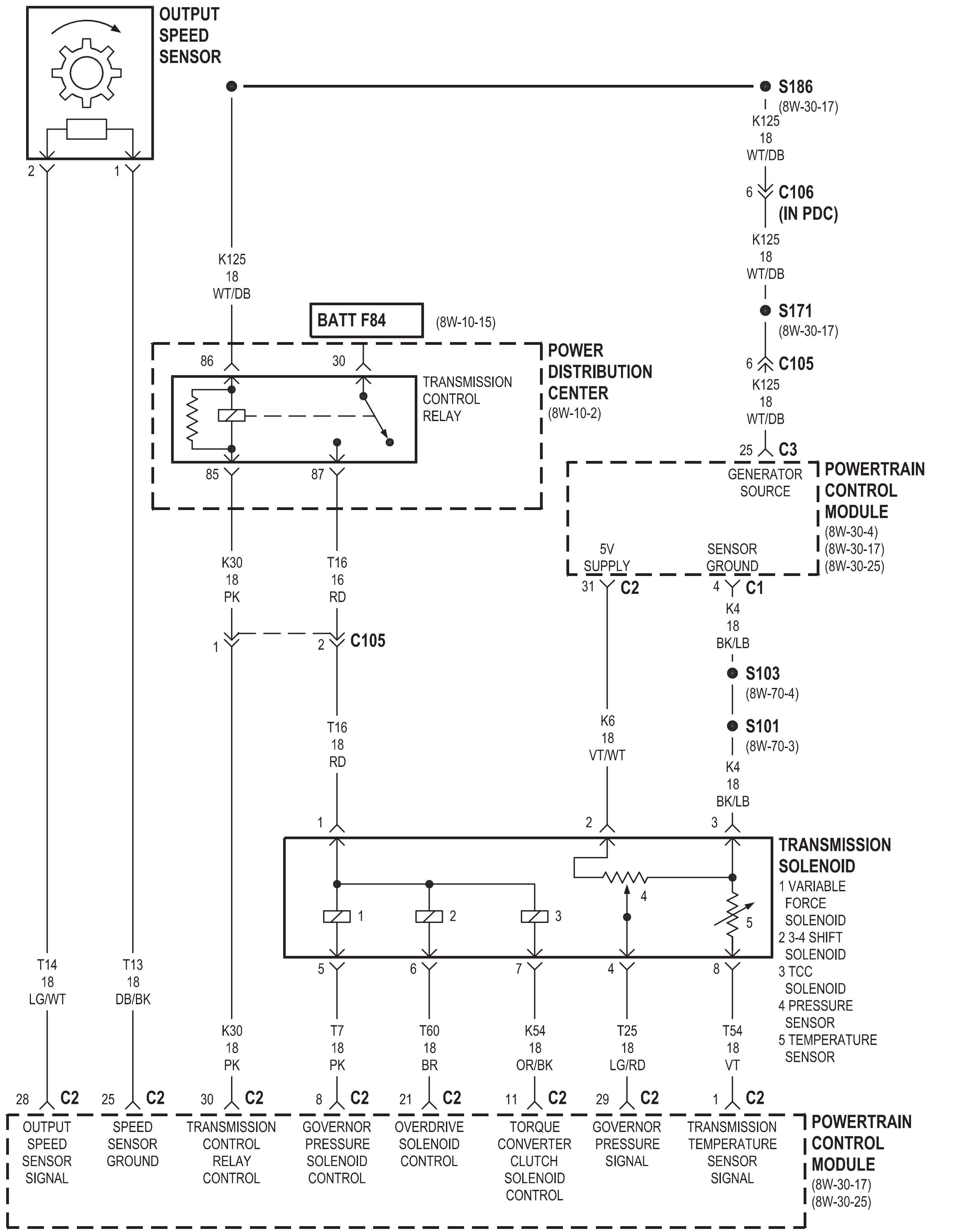


BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
15A
(8W-12-11)
9 C7
M1
18
PK
1
JOINT CONNECTOR NO. 4
(8W-10-36)
11
M1
18
PK
16
DATA LINK CONNECTOR
5
Z12
16
BK/TN
15 C200
Z12
16
BK/TN
8 C106 (IN PDC)
Z12
16
BK/TN
S105
(8W-15-7)
Z12
12
BK/TN
G107
(8W-15-7)
4
Z11
18
BK/WT
14
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)
14
D22
20
PK/BK
29
D22
20
PK/BK
6
C128
3
D22
20
PK/BK
46
7
D21
18
PK/DB
D21
20
PK
TRANSMISSION CONTROL MODULE
SCI RECEIVE
SCI TRANSMIT
(8W-31-5)
7
D21
20
PK/DB
23
D21
18
PK/DB
4.7L
OTHER
S191
D21
18
PK/DB
6
D20
20
LG
30 C200
D20
18
LG
27 C3
29 C3
POWERTRAIN CONTROL MODULE
SCI TRANSMIT
SCI RECEIVE

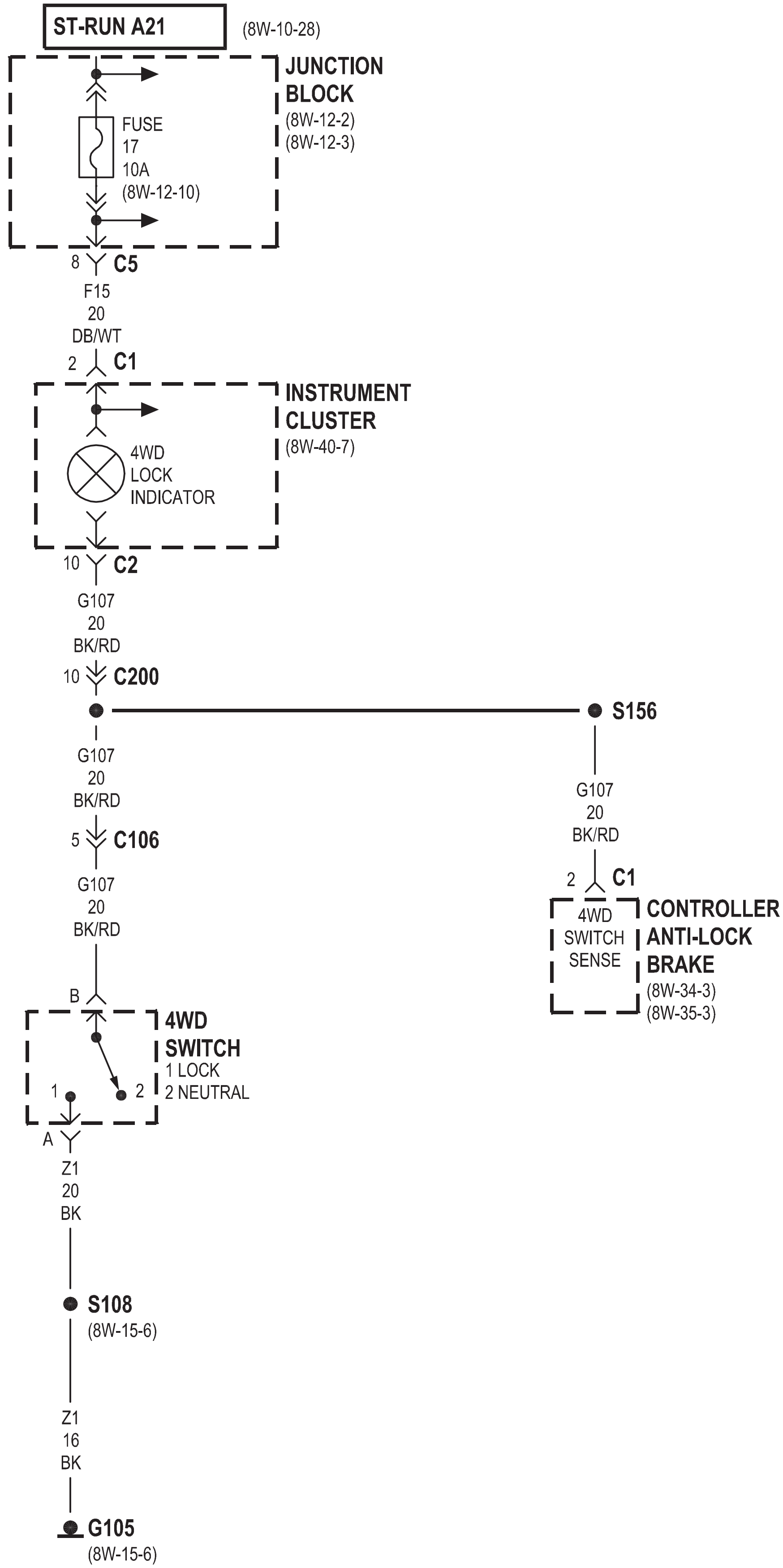
8W-31 TRANSMISSION CONTROL SYSTEM

Component	Page
Clutch Interlock Switch Jumper	8W-31-10
Controller Anti-Lock Brake	8W-31-3, 4
Controller Anti-Lock Brake	8W-31-4
Crankshaft Position Sensor	8W-31-11
Data Link Connector	8W-31-4, 5
Engine Starter Motor Relay	8W-31-8
Fuse 2 (JB)	8W-31-10
Fuse 17 (JB)	8W-31-3
Fuse F (PDC)	8W-31-5, 6
G103	8W-31-6
G105	8W-31-3
G107	8W-31-7
Ignition Switch	8W-31-10
Input Speed Sensor	8W-31-9
Instrument Cluster	8W-31-3, 4, 5
Joint Connector No. 1	8W-31-10
Joint Connector No. 3	8W-31-4
Junction Block	8W-31-3, 10
Line Pressure Sensor	8W-31-9
Output Speed Sensor	8W-31-2, 9
Overdrive Switch	8W-31-4, 11
Power Distribution Center	8W-31-2, 5, 6
Powertrain Control Module	8W-31-2, 4, 5, 8, 11
PRNDL	8W-31-5
Throttle Position Sensor	8W-31-11
Transmission Control Module	8W-31-4, 5, 6, 7, 8, 9, 10, 11
Transmission Control Relay	8W-31-2, 6, 7, 8
Transmission Solenoid	8W-31-2
Transmission Solenoid Assembly	8W-31-6, 7, 8, 9, 10

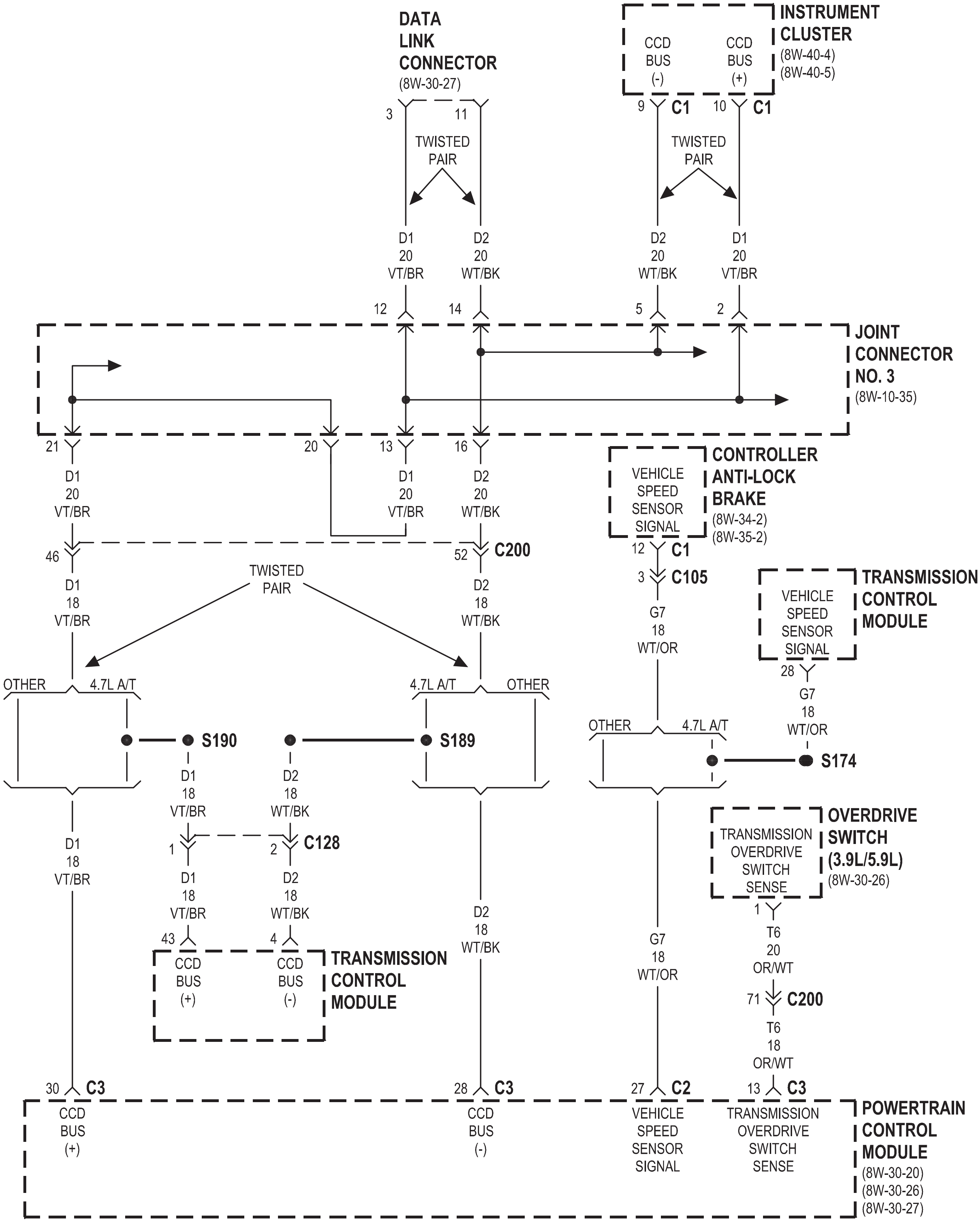
3.9L/5.9L



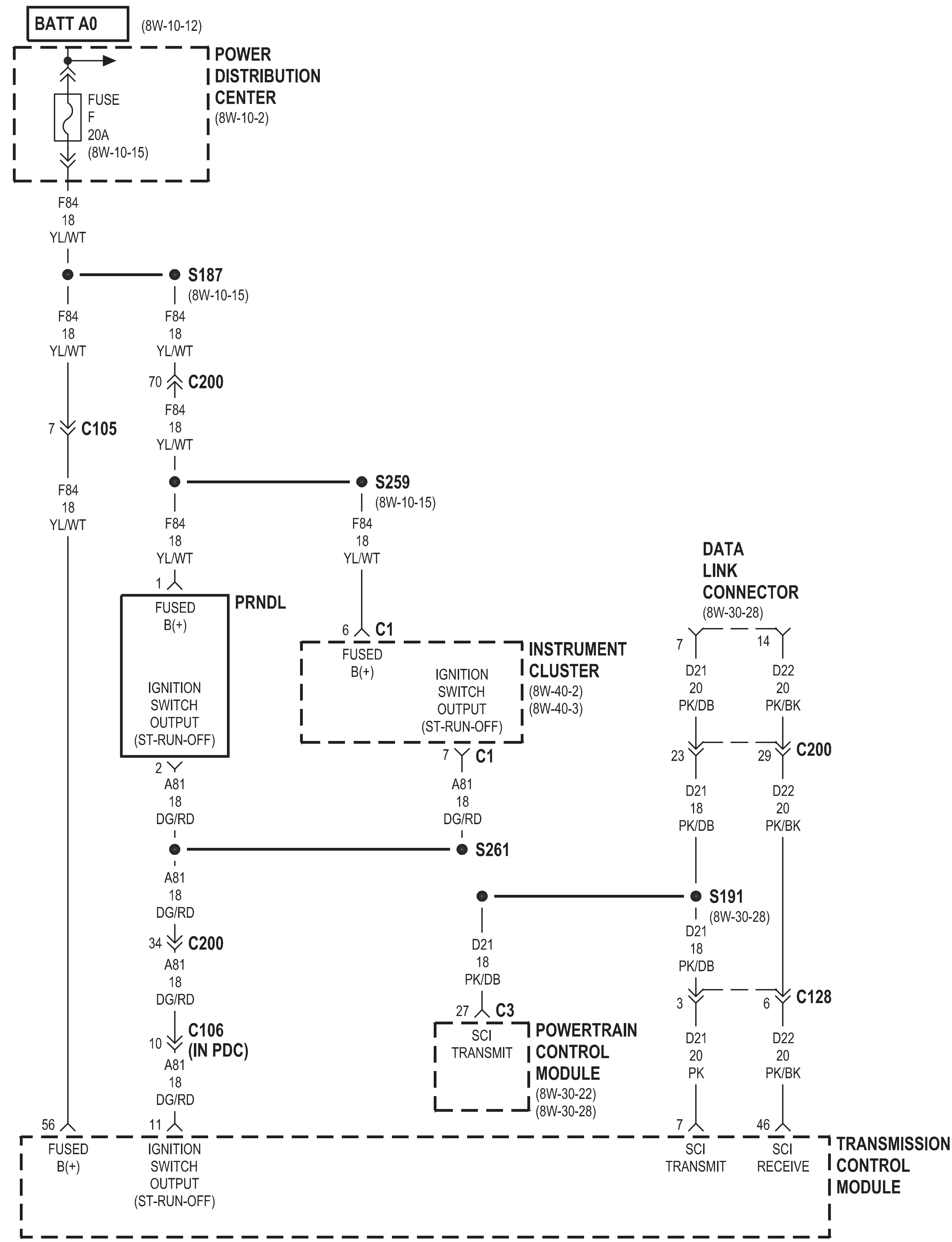
J008W-1 AN003102

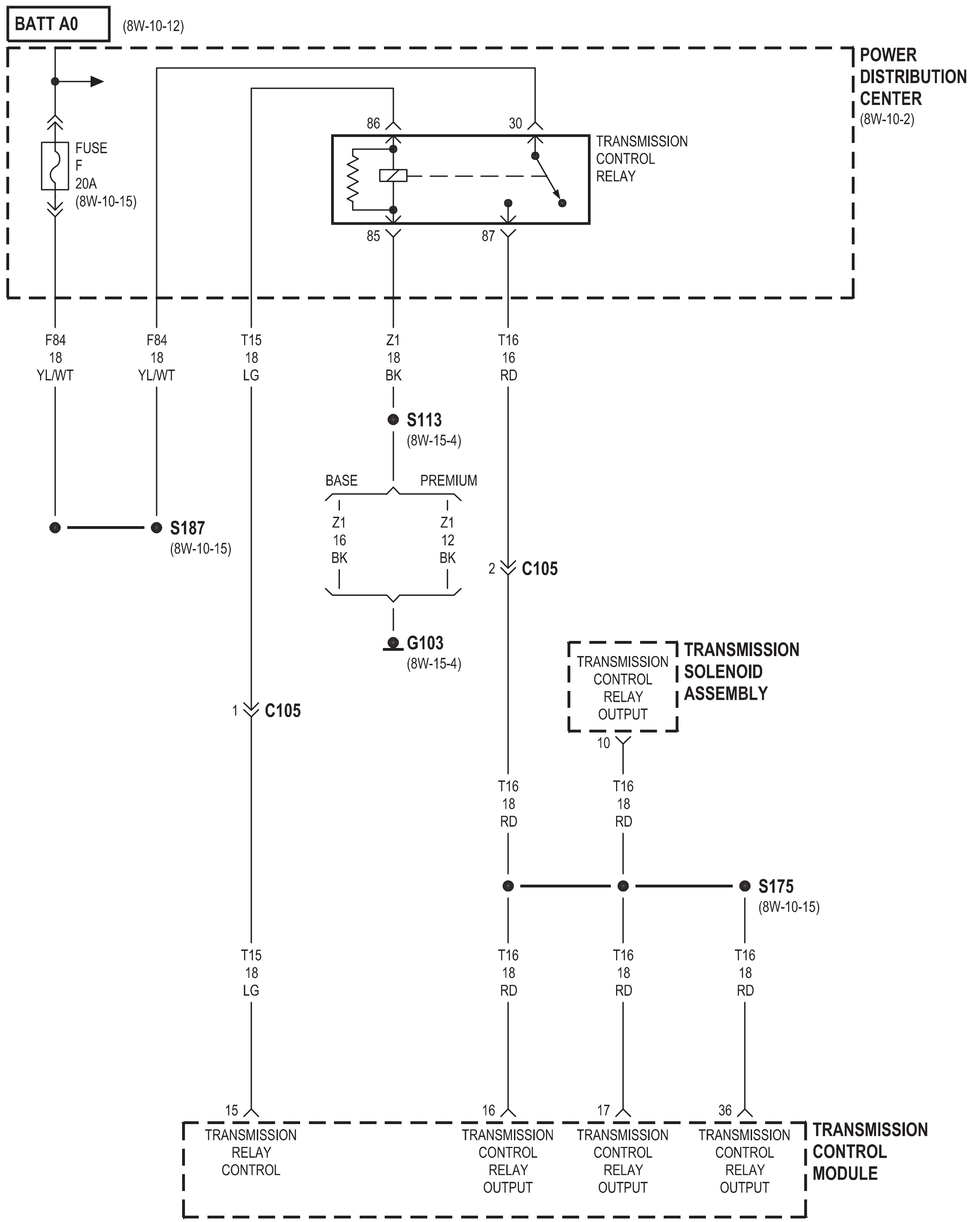


ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
17
10A
(8W-12-10)
8
C5
F15
20
DB/WT
2
C1
INSTRUMENT CLUSTER
(8W-40-7)
4WD
LOCK
INDICATOR
10
C2
G107
20
BK/RD
10
C200
S156
G107
20
BK/RD
5
C106
G107
20
BK/RD
G107
20
BK/RD
2
C1
4WD
SWITCH
SENSE
CONTROLLER ANTI-LOCK BRAKE
(8W-34-3)
(8W-35-3)
B
4WD SWITCH
1 LOCK
2 NEUTRAL
1
2
A
Z1
20
BK
S108
(8W-15-6)
Z1
16
BK
G105
(8W-15-6)

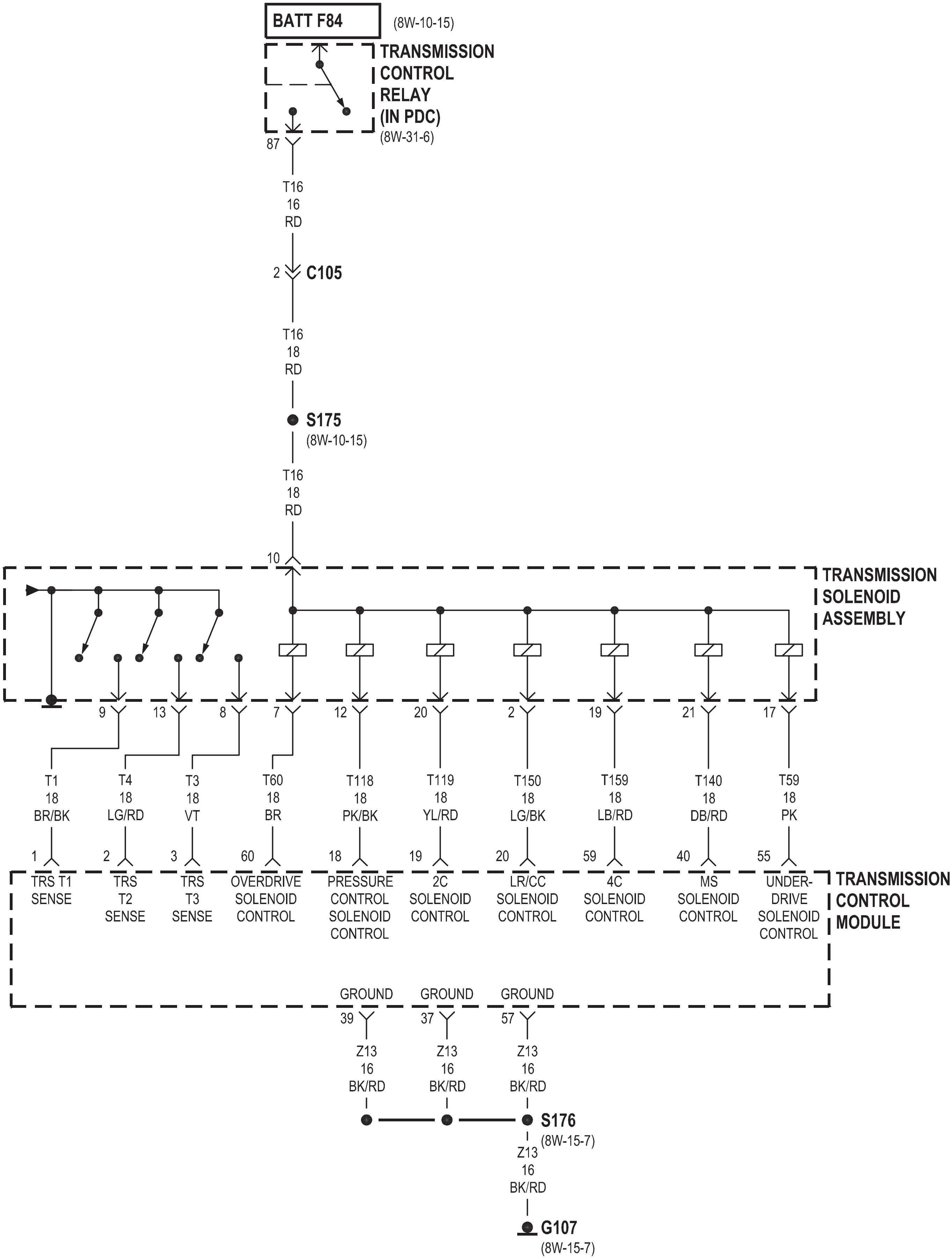

DATA LINK CONNECTOR
(8W-30-27)
3
11
TWISTED PAIR
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
CCD BUS (-)
CCD BUS (+)
9 C1
10 C1
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
D2 20 WT/BK
D1 20 VT/BR
12
14
5
2
JOINT CONNECTOR NO. 3
(8W-10-35)
21
20
13
16
D1 20 VT/BR
D1 20 VT/BR
D2 20 WT/BK
46
52 C200
CONTROLLER ANTI-LOCK BRAKE
(8W-34-2)
(8W-35-2)
VEHICLE SPEED SENSOR SIGNAL
12 C1
3 C105
G7 18 WT/OR
TRANSMISSION CONTROL MODULE
VEHICLE SPEED SENSOR SIGNAL
28
G7 18 WT/OR
D1 18 VT/BR
TWISTED PAIR
D2 18 WT/BK
OTHER
4.7L A/T
4.7L A/T
OTHER
S190
S189
OTHER
4.7L A/T
S174
D1 18 VT/BR
D2 18 WT/BK
1
2 C128
D1 18 VT/BR
D2 18 WT/BK
43
4
TRANSMISSION CONTROL MODULE
CCD BUS (+)
CCD BUS (-)
D1 18 VT/BR
D2 18 WT/BK
G7 18 WT/OR
OVERDRIVE SWITCH (3.9L/5.9L)
(8W-30-26)
TRANSMISSION OVERDRIVE SWITCH SENSE
1
T6 20 OR/WT
71 C200
T6 18 OR/WT
30 C3
28 C3
27 C2
13 C3
CCD BUS (+)
CCD BUS (-)
VEHICLE SPEED SENSOR SIGNAL
TRANSMISSION OVERDRIVE SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-20)
(8W-30-26)
(8W-30-27)

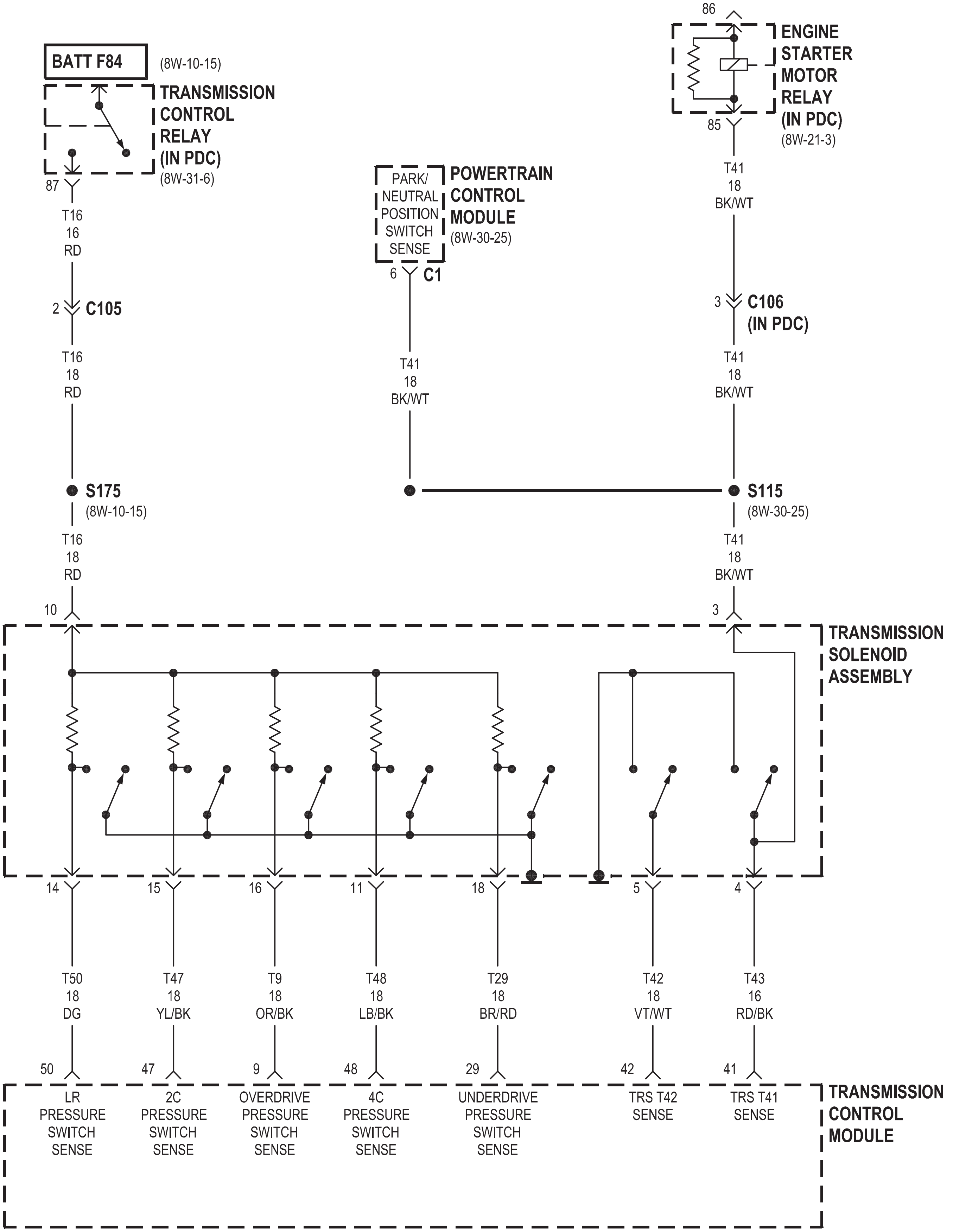
4.7L


BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
F
20A
(8W-10-15)
F84
18
YL/WT
S187
(8W-10-15)
70
C200
7
C105
S259
1
PRNDL
FUSED
B(+)
IGNITION
SWITCH
OUTPUT
(ST-RUN-OFF)
2
A81
18
DG/RD
6
C1
INSTRUMENT
CLUSTER
(8W-40-2)
(8W-40-3)
7
S261
34
C106
(IN PDC)
10
DATA
LINK
CONNECTOR
(8W-30-28)
14
D21
20
PK/DB
D22
PK/BK
23
29
S191
(8W-30-28)
D21
18
PK/DB
27
C3
SCI
TRANSMIT
POWERTRAIN
CONTROL
MODULE
(8W-30-22)
(8W-30-28)
3
6
C128
D21
20
PK
56
11
46
SCI
RECEIVE
TRANSMISSION
CONTROL
MODULE

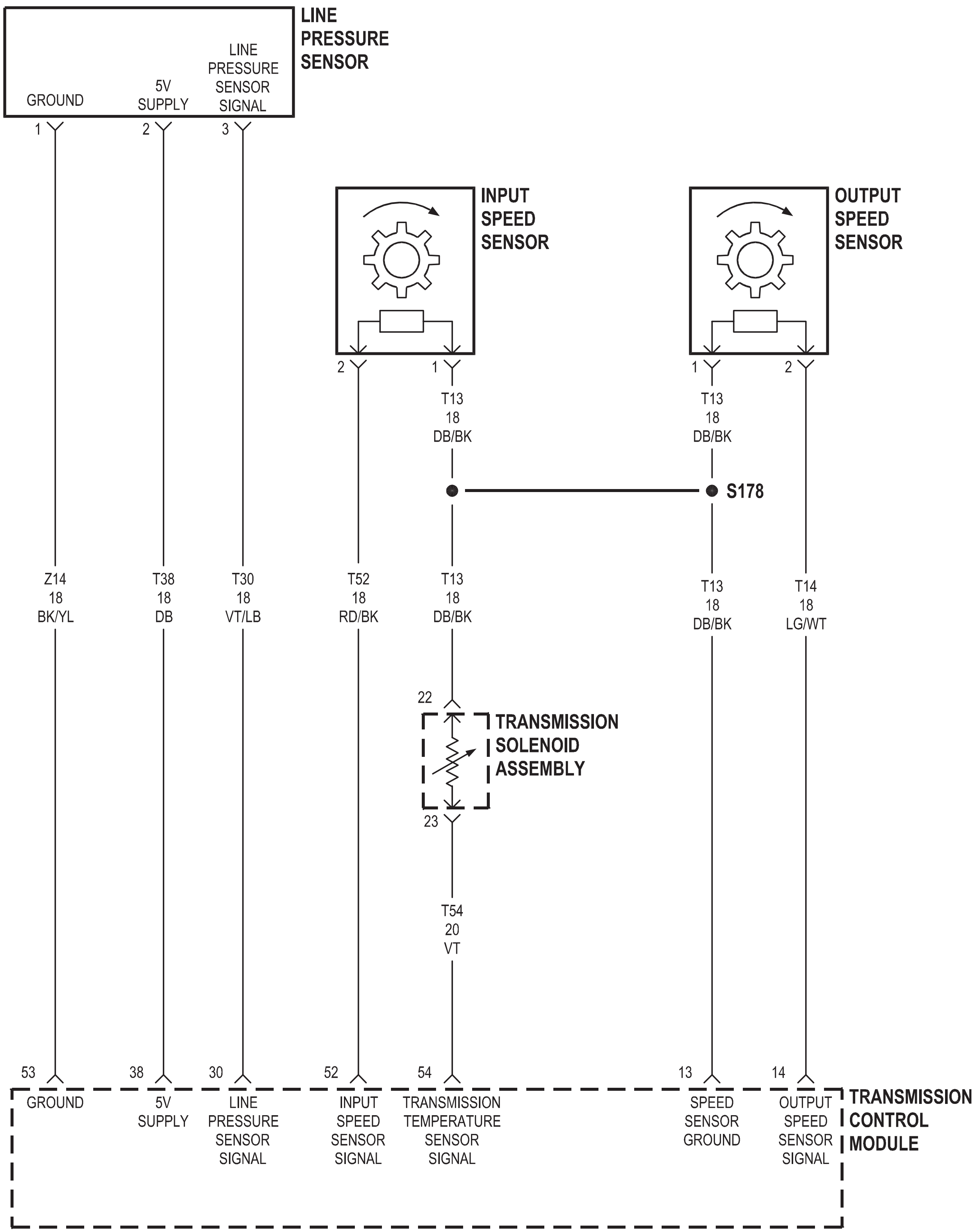

BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE F 20A
(8W-10-15)
86
30
TRANSMISSION CONTROL RELAY
85
87
F84 18 YL/WT
F84 18 YL/WT
T15 18 LG
Z1 18 BK
T16 16 RD
S113
(8W-15-4)
BASE
PREMIUM
Z1 16 BK
Z1 12 BK
S187
(8W-10-15)
2 C105
G103
(8W-15-4)
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION SOLENOID ASSEMBLY
1 C105
10
T16 18 RD
T16 18 RD
S175
(8W-10-15)
T15 18 LG
T16 18 RD
T16 18 RD
T16 18 RD
15
16
17
36
TRANSMISSION RELAY CONTROL
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION CONTROL MODULE

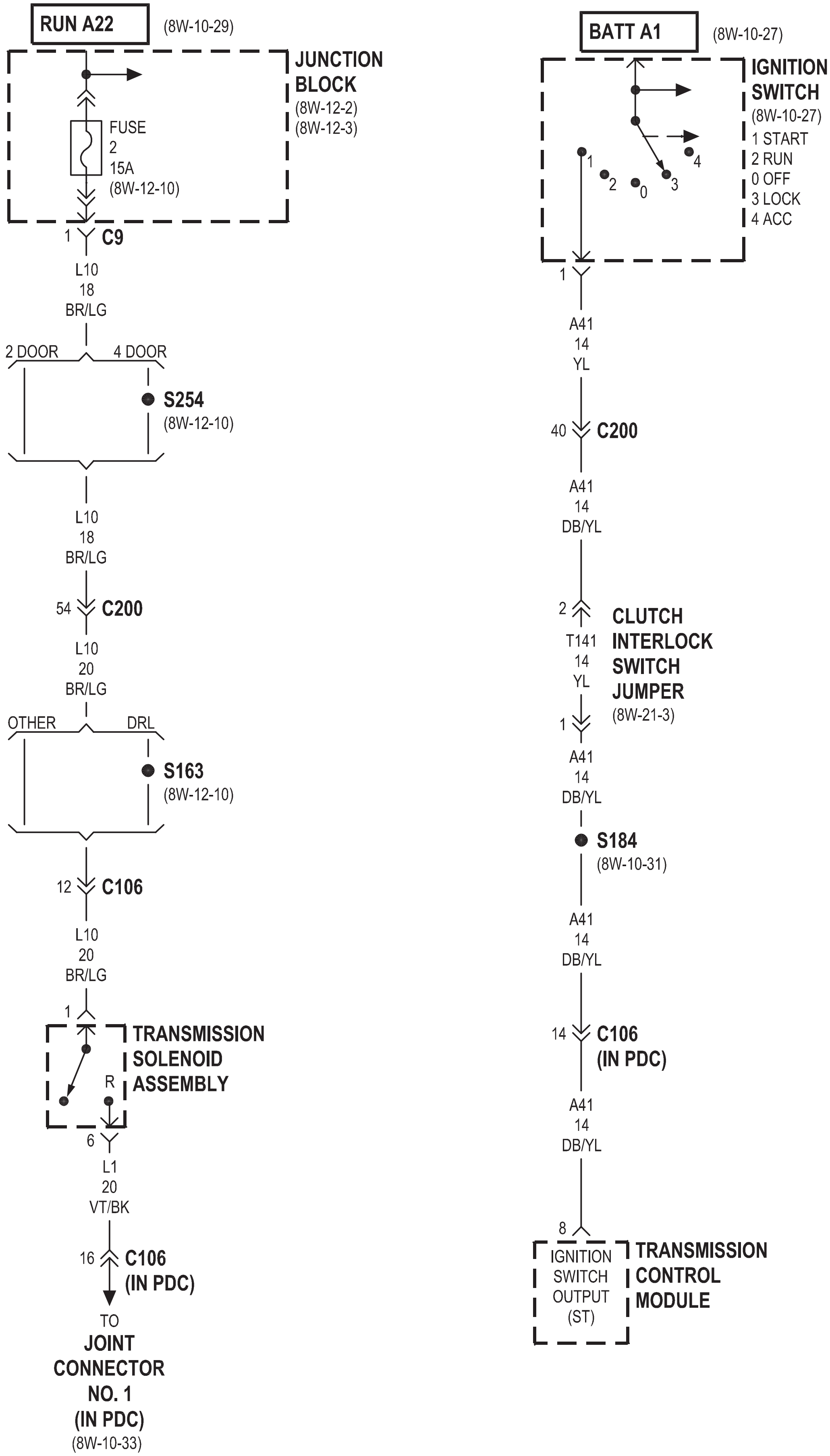
4.7L

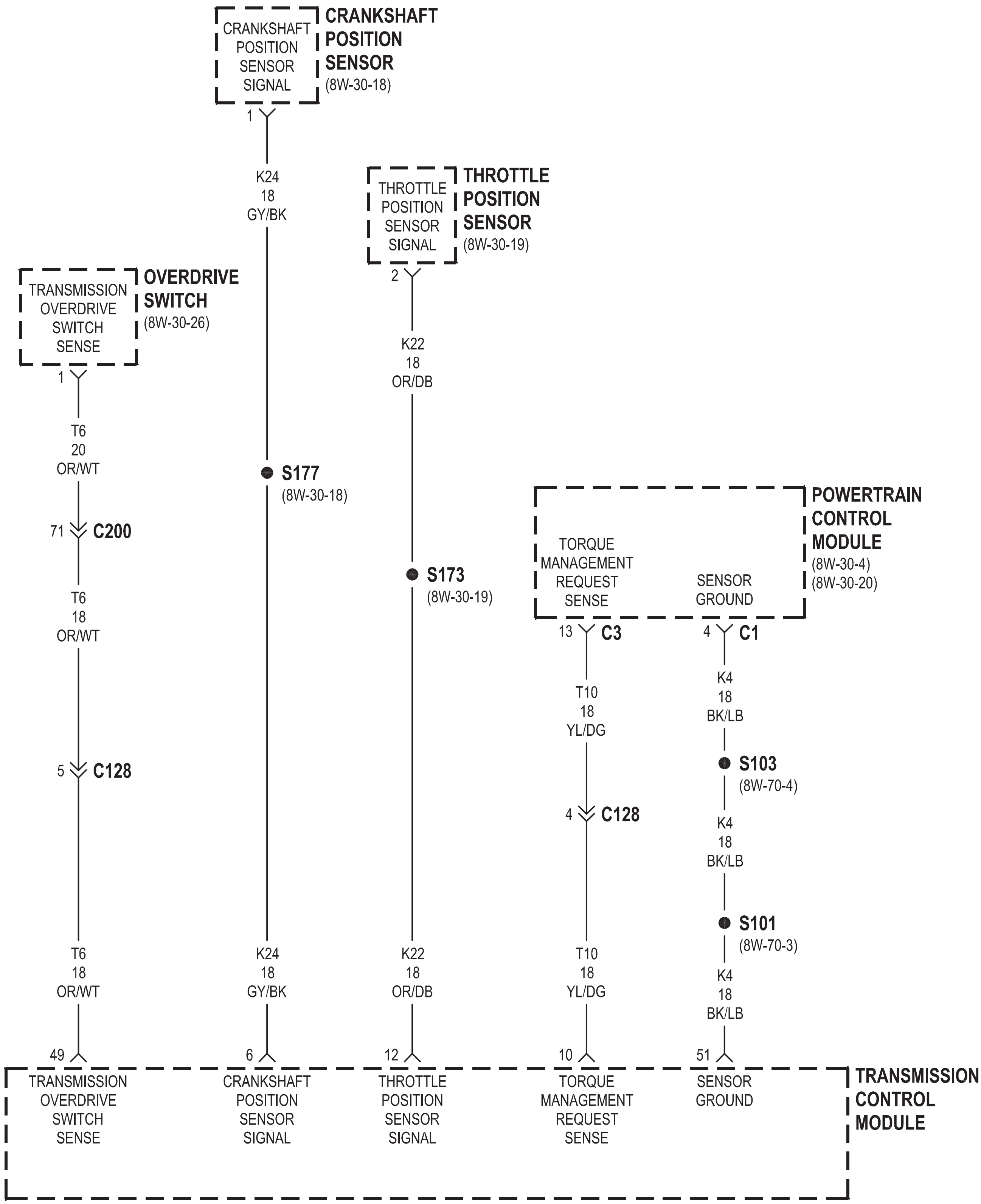

BATT F84
(8W-10-15)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-6)
87
T16 16 RD
2 C105
T16 18 RD
S175
(8W-10-15)
T16 18 RD
10
TRANSMISSION SOLENOID ASSEMBLY
9 13 8 7 12 20 2 19 21 17
T1 18 BR/BK
T4 18 LG/RD
T3 18 VT
T60 18 BR
T118 18 PK/BK
T119 18 YL/RD
T150 18 LG/BK
T159 18 LB/RD
T140 18 DB/RD
T59 18 PK
1 2 3 60 18 19 20 59 40 55
TRS T1 SENSE
TRS T2 SENSE
TRS T3 SENSE
OVERDRIVE SOLENOID CONTROL
PRESSURE CONTROL SOLENOID CONTROL
2C SOLENOID CONTROL
LR/CC SOLENOID CONTROL
4C SOLENOID CONTROL
MS SOLENOID CONTROL
UNDER-DRIVE SOLENOID CONTROL
TRANSMISSION CONTROL MODULE
GROUND GROUND GROUND
39 37 57
Z13 16 BK/RD
Z13 16 BK/RD
Z13 16 BK/RD
S176
(8W-15-7)
Z13 16 BK/RD
G107
(8W-15-7)



BATT F84
(8W-10-15)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-6)
87
T16
16
RD
2
C105
T16
18
RD
S175
(8W-10-15)
T16
18
RD
10
PARK/ NEUTRAL POSITION SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-25)
6
C1
T41
18
BK/WT
86
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-3)
85
T41
18
BK/WT
3
C106 (IN PDC)
T41
18
BK/WT
S115
(8W-30-25)
T41
18
BK/WT
3
TRANSMISSION SOLENOID ASSEMBLY
14
15
16
11
18
5
4
T50
18
DG
T47
18
YL/BK
T9
18
OR/BK
T48
18
LB/BK
T29
18
BR/RD
T42
18
VT/WT
T43
16
RD/BK
50
47
9
48
29
42
41
LR PRESSURE SWITCH SENSE
2C PRESSURE SWITCH SENSE
OVERDRIVE PRESSURE SWITCH SENSE
4C PRESSURE SWITCH SENSE
UNDERDRIVE PRESSURE SWITCH SENSE
TRS T42 SENSE
TRS T41 SENSE
TRANSMISSION CONTROL MODULE


LINE PRESSURE SENSOR
GROUND
5V SUPPLY
LINE PRESSURE SENSOR SIGNAL
1
2
3
INPUT SPEED SENSOR
OUTPUT SPEED SENSOR
2
1
1
2
T13 18 DB/BK
T13 18 DB/BK
S178
Z14 18 BK/YL
T38 18 DB
T30 18 VT/LB
T52 18 RD/BK
T13 18 DB/BK
T13 18 DB/BK
T14 18 LG/WT
22
TRANSMISSION SOLENOID ASSEMBLY
23
T54 20 VT
53
38
30
52
54
13
14
GROUND
5V SUPPLY
LINE PRESSURE SENSOR SIGNAL
INPUT SPEED SENSOR SIGNAL
TRANSMISSION TEMPERATURE SENSOR SIGNAL
SPEED SENSOR GROUND
OUTPUT SPEED SENSOR SIGNAL
TRANSMISSION CONTROL MODULE

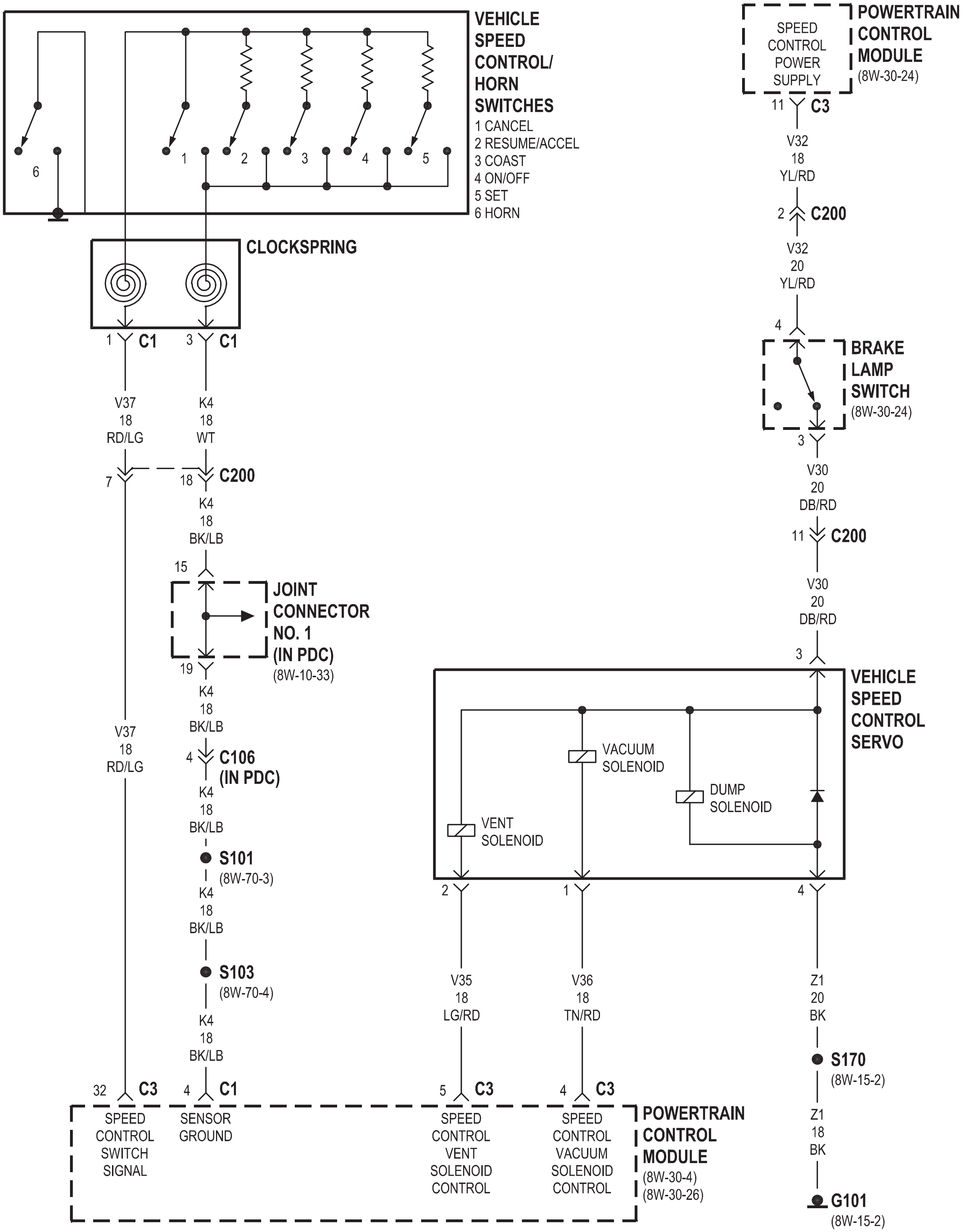

RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
2
15A
(8W-12-10)
1
C9
L10
18
BR/LG
2 DOOR
4 DOOR
S254
(8W-12-10)
L10
18
BR/LG
54
C200
L10
20
BR/LG
OTHER
DRL
S163
(8W-12-10)
12
C106
L10
20
BR/LG
1
TRANSMISSION SOLENOID ASSEMBLY
R
6
L1
20
VT/BK
16
C106
(IN PDC)
TO
JOINT CONNECTOR NO. 1
(IN PDC)
(8W-10-33)
BATT A1
(8W-10-27)
IGNITION SWITCH
(8W-10-27)
1 START
2 RUN
0 OFF
3 LOCK
4 ACC
1
2
0
3
4
1
A41
14
YL
40
C200
A41
14
DB/YL
2
CLUTCH INTERLOCK SWITCH JUMPER
(8W-21-3)
T141
14
YL
1
A41
14
DB/YL
S184
(8W-10-31)
A41
14
DB/YL
14
C106
(IN PDC)
A41
14
DB/YL
8
IGNITION SWITCH OUTPUT (ST)
TRANSMISSION CONTROL MODULE


CRANKSHAFT POSITION SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR
(8W-30-18)
1
K24
18
GY/BK
THROTTLE POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR
(8W-30-19)
2
K22
18
OR/DB
TRANSMISSION OVERDRIVE SWITCH SENSE
OVERDRIVE SWITCH
(8W-30-26)
1
T6
20
OR/WT
S177
(8W-30-18)
71
C200
T6
18
OR/WT
S173
(8W-30-19)
POWERTRAIN CONTROL MODULE
(8W-30-4)
(8W-30-20)
TORQUE MANAGEMENT REQUEST SENSE
SENSOR GROUND
13
C3
4
C1
T10
18
YL/DG
K4
18
BK/LB
S103
(8W-70-4)
5
C128
4
C128
S101
(8W-70-3)
T6
18
OR/WT
K24
18
GY/BK
K22
18
OR/DB
T10
18
YL/DG
K4
18
BK/LB
49
6
12
10
51
TRANSMISSION OVERDRIVE SWITCH SENSE
CRANKSHAFT POSITION SENSOR SIGNAL
THROTTLE POSITION SENSOR SIGNAL
TORQUE MANAGEMENT REQUEST SENSE
SENSOR GROUND
TRANSMISSION CONTROL MODULE

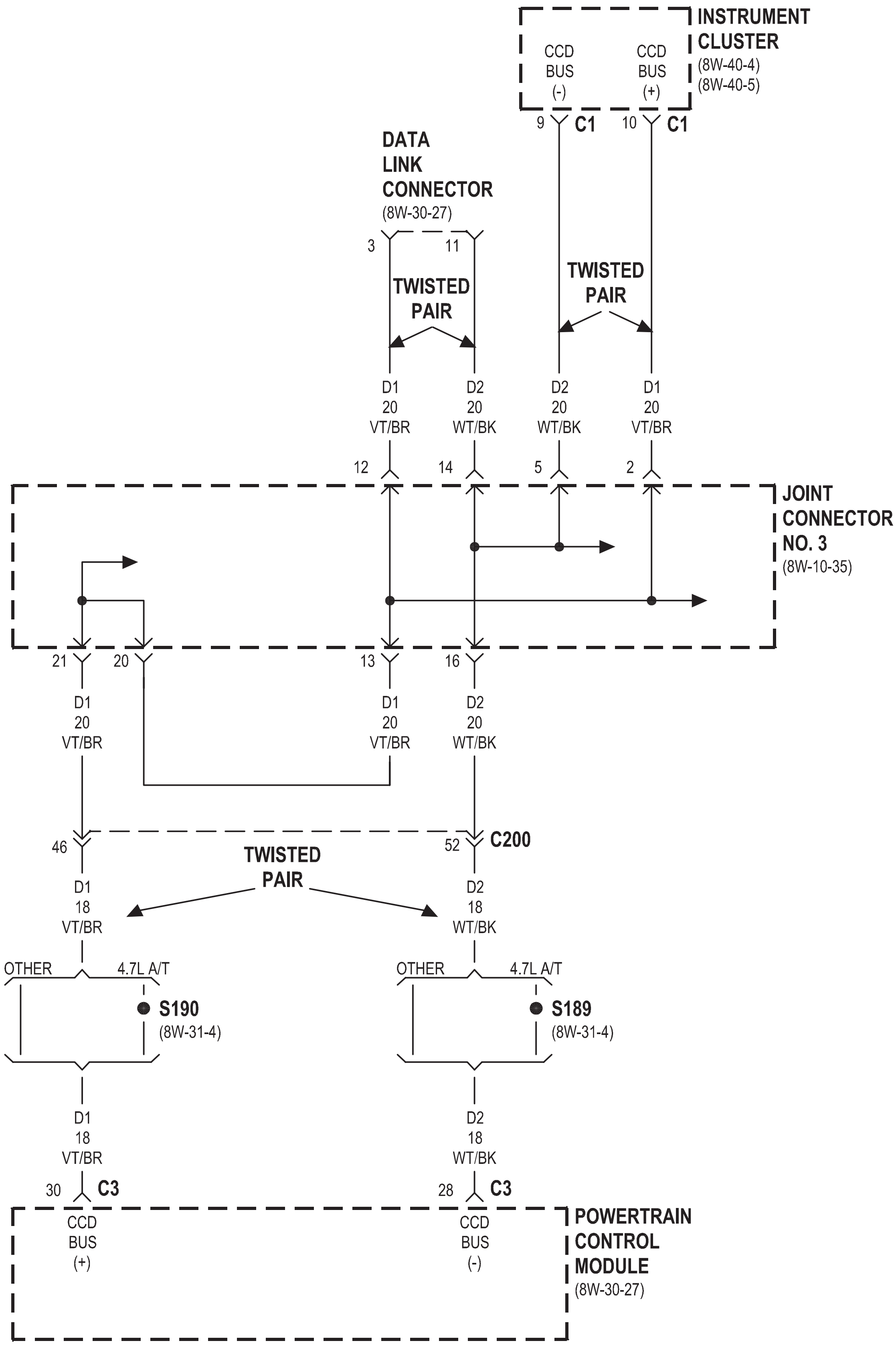
8W-33 VEHICLE SPEED CONTROL

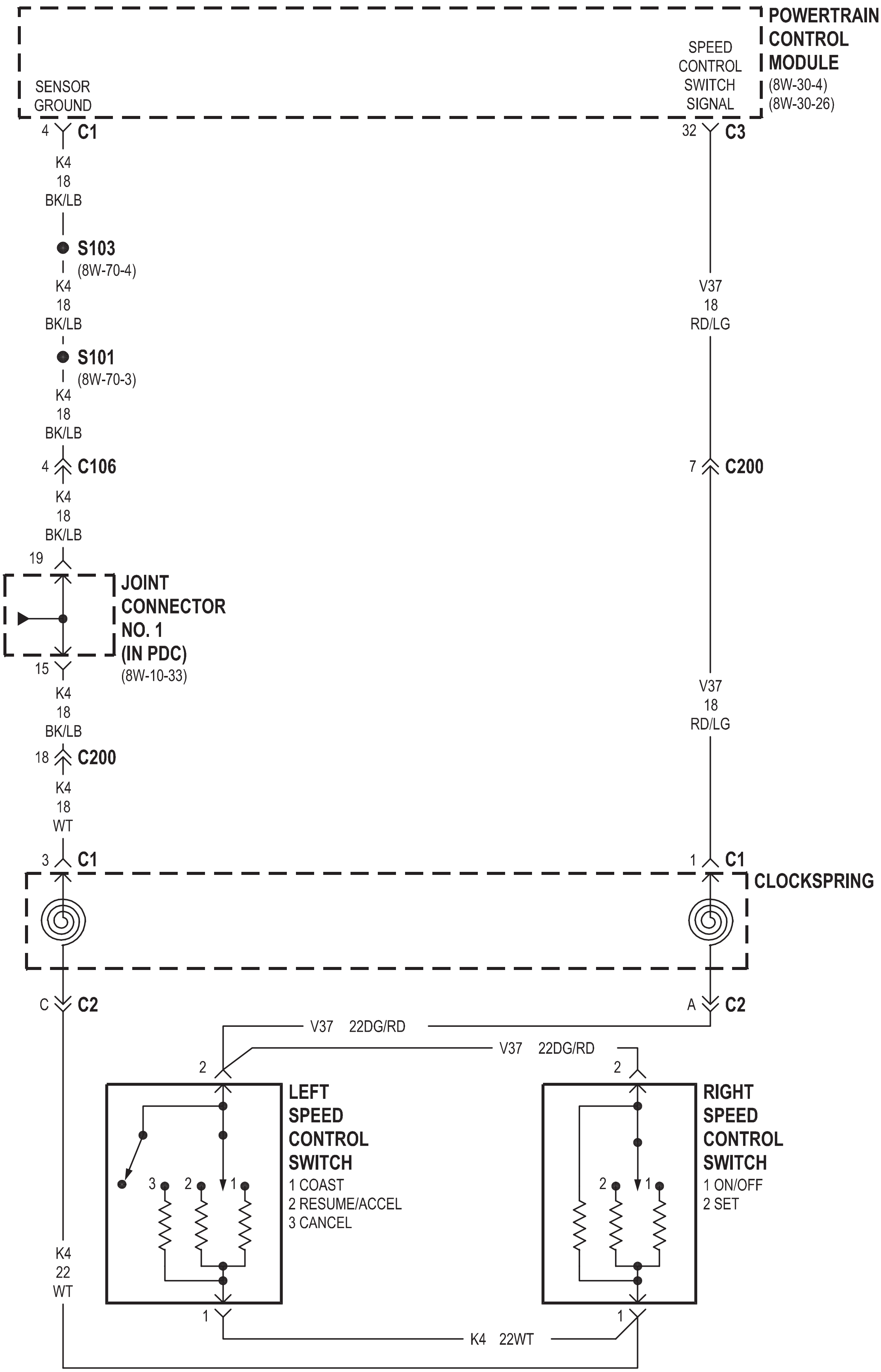
Component **Page**

Brake Lamp Switch 8W-33-2
Clockspring No. 1 . . . . 8W-33-2
Clockspring No. 1 . . . . 8W-33-4
Data Link Connector 8W-33-3
G101 . . . . 8W-33-2
Instrument Cluster 8W-33-3
Joint Connector No. 1 . . . . 8W-33-2, 4
Joint Connector No. 3 . . . . 8W-33-3
Left Speed Control Switch 8W-33-4
Powertrain Control Module 8W-33-2, 3, 4
Right Speed Control Switch 8W-33-4
Vehicle Speed Control Servo 8W-33-2
Vehicle Speed Control/Horn Switches 8W-33-2



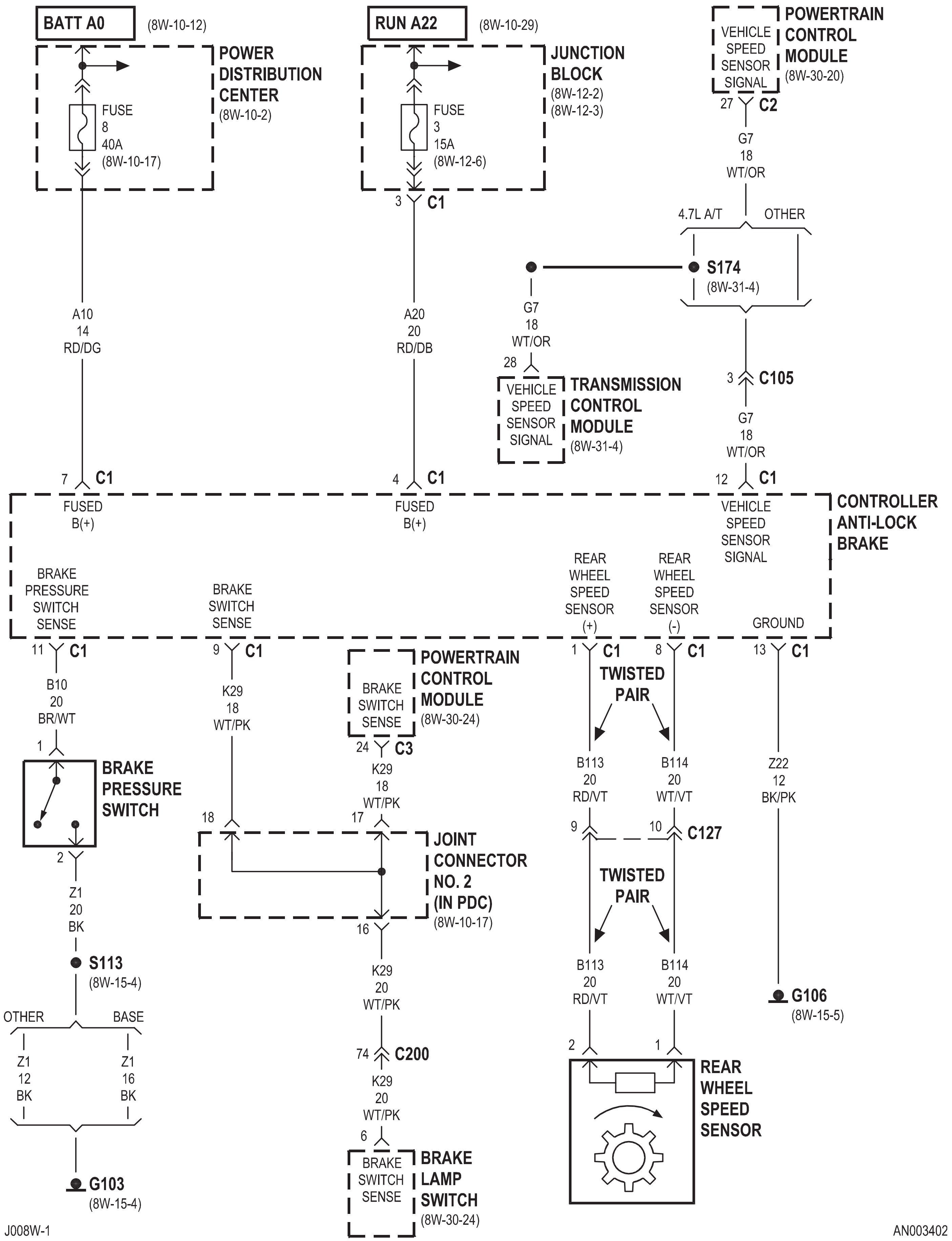
J008W-1 AN003302


INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
CCD BUS (-)
CCD BUS (+)
9 C1
10 C1
DATA LINK CONNECTOR
(8W-30-27)
3
11
TWISTED PAIR
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
D2 20 WT/BK
D1 20 VT/BR
12
14
5
2
JOINT CONNECTOR NO. 3
(8W-10-35)
21
20
13
16
D1 20 VT/BR
D1 20 VT/BR
D2 20 WT/BK
46
52
C200
TWISTED PAIR
D1 18 VT/BR
D2 18 WT/BK
OTHER
4.7L A/T
S190
(8W-31-4)
OTHER
4.7L A/T
S189
(8W-31-4)
D1 18 VT/BR
D2 18 WT/BK
30 C3
28 C3
CCD BUS (+)
CCD BUS (-)
POWERTRAIN CONTROL MODULE
(8W-30-27)


POWERTRAIN
CONTROL
MODULE
(8W-30-4)
(8W-30-26)
SENSOR
GROUND
SPEED
CONTROL
SWITCH
SIGNAL
4 C1
32 C3
K4
18
BK/LB
S103
(8W-70-4)
S101
(8W-70-3)
V37
18
RD/LG
4 C106
7 C200
19
JOINT
CONNECTOR
NO. 1
(IN PDC)
(8W-10-33)
15
18 C200
K4
18
WT
3 C1
1 C1
CLOCKSPRING
C C2
A C2
V37 22DG/RD
V37 22DG/RD
2
LEFT
SPEED
CONTROL
SWITCH
1 COAST
2 RESUME/ACCEL
3 CANCEL
RIGHT
SPEED
CONTROL
SWITCH
1 ON/OFF
2 SET
K4
22
WT
1
K4 22WT

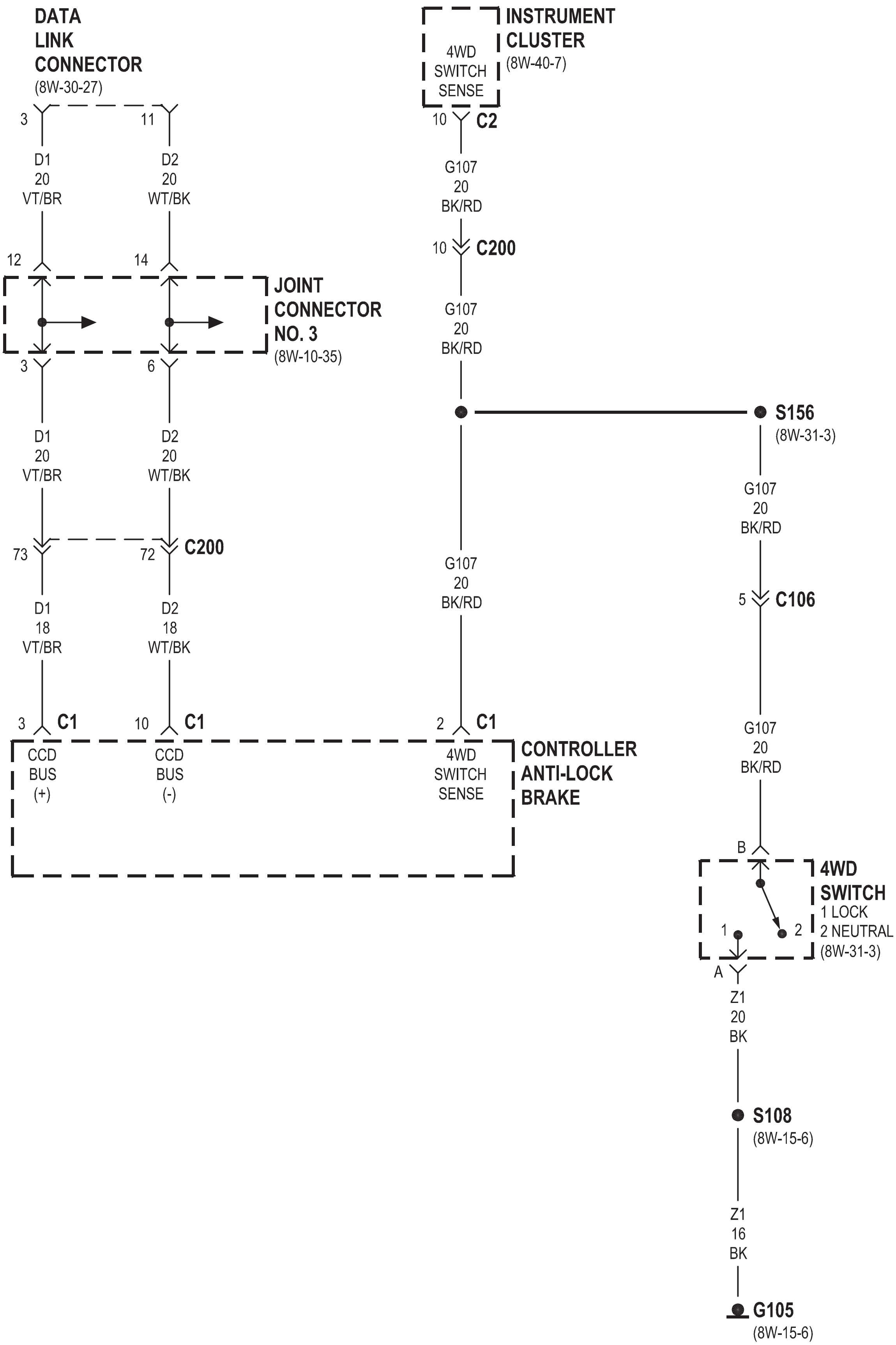
8W-34 REAR WHEEL ANTI-LOCK BRAKES

Component	Page
Brake Lamp Switch	8W-34-2
Brake Pressure Switch	8W-34-2
Controller Anti-Lock Brake	8W-34-2, 3
Data Link Connector	8W-34-3
Fuse 3 (JB)	8W-34-2
Fuse 8 (PDC)	8W-34-2
G103	8W-34-2
G105	8W-34-3
G106	8W-34-2
Instrument Cluster	8W-34-3
Joint Connector No. 2	8W-34-2
Joint Connector No. 3	8W-34-3
Junction Block	8W-34-2
Power Distribution Center	8W-34-2
Powertrain Control Module	8W-34-2
Rear Wheel Speed Sensor	8W-34-2
Transmission Control Module	8W-34-2



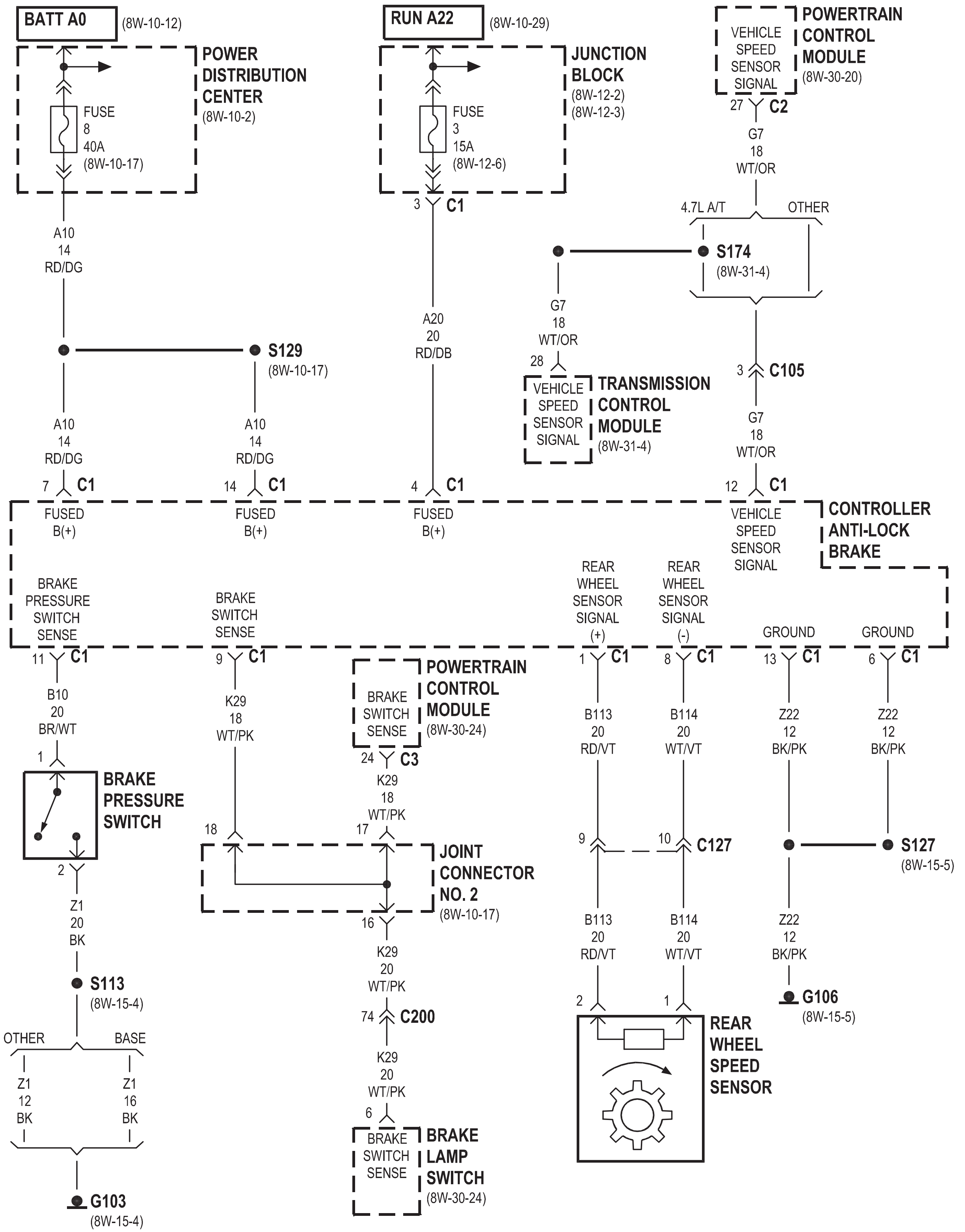
J008W-1

AN003402

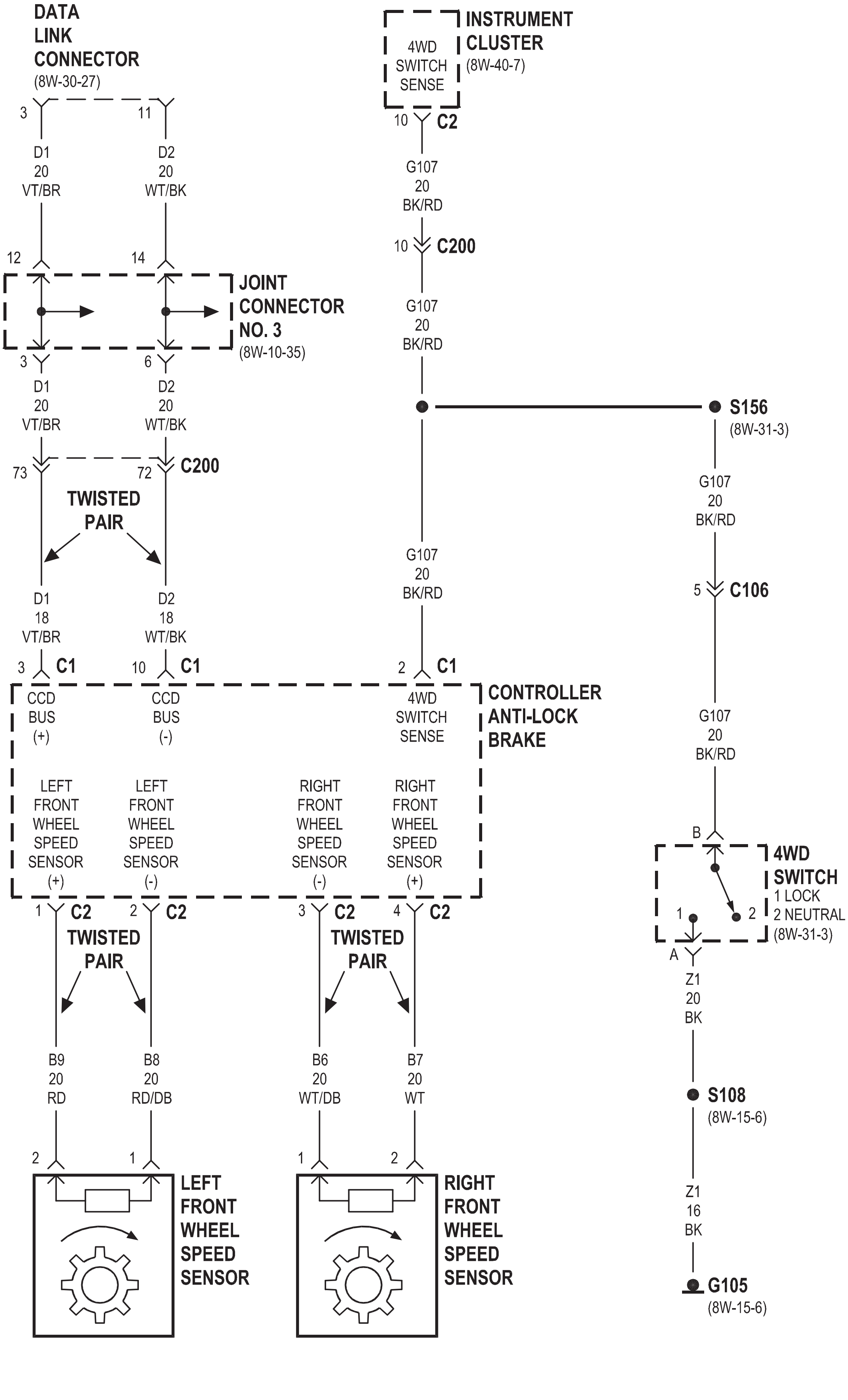

DATA
LINK
CONNECTOR
(8W-30-27)
3
11
D1
20
VT/BR
D2
20
WT/BK
12
14
JOINT
CONNECTOR
NO. 3
(8W-10-35)
3
6
D1
20
VT/BR
D2
20
WT/BK
73
72
C200
D1
18
VT/BR
D2
18
WT/BK
3
C1
10
C1
CCD
BUS
(+)
CCD
BUS
(-)
INSTRUMENT
CLUSTER
(8W-40-7)
4WD
SWITCH
SENSE
10
C2
G107
20
BK/RD
10
C200
G107
20
BK/RD
S156
(8W-31-3)
G107
20
BK/RD
G107
20
BK/RD
5
C106
2
C1
4WD
SWITCH
SENSE
CONTROLLER
ANTI-LOCK
BRAKE
G107
20
BK/RD
B
4WD
SWITCH
1 LOCK
2 NEUTRAL
(8W-31-3)
1
2
A
Z1
20
BK
S108
(8W-15-6)
Z1
16
BK
G105
(8W-15-6)

8W-35 ALL-WHEEL ANTI-LOCK BRAKES

Component	Page
Brake Lamp Switch	8W-35-2
Brake Pressure Switch	8W-35-2
Controller Anti-Lock Brake	8W-35-2, 3
Data Link Connector	8W-35-3
Fuse 3 (JB)	8W-35-2
Fuse 8 (PDC)	8W-35-2
G103	8W-35-2
G105	8W-35-3
G106	8W-35-2
Instrument Cluster	8W-35-3
Joint Connector No. 2	8W-35-2
Joint Connector No. 3	8W-35-3
Junction Block	8W-35-2
Left Front Wheel Speed Sensor	8W-35-3
Power Distribution Center	8W-35-2
Powertrain Control Module	8W-35-2
Rear Wheel Speed Sensor	8W-35-2
Right Front Wheel Speed Sensor	8W-35-3
Transmission Control Module	8W-35-2

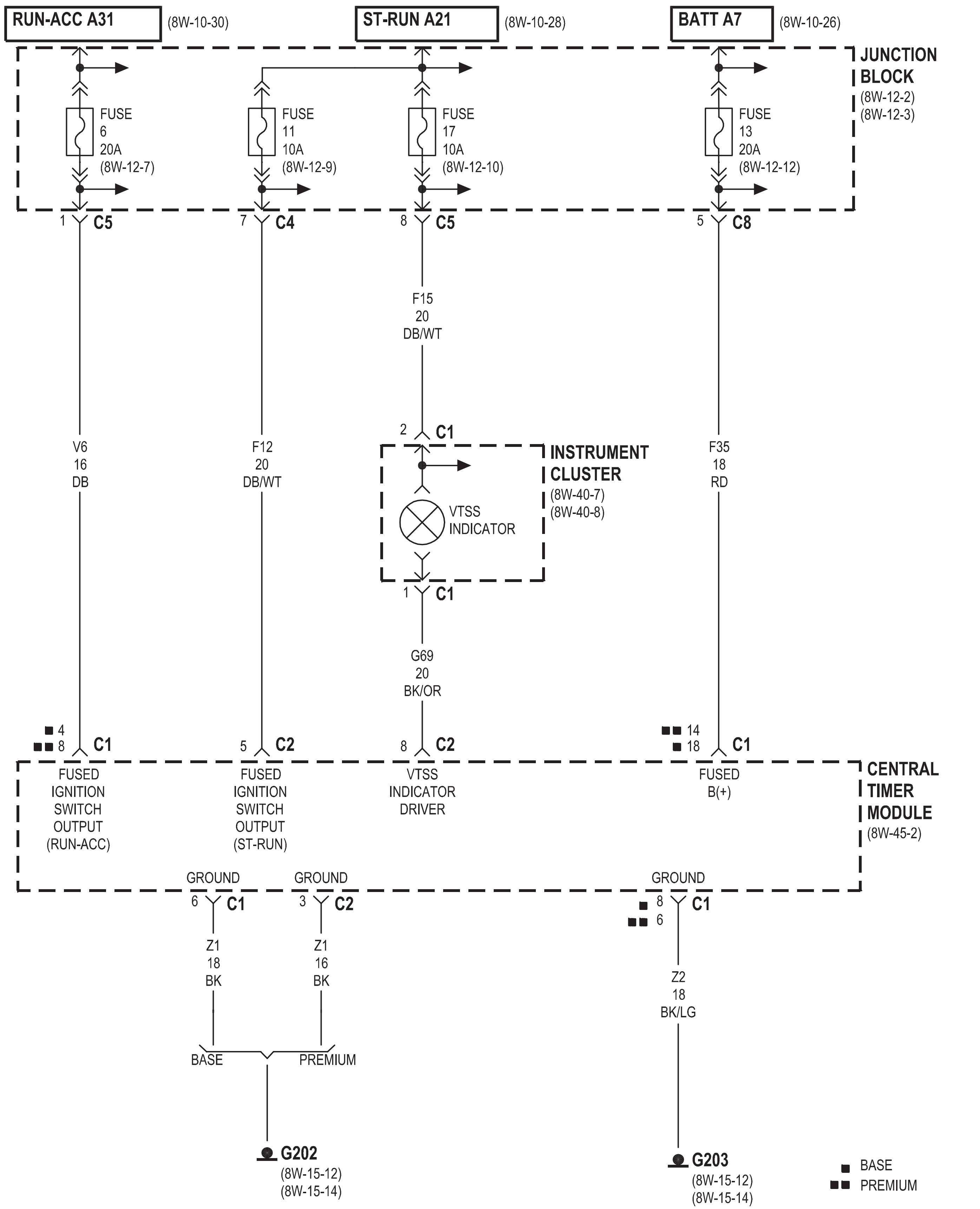


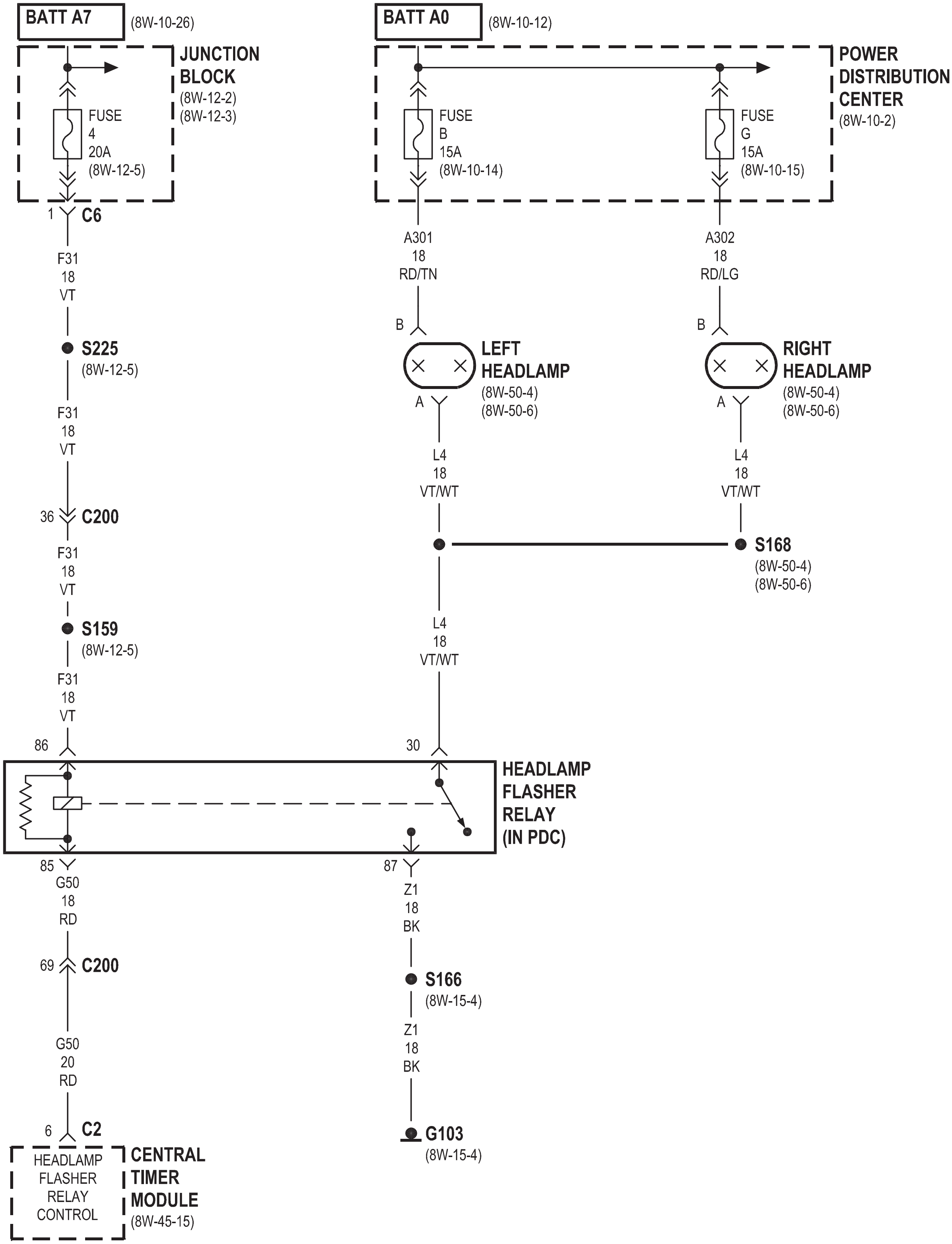
J008W-1 AN003502

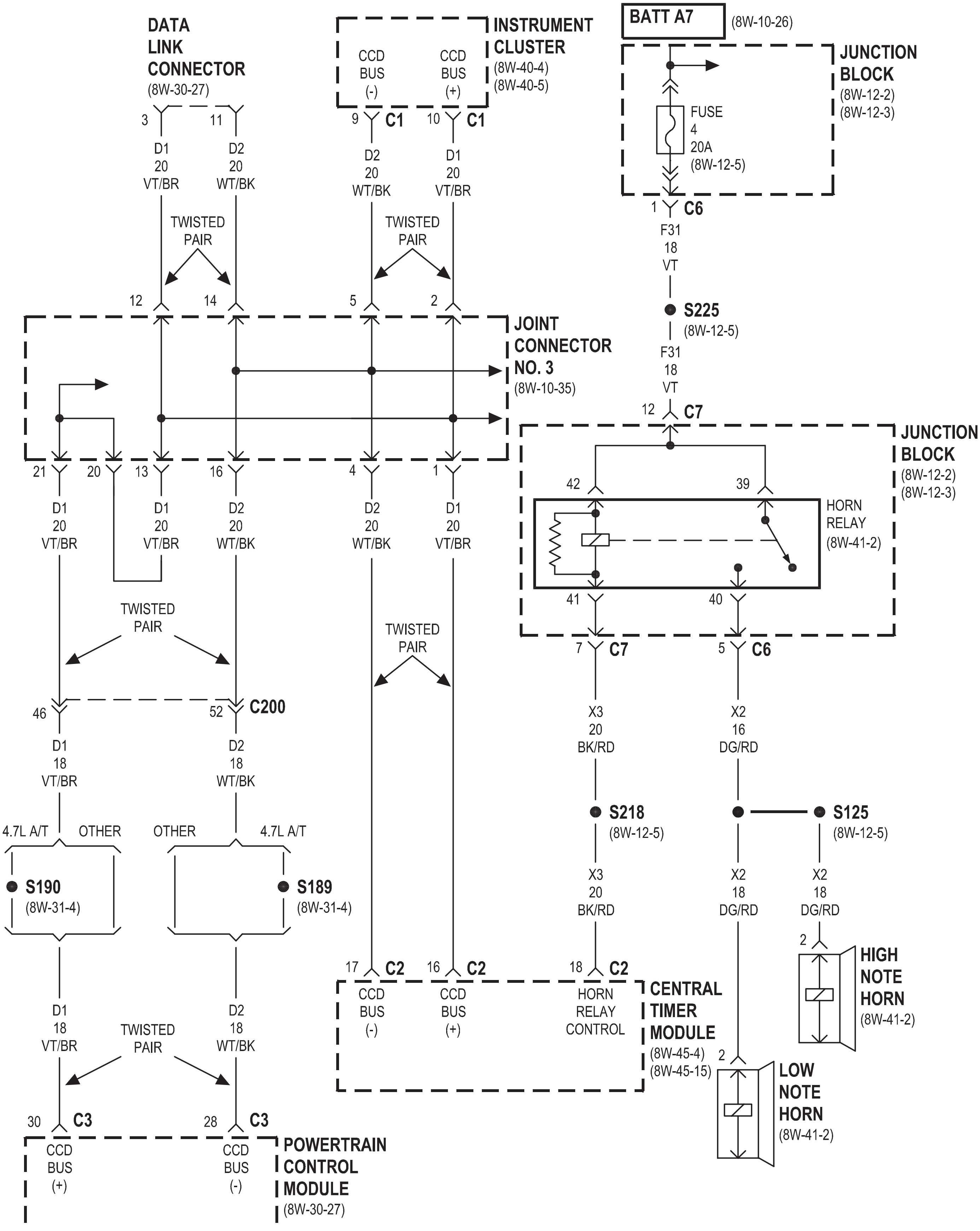

DATA
LINK
CONNECTOR
(8W-30-27)
3
11
D1
20
VT/BR
D2
20
WT/BK
12
14
JOINT
CONNECTOR
NO. 3
(8W-10-35)
3
6
D1
20
VT/BR
D2
20
WT/BK
73
72
C200
TWISTED
PAIR
D1
18
VT/BR
D2
18
WT/BK
3 C1
10 C1
INSTRUMENT
CLUSTER
(8W-40-7)
4WD
SWITCH
SENSE
10 C2
G107
20
BK/RD
10 C200
G107
20
BK/RD
S156
(8W-31-3)
G107
20
BK/RD
5 C106
G107
20
BK/RD
2 C1
CONTROLLER
ANTI-LOCK
BRAKE
CCD
BUS
(+)
CCD
BUS
(-)
4WD
SWITCH
SENSE
LEFT
FRONT
WHEEL
SPEED
SENSOR
(+)
LEFT
FRONT
WHEEL
SPEED
SENSOR
(-)
RIGHT
FRONT
WHEEL
SPEED
SENSOR
(-)
RIGHT
FRONT
WHEEL
SPEED
SENSOR
(+)
1 C2
2 C2
3 C2
4 C2
TWISTED
PAIR
TWISTED
PAIR
B9
20
RD
B8
20
RD/DB
B6
20
WT/DB
B7
20
WT
2
1
1
2
LEFT
FRONT
WHEEL
SPEED
SENSOR
RIGHT
FRONT
WHEEL
SPEED
SENSOR
B
4WD
SWITCH
1 LOCK
2 NEUTRAL
(8W-31-3)
1
2
A
Z1
20
BK
S108
(8W-15-6)
Z1
16
BK
G105
(8W-15-6)

8W-39 VEHICLE THEFT SECURITY SYSTEM

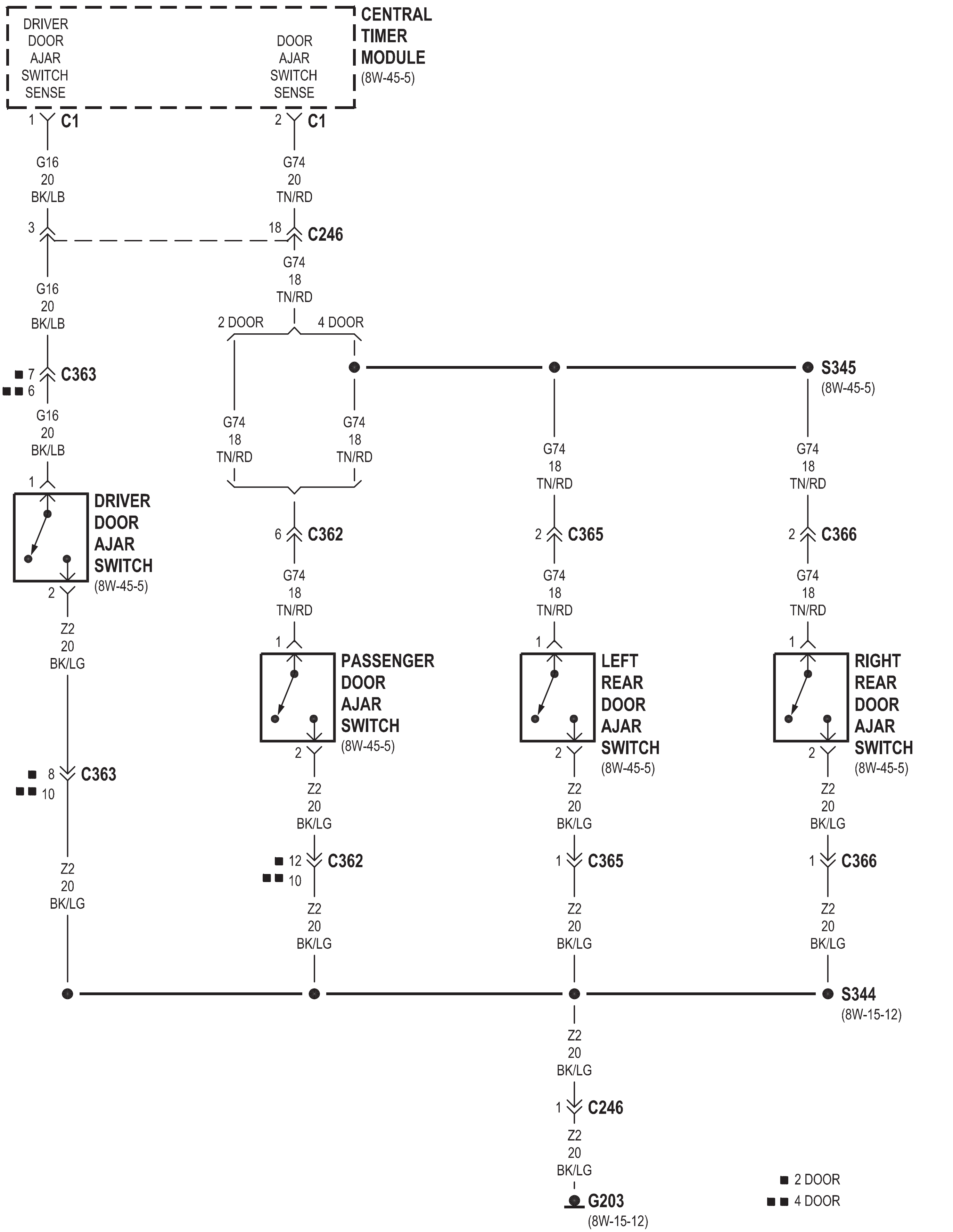
Component	Page
Central Timer Module	8W-39-2, 3, 4, 5, 6, 7, 8, 9, 10
Circuit Breaker 20 (JB)	8W-39-9, 10
Data Link Connector	8W-39-4
Driver Door Ajar Switch	8W-39-5
Driver Door Key Cylinder Switch	8W-39-6, 7
Driver Door Lock Motor/Ajar Switch	8W-39-6, 7
Driver Power Lock/Window Switch	8W-39-9, 10
Fuse 2 (JB)	8W-39-10
Fuse 4 (JB)	8W-39-3
Fuse 4 (PDC)	8W-39-4
Fuse 6 (JB)	8W-39-2
Fuse 11 (JB)	8W-39-2
Fuse 13 (JB)	8W-39-2, 9, 10
Fuse 17 (JB)	8W-39-2
Fuse B (PDC)	8W-39-3
Fuse G (PDC)	8W-39-3
G103	8W-39-3
G200	8W-39-9, 10
G202	8W-39-2
G203	8W-39-2, 5, 6, 7, 8
Headlamp Flasher Relay	8W-39-3
High Note Horn	8W-39-4
Horn Relay	8W-39-4
Instrument Cluster	8W-39-2, 4
Joint Connector No. 3	8W-39-4
Junction Block	8W-39-2, 3, 4, 9, 10
Left Headlamp	8W-39-3
Left Rear Door Ajar Switch	8W-39-5
Left Rear Door Lock Motor/Ajar Switch	8W-39-8
Low Note Horn	8W-39-4
Passenger Door Ajar Switch	8W-39-5
Passenger Door Key Cylinder Switch	8W-39-6, 7
Passenger Door Lock Motor/Ajar Switch	8W-39-6, 8
Passenger Door Lock Switch	8W-39-10
Passenger Power Lock/Window Switch	8W-39-9
Power Distribution Center	8W-39-3
Powertrain Control Module	8W-39-4
Right Headlamp	8W-39-3
Right Rear Door Ajar Switch	8W-39-5
Right Rear Door Lock Motor/Ajar Switch	8W-39-8
VTSS Indicator	8W-39-2


RUN-ACC A31
(8W-10-30)
ST-RUN A21
(8W-10-28)
BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 20A (8W-12-7)
FUSE 11 10A (8W-12-9)
FUSE 17 10A (8W-12-10)
FUSE 13 20A (8W-12-12)
1 C5
7 C4
8 C5
5 C8
F15 20 DB/WT
2 C1
INSTRUMENT CLUSTER
(8W-40-7)
(8W-40-8)
VTSS INDICATOR
1 C1
V6 16 DB
F12 20 DB/WT
F35 18 RD
G69 20 BK/OR
4
8 C1
5 C2
8 C2
14
18 C1
CENTRAL TIMER MODULE
(8W-45-2)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
VTSS INDICATOR DRIVER
FUSED B(+)
GROUND
GROUND
GROUND
6 C1
3 C2
8
6 C1
Z1 18 BK
Z1 16 BK
Z2 18 BK/LG
BASE
PREMIUM
G202
(8W-15-12)
(8W-15-14)
G203
(8W-15-12)
(8W-15-14)
BASE
PREMIUM

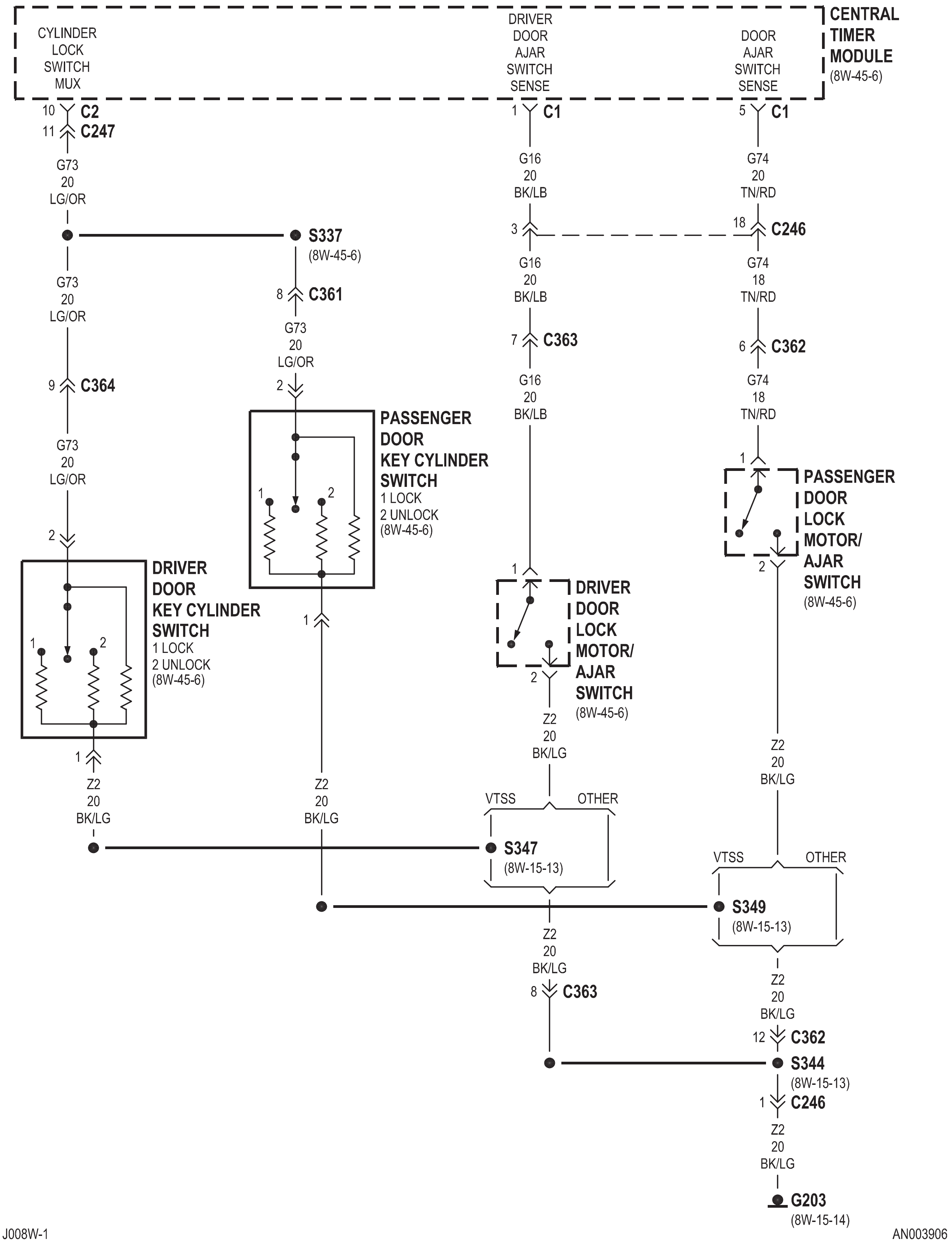

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 20A (8W-12-5)
1 C6
F31 18 VT
S225
(8W-12-5)
F31 18 VT
36 C200
F31 18 VT
S159
(8W-12-5)
F31 18 VT
86
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE B 15A (8W-10-14)
FUSE G 15A (8W-10-15)
A301 18 RD/TN
A302 18 RD/LG
B
LEFT HEADLAMP
(8W-50-4)
(8W-50-6)
A
B
RIGHT HEADLAMP
(8W-50-4)
(8W-50-6)
A
L4 18 VT/WT
L4 18 VT/WT
S168
(8W-50-4)
(8W-50-6)
L4 18 VT/WT
30
HEADLAMP FLASHER RELAY (IN PDC)
85
G50 18 RD
69 C200
G50 20 RD
6 C2
HEADLAMP FLASHER RELAY CONTROL
CENTRAL TIMER MODULE
(8W-45-15)
87
Z1 18 BK
S166
(8W-15-4)
Z1 18 BK
G103
(8W-15-4)


DATA LINK CONNECTOR
(8W-30-27)
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
CCD BUS (-)
CCD BUS (+)
BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 20A (8W-12-5)
C1
C6
F31 18 VT
S225
(8W-12-5)
D1 20 VT/BR
D2 20 WT/BK
TWISTED PAIR
JOINT CONNECTOR NO. 3
(8W-10-35)
C7
HORN RELAY
(8W-41-2)
C200
D1 18 VT/BR
D2 18 WT/BK
X3 20 BK/RD
X2 16 DG/RD
S218
(8W-12-5)
S125
(8W-12-5)
X2 18 DG/RD
4.7L A/T
OTHER
S190
(8W-31-4)
S189
(8W-31-4)
C2
CENTRAL TIMER MODULE
(8W-45-4)
(8W-45-15)
HORN RELAY CONTROL
HIGH NOTE HORN
(8W-41-2)
LOW NOTE HORN
(8W-41-2)
C3
POWERTRAIN CONTROL MODULE
(8W-30-27)
CCD BUS (+)
CCD BUS (-)

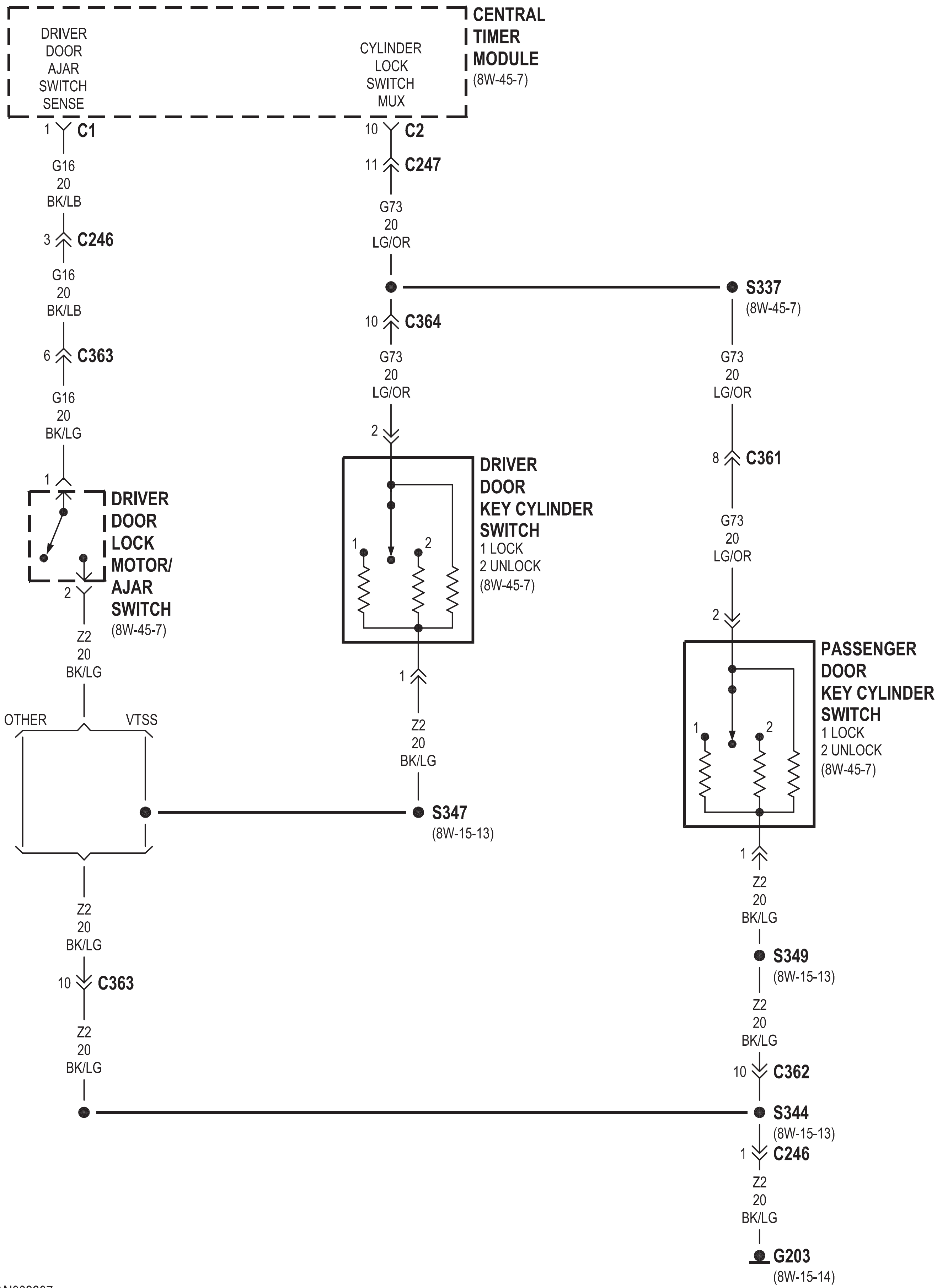
BASE


CENTRAL TIMER MODULE
(8W-45-5)
DRIVER DOOR AJAR SWITCH SENSE
DOOR AJAR SWITCH SENSE
1 C1
2 C1
G16 20 BK/LB
G74 20 TN/RD
3
18 C246
G74 18 TN/RD
G16 20 BK/LB
2 DOOR
4 DOOR
7 C363
6
S345
(8W-45-5)
G16 20 BK/LB
G74 18 TN/RD
1
DRIVER DOOR AJAR SWITCH
(8W-45-5)
2
6 C362
2 C365
2 C366
Z2 20 BK/LG
1
PASSENGER DOOR AJAR SWITCH
(8W-45-5)
LEFT REAR DOOR AJAR SWITCH
(8W-45-5)
RIGHT REAR DOOR AJAR SWITCH
(8W-45-5)
8 C363
10
12 C362
10
1 C365
1 C366
S344
(8W-15-12)
1 C246
G203
(8W-15-12)
■ 2 DOOR
■■ 4 DOOR

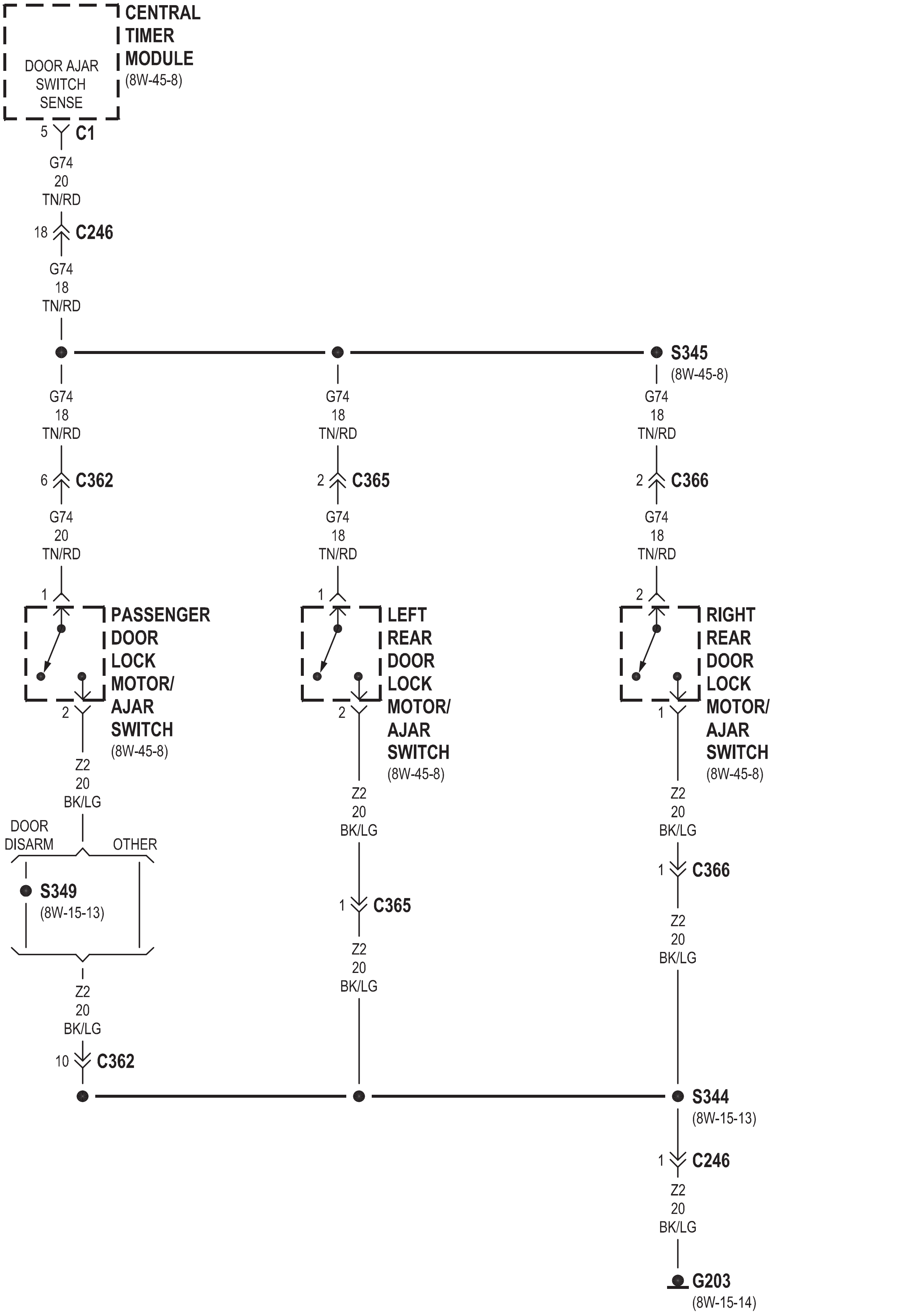
PREMIUM 2 DOOR



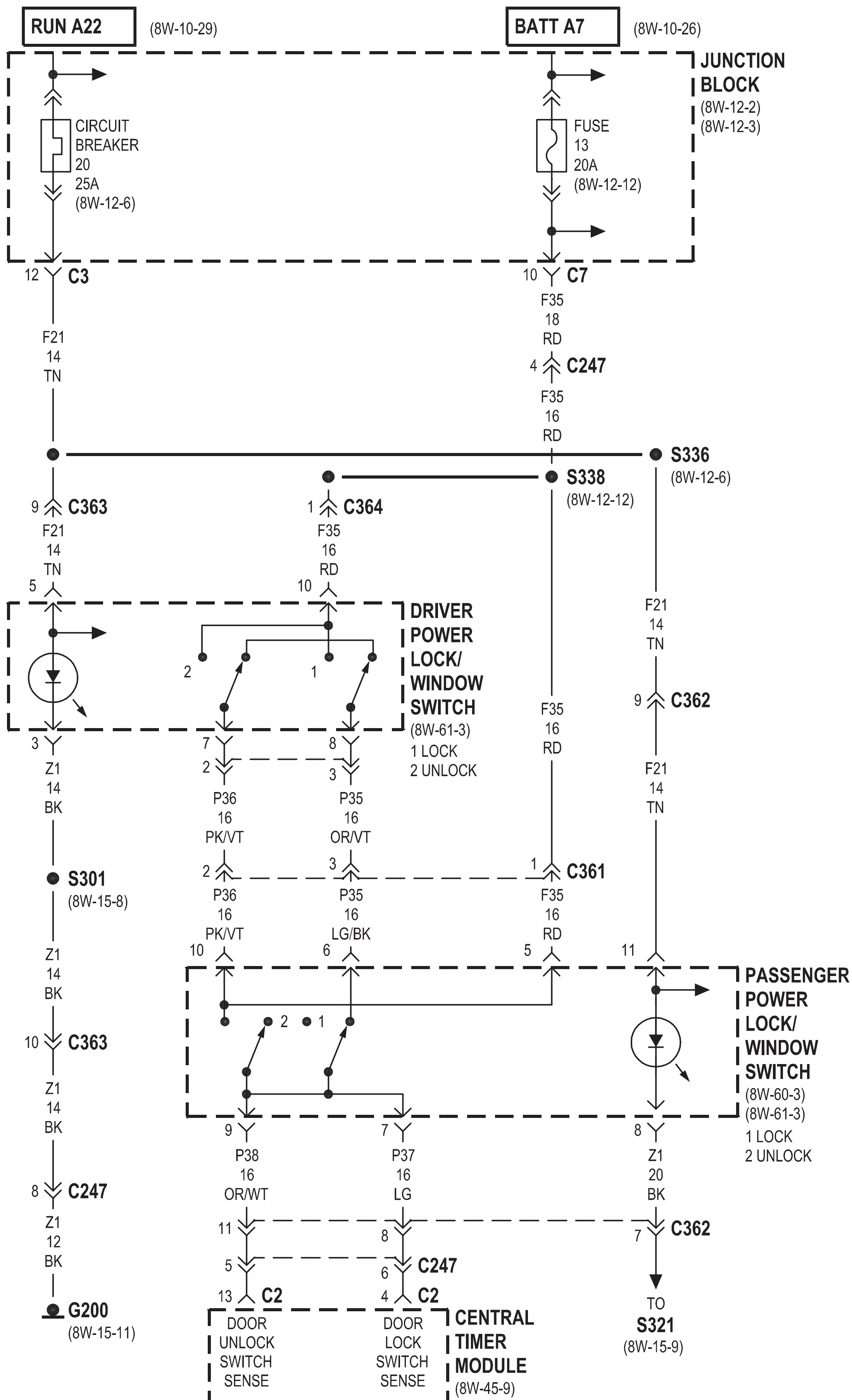
PREMIUM 4 DOOR



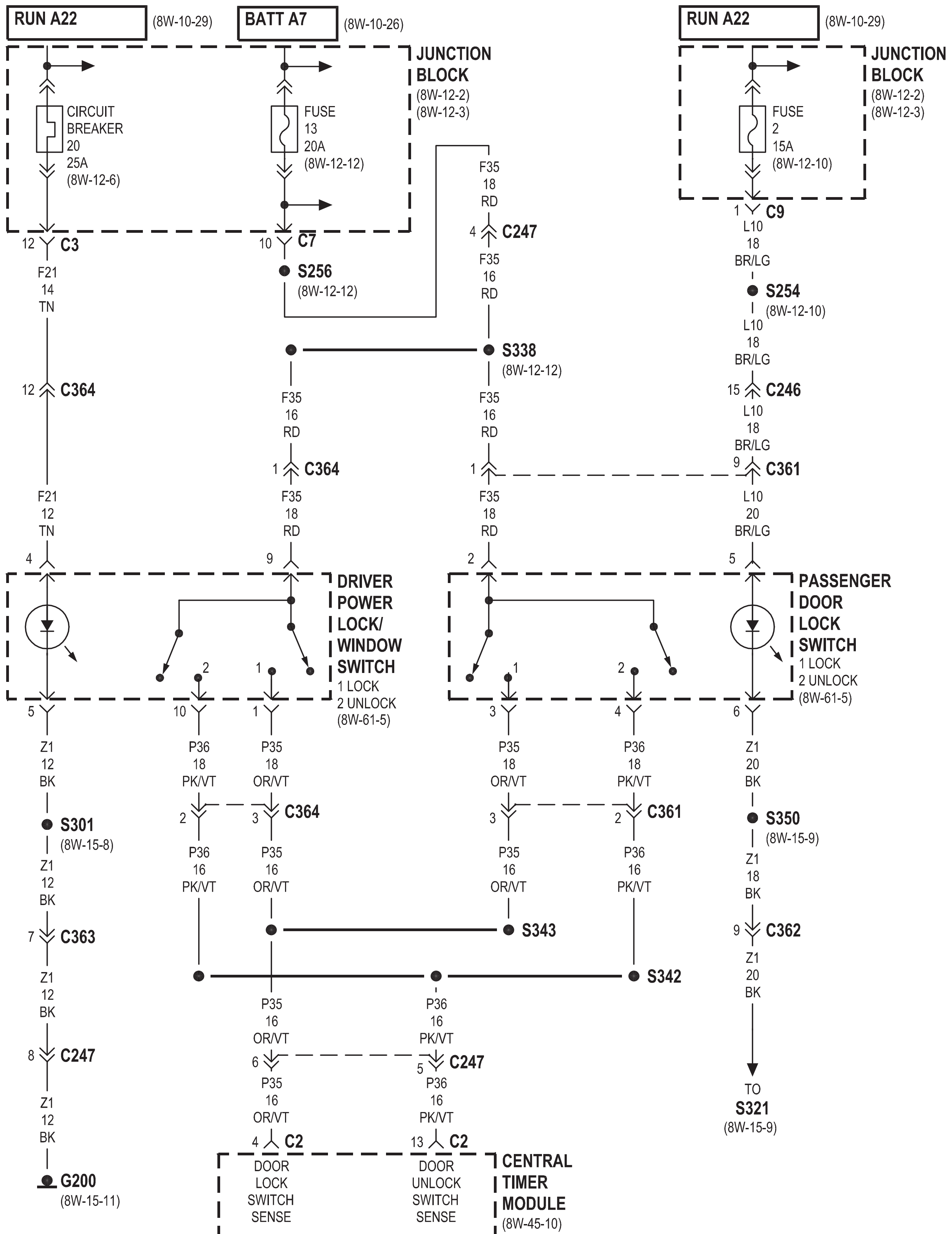
PREMIUM 4 DOOR



2 DOOR

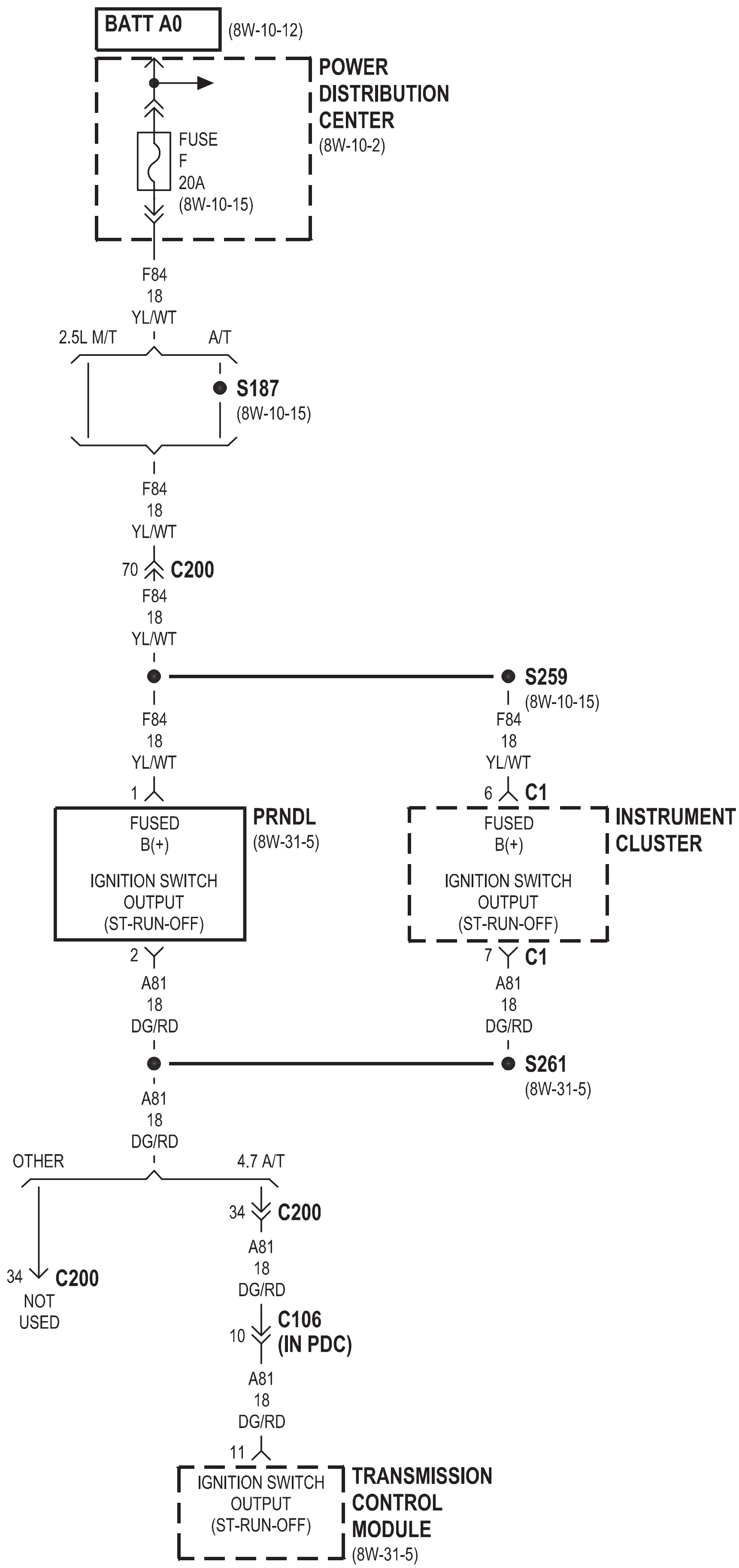


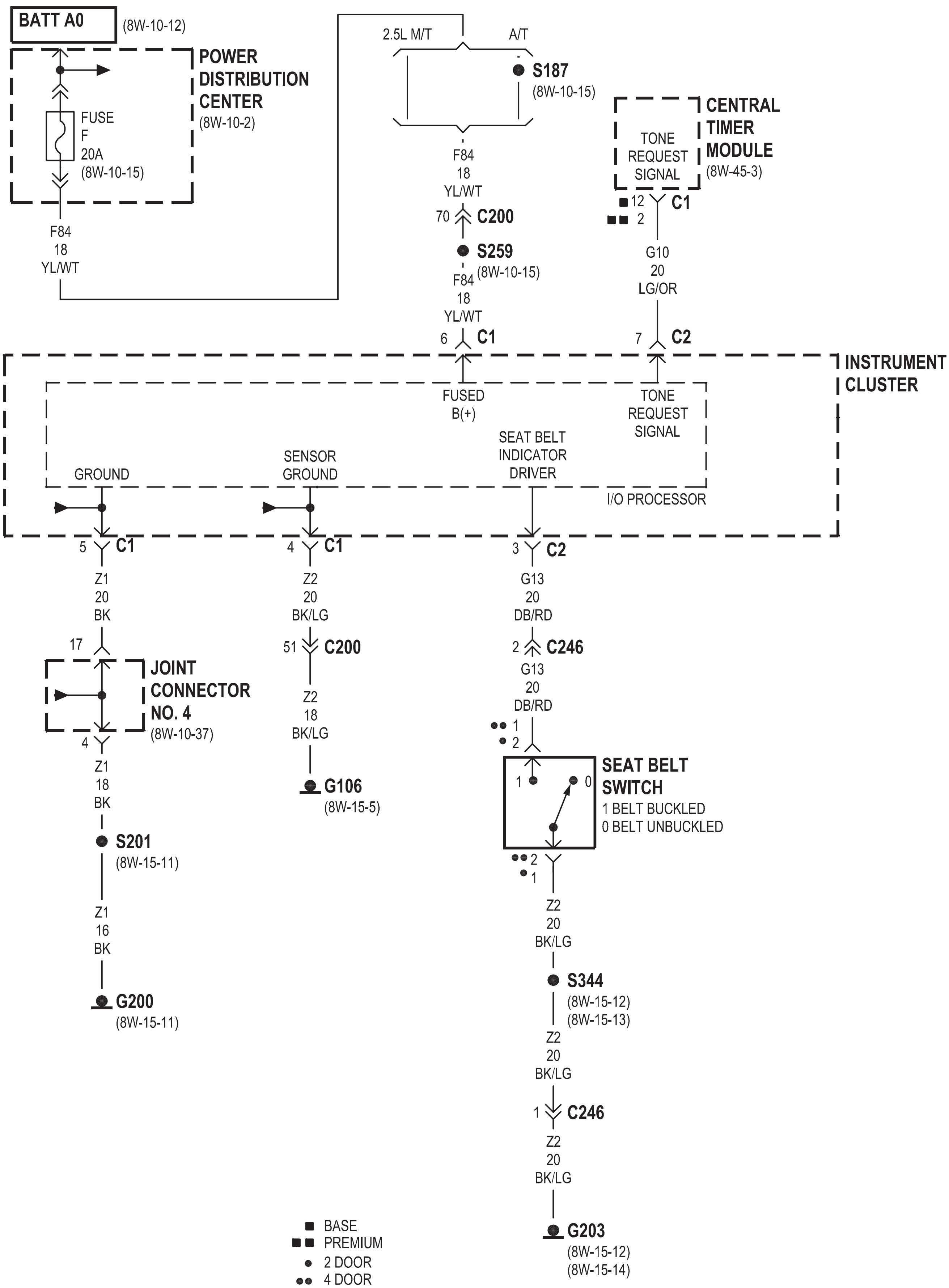
AN003909 J008W-1

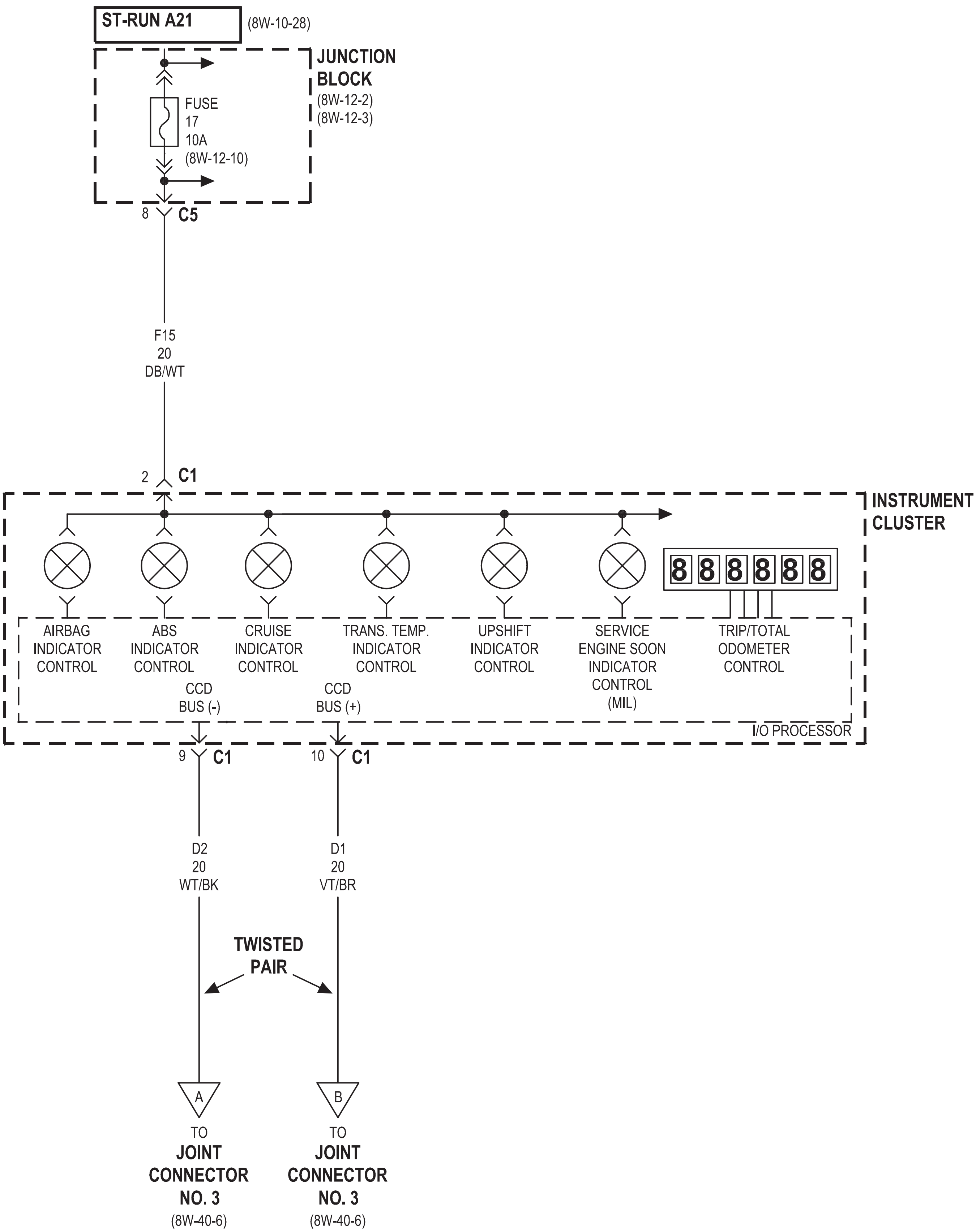

RUN A22
(8W-10-29)
BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER 20 25A (8W-12-6)
FUSE 13 20A (8W-12-12)
FUSE 2 15A (8W-12-10)
C3
C7
C9
S256
(8W-12-12)
F35 18 RD
C247
F35 16 RD
F21 14 TN
L10 18 BR/LG
S254
(8W-12-10)
S338
(8W-12-12)
C364
C246
C361
F21 12 TN
F35 18 RD
L10 20 BR/LG
DRIVER POWER LOCK/ WINDOW SWITCH
1 LOCK
2 UNLOCK
(8W-61-5)
PASSENGER DOOR LOCK SWITCH
1 LOCK
2 UNLOCK
(8W-61-5)
Z1 12 BK
P36 18 PK/VT
P35 18 OR/VT
Z1 20 BK
S301
(8W-15-8)
S350
(8W-15-9)
P36 16 PK/VT
P35 16 OR/VT
Z1 18 BK
C363
C362
S343
S342
C247
TO S321
(8W-15-9)
C2
G200
(8W-15-11)
CENTRAL TIMER MODULE
(8W-45-10)
DOOR LOCK SWITCH SENSE
DOOR UNLOCK SWITCH SENSE

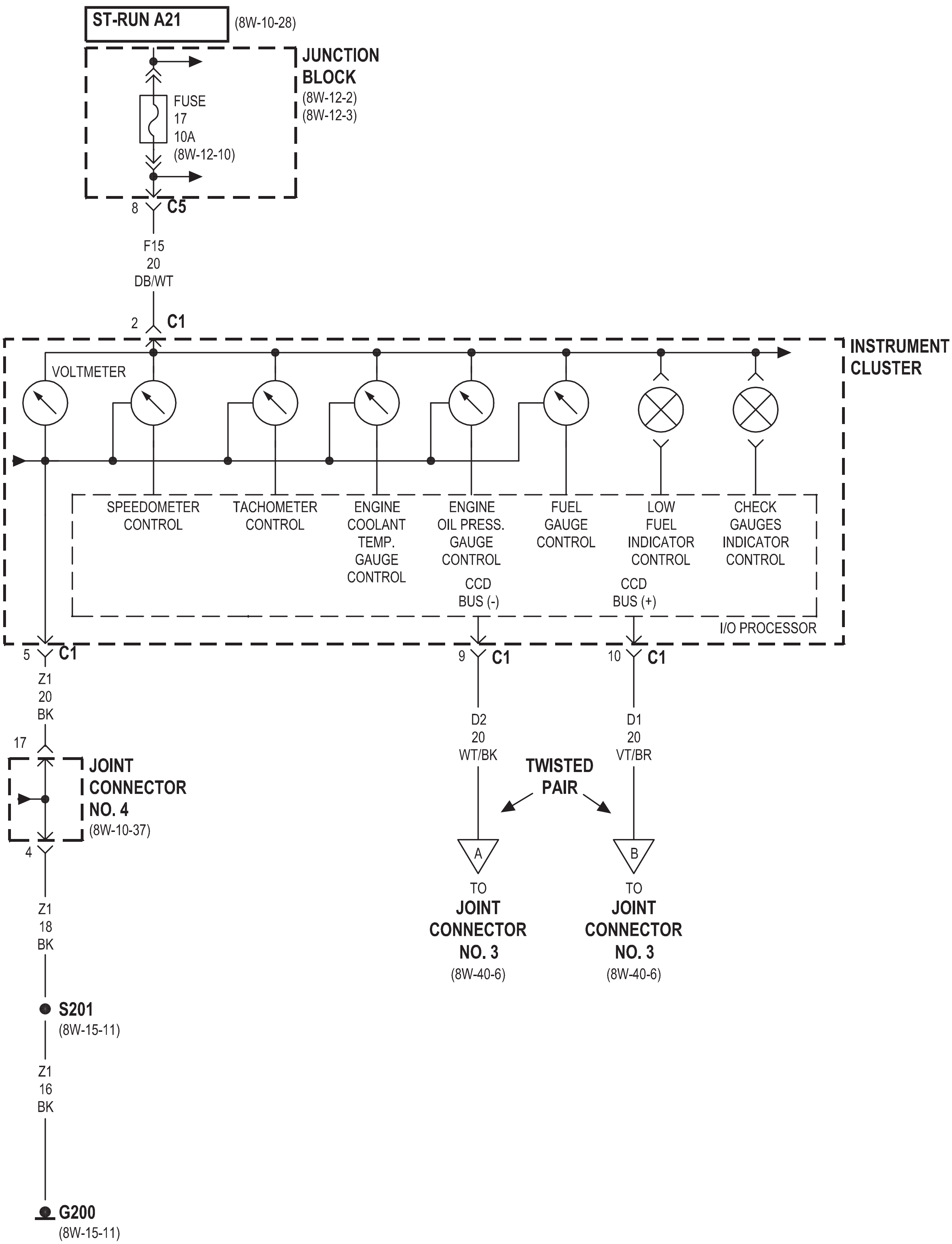
8W-40 INSTRUMENT CLUSTER

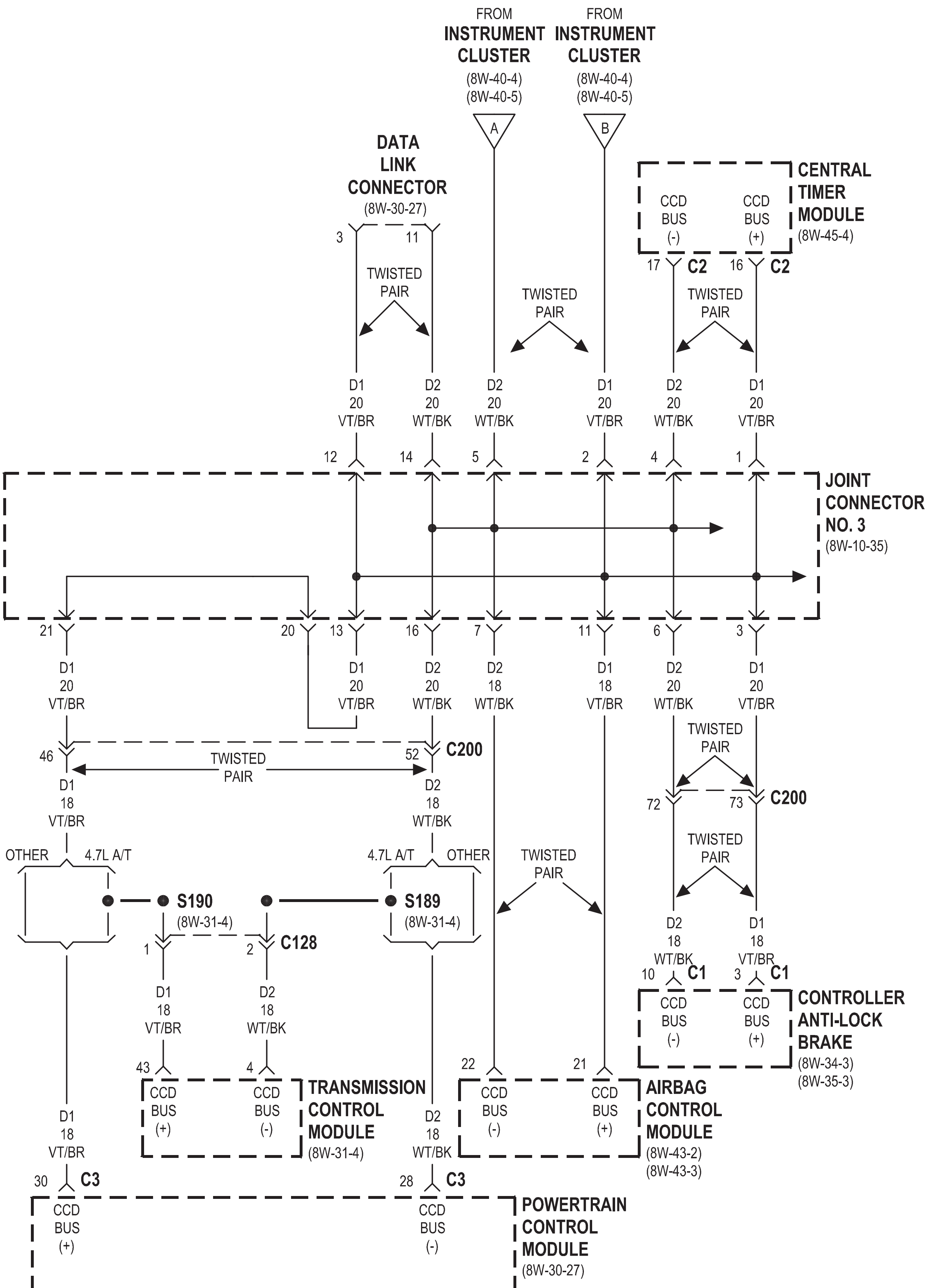
Component	Page
Airbag Control Module	8W-40-6
Brake Warning Indicator	8W-40-8
Central Timer Module	8W-40-3, 6, 8
Cluster Illumination Lamps	8W-40-10
Controller Anti-Lock Brake	8W-40-6, 7
Data Link Connector	8W-40-6
Daytime Running Lamp Module	8W-40-8, 9
Fuse 5 (JB)	8W-40-10
Fuse 14 (JB)	8W-40-10
Fuse 17 (JB)	8W-40-4, 5, 7, 8
Fuse F (PDC)	8W-40-2, 3
G101	8W-40-7
G105	8W-40-7
G106	8W-40-3, 10
G200	8W-40-3, 5, 9, 10
G203	8W-40-3
Headlamp Switch	8W-40-10
High Beam Indicator	8W-40-9
I/O Processor	8W-40-3, 7
Instrument Cluster	8W-40-2, 3, 4, 5, 6, 7, 8, 9, 10
Joint Connector No. 3	8W-40-6
Joint Connector No. 4	8W-40-3, 5, 9, 10
Junction Block	8W-40-4, 5, 7, 8, 9, 10
Left Turn Indicator	8W-40-9
Low Washer Fluid Indicator	8W-40-7
Multi- Function Switch	8W-40-9
Park Brake Switch	8W-40-8
Power Distribution Center	8W-40-2, 3
Powertrain Control Module	8W-40-6
PRNDL	8W-40-2
Right Turn Indicator	8W-40-9
Seat Belt Switch	8W-40-3
Transmission Control Module	8W-40-2, 6
Turn Signal/Hazard Switch	8W-40-9
Voltmeter	8W-40-5
VTSS Indicator	8W-40-8
Washer Fluid Level Sensor	8W-40-7

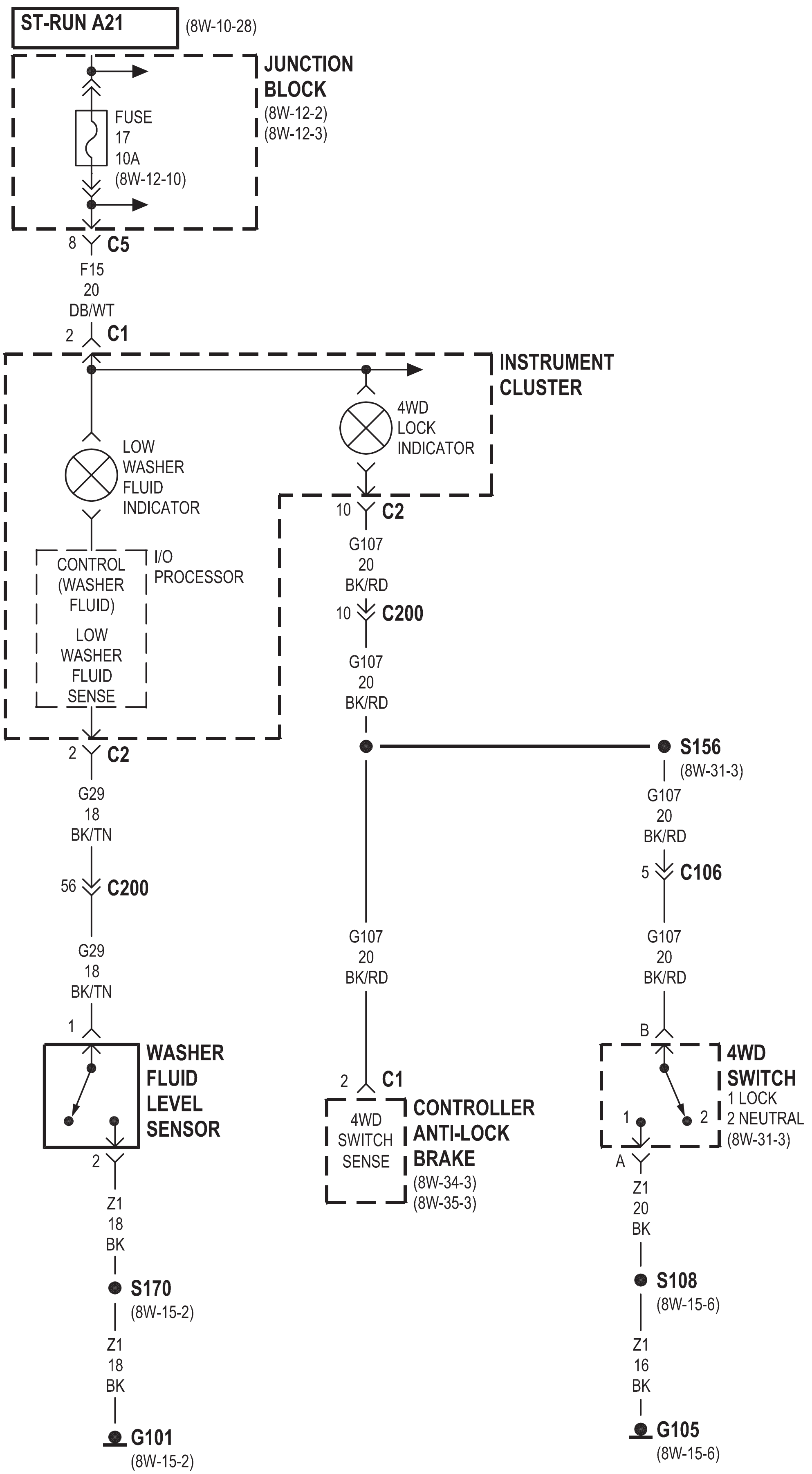

BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
F
20A
(8W-10-15)
F84
18
YL/WT
2.5L M/T
A/T
S187
(8W-10-15)
F84
18
YL/WT
70
C200
F84
18
YL/WT
S259
(8W-10-15)
F84
18
YL/WT
F84
18
YL/WT
1
6
C1
FUSED
B(+)
IGNITION SWITCH
OUTPUT
(ST-RUN-OFF)
PRNDL
(8W-31-5)
FUSED
B(+)
IGNITION SWITCH
OUTPUT
(ST-RUN-OFF)
INSTRUMENT CLUSTER
2
7
C1
A81
18
DG/RD
A81
18
DG/RD
S261
(8W-31-5)
A81
18
DG/RD
OTHER
4.7 A/T
34
C200
34
C200
NOT
USED
A81
18
DG/RD
10
C106
(IN PDC)
A81
18
DG/RD
11
IGNITION SWITCH
OUTPUT
(ST-RUN-OFF)
TRANSMISSION CONTROL MODULE
(8W-31-5)

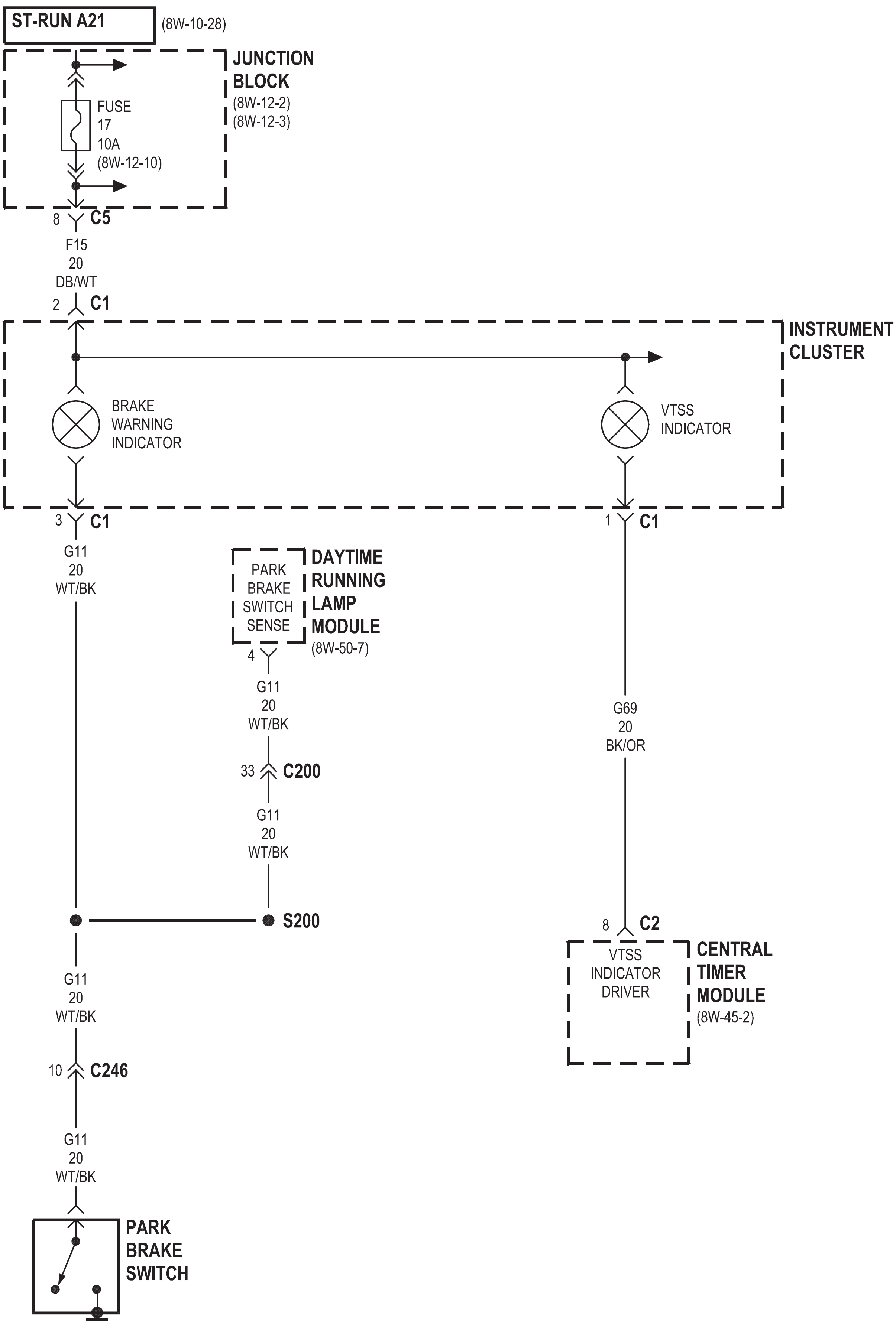

BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
F
20A
(8W-10-15)
F84
18
YL/WT
2.5L M/T
A/T
S187
(8W-10-15)
F84
18
YL/WT
70
C200
S259
(8W-10-15)
F84
18
YL/WT
6
C1
CENTRAL TIMER MODULE
(8W-45-3)
TONE REQUEST SIGNAL
12
2
C1
G10
20
LG/OR
7
C2
INSTRUMENT CLUSTER
FUSED B(+)
TONE REQUEST SIGNAL
SEAT BELT INDICATOR DRIVER
SENSOR GROUND
GROUND
I/O PROCESSOR
5
C1
4
C1
3
C2
Z1
20
BK
17
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)
Z2
20
BK/LG
51
C200
Z2
18
BK/LG
G106
(8W-15-5)
G13
20
DB/RD
2
C246
G13
20
DB/RD
1
2
SEAT BELT SWITCH
1
0
1 BELT BUCKLED
0 BELT UNBUCKLED
2
1
Z2
20
BK/LG
S344
(8W-15-12)
(8W-15-13)
Z2
20
BK/LG
1
C246
Z2
20
BK/LG
G203
(8W-15-12)
(8W-15-14)
BASE
PREMIUM
2 DOOR
4 DOOR


ST-RUN A21
(8W-10-28)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
17
10A
(8W-12-10)
8
C5
F15
20
DB/WT
2
C1
INSTRUMENT
CLUSTER
888888
AIRBAG
INDICATOR
CONTROL
ABS
INDICATOR
CONTROL
CRUISE
INDICATOR
CONTROL
TRANS. TEMP.
INDICATOR
CONTROL
UPSHIFT
INDICATOR
CONTROL
SERVICE
ENGINE SOON
INDICATOR
CONTROL
(MIL)
TRIP/TOTAL
ODOMETER
CONTROL
CCD
BUS (-)
CCD
BUS (+)
I/O PROCESSOR
9
C1
10
C1
D2
20
WT/BK
D1
20
VT/BR
TWISTED
PAIR
A
B
TO
JOINT
CONNECTOR
NO. 3
(8W-40-6)
TO
JOINT
CONNECTOR
NO. 3
(8W-40-6)

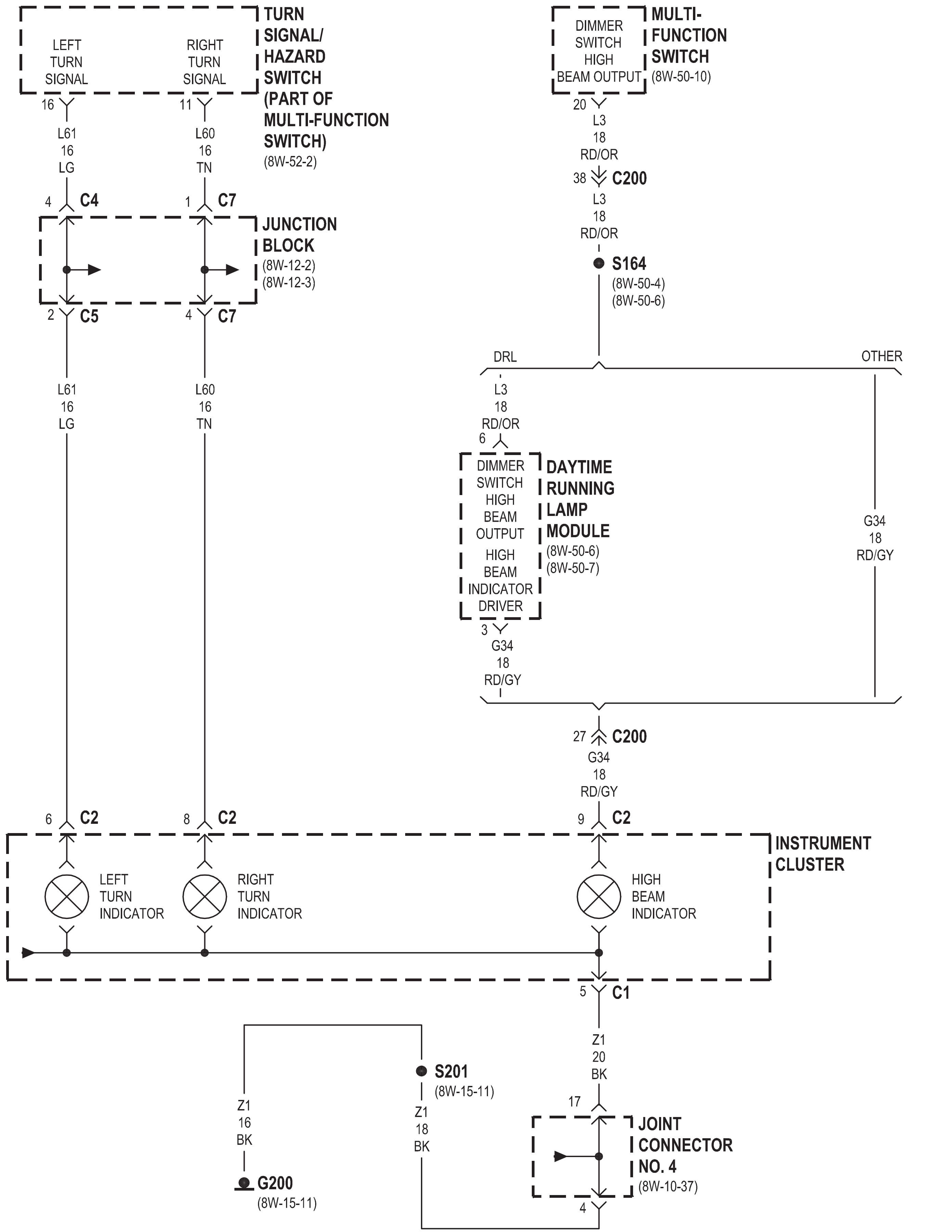

ST-RUN A21
(8W-10-28)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
17
10A
(8W-12-10)
8
C5
F15
20
DB/WT
2
C1
INSTRUMENT
CLUSTER
VOLTMETER
SPEEDOMETER
CONTROL
TACHOMETER
CONTROL
ENGINE
COOLANT
TEMP.
GAUGE
CONTROL
ENGINE
OIL PRESS.
GAUGE
CONTROL
FUEL
GAUGE
CONTROL
LOW
FUEL
INDICATOR
CONTROL
CHECK
GAUGES
INDICATOR
CONTROL
CCD
BUS (-)
CCD
BUS (+)
I/O PROCESSOR
5
C1
9
C1
10
C1
Z1
20
BK
17
JOINT
CONNECTOR
NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)
D2
20
WT/BK
D1
20
VT/BR
TWISTED
PAIR
A
B
TO
JOINT
CONNECTOR
NO. 3
(8W-40-6)
TO
JOINT
CONNECTOR
NO. 3
(8W-40-6)


FROM
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
A
FROM
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
B
DATA LINK CONNECTOR
(8W-30-27)
3
11
TWISTED PAIR
CENTRAL TIMER MODULE
(8W-45-4)
CCD BUS (-)
CCD BUS (+)
17 C2
16 C2
D1 20 VT/BR
D2 20 WT/BK
D2 20 WT/BK
D1 20 VT/BR
D2 20 WT/BK
D1 20 VT/BR
12
14
5
2
4
1
JOINT CONNECTOR NO. 3
(8W-10-35)
21
20
13
16
7
11
6
3
D1 20 VT/BR
D1 20 VT/BR
D2 20 WT/BK
D2 18 WT/BK
D1 18 VT/BR
D2 20 WT/BK
D1 20 VT/BR
46
52
C200
D1 18 VT/BR
D2 18 WT/BK
72
73
C200
OTHER
4.7L A/T
4.7L A/T
OTHER
S190
(8W-31-4)
S189
(8W-31-4)
1
2
C128
D1 18 VT/BR
D2 18 WT/BK
D2 18 WT/BK
D1 18 VT/BR
10 C1
3 C1
CONTROLLER ANTI-LOCK BRAKE
(8W-34-3)
(8W-35-3)
43
4
TRANSMISSION CONTROL MODULE
(8W-31-4)
22
21
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
CCD BUS (+)
CCD BUS (-)
D1 18 VT/BR
D2 18 WT/BK
30 C3
28 C3
POWERTRAIN CONTROL MODULE
(8W-30-27)

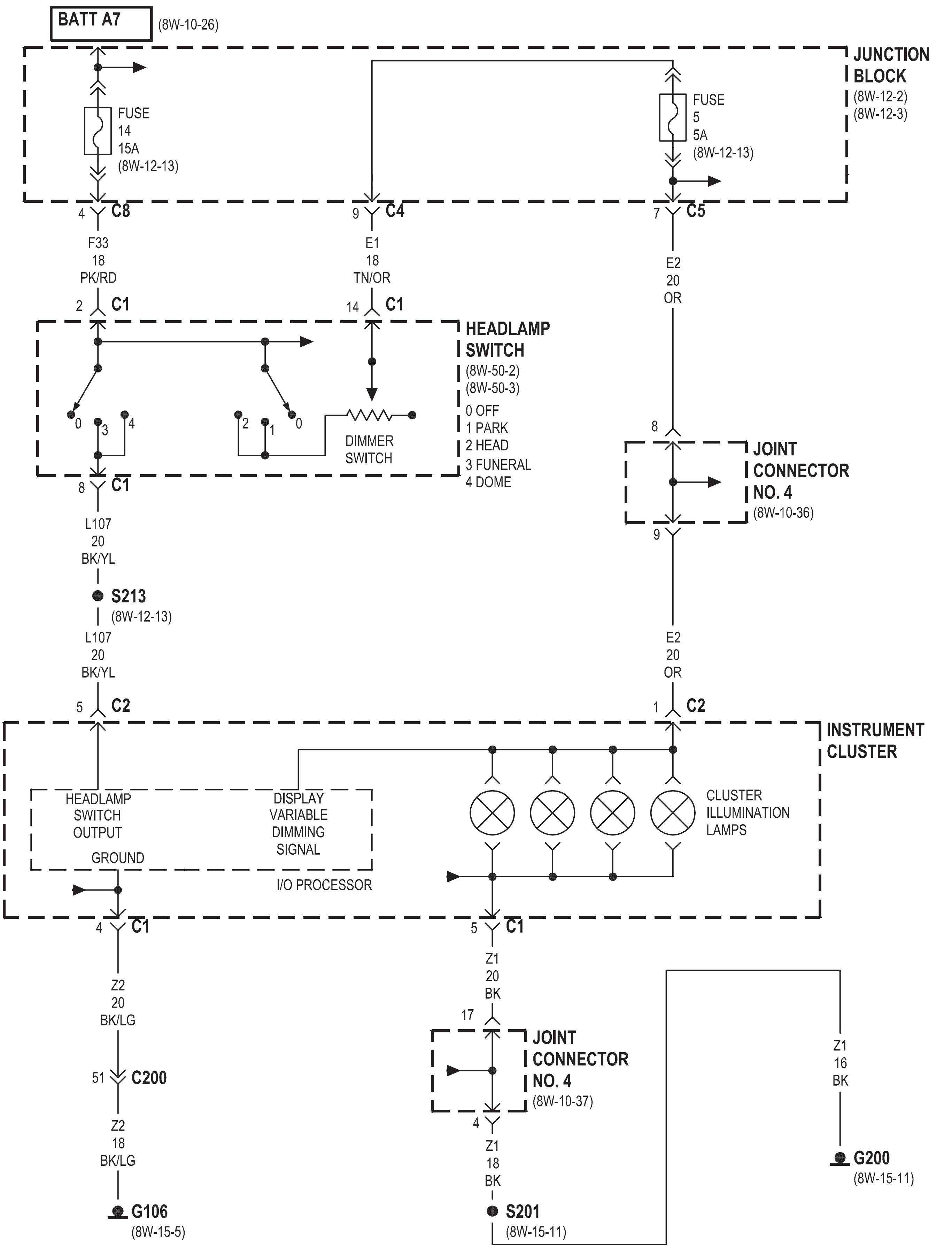

ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 17 10A
(8W-12-10)
8 C5
F15 20 DB/WT
2 C1
INSTRUMENT CLUSTER
4WD LOCK INDICATOR
LOW WASHER FLUID INDICATOR
CONTROL (WASHER FLUID)
LOW WASHER FLUID SENSE
I/O PROCESSOR
10 C2
G107 20 BK/RD
10 C200
G107 20 BK/RD
2 C2
G29 18 BK/TN
56 C200
G29 18 BK/TN
S156
(8W-31-3)
G107 20 BK/RD
5 C106
G107 20 BK/RD
G107 20 BK/RD
1
WASHER FLUID LEVEL SENSOR
2
2 C1
4WD SWITCH SENSE
CONTROLLER ANTI-LOCK BRAKE
(8W-34-3)
(8W-35-3)
B
4WD SWITCH
1 LOCK
2 NEUTRAL
(8W-31-3)
1 2
A
Z1 18 BK
S170
(8W-15-2)
Z1 18 BK
G101
(8W-15-2)
Z1 20 BK
S108
(8W-15-6)
Z1 16 BK
G105
(8W-15-6)



ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
17
10A
(8W-12-10)
8 C5
F15
20
DB/WT
2 C1
INSTRUMENT CLUSTER
BRAKE WARNING INDICATOR
VTSS INDICATOR
3 C1
1 C1
G11
20
WT/BK
PARK BRAKE SWITCH SENSE
DAYTIME RUNNING LAMP MODULE
(8W-50-7)
4
G11
20
WT/BK
33 C200
G11
20
WT/BK
S200
G69
20
BK/OR
8 C2
VTSS INDICATOR DRIVER
CENTRAL TIMER MODULE
(8W-45-2)
G11
20
WT/BK
10 C246
G11
20
WT/BK
PARK BRAKE SWITCH



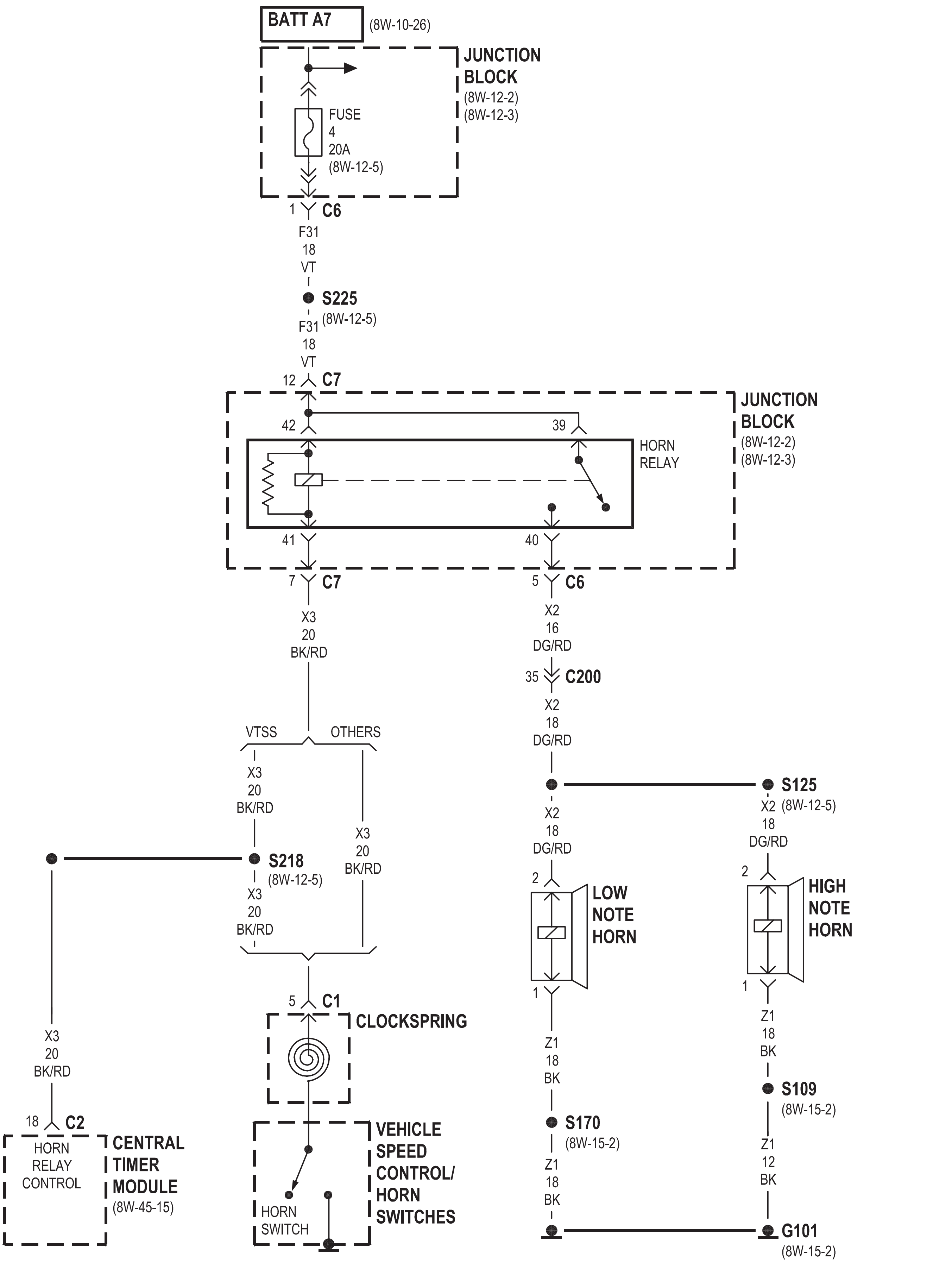
AN004009 J008W-1

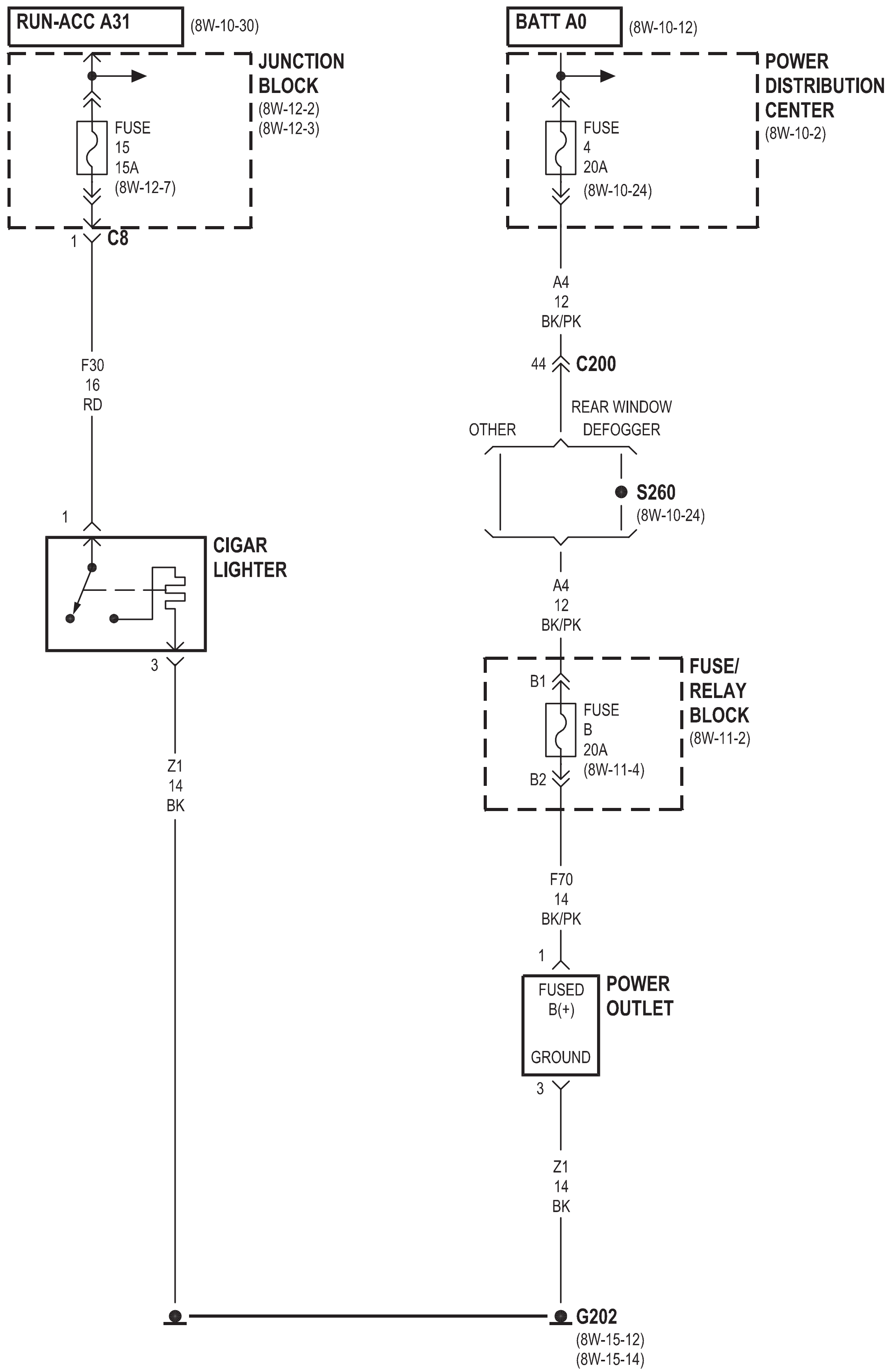


BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
14
15A
(8W-12-13)
FUSE
5
5A
(8W-12-13)
4 C8
9 C4
7 C5
F33
18
PK/RD
E1
18
TN/OR
E2
20
OR
2 C1
14 C1
HEADLAMP SWITCH
(8W-50-2)
(8W-50-3)
0 OFF
1 PARK
2 HEAD
3 FUNERAL
4 DOME
DIMMER SWITCH
8 C1
L107
20
BK/YL
S213
(8W-12-13)
8
JOINT CONNECTOR NO. 4
(8W-10-36)
9
5 C2
1 C2
INSTRUMENT CLUSTER
HEADLAMP SWITCH OUTPUT
DISPLAY VARIABLE DIMMING SIGNAL
GROUND
I/O PROCESSOR
CLUSTER ILLUMINATION LAMPS
4 C1
5 C1
Z2
20
BK/LG
51 C200
Z2
18
BK/LG
G106
(8W-15-5)
Z1
20
BK
17
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)

8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

Component	Page
Central Timer Module	8W-41-2
Cigar Lighter	8W-41-3
Clockspring	8W-41-2
Fuse 4 (JB)	8W-41-2
Fuse 4 (PDC)	8W-41-3
Fuse 15 (JB)	8W-41-3
Fuse B (F/RB)	8W-41-3
Fuse/Relay Block	8W-41-3
G101	8W-41-2
G202	8W-41-3
High Note Horn	8W-41-2
Horn Relay	8W-41-2
Junction Block	8W-41-2, 3
Low Note Horn	8W-41-2
Power Distribution Center	8W-41-3
Power Outlet	8W-41-3
Vehicle Speed Control/Horn Switches	8W-41-2

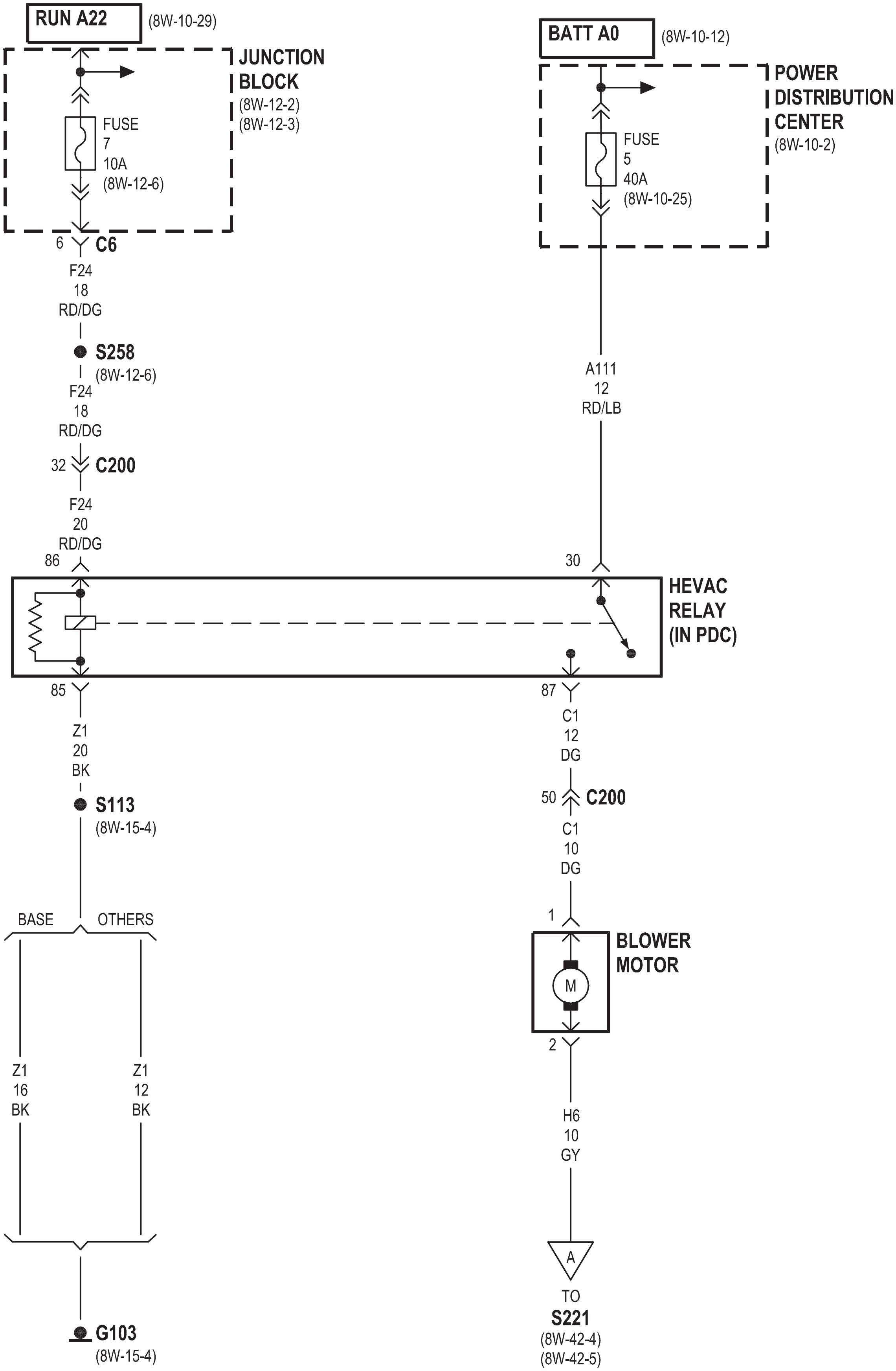

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
4
20A
(8W-12-5)
1 C6
F31
18
VT
S225
(8W-12-5)
F31
18
VT
12 C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
42
39
HORN RELAY
41
40
7 C7
5 C6
X3
20
BK/RD
X2
16
DG/RD
35 C200
X2
18
DG/RD
VTSS
OTHERS
X3
20
BK/RD
S125
X2
18
DG/RD
(8W-12-5)
X2
18
DG/RD
S218
(8W-12-5)
X3
20
BK/RD
2
LOW NOTE HORN
2
HIGH NOTE HORN
1
1
5 C1
CLOCKSPRING
Z1
18
BK
X3
20
BK/RD
S109
(8W-15-2)
Z1
18
BK
18 C2
HORN RELAY CONTROL
CENTRAL TIMER MODULE
(8W-45-15)
VEHICLE SPEED CONTROL/ HORN SWITCHES
HORN SWITCH
S170
(8W-15-2)
Z1
18
BK
Z1
12
BK
G101
(8W-15-2)

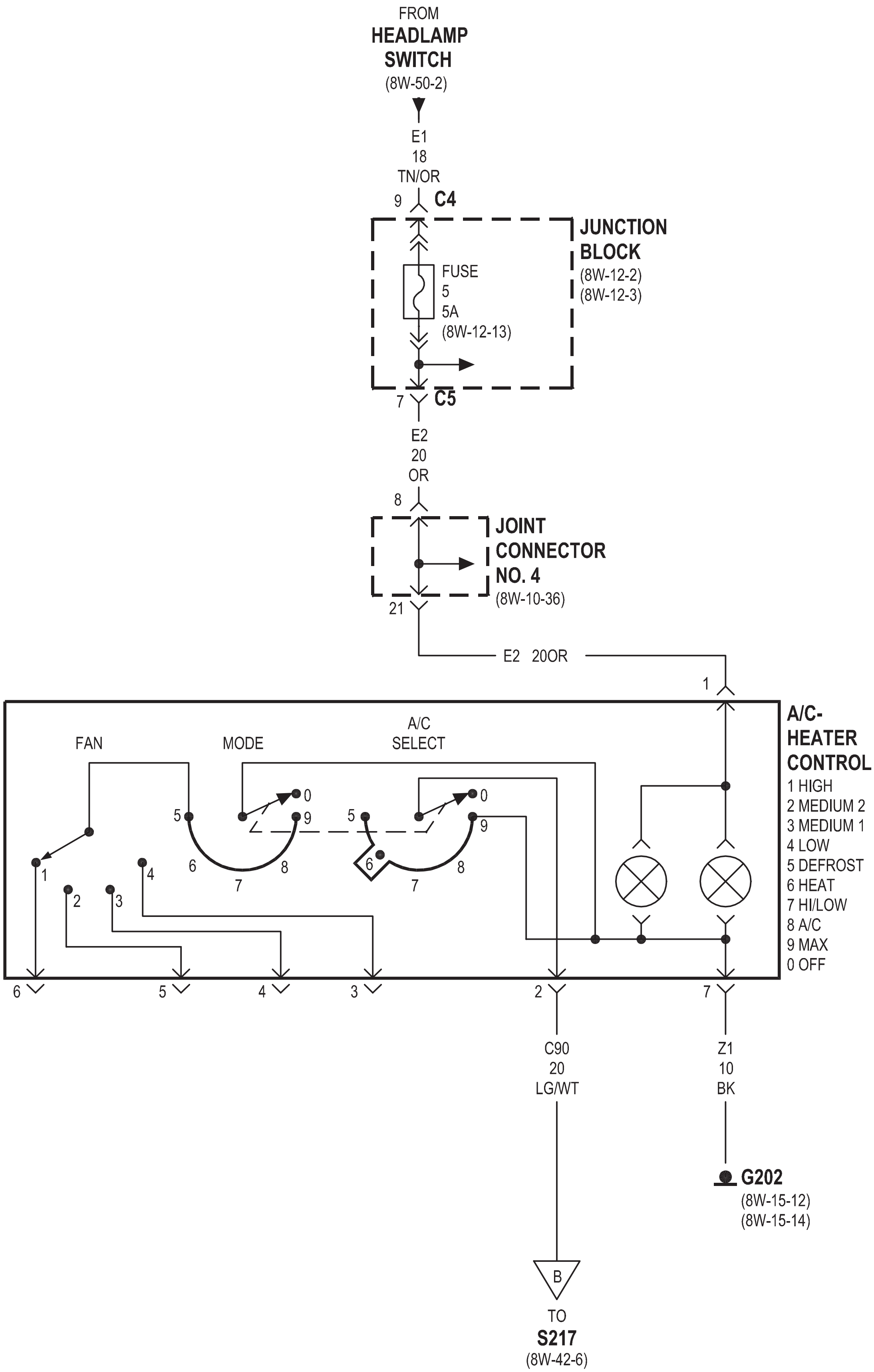


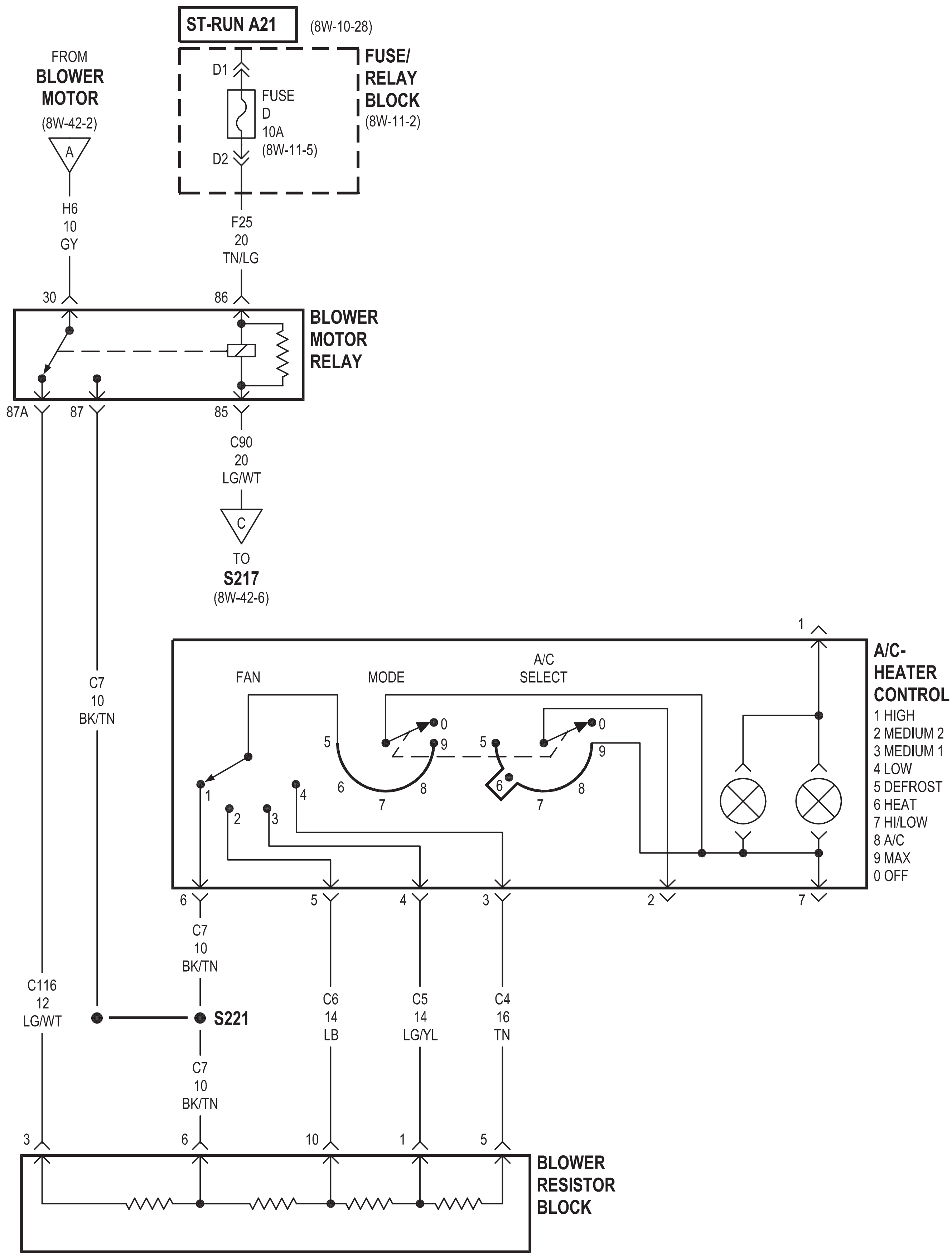
RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
15
15A
(8W-12-7)
1
C8
F30
16
RD
1
CIGAR LIGHTER
3
Z1
14
BK
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
4
20A
(8W-10-24)
A4
12
BK/PK
44
C200
OTHER
REAR WINDOW DEFOGGER
S260
(8W-10-24)
A4
12
BK/PK
FUSE/ RELAY BLOCK
(8W-11-2)
B1
FUSE
B
20A
(8W-11-4)
B2
F70
14
BK/PK
1
FUSED B(+)
GROUND
POWER OUTLET
3
Z1
14
BK
G202
(8W-15-12)
(8W-15-14)

8W-42 AIR CONDITIONING/HEATER

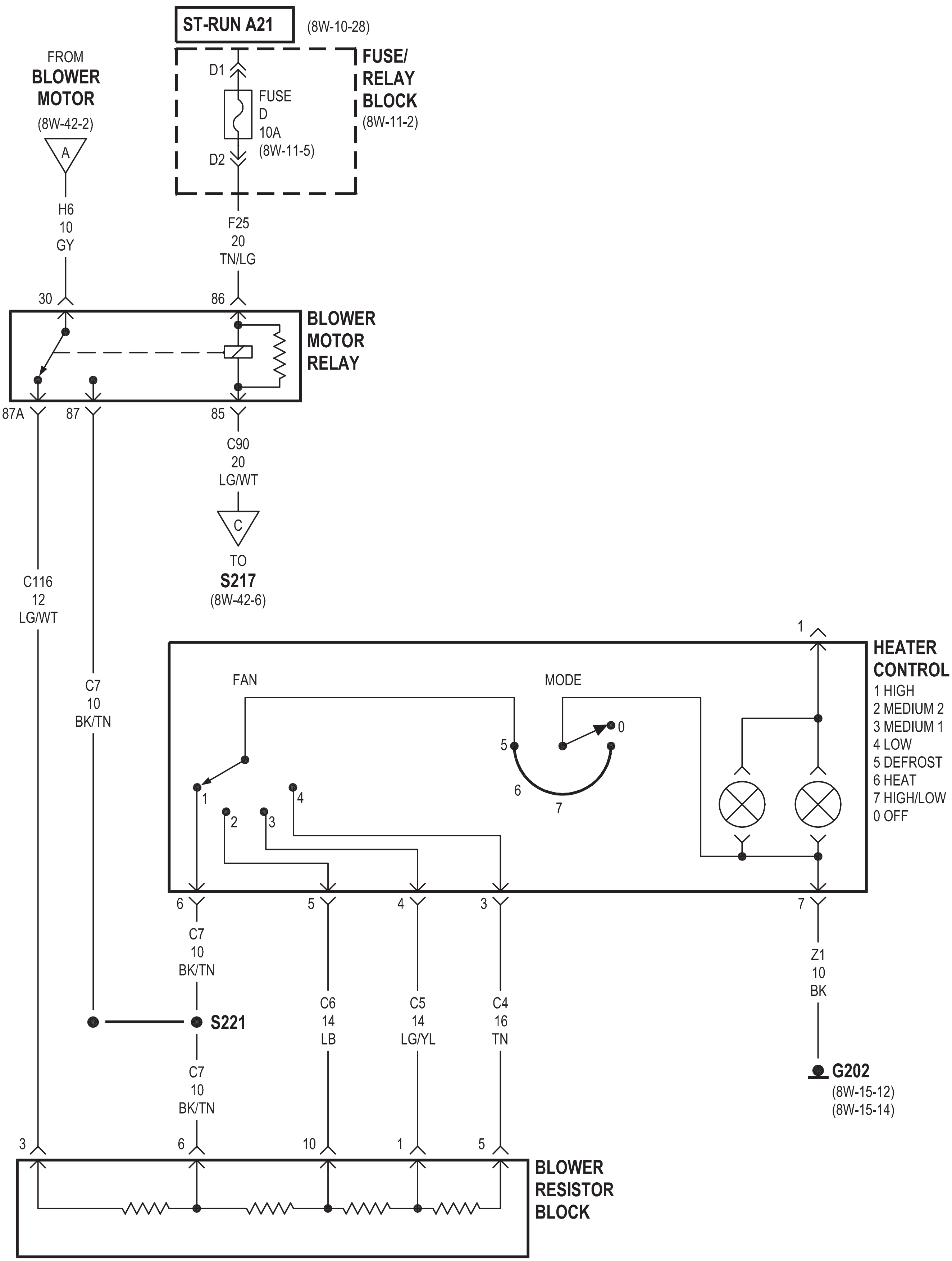
Component	Page
A/C Compressor Clutch	8W-42-6
A/C Compressor Clutch Relay	8W-42-6
A/C High Pressure Switch	8W-42-6
A/C Low Pressure Switch	8W-42-6
A/C- Heater Control	8W-42-3, 4, 6
Blower Motor	8W-42-2, 4, 5
Blower Motor Relay	8W-42-4, 5, 6
Blower Resistor Block	8W-42-4, 5
Fuse 2 (PDC)	8W-42-7, 8
Fuse 4 (JB)	8W-42-6
Fuse 5 (JB)	8W-42-3
Fuse 5 (PDC)	8W-42-2
Fuse 7 (JB)	8W-42-2, 6
Fuse 9 (JB)	8W-42-7, 8
Fuse D (F/RB)	8W-42-4, 5
Fuse/Relay Block	8W-42-4, 5
G101	8W-42-7, 8
G103	8W-42-2
G105	8W-42-6
G202	8W-42-3, 5
Headlamp Switch	8W-42-3
Heater Control	8W-42-5
Hevac Relay	8W-42-2
Joint Connector No. 1	8W-42-7, 8
Joint Connector No. 4	8W-42-3
Junction Block	8W-42-2, 3, 6, 7, 8
Power Distribution Center	8W-42-2, 7, 8
Powertrain Control Module	8W-42-6, 7, 8
Radiator Fan Motor	8W-42-7, 8
Radiator Fan Relay	8W-42-7, 8

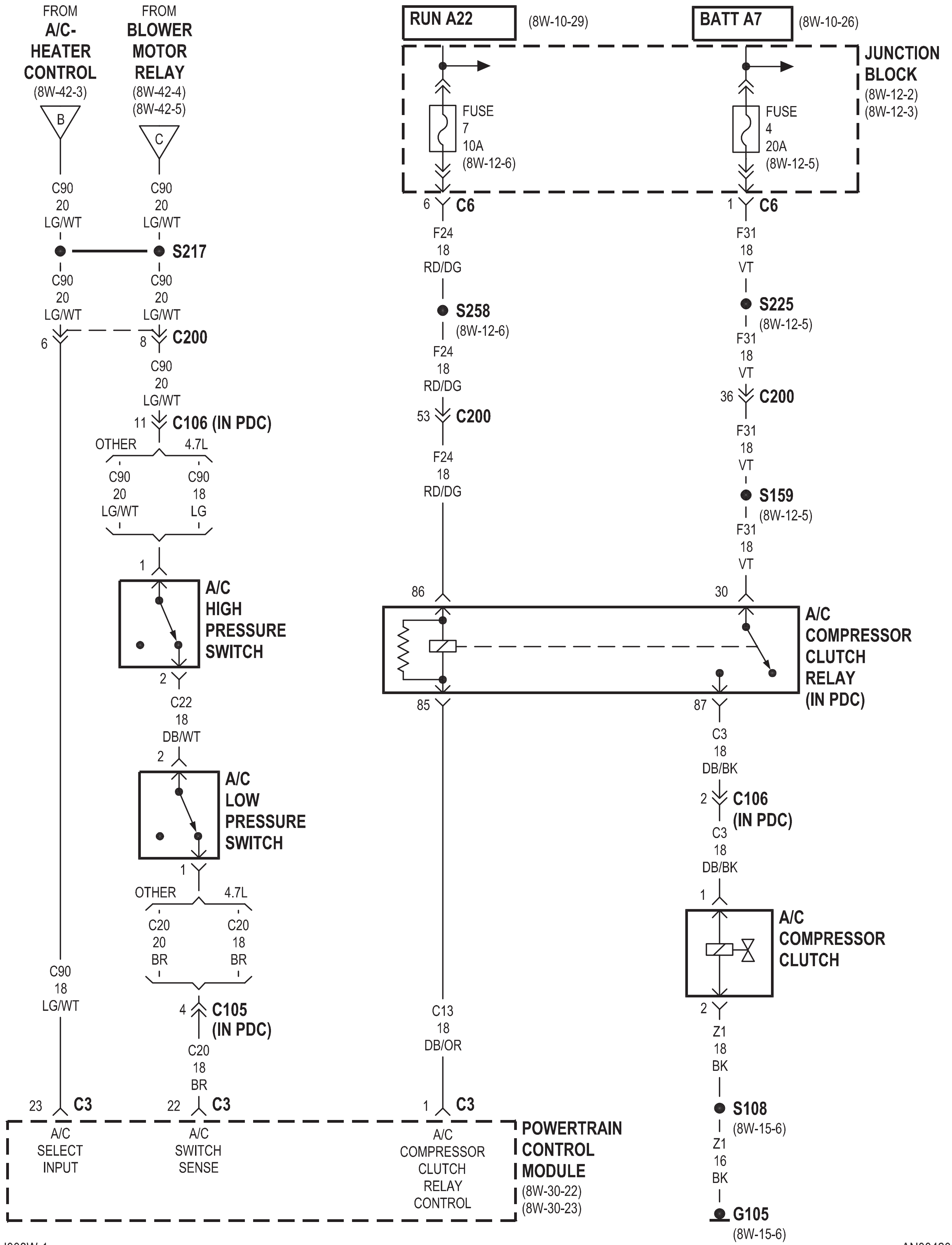

RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-6)
6
C6
F24
18
RD/DG
S258
(8W-12-6)
F24
18
RD/DG
32
C200
F24
20
RD/DG
86
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
5
40A
(8W-10-25)
A111
12
RD/LB
30
HEVAC RELAY (IN PDC)
85
87
Z1
20
BK
S113
(8W-15-4)
BASE
OTHERS
Z1
16
BK
Z1
12
BK
G103
(8W-15-4)
C1
12
DG
50
C200
C1
10
DG
1
BLOWER MOTOR
M
2
H6
10
GY
A
TO
S221
(8W-42-4)
(8W-42-5)


FROM
HEADLAMP
SWITCH
(8W-50-2)
E1
18
TN/OR
9
C4
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
5
5A
(8W-12-13)
7
C5
E2
20
OR
8
JOINT
CONNECTOR
NO. 4
(8W-10-36)
21
E2 20OR
1
A/C-
HEATER
CONTROL
1 HIGH
2 MEDIUM 2
3 MEDIUM 1
4 LOW
5 DEFROST
6 HEAT
7 HI/LOW
8 A/C
9 MAX
0 OFF
FAN
MODE
A/C
SELECT
6
5
4
3
2
7
C90
20
LG/WT
Z1
10
BK
G202
(8W-15-12)
(8W-15-14)
B
TO
S217
(8W-42-6)

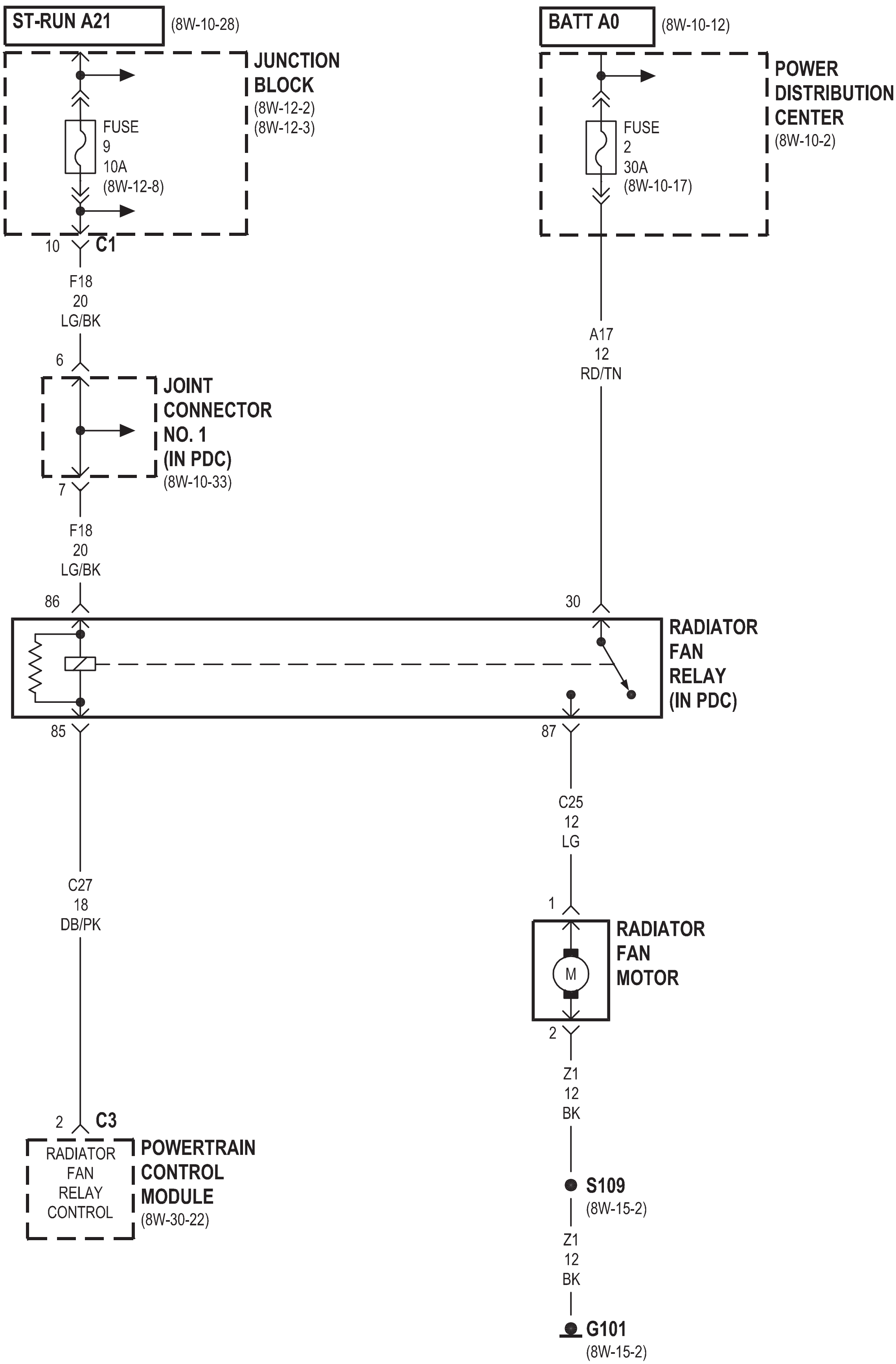

ST-RUN A21
(8W-10-28)
FUSE/
RELAY
BLOCK
(8W-11-2)
D1
FUSE
D
10A
(8W-11-5)
D2
FROM
BLOWER
MOTOR
(8W-42-2)
A
H6
10
GY
F25
20
TN/LG
30
86
BLOWER
MOTOR
RELAY
87A
87
85
C90
20
LG/WT
C
TO
S217
(8W-42-6)
C7
10
BK/TN
1
A/C-
HEATER
CONTROL
1 HIGH
2 MEDIUM 2
3 MEDIUM 1
4 LOW
5 DEFROST
6 HEAT
7 HI/LOW
8 A/C
9 MAX
0 OFF
FAN
MODE
A/C
SELECT
5
0
9
6
7
8
1
2
3
4
6
5
4
3
2
7
C7
10
BK/TN
C116
12
LG/WT
S221
C6
14
LB
C5
14
LG/YL
C4
16
TN
C7
10
BK/TN
3
6
10
1
5
BLOWER
RESISTOR
BLOCK

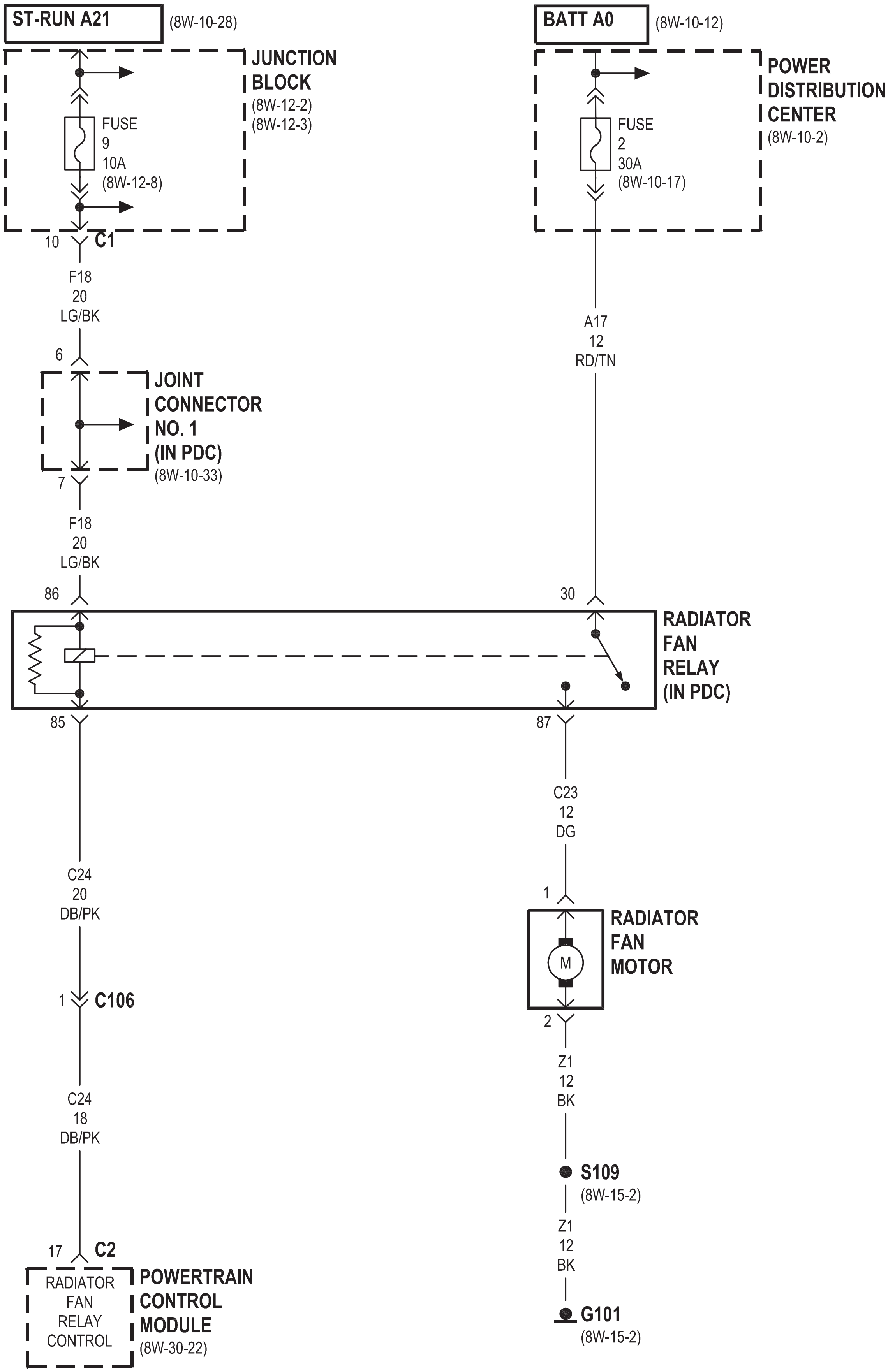
HEATER ONLY


ST-RUN A21
(8W-10-28)
FROM
BLOWER
MOTOR
(8W-42-2)
A
D1
FUSE
D
10A
(8W-11-5)
D2
FUSE/
RELAY
BLOCK
(8W-11-2)
H6
10
GY
F25
20
TN/LG
30
86
BLOWER
MOTOR
RELAY
87A
87
85
C90
20
LG/WT
C
TO
S217
(8W-42-6)
C116
12
LG/WT
C7
10
BK/TN
1
HEATER
CONTROL
1 HIGH
2 MEDIUM 2
3 MEDIUM 1
4 LOW
5 DEFROST
6 HEAT
7 HIGH/LOW
0 OFF
FAN
MODE
5
0
6
7
1
2
3
4
6
5
4
3
7
C7
10
BK/TN
Z1
10
BK
S221
C6
14
LB
C5
14
LG/YL
C4
16
TN
G202
(8W-15-12)
(8W-15-14)
C7
10
BK/TN
3
6
10
1
5
BLOWER
RESISTOR
BLOCK


FROM
A/C-HEATER CONTROL
(8W-42-3)
FROM
BLOWER MOTOR RELAY
(8W-42-4)
(8W-42-5)
B
C
C90 20 LG/WT
S217
C200
C106 (IN PDC)
OTHER
4.7L
C90 18 LG
A/C HIGH PRESSURE SWITCH
C22 18 DB/WT
A/C LOW PRESSURE SWITCH
C20 20 BR
C20 18 BR
C105 (IN PDC)
C90 18 LG/WT
C3
A/C SELECT INPUT
A/C SWITCH SENSE
A/C COMPRESSOR CLUTCH RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-22)
(8W-30-23)
RUN A22
(8W-10-29)
BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 7 10A (8W-12-6)
FUSE 4 20A (8W-12-5)
C6
F24 18 RD/DG
S258
(8W-12-6)
F31 18 VT
S225
(8W-12-5)
S159
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
C13 18 DB/OR
C3 18 DB/BK
C106 (IN PDC)
A/C COMPRESSOR CLUTCH
Z1 18 BK
S108
(8W-15-6)
Z1 16 BK
G105
(8W-15-6)

2.5L

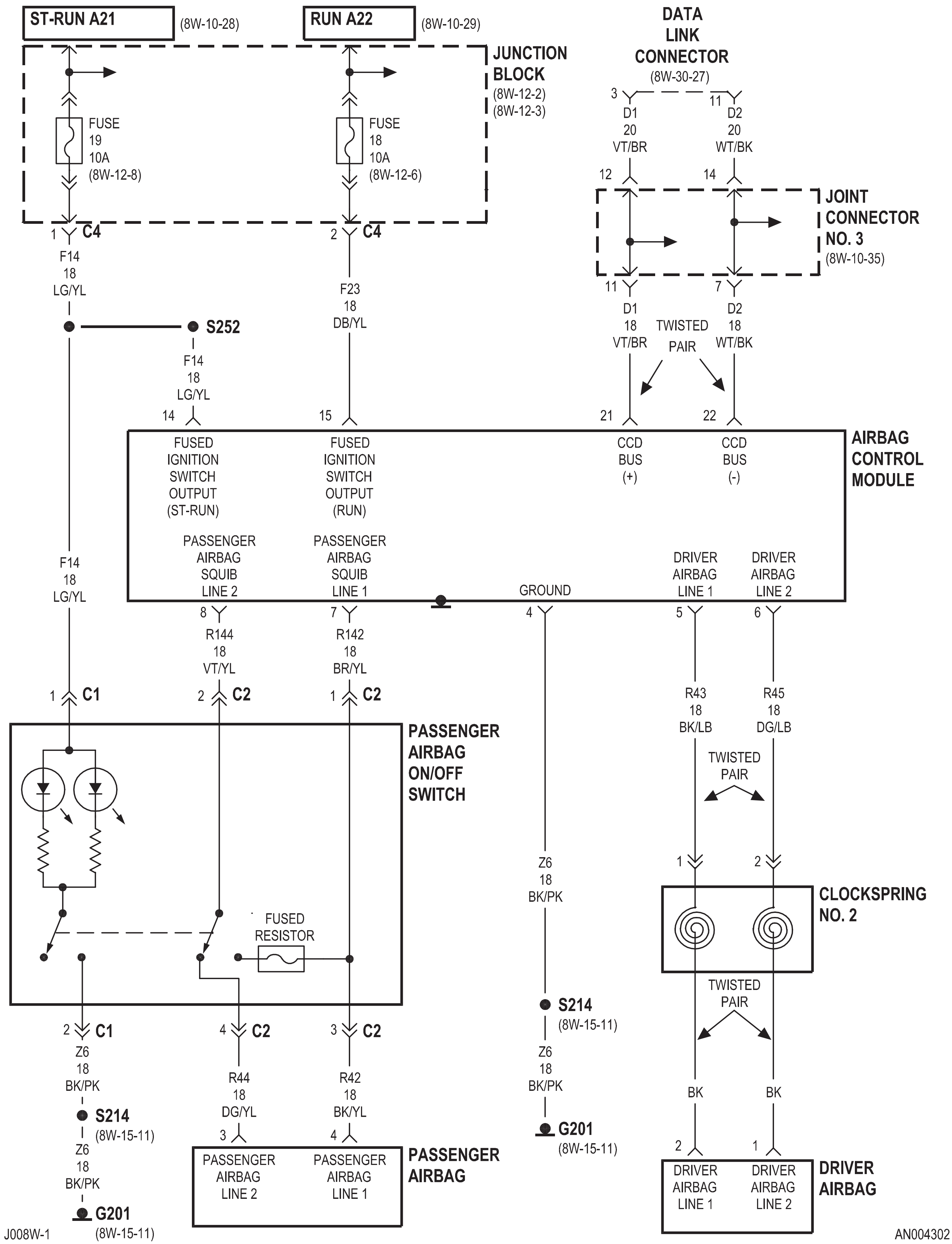

ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
10A
(8W-12-8)
10
C1
F18
20
LG/BK
6
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
7
F18
20
LG/BK
86
85
C27
18
DB/PK
2
C3
RADIATOR FAN RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-22)
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
2
30A
(8W-10-17)
A17
12
RD/TN
30
RADIATOR FAN RELAY (IN PDC)
87
C25
12
LG
1
RADIATOR FAN MOTOR
M
2
Z1
12
BK
S109
(8W-15-2)
Z1
12
BK
G101
(8W-15-2)

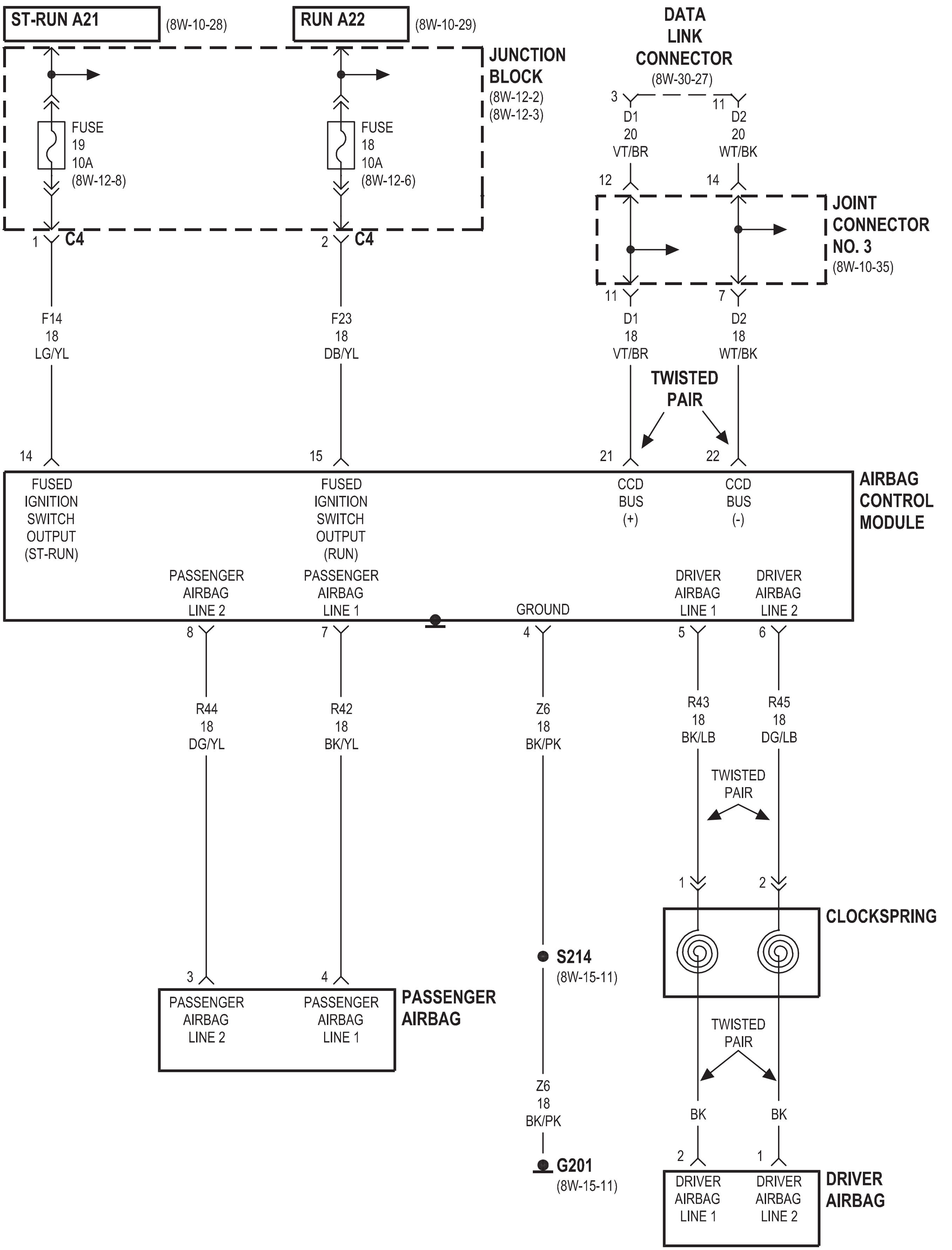

ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
10A
(8W-12-8)
10
C1
F18
20
LG/BK
6
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
7
F18
20
LG/BK
86
85
C24
20
DB/PK
1
C106
C24
18
DB/PK
17
C2
RADIATOR FAN RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-22)
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
2
30A
(8W-10-17)
A17
12
RD/TN
30
RADIATOR FAN RELAY (IN PDC)
87
C23
12
DG
1
M
RADIATOR FAN MOTOR
2
Z1
12
BK
S109
(8W-15-2)
Z1
12
BK
G101
(8W-15-2)

8W-43 AIRBAG SYSTEM

Component	Page
Airbag Control Module	8W-43-2, 3
Clockspring	8W-43-3
Clockspring No. 2	8W-43-2
Data Link Connector	8W-43-2, 3
Driver Airbag	8W-43-2, 3
Fuse 18 (JB)	8W-43-2, 3
Fuse 19 (JB)	8W-43-2, 3
G201	8W-43-2, 3
Joint Connector No. 3	8W-43-2, 3
Junction Block	8W-43-2, 3
Passenger Airbag	8W-43-2, 3
Passenger Airbag On/Off Switch	8W-43-2

2 DOOR


ST-RUN A21
(8W-10-28)
RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 19 10A (8W-12-8)
FUSE 18 10A (8W-12-6)
DATA LINK CONNECTOR
(8W-30-27)
D1 20 VT/BR
D2 20 WT/BK
JOINT CONNECTOR NO. 3
(8W-10-35)
C4
F14 18 LG/YL
F23 18 DB/YL
S252
D1 18 VT/BR
D2 18 WT/BK
TWISTED PAIR
AIRBAG CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
FUSED IGNITION SWITCH OUTPUT (RUN)
CCD BUS (+)
CCD BUS (-)
PASSENGER AIRBAG SQUIB LINE 2
PASSENGER AIRBAG SQUIB LINE 1
GROUND
DRIVER AIRBAG LINE 1
DRIVER AIRBAG LINE 2
R144 18 VT/YL
R142 18 BR/YL
R43 18 BK/LB
R45 18 DG/LB
C1
C2
PASSENGER AIRBAG ON/OFF SWITCH
FUSED RESISTOR
Z6 18 BK/PK
CLOCKSPRING NO. 2
S214
(8W-15-11)
R44 18 DG/YL
R42 18 BK/YL
BK
G201
(8W-15-11)
PASSENGER AIRBAG LINE 2
PASSENGER AIRBAG LINE 1
PASSENGER AIRBAG
DRIVER AIRBAG LINE 1
DRIVER AIRBAG LINE 2
DRIVER AIRBAG
J008W-1
AN004302

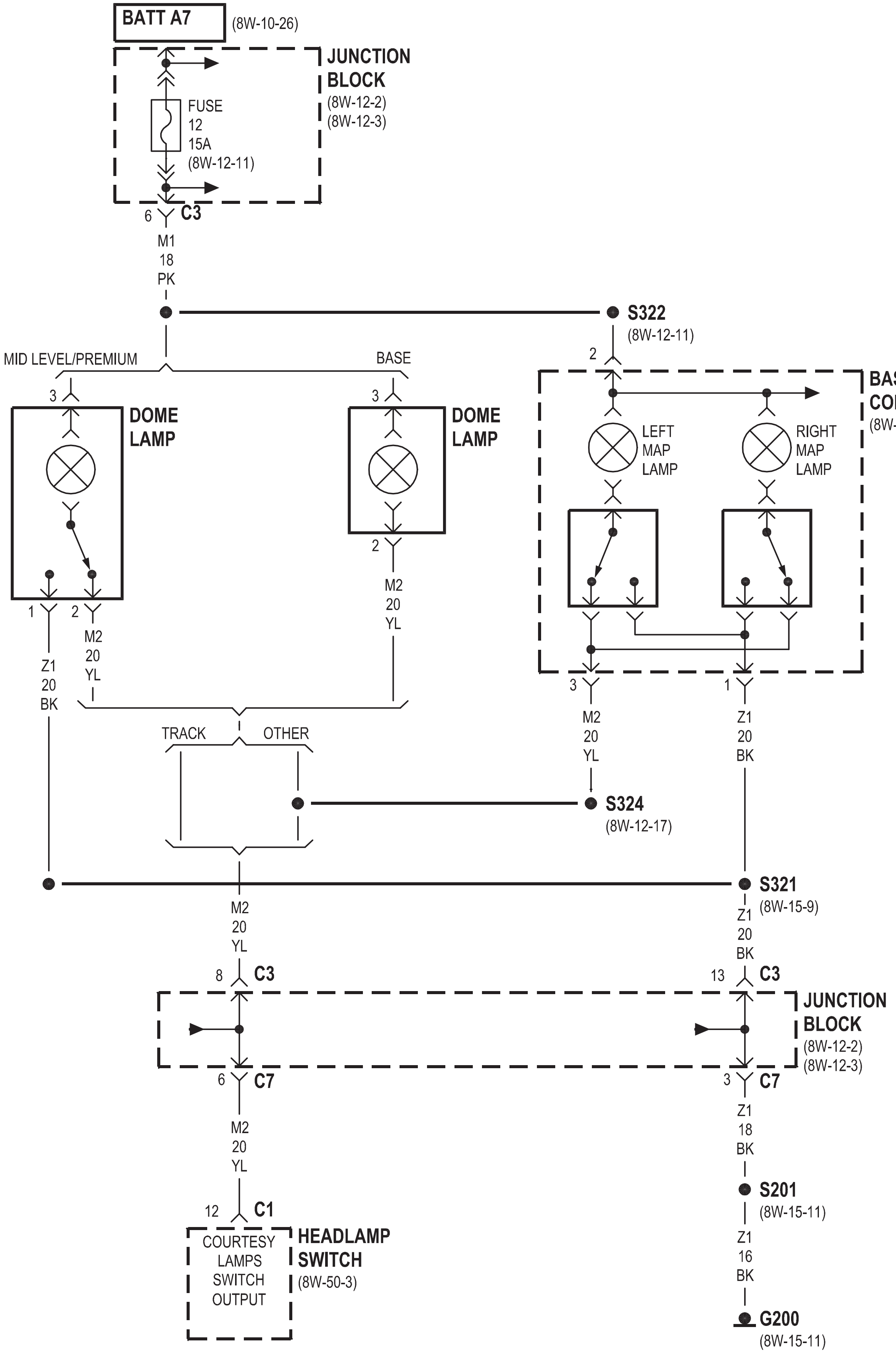

ST-RUN A21
(8W-10-28)
RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 19 10A (8W-12-8)
FUSE 18 10A (8W-12-6)
C4
F14 18 LG/YL
F23 18 DB/YL
DATA LINK CONNECTOR
(8W-30-27)
D1 20 VT/BR
D2 20 WT/BK
JOINT CONNECTOR NO. 3
(8W-10-35)
D1 18 VT/BR
D2 18 WT/BK
TWISTED PAIR
AIRBAG CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
FUSED IGNITION SWITCH OUTPUT (RUN)
CCD BUS (+)
CCD BUS (-)
PASSENGER AIRBAG LINE 2
PASSENGER AIRBAG LINE 1
GROUND
DRIVER AIRBAG LINE 1
DRIVER AIRBAG LINE 2
R44 18 DG/YL
R42 18 BK/YL
Z6 18 BK/PK
R43 18 BK/LB
R45 18 DG/LB
TWISTED PAIR
CLOCKSPRING
S214
(8W-15-11)
PASSENGER AIRBAG
PASSENGER AIRBAG LINE 2
PASSENGER AIRBAG LINE 1
Z6 18 BK/PK
G201
(8W-15-11)
TWISTED PAIR
BK
BK
DRIVER AIRBAG
DRIVER AIRBAG LINE 1
DRIVER AIRBAG LINE 2

8W-44 INTERIOR LIGHTING

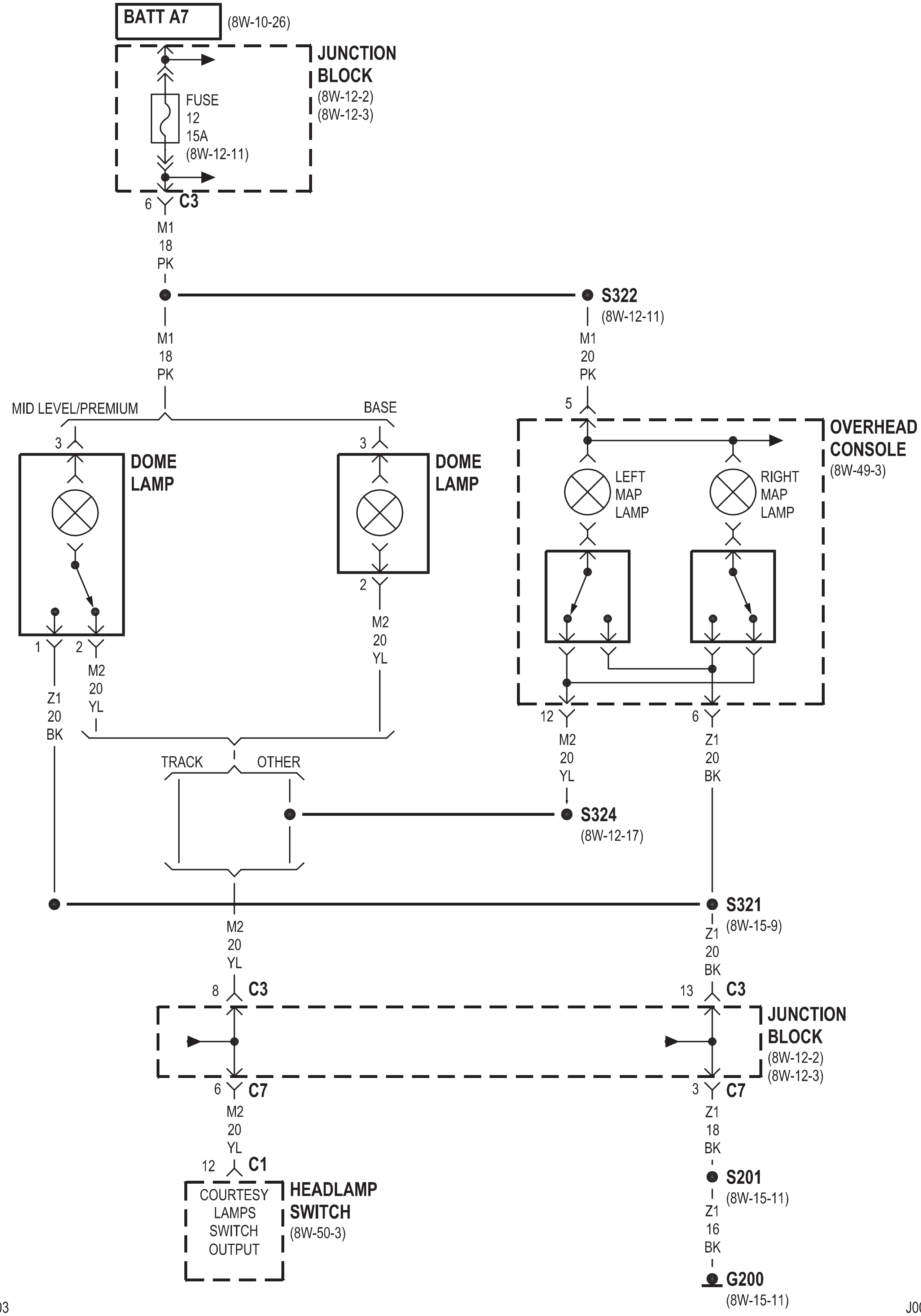
Component	Page
A/C- Heater Control	8W-44-8
Airbag Control Module	8W-44-12
Ash Receiver Lamp	8W-44-8
Automatic Day/Night Mirror	8W-44-13
Back-Up Lamp Switch	8W-44-13
Base Console	8W-44-2
Cargo Lamp No. 1	8W-44-9
Cargo Lamp No. 2	8W-44-9
Central Timer Module	8W-44-5, 6, 7, 10, 11
Controller Anti-Lock Brake	8W-44-12
Data Link Connector	8W-44-4, 12
Dome Lamp	8W-44-2, 3
Driver Door Ajar Switch	8W-44-5, 10
Driver Door Lock Motor/Ajar Switch	8W-44-6, 7, 10
Fuse 2 (JB)	8W-44-13
Fuse 5 (JB)	8W-44-8
Fuse 6 (JB)	8W-44-11
Fuse 11 (JB)	8W-44-11, 13
Fuse 12 (JB)	8W-44-2, 3, 4, 9
Fuse 13 (JB)	8W-44-11
Fuse 14 (JB)	8W-44-8
G103	8W-44-9
G200	8W-44-2, 3, 4, 8, 9, 10, 13
G202	8W-44-8, 11
G203	8W-44-5, 6, 7, 8, 10, 11

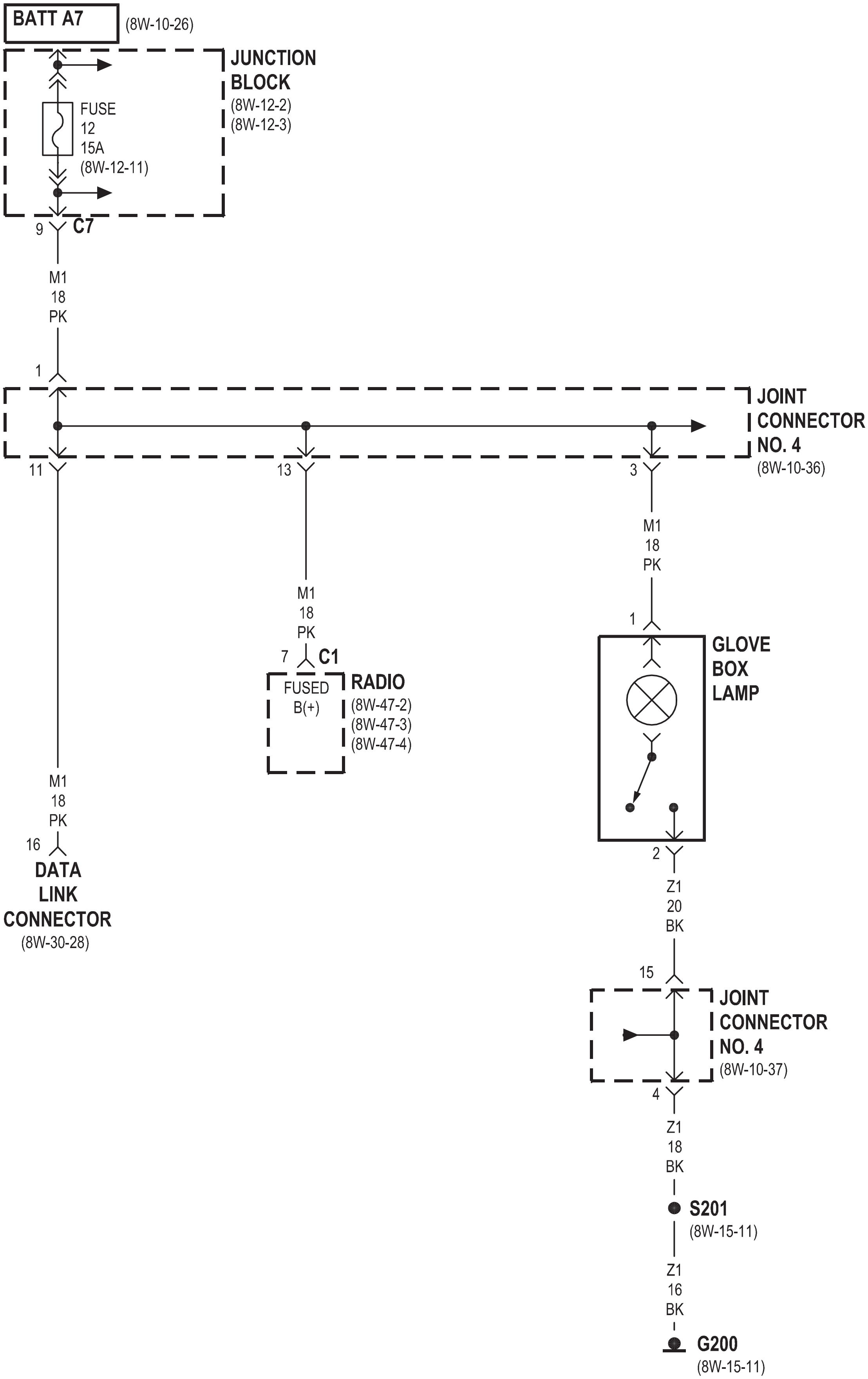
Component	Page
Glove Box Lamp	8W-44-4
Headlamp Switch	8W-44-2, 3, 8, 9, 10
Instrument Cluster	8W-44-8, 10, 12
Joint Connector No. 1	8W-44-13
Joint Connector No. 3	8W-44-12
Joint Connector No. 4	8W-44-4, 8, 9, 10
Junction Block	8W-44-2, 3, 4, 8, 9, 11, 13
Key-In Switch	8W-44-10
Left Map Lamp	8W-44-2, 3
Left Rear Door Ajar Switch	8W-44-5
Left Rear Door Lock Motor/Ajar Switch	8W-44-7
Overhead Console	8W-44-3
Park/Neutral Position Switch	8W-44-13
Passenger Door Ajar Switch	8W-44-5
Passenger Door Lock Motor/Ajar Switch	8W-44-6, 7
Powertrain Control Module	8W-44-12
Radio	8W-44-4, 8
Right Map Lamp	8W-44-2, 3
Right Rear Door Ajar Switch	8W-44-5
Right Rear Door Lock Motor/Ajar Switch	8W-44-7
Shift Bezel Lamp	8W-44-8
Transmission Control Module	8W-44-12
Transmission Solenoid Assembly	8W-44-13
Underhood Lamp/Switch	8W-44-9

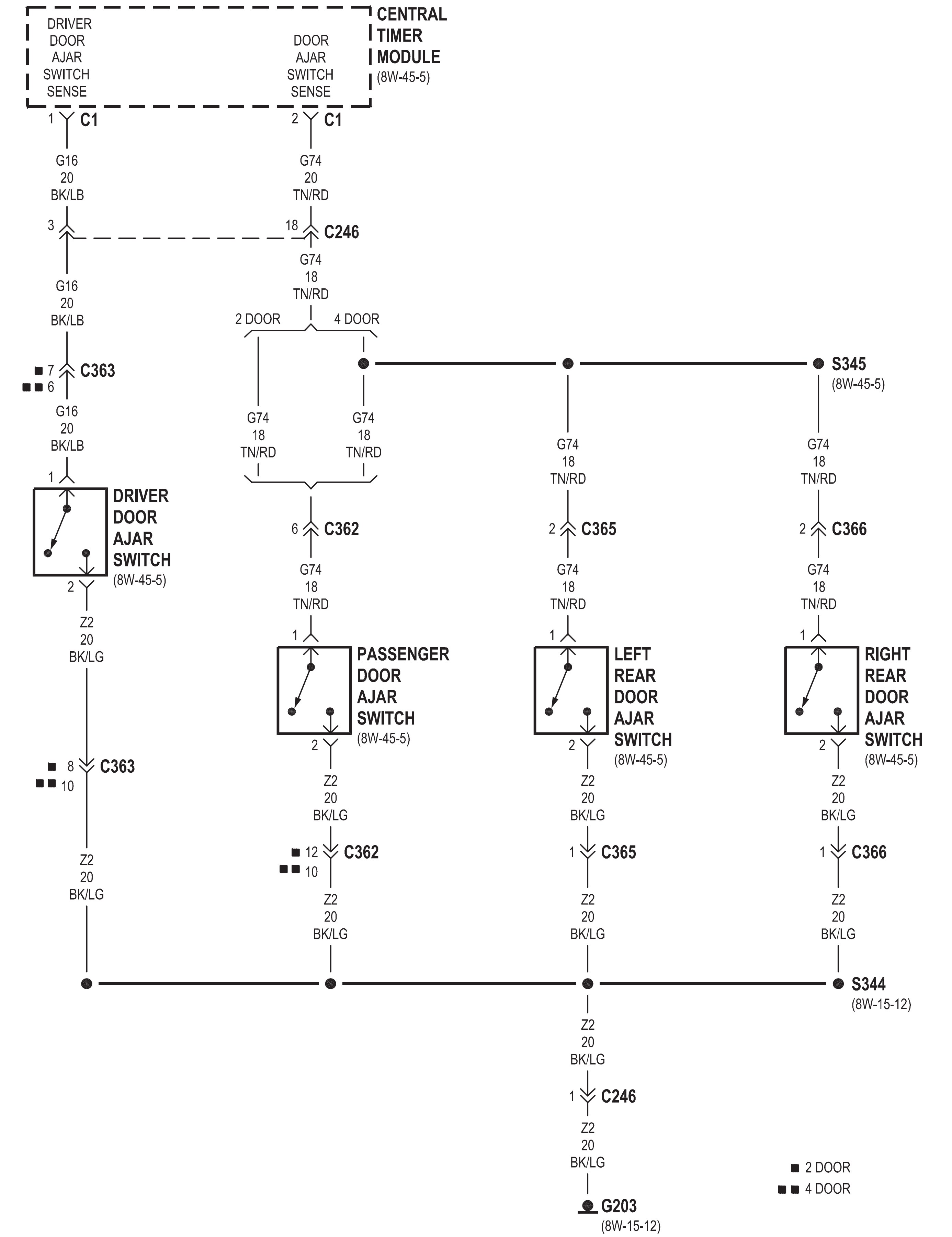
BASE CONSOLE



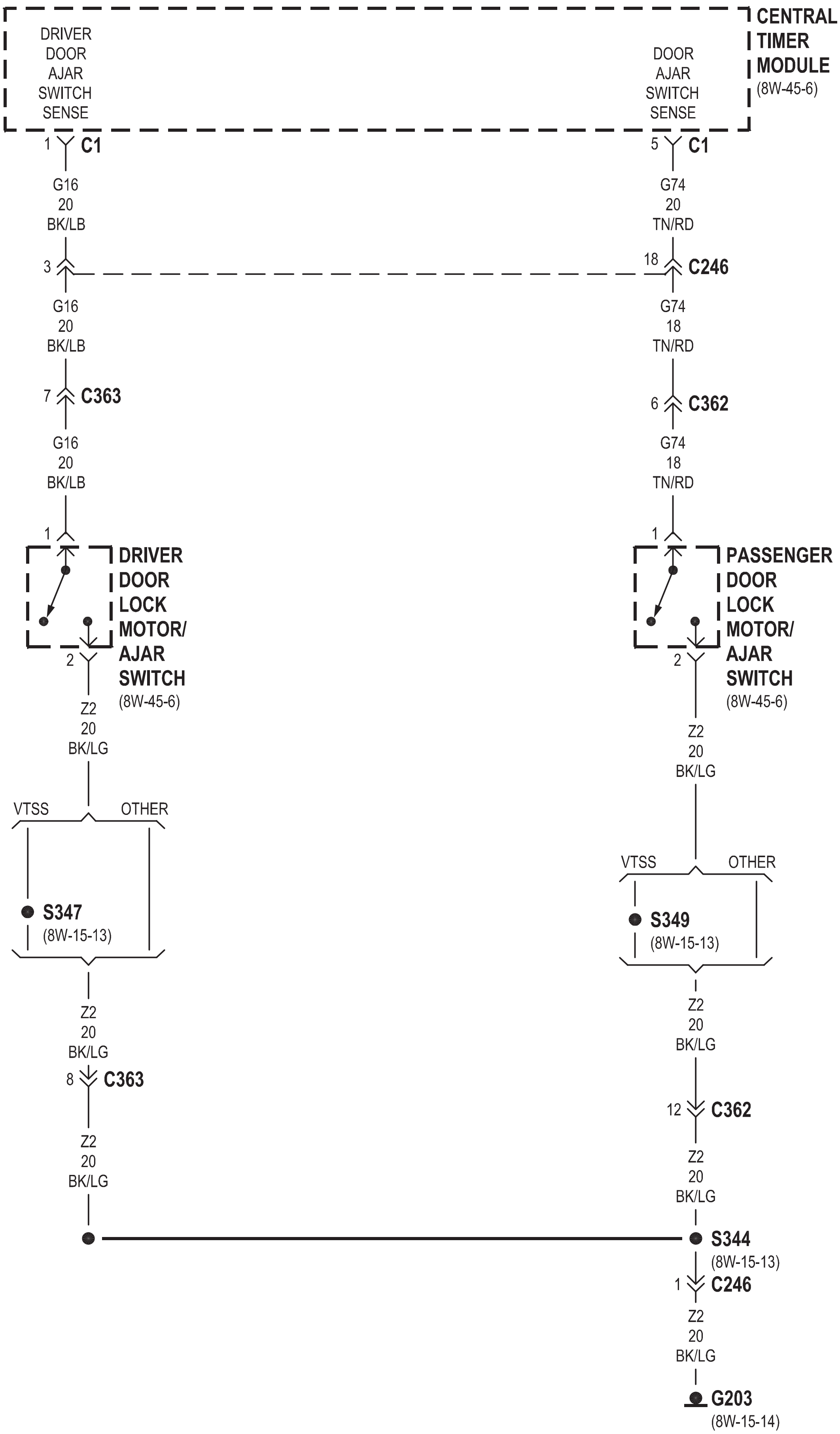
OVERHEAD CONSOLE

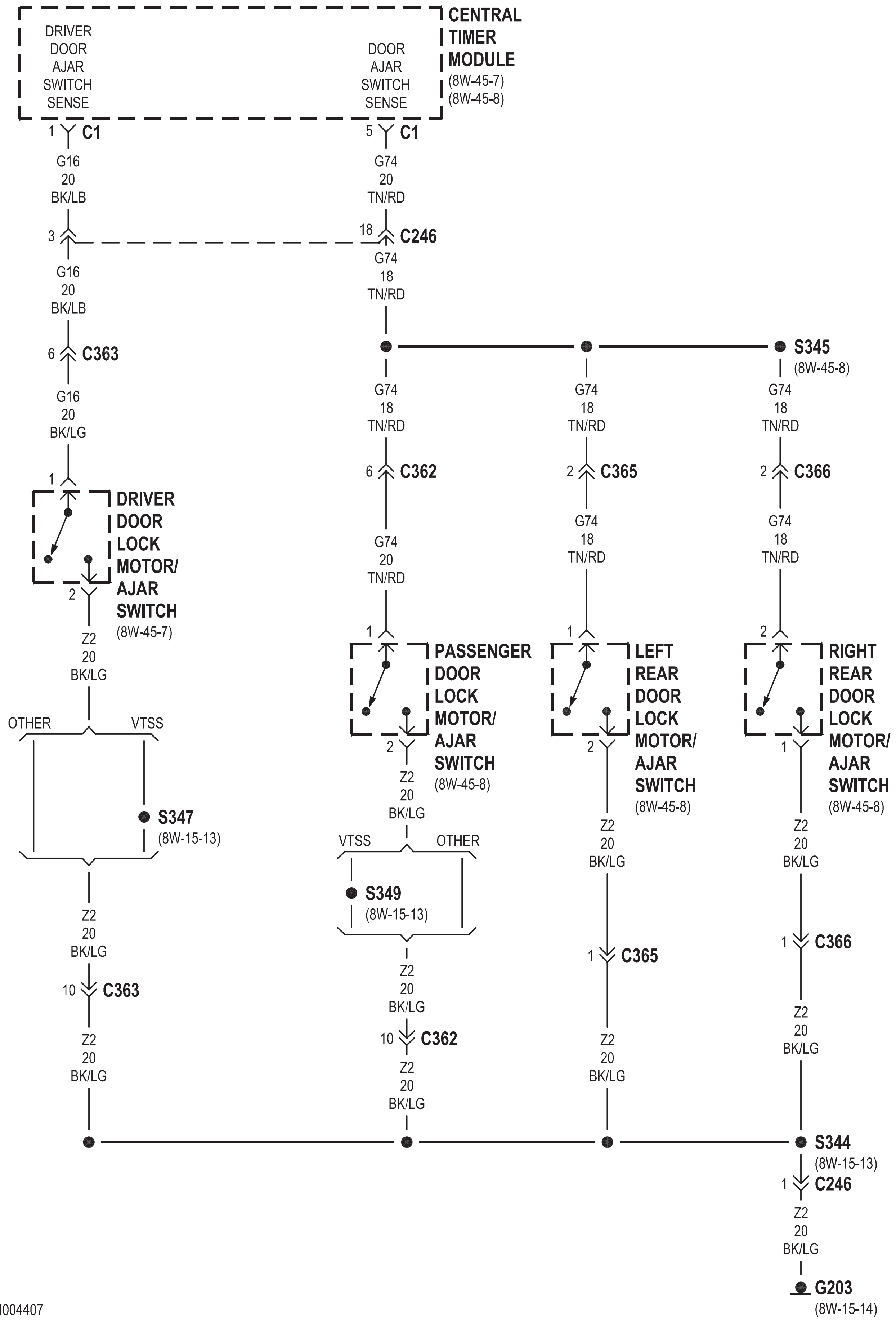


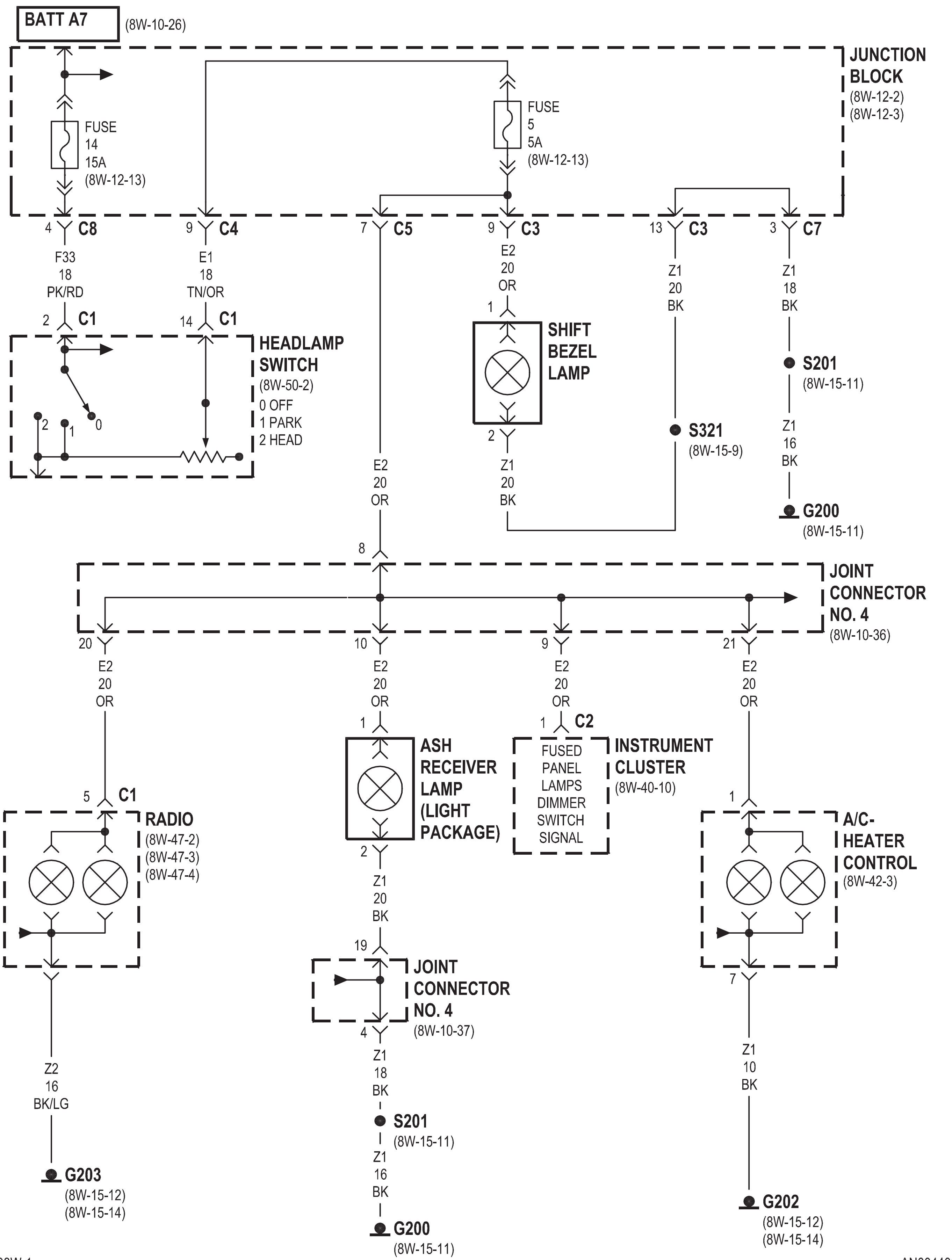

BATT A7
(8W-10-26)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
15A
(8W-12-11)
9
C7
M1
18
PK
1
JOINT
CONNECTOR
NO. 4
(8W-10-36)
11
13
3
M1
18
PK
M1
18
PK
7
C1
FUSED
B(+)
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
1
GLOVE
BOX
LAMP
M1
18
PK
16
DATA
LINK
CONNECTOR
(8W-30-28)
2
Z1
20
BK
15
JOINT
CONNECTOR
NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)


DRIVER DOOR AJAR SWITCH SENSE
DOOR AJAR SWITCH SENSE
CENTRAL TIMER MODULE
(8W-45-5)
1 C1
2 C1
G16 20 BK/LB
G74 20 TN/RD
3
18 C246
G74 18 TN/RD
G16 20 BK/LB
2 DOOR
4 DOOR
7 C363
6
S345
(8W-45-5)
G16 20 BK/LB
G74 18 TN/RD
G74 18 TN/RD
G74 18 TN/RD
G74 18 TN/RD
1
DRIVER DOOR AJAR SWITCH
(8W-45-5)
6 C362
2 C365
2 C366
2
G74 18 TN/RD
G74 18 TN/RD
G74 18 TN/RD
Z2 20 BK/LG
1
1
1
PASSENGER DOOR AJAR SWITCH
(8W-45-5)
LEFT REAR DOOR AJAR SWITCH
(8W-45-5)
RIGHT REAR DOOR AJAR SWITCH
(8W-45-5)
2
2
2
8 C363
10
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
12 C362
10
1 C365
1 C366
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
S344
(8W-15-12)
Z2 20 BK/LG
1 C246
Z2 20 BK/LG
2 DOOR
4 DOOR
G203
(8W-15-12)

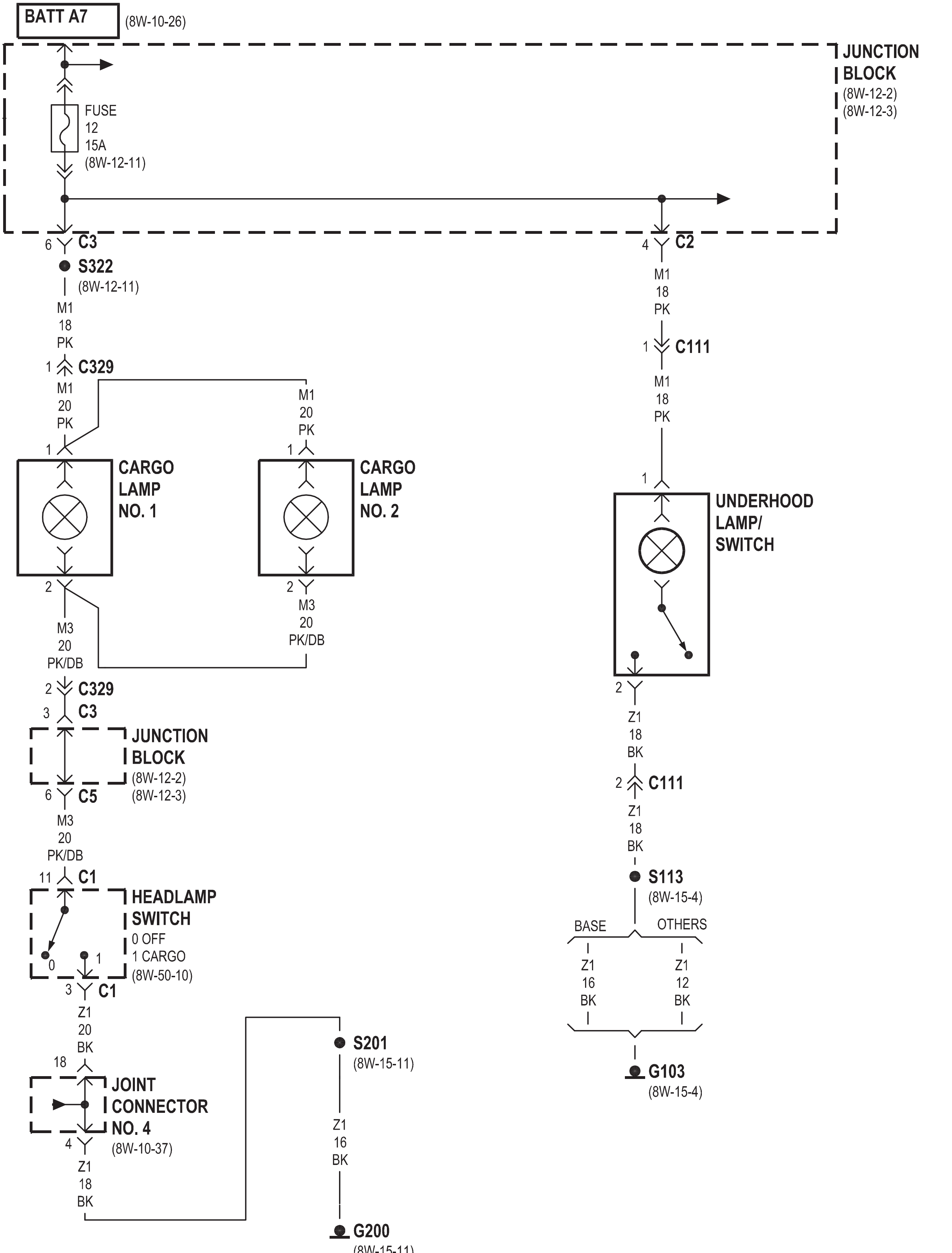
PREMIUM 2 DOOR

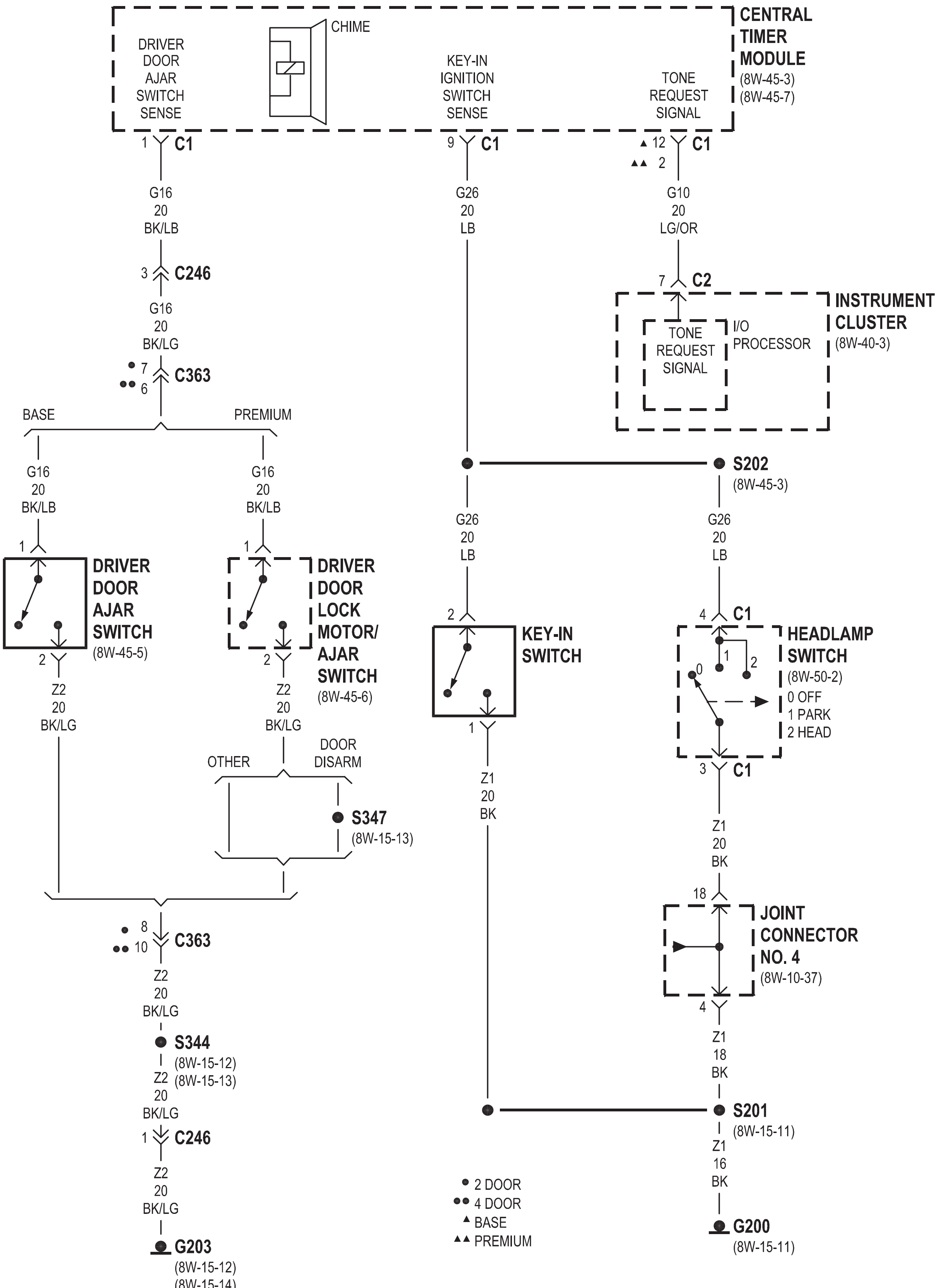


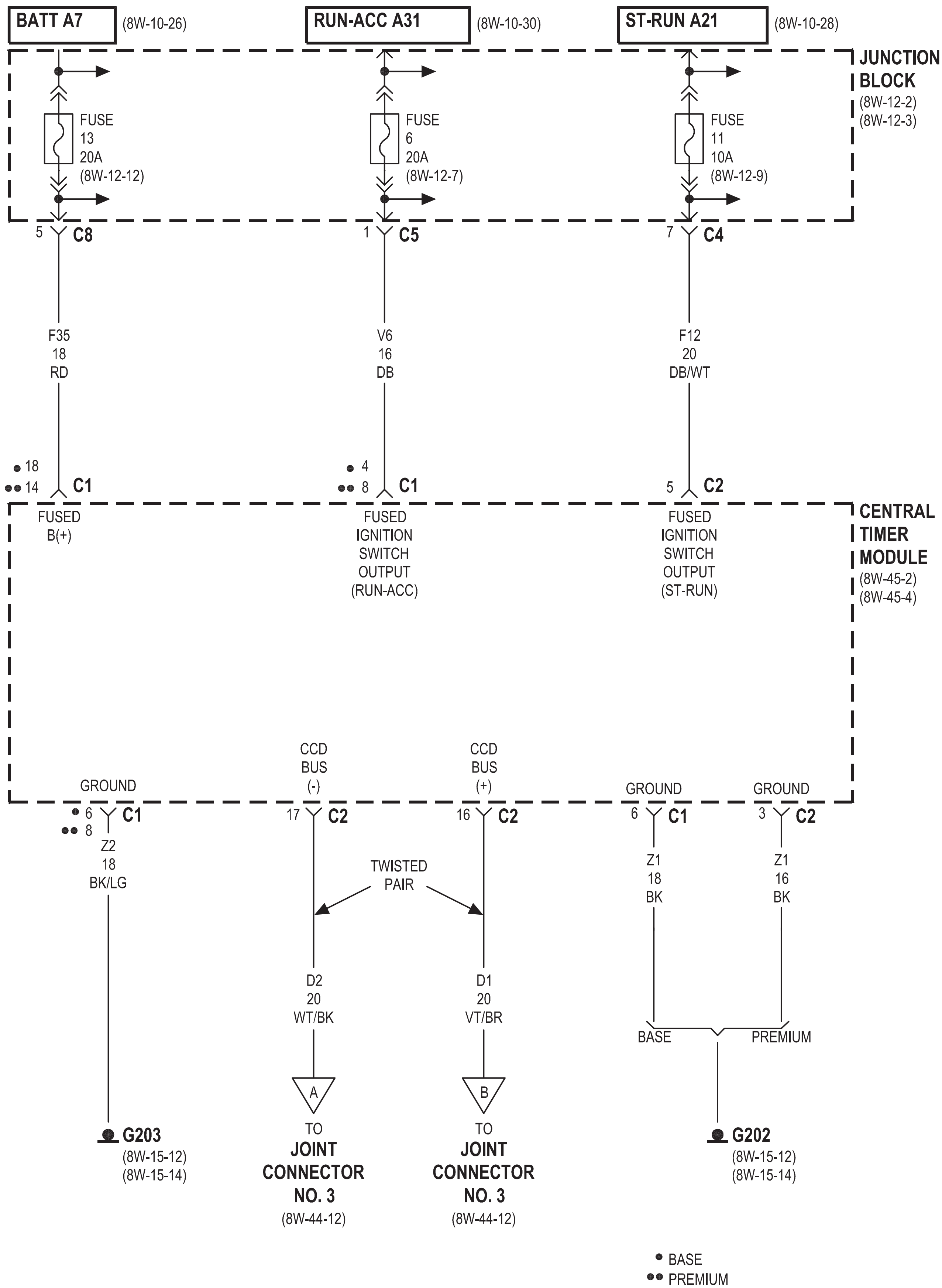

CENTRAL TIMER MODULE
(8W-45-7)
(8W-45-8)
DRIVER DOOR AJAR SWITCH SENSE
DOOR AJAR SWITCH SENSE
1 C1
5 C1
G16 20 BK/LB
G74 20 TN/RD
3
18 C246
G16 20 BK/LB
G74 18 TN/RD
6 C363
S345
(8W-45-8)
G16 20 BK/LG
G74 18 TN/RD
G74 18 TN/RD
G74 18 TN/RD
6 C362
2 C365
2 C366
G74 20 TN/RD
G74 18 TN/RD
G74 18 TN/RD
1
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-45-7)
2
Z2 20 BK/LG
OTHER
VTSS
S347
(8W-15-13)
1
1
2
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-45-8)
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-45-8)
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-45-8)
2
2
1
Z2 20 BK/LG
VTSS
OTHER
S349
(8W-15-13)
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
10 C363
1 C365
1 C366
Z2 20 BK/LG
Z2 20 BK/LG
10 C362
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
S344
(8W-15-13)
1 C246
Z2 20 BK/LG
G203
(8W-15-14)



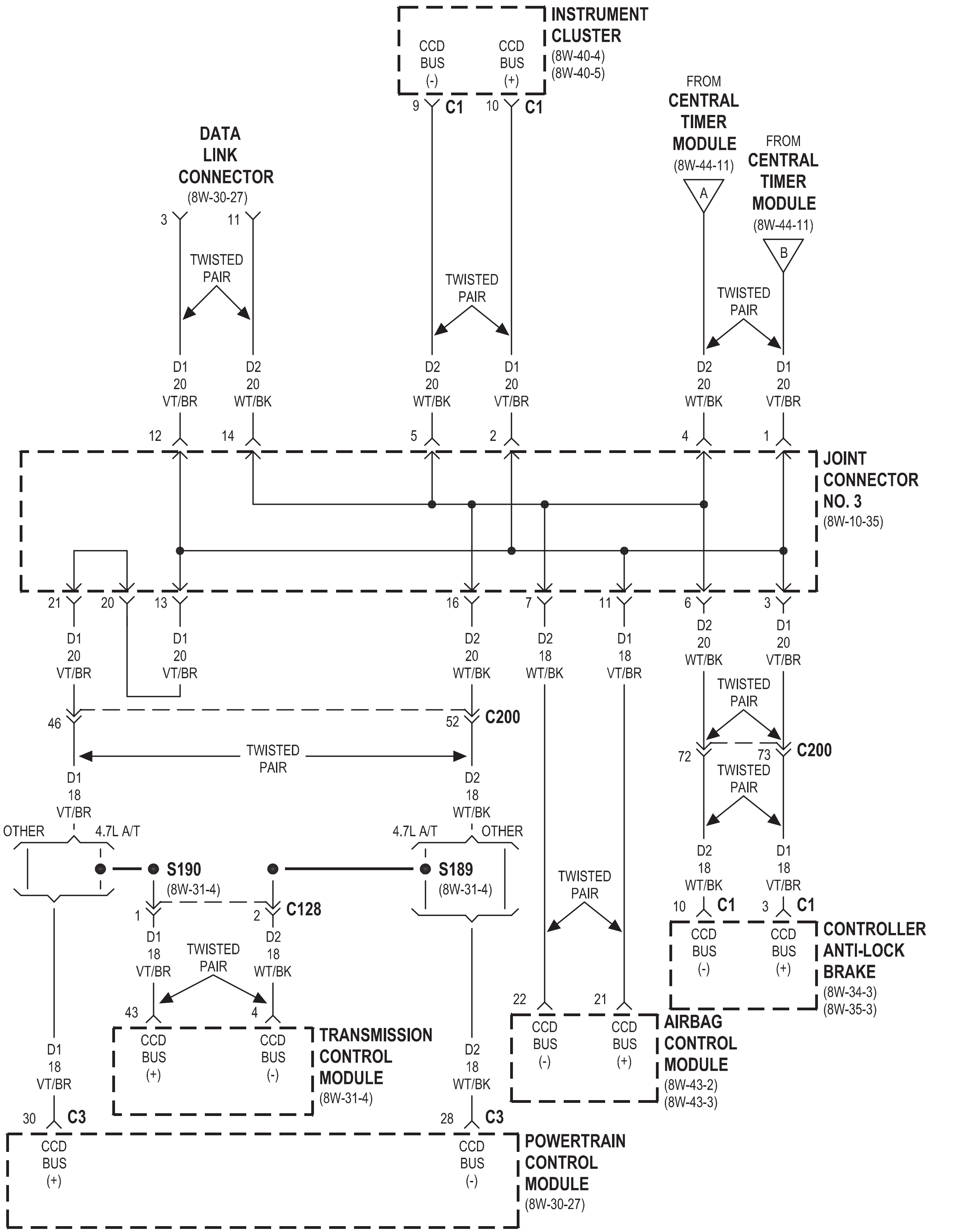
J008W-1 AN004408

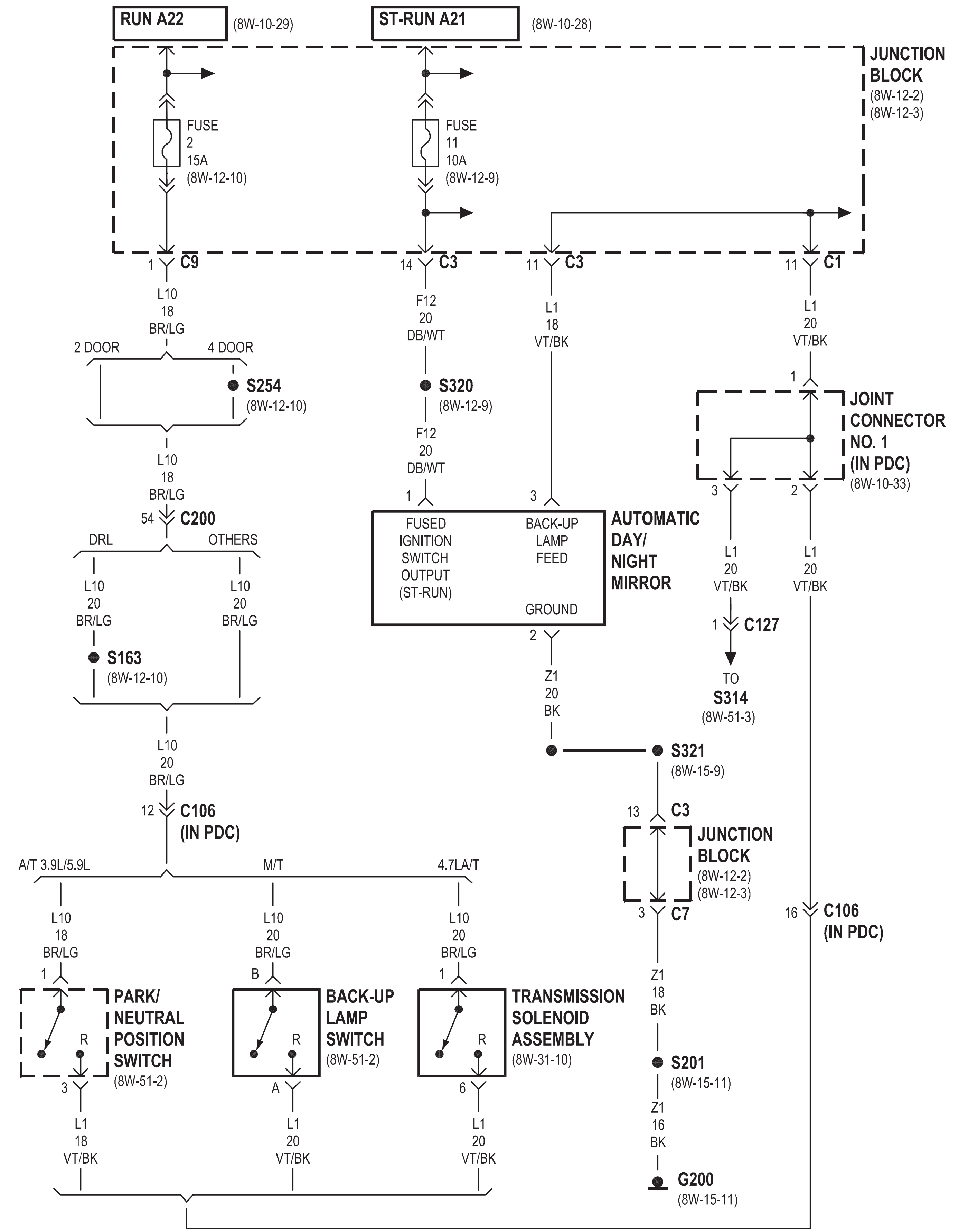

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
15A
(8W-12-11)
6 C3
S322
(8W-12-11)
M1
18
PK
1 C329
M1
20
PK
1
CARGO LAMP NO. 1
CARGO LAMP NO. 2
2
M3
20
PK/DB
2 C329
3 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
6 C5
11 C1
HEADLAMP SWITCH
0 OFF
1 CARGO
(8W-50-10)
3 C1
Z1
20
BK
18
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)
4 C2
M1
18
PK
1 C111
UNDERHOOD LAMP/ SWITCH
2
Z1
18
BK
2 C111
S113
(8W-15-4)
BASE
OTHERS
Z1
16
BK
Z1
12
BK
G103
(8W-15-4)


CENTRAL TIMER MODULE
(8W-45-3)
(8W-45-7)
DRIVER DOOR AJAR SWITCH SENSE
CHIME
KEY-IN IGNITION SWITCH SENSE
TONE REQUEST SIGNAL
1 C1
9 C1
▲ 12 C1
▲▲ 2
G16 20 BK/LB
G26 20 LB
G10 20 LG/OR
3 C246
G16 20 BK/LG
7 C2
INSTRUMENT CLUSTER
(8W-40-3)
TONE REQUEST SIGNAL
I/O PROCESSOR
● 7
●● 6 C363
BASE
PREMIUM
G16 20 BK/LB
G16 20 BK/LB
S202
(8W-45-3)
G26 20 LB
G26 20 LB
DRIVER DOOR AJAR SWITCH
(8W-45-5)
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-45-6)
KEY-IN SWITCH
4 C1
HEADLAMP SWITCH
(8W-50-2)
0 OFF
1 PARK
2 HEAD
3 C1
Z2 20 BK/LG
Z2 20 BK/LG
Z1 20 BK
OTHER
DOOR DISARM
S347
(8W-15-13)
Z1 20 BK
18
JOINT CONNECTOR NO. 4
(8W-10-37)
● 8
●● 10 C363
Z2 20 BK/LG
S344
(8W-15-12)
(8W-15-13)
Z2 20 BK/LG
1 C246
Z2 20 BK/LG
G203
(8W-15-12)
(8W-15-14)
Z1 18 BK
S201
(8W-15-11)
Z1 16 BK
G200
(8W-15-11)
● 2 DOOR
●● 4 DOOR
▲ BASE
▲▲ PREMIUM



BATT A7
(8W-10-26)
RUN-ACC A31
(8W-10-30)
ST-RUN A21
(8W-10-28)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
13
20A
(8W-12-12)
FUSE
6
20A
(8W-12-7)
FUSE
11
10A
(8W-12-9)
5 C8
1 C5
7 C4
F35
18
RD
V6
16
DB
F12
20
DB/WT
18
14 C1
4
8 C1
5 C2
CENTRAL
TIMER
MODULE
(8W-45-2)
(8W-45-4)
FUSED
B(+)
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-ACC)
FUSED
IGNITION
SWITCH
OUTPUT
(ST-RUN)
GROUND
CCD
BUS
(-)
CCD
BUS
(+)
GROUND
GROUND
6
8 C1
17 C2
16 C2
6 C1
3 C2
Z2
18
BK/LG
TWISTED
PAIR
Z1
18
BK
Z1
16
BK
D2
20
WT/BK
D1
20
VT/BR
BASE
PREMIUM
A
B
G203
(8W-15-12)
(8W-15-14)
TO
JOINT
CONNECTOR
NO. 3
(8W-44-12)
TO
JOINT
CONNECTOR
NO. 3
(8W-44-12)
G202
(8W-15-12)
(8W-15-14)
• BASE
•• PREMIUM

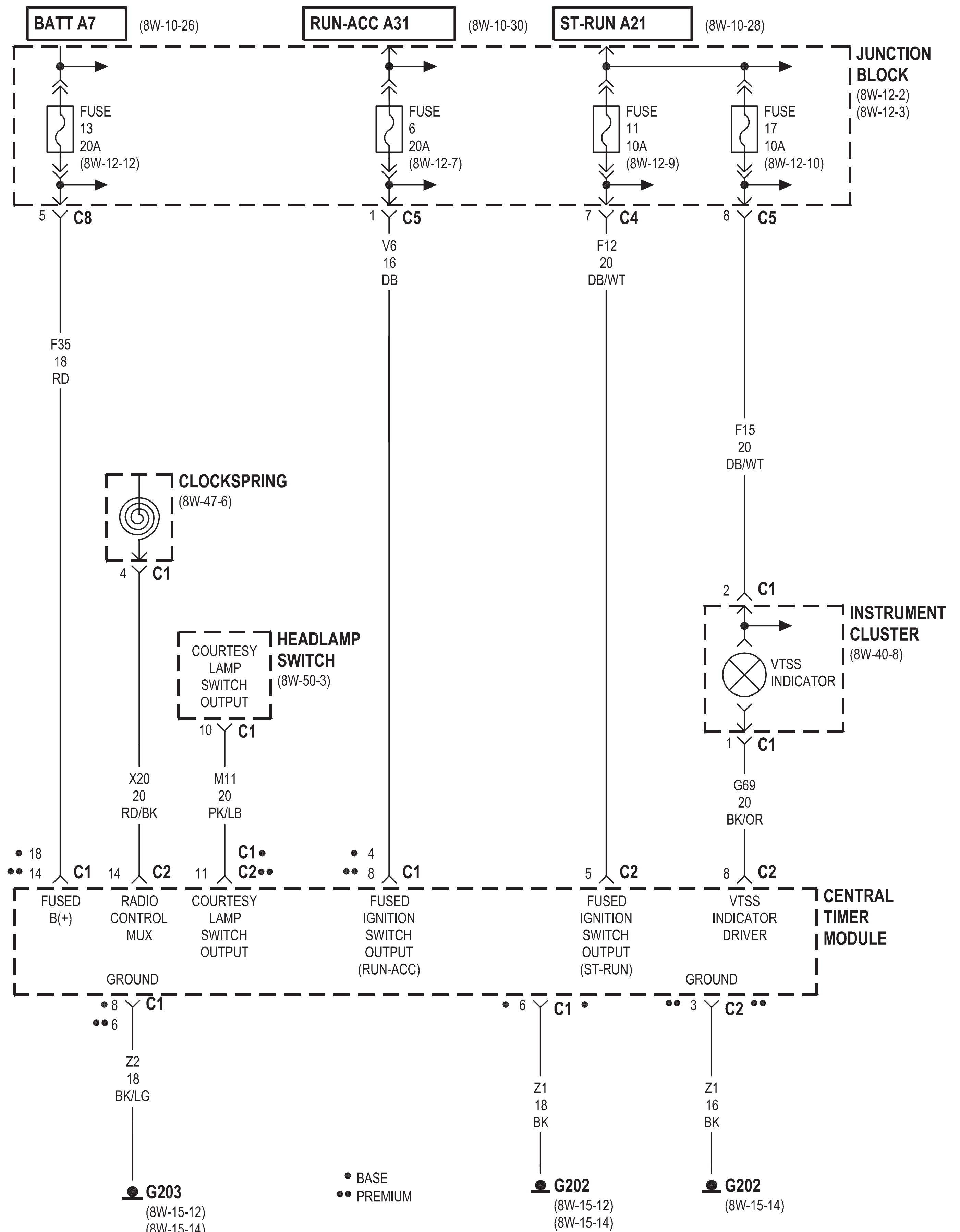

INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
CCD BUS (-)
CCD BUS (+)
9 C1
10 C1
DATA LINK CONNECTOR
(8W-30-27)
3
11
FROM CENTRAL TIMER MODULE
(8W-44-11)
A
FROM CENTRAL TIMER MODULE
(8W-44-11)
B
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
JOINT CONNECTOR NO. 3
(8W-10-35)
12
14
5
2
4
1
21
20
13
16
7
11
6
3
D2 18 WT/BK
D1 18 VT/BR
C200
46
52
72
73
OTHER
4.7L A/T
S190
(8W-31-4)
S189
(8W-31-4)
C128
TRANSMISSION CONTROL MODULE
(8W-31-4)
CCD BUS (+)
CCD BUS (-)
43
4
CONTROLLER ANTI-LOCK BRAKE
(8W-34-3)
(8W-35-3)
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
22
21
POWERTRAIN CONTROL MODULE
(8W-30-27)
30 C3
28 C3

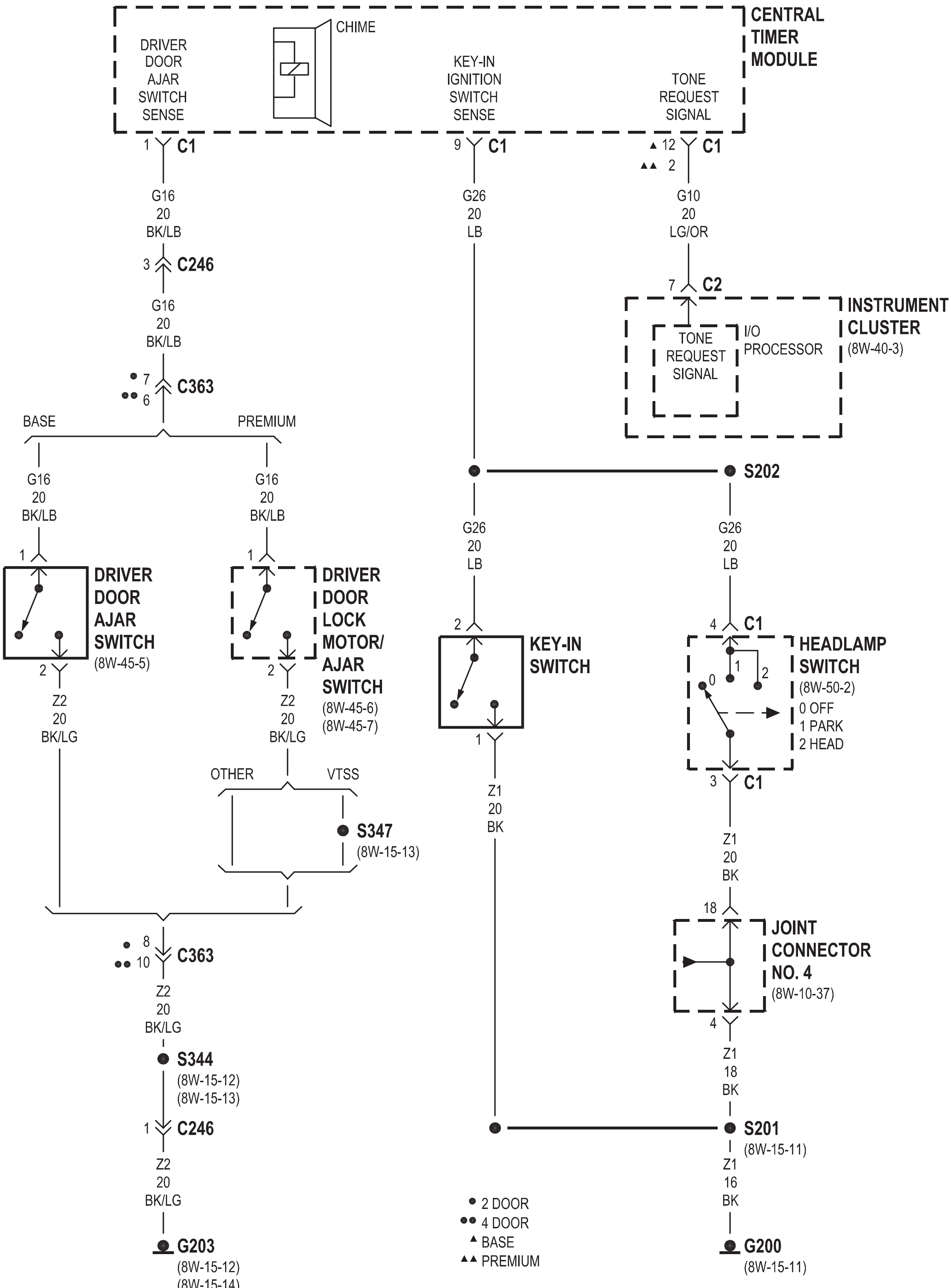


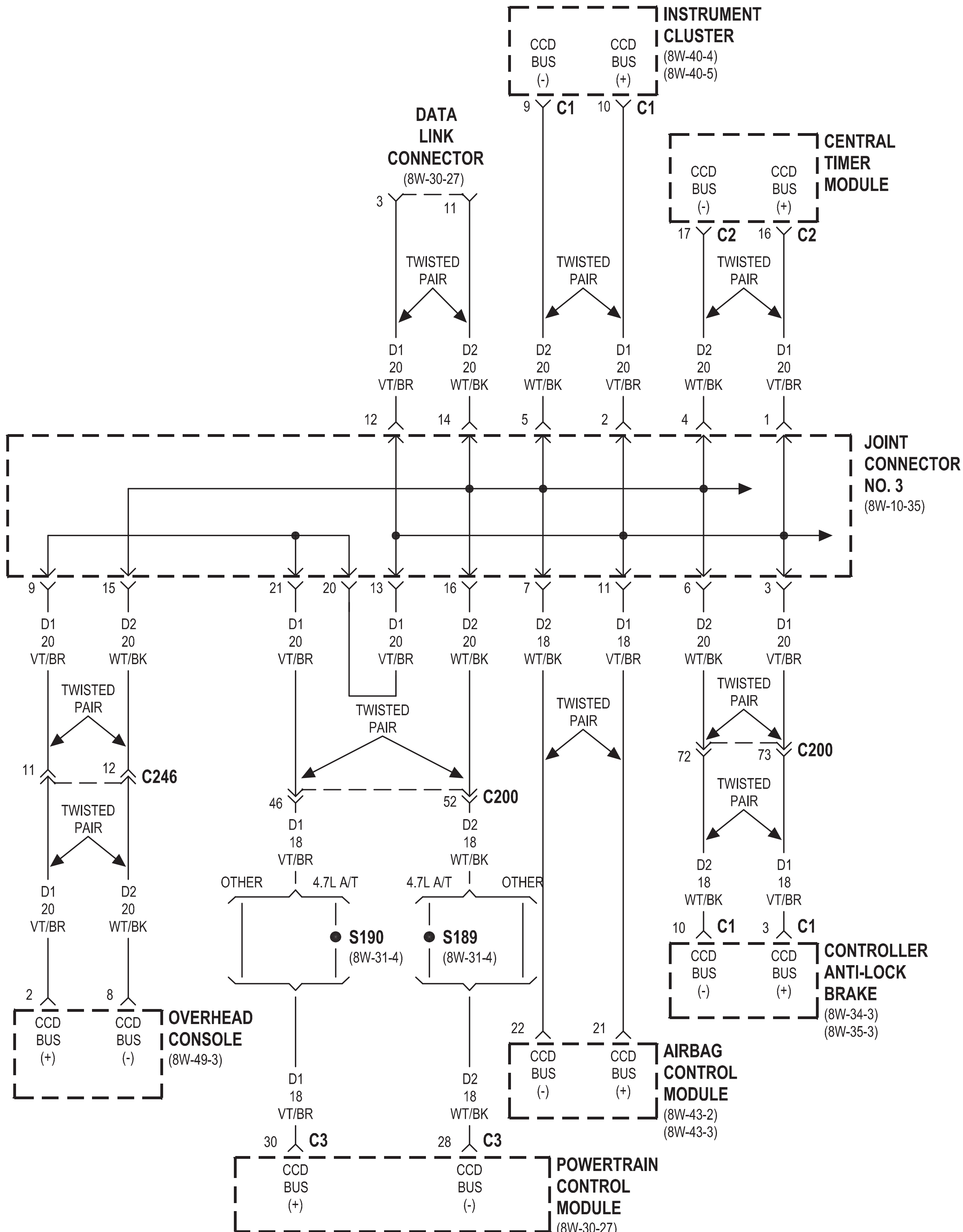
AN004413 J008W-1

8W-45 CENTRAL TIMER MODULE

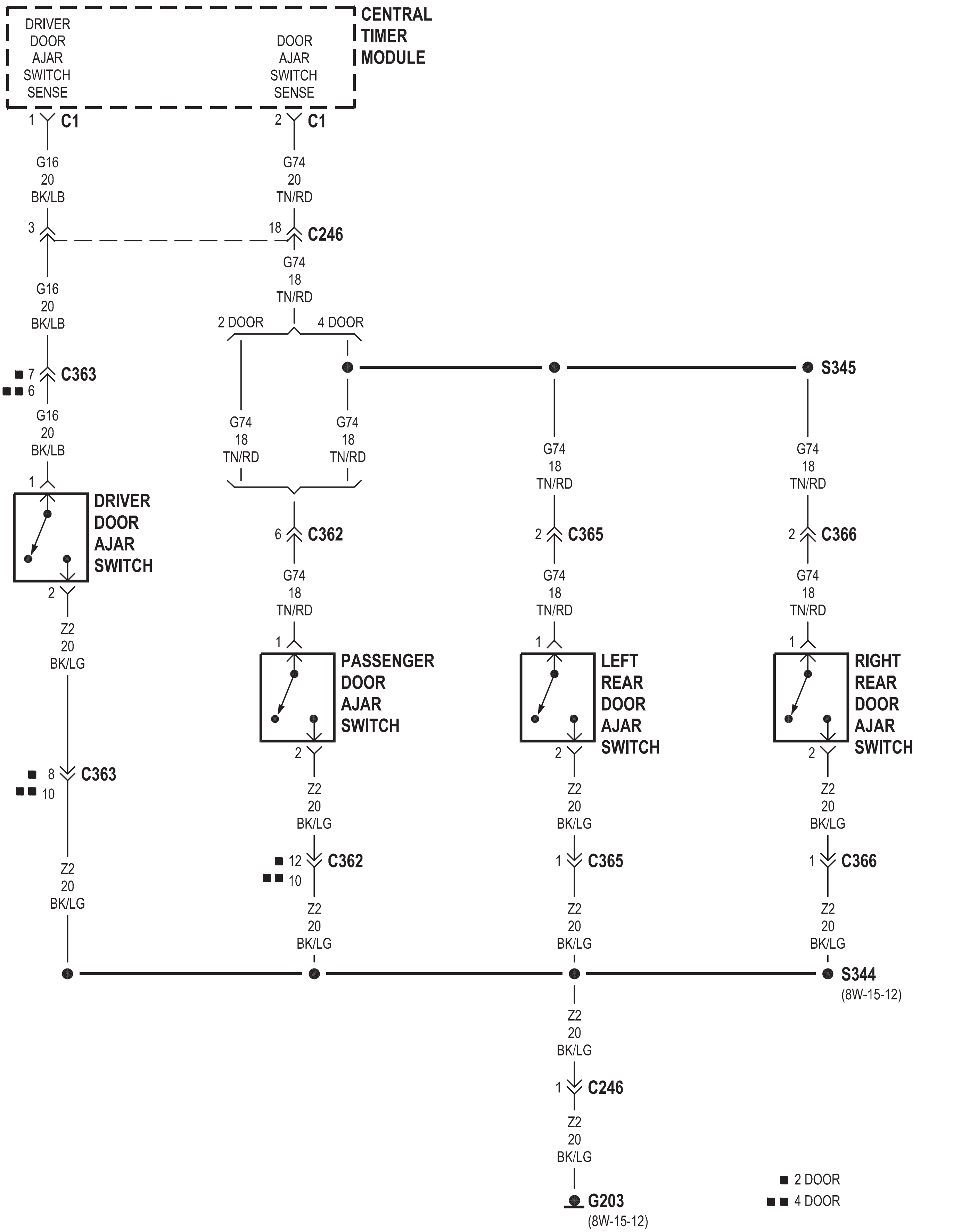
Component	Page
Airbag Control Module	8W-45-4
Base Console	8W-45-16
Central Timer Module	8W-45-2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
Clockspring	8W-45-2
Controller Anti-Lock Brake	8W-45-4
Data Link Connector	8W-45-4
Dome Lamp	8W-45-16
Driver Door Ajar Switch	8W-45-3, 5
Driver Door Key Cylinder Switch	8W-45-6, 7
Driver Door Lock Motor/Ajar Switch	8W-45-3, 6, 7, 11, 12
Driver Power Lock/Window Switch	8W-45-9, 10
Driver Unlock Relay	8W-45-12
Fuse 4 (JB)	8W-45-15
Fuse 6 (JB)	8W-45-2, 13, 14
Fuse 11 (JB)	8W-45-2
Fuse 13 (JB)	8W-45-2, 9, 10, 12
Fuse 17 (JB)	8W-45-2
G101	8W-45-13
G103	8W-45-14
G200	8W-45-3, 16
G202	8W-45-2
G203	8W-45-2, 3, 5, 6, 7, 8
Headlamp Flasher Relay	8W-45-15
Headlamp Switch	8W-45-2, 3, 16
High Note Horn	8W-45-15
Horn Relay	8W-45-15
Instrument Cluster	8W-45-2, 3, 4
Joint Connector No. 2	8W-45-14
Joint Connector No. 3	8W-45-4
Joint Connector No. 4	8W-45-3
Junction Block	8W-45-2, 9, 10, 12, 13, 14, 15, 16
Key-In Switch	8W-45-3
Left Rear Door Ajar Switch	8W-45-5
Left Rear Door Lock Motor/Ajar Switch	8W-45-8, 12
Low Note Horn	8W-45-15
Overhead Console	8W-45-4, 16
Passenger Door Ajar Switch	8W-45-5
Passenger Door Key Cylinder Switch	8W-45-6, 7
Passenger Door Lock Motor/Ajar Switch	8W-45-6, 8, 11, 12
Passenger Door Lock Switch	8W-45-10
Passenger Power Lock/Window Switch	8W-45-9
Powertrain Control Module	8W-45-4
Right Rear Door Ajar Switch	8W-45-5
Right Rear Door Lock Motor/Ajar Switch	8W-45-8, 12
VTSS Indicator	8W-45-2
Windshield Washer Pump	8W-45-13
Wiper Motor	8W-45-14
Wiper Relay	8W-45-14
Wiper Switch	8W-45-13


BATT A7
(8W-10-26)
RUN-ACC A31
(8W-10-30)
ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 13 20A (8W-12-12)
FUSE 6 20A (8W-12-7)
FUSE 11 10A (8W-12-9)
FUSE 17 10A (8W-12-10)
5 C8
1 C5
7 C4
8 C5
V6 16 DB
F12 20 DB/WT
F35 18 RD
F15 20 DB/WT
CLOCKSPRING
(8W-47-6)
4 C1
HEADLAMP SWITCH
(8W-50-3)
COURTESY LAMP SWITCH OUTPUT
10 C1
INSTRUMENT CLUSTER
(8W-40-8)
2 C1
VTSS INDICATOR
1 C1
X20 20 RD/BK
M11 20 PK/LB
G69 20 BK/OR
• 18
•• 14 C1
14 C2
11 C1• C2••
• 4
•• 8 C1
5 C2
8 C2
CENTRAL TIMER MODULE
FUSED B(+)
RADIO CONTROL MUX
COURTESY LAMP SWITCH OUTPUT
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
VTSS INDICATOR DRIVER
GROUND
GROUND
• 8 C1
•• 6
• 6 C1 •
•• 3 C2 ••
Z2 18 BK/LG
Z1 18 BK
Z1 16 BK
G203
(8W-15-12)
(8W-15-14)
G202
(8W-15-12)
(8W-15-14)
G202
(8W-15-14)
• BASE
•• PREMIUM


CENTRAL TIMER MODULE
DRIVER DOOR AJAR SWITCH SENSE
CHIME
KEY-IN IGNITION SWITCH SENSE
TONE REQUEST SIGNAL
1 C1
9 C1
▲ 12 C1
▲▲ 2
G16 20 BK/LB
G26 20 LB
G10 20 LG/OR
3 C246
7 C2
INSTRUMENT CLUSTER
(8W-40-3)
TONE REQUEST SIGNAL
I/O PROCESSOR
● 7
●● 6
C363
BASE
PREMIUM
S202
1
DRIVER DOOR AJAR SWITCH
(8W-45-5)
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-45-6)
(8W-45-7)
2
Z2 20 BK/LG
KEY-IN SWITCH
4 C1
HEADLAMP SWITCH
(8W-50-2)
0 OFF
1 PARK
2 HEAD
0
3 C1
Z1 20 BK
OTHER
VTSS
S347
(8W-15-13)
18
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1 18 BK
● 8
●● 10
C363
S344
(8W-15-12)
(8W-15-13)
1 C246
S201
(8W-15-11)
Z1 16 BK
● 2 DOOR
●● 4 DOOR
▲ BASE
▲▲ PREMIUM
G203
(8W-15-12)
(8W-15-14)
G200
(8W-15-11)

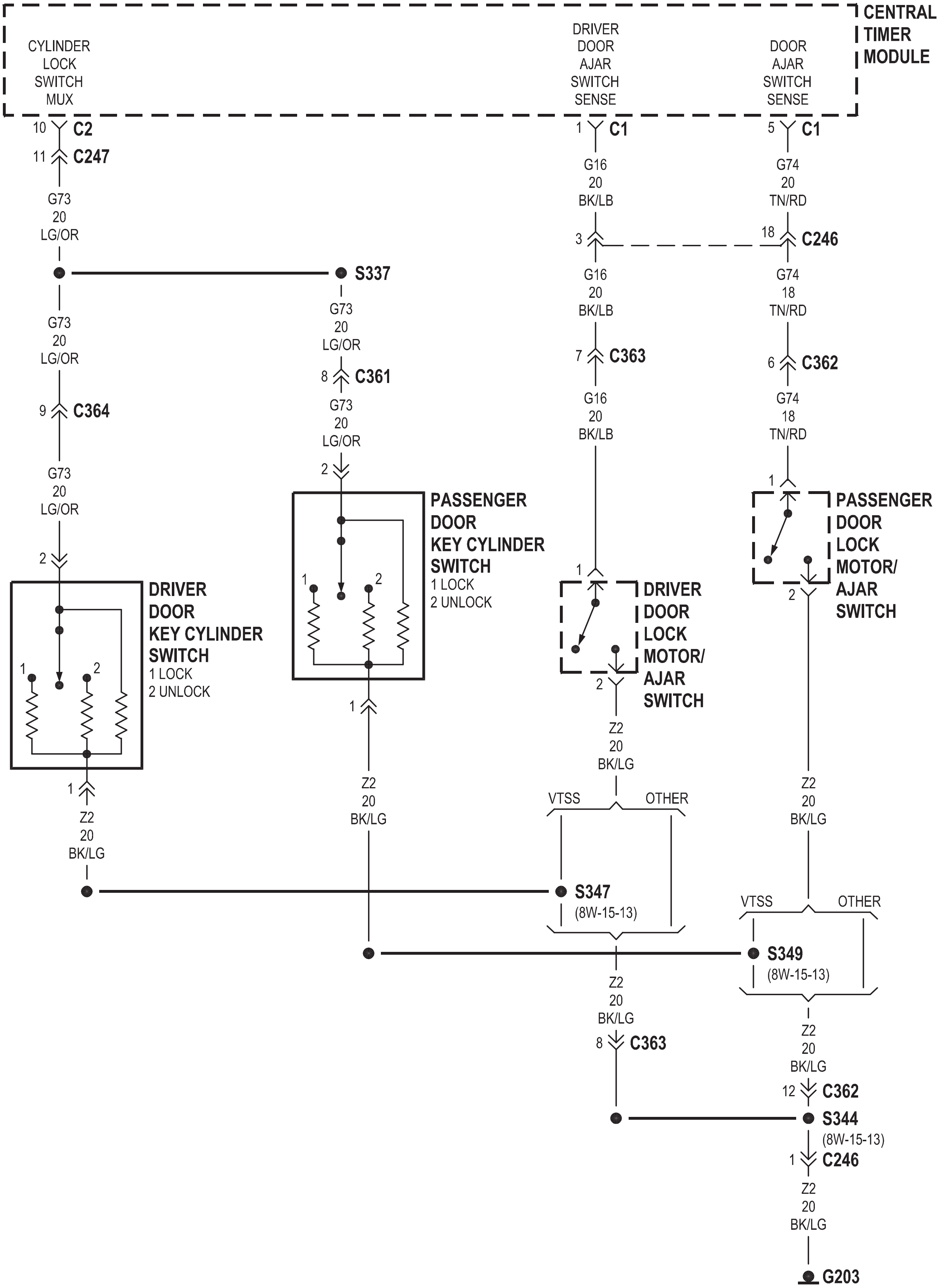

INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
CCD BUS (-)
CCD BUS (+)
9 C1
10 C1
DATA LINK CONNECTOR
(8W-30-27)
3
11
CENTRAL TIMER MODULE
CCD BUS (-)
CCD BUS (+)
17 C2
16 C2
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
D2 20 WT/BK
D1 20 VT/BR
D2 20 WT/BK
D1 20 VT/BR
12
14
5
2
4
1
JOINT CONNECTOR NO. 3
(8W-10-35)
9
15
21
20
13
16
7
11
6
3
D1 20 VT/BR
D2 20 WT/BK
D1 20 VT/BR
D1 20 VT/BR
D2 20 WT/BK
D2 18 WT/BK
D1 18 VT/BR
D2 20 WT/BK
D1 20 VT/BR
TWISTED PAIR
11
12
C246
72
73
C200
46
52
C200
D1 18 VT/BR
D2 18 WT/BK
OTHER
4.7L A/T
4.7L A/T
OTHER
S190
(8W-31-4)
S189
(8W-31-4)
D1 20 VT/BR
D2 20 WT/BK
D2 18 WT/BK
D1 18 VT/BR
10 C1
3 C1
CONTROLLER ANTI-LOCK BRAKE
(8W-34-3)
(8W-35-3)
2
8
OVERHEAD CONSOLE
(8W-49-3)
CCD BUS (+)
CCD BUS (-)
22
21
AIRBAG CONTROL MODULE
(8W-43-2)
(8W-43-3)
D1 18 VT/BR
D2 18 WT/BK
30 C3
28 C3
POWERTRAIN CONTROL MODULE
(8W-30-27)
CCD BUS (+)
CCD BUS (-)

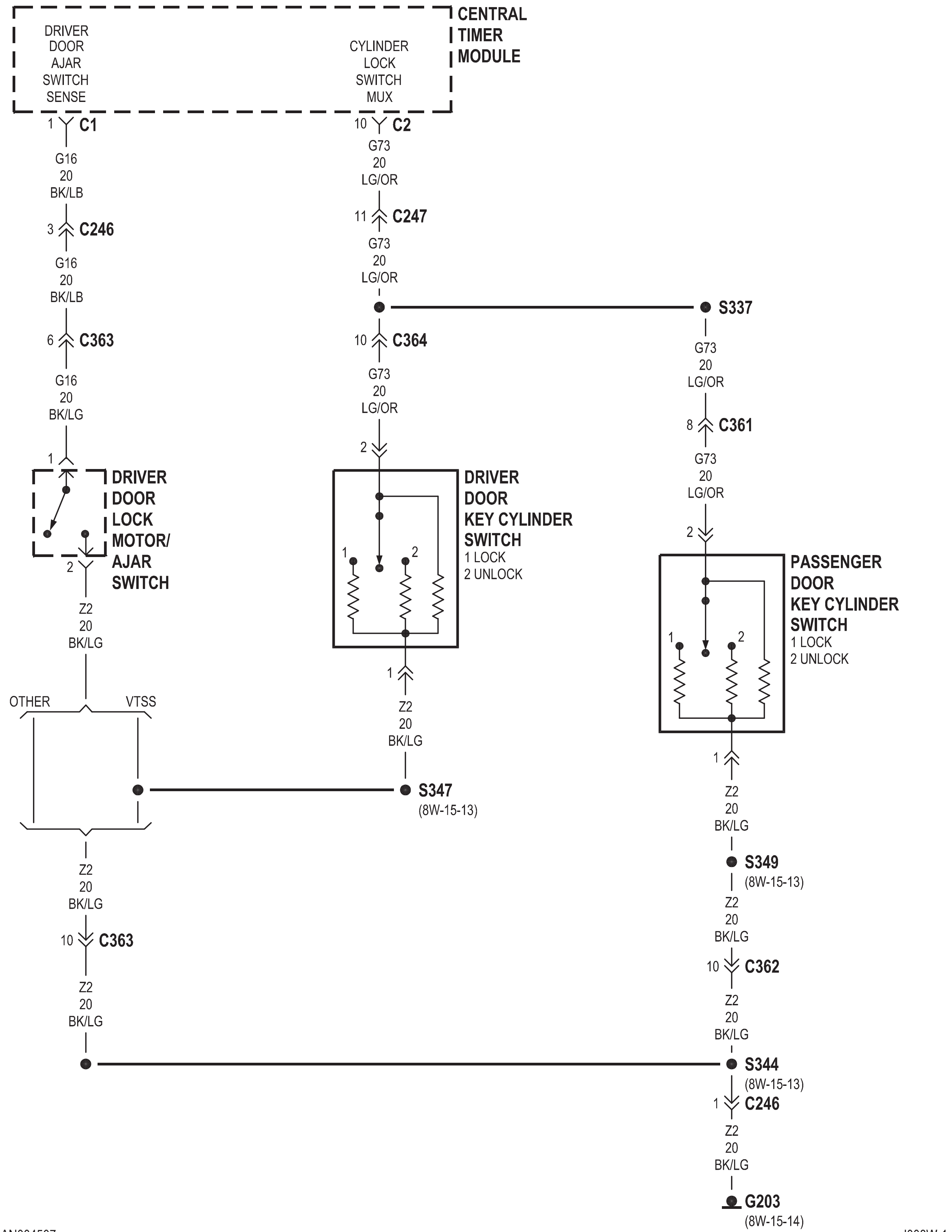
BASE



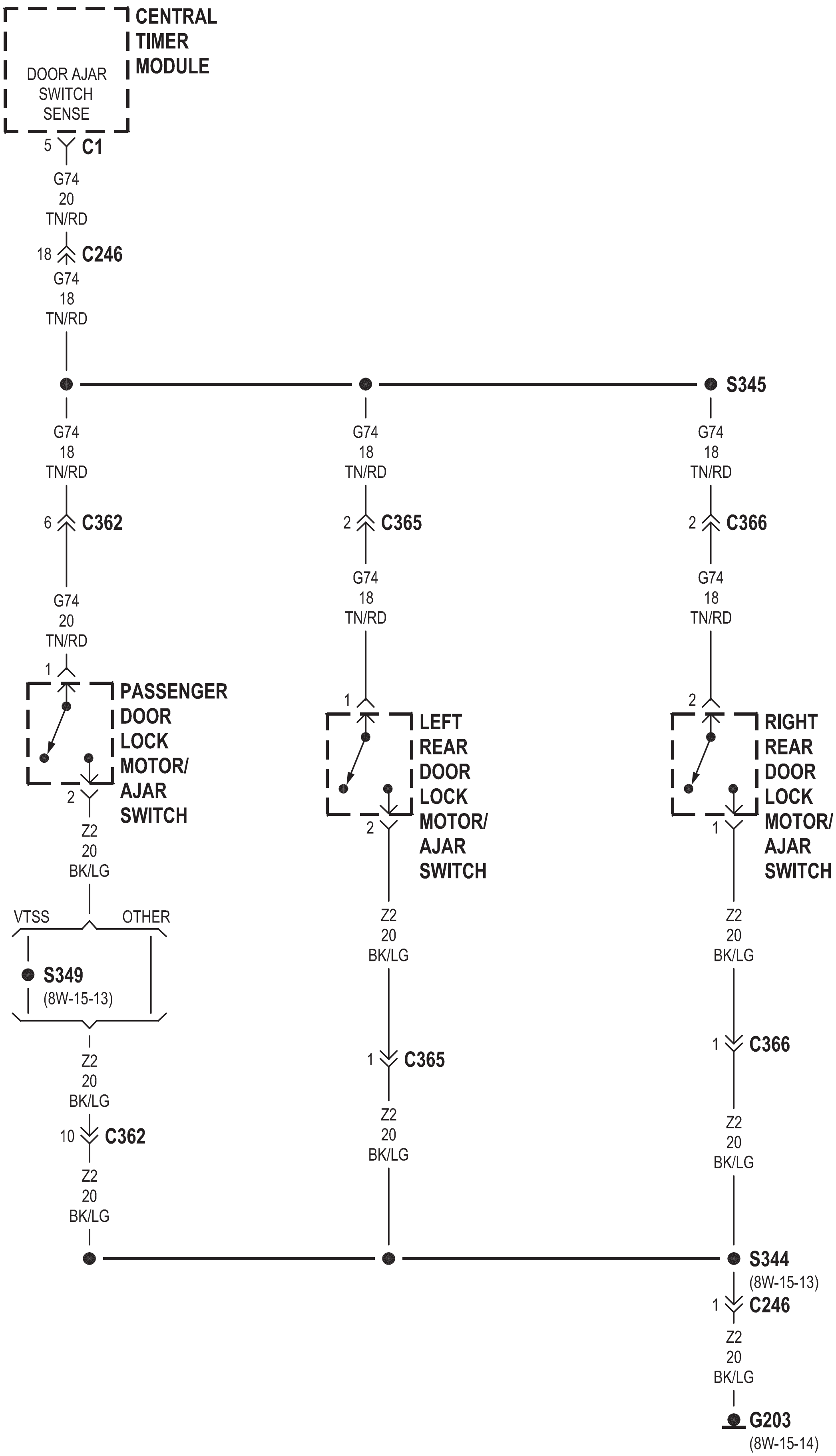
CENTRAL TIMER MODULE
DRIVER DOOR AJAR SWITCH SENSE
DOOR AJAR SWITCH SENSE
1 C1
2 C1
G16 20 BK/LB
G74 20 TN/RD
3
18 C246
G74 18 TN/RD
G16 20 BK/LB
2 DOOR
4 DOOR
7 C363
6
S345
G16 20 BK/LB
G74 18 TN/RD
G74 18 TN/RD
G74 18 TN/RD
G74 18 TN/RD
1
DRIVER DOOR AJAR SWITCH
6 C362
2 C365
2 C366
2
G74 18 TN/RD
G74 18 TN/RD
G74 18 TN/RD
Z2 20 BK/LG
1
1
1
PASSENGER DOOR AJAR SWITCH
LEFT REAR DOOR AJAR SWITCH
RIGHT REAR DOOR AJAR SWITCH
2
2
2
8 C363
10
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
12 C362
10
1 C365
1 C366
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
Z2 20 BK/LG
S344
(8W-15-12)
Z2 20 BK/LG
1 C246
Z2 20 BK/LG
G203
(8W-15-12)
■ 2 DOOR
■■ 4 DOOR

PREMIUM 2 DOOR

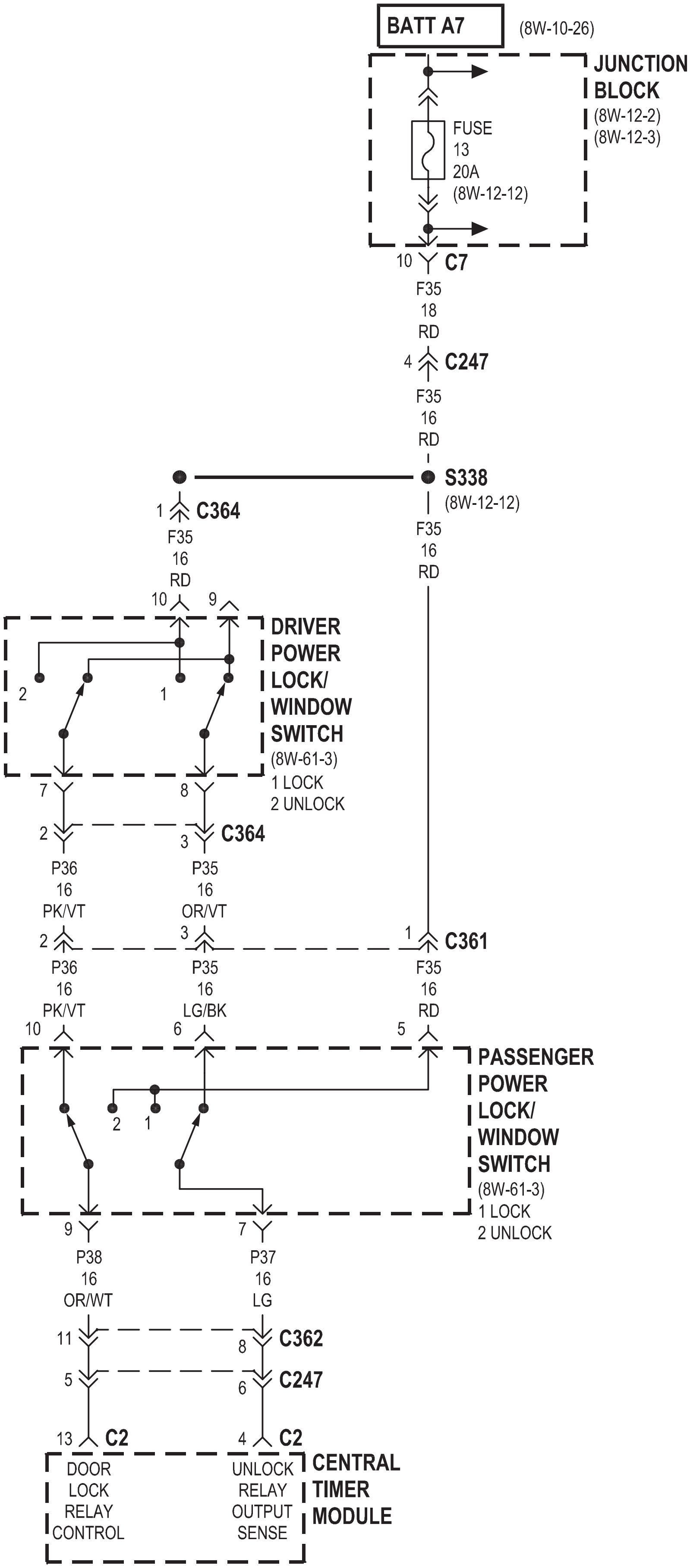



CENTRAL TIMER MODULE
DRIVER DOOR AJAR SWITCH SENSE
CYLINDER LOCK SWITCH MUX
1 C1
10 C2
G16 20 BK/LB
3 C246
G16 20 BK/LB
6 C363
G16 20 BK/LG
G73 20 LG/OR
11 C247
G73 20 LG/OR
S337
10 C364
G73 20 LG/OR
G73 20 LG/OR
8 C361
G73 20 LG/OR
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
DRIVER DOOR KEY CYLINDER SWITCH
1 LOCK
2 UNLOCK
PASSENGER DOOR KEY CYLINDER SWITCH
1 LOCK
2 UNLOCK
Z2 20 BK/LG
OTHER
VTSS
Z2 20 BK/LG
S347
(8W-15-13)
Z2 20 BK/LG
S349
(8W-15-13)
Z2 20 BK/LG
10 C362
Z2 20 BK/LG
Z2 20 BK/LG
10 C363
Z2 20 BK/LG
S344
(8W-15-13)
1 C246
Z2 20 BK/LG
G203
(8W-15-14)

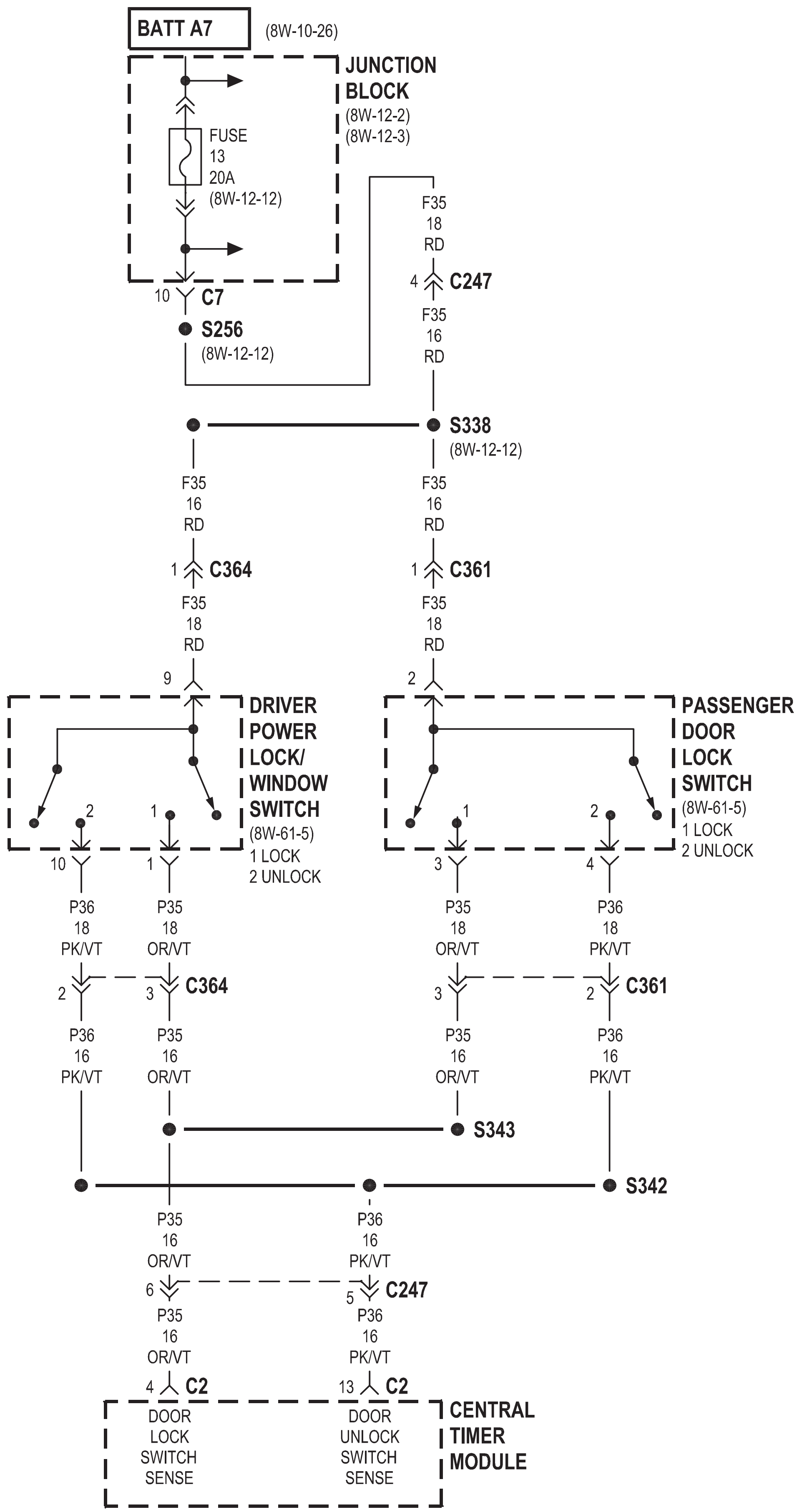
PREMIUM 4 DOOR

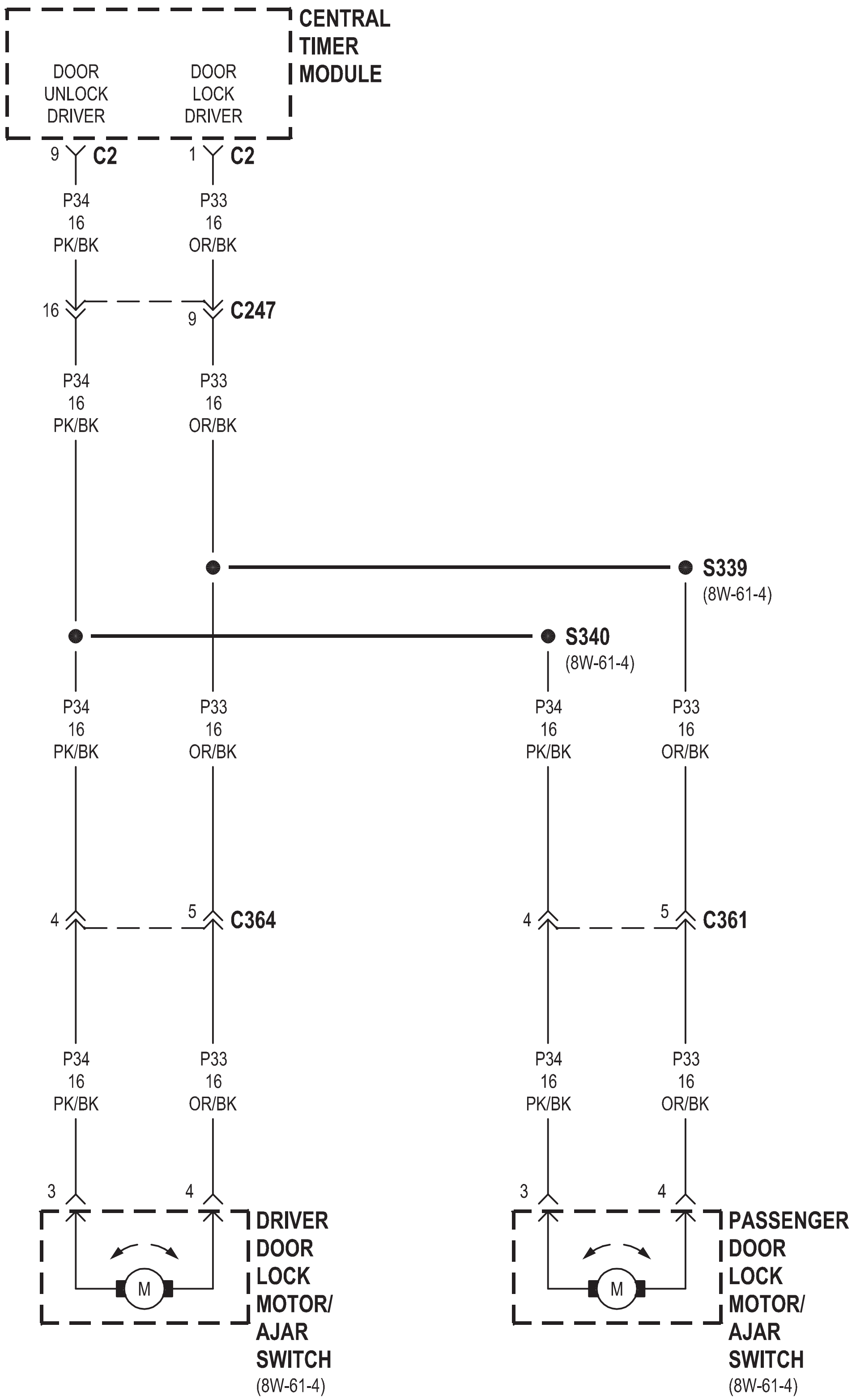


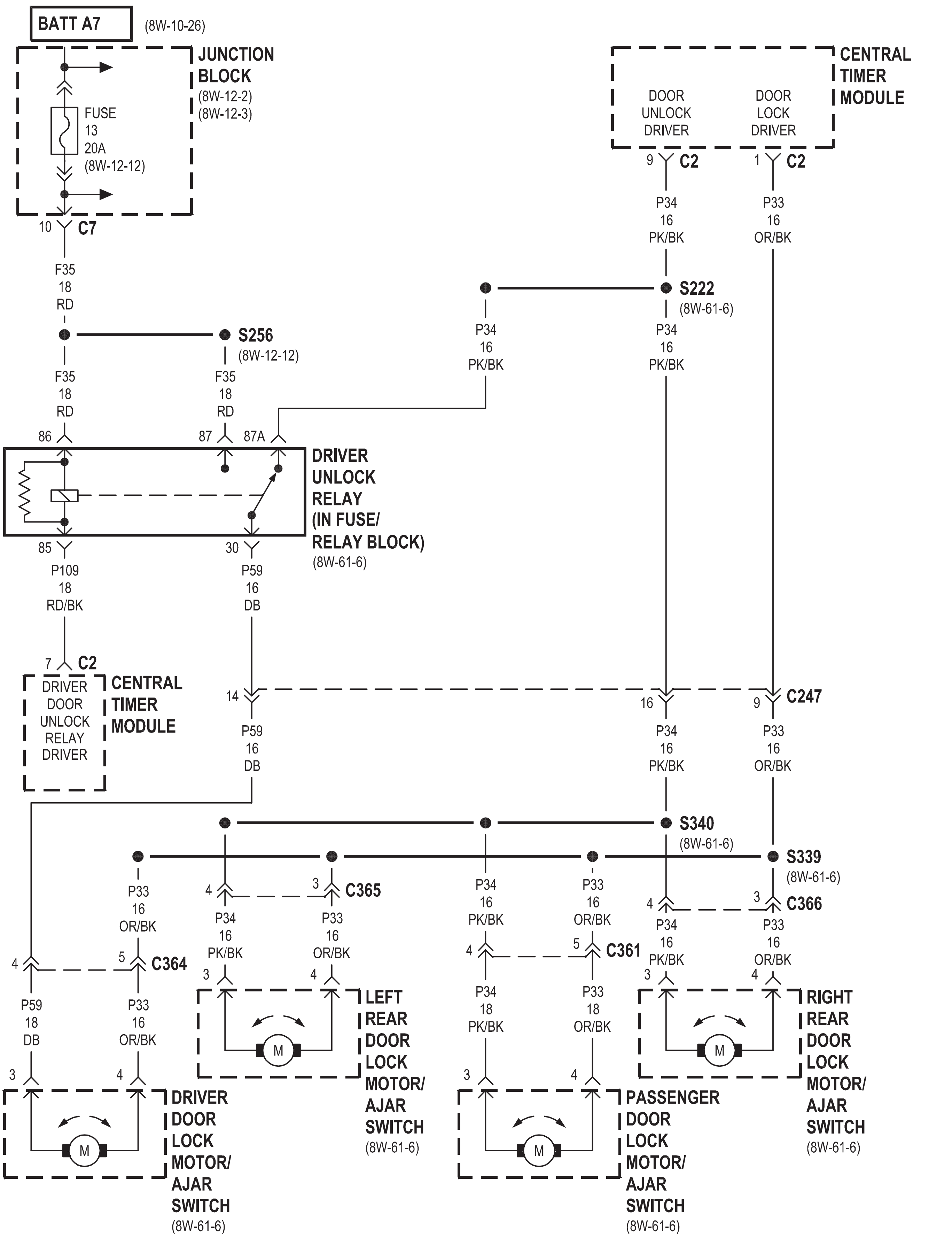
PREMIUM 2 DOOR

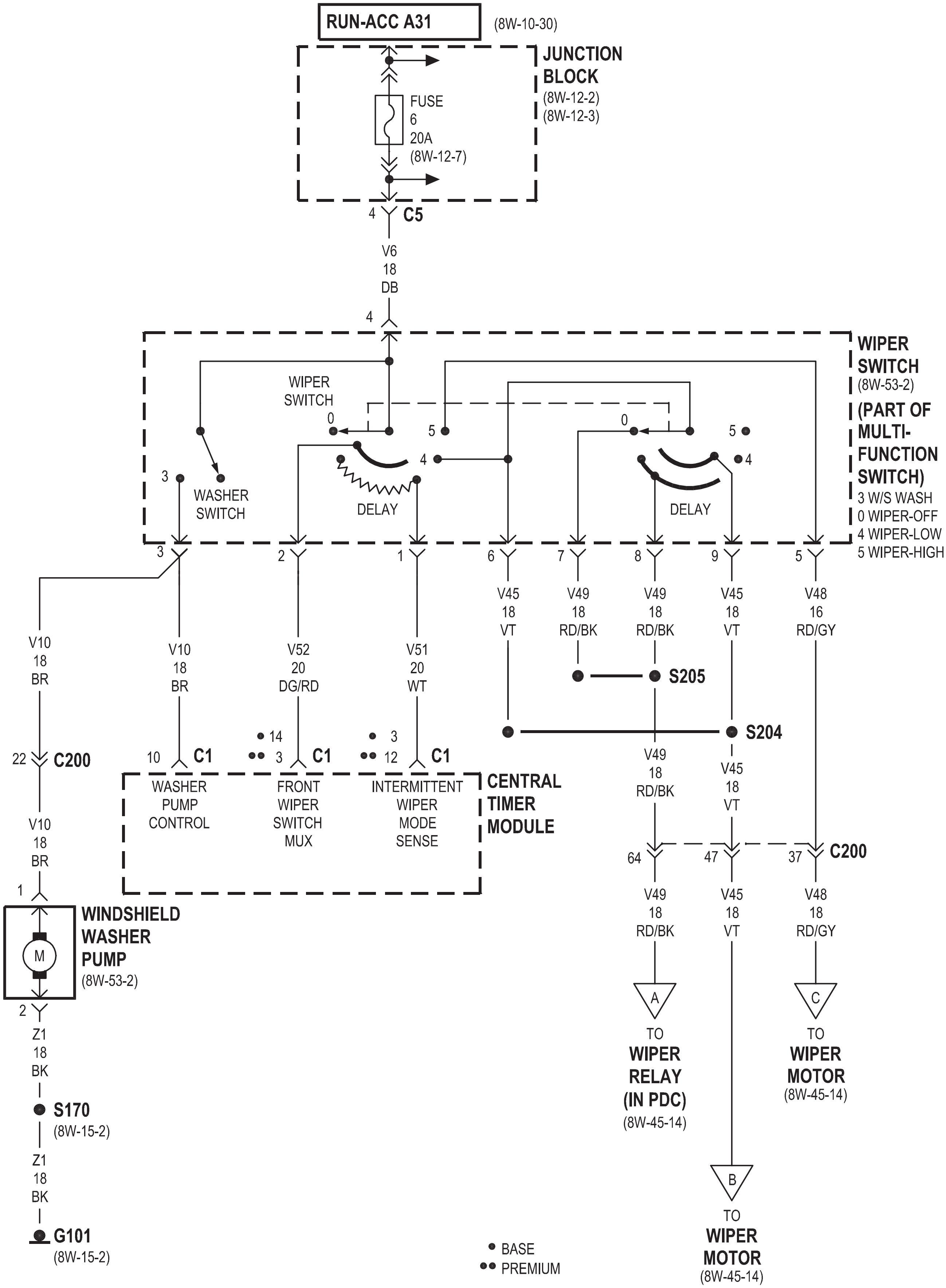


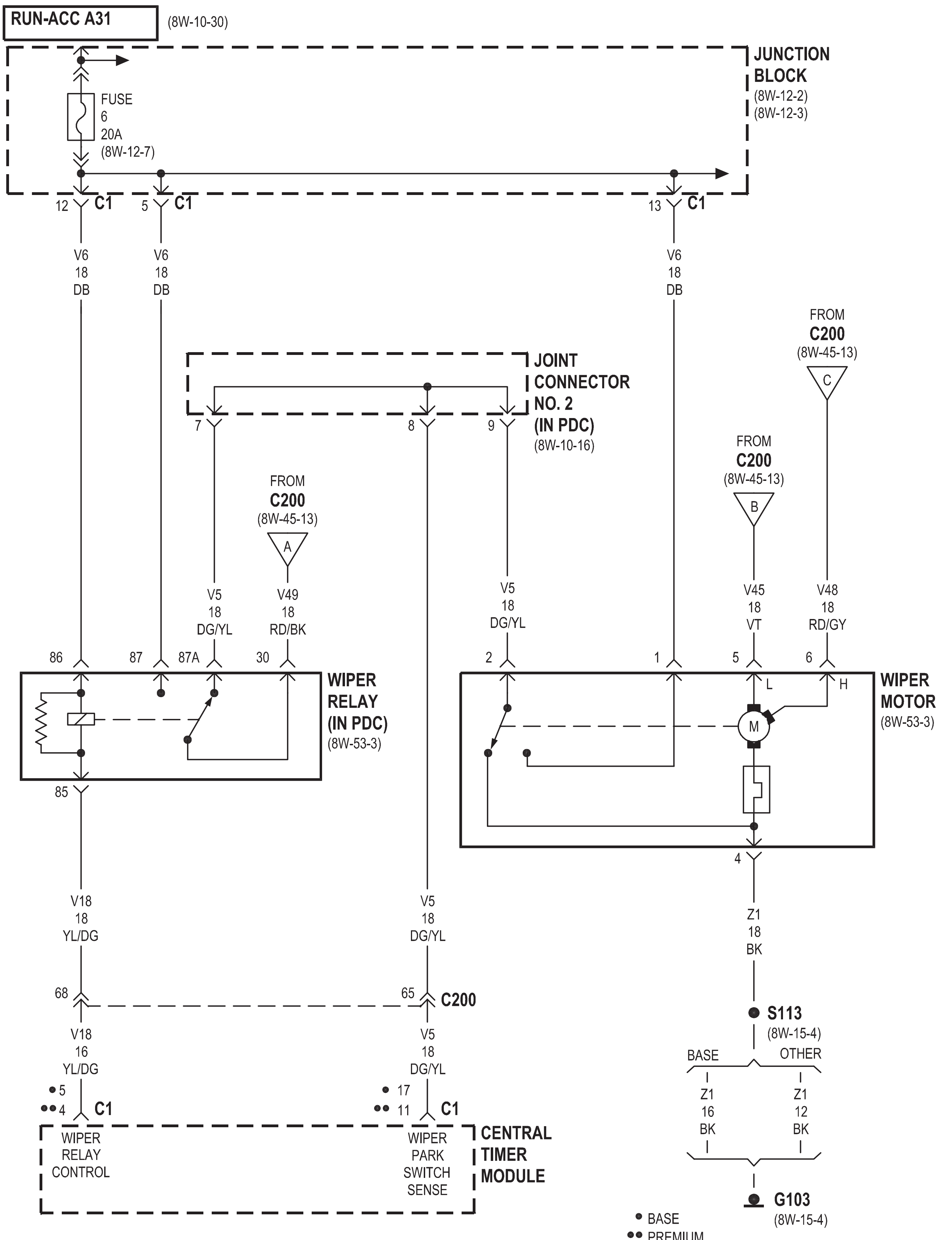
PREMIUM 4 DOOR



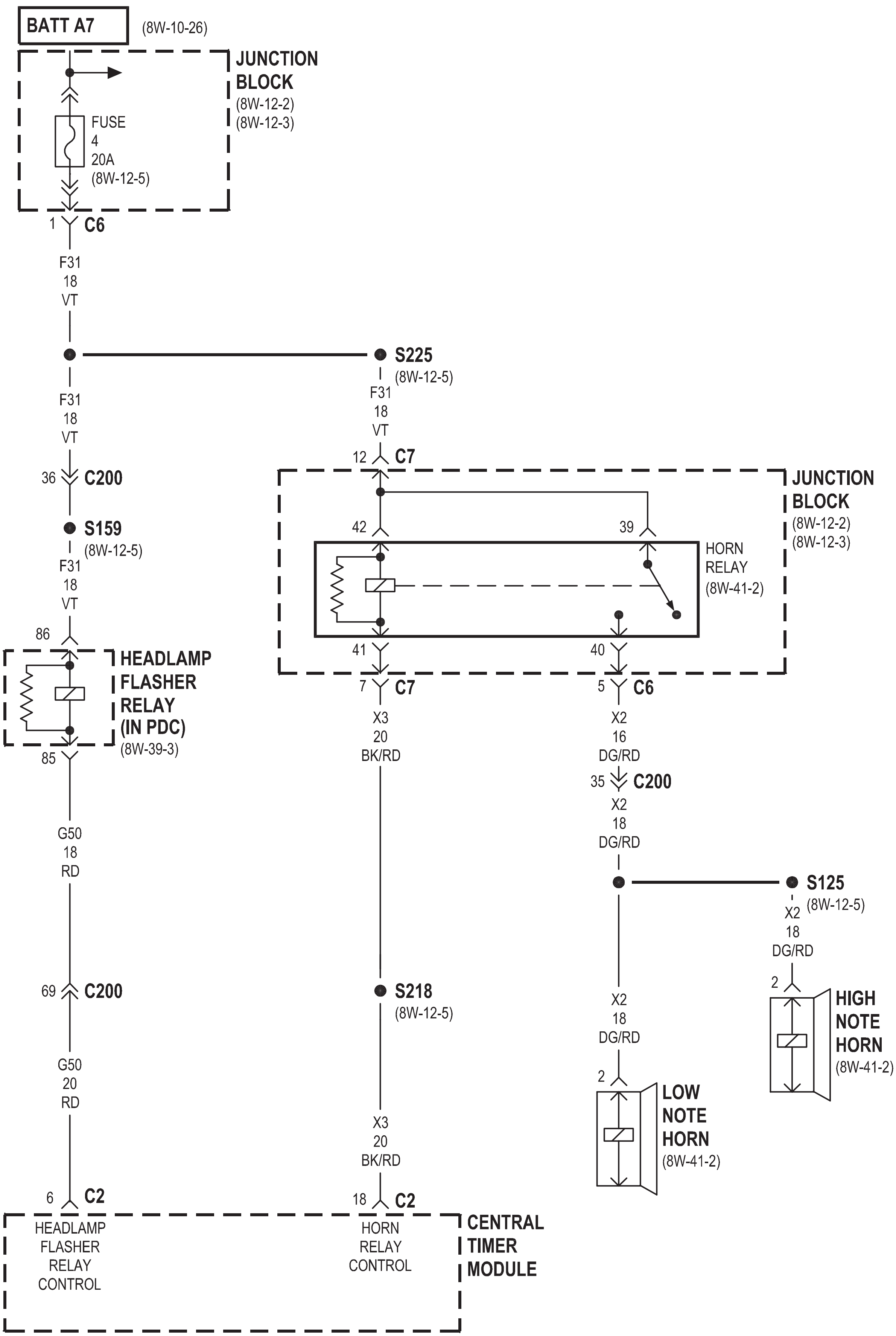

CENTRAL TIMER MODULE
DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
9 C2
1 C2
P34 16 PK/BK
P33 16 OR/BK
16
9 C247
S339
(8W-61-4)
S340
(8W-61-4)
4
5 C364
4
5 C361
3
4
M
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)

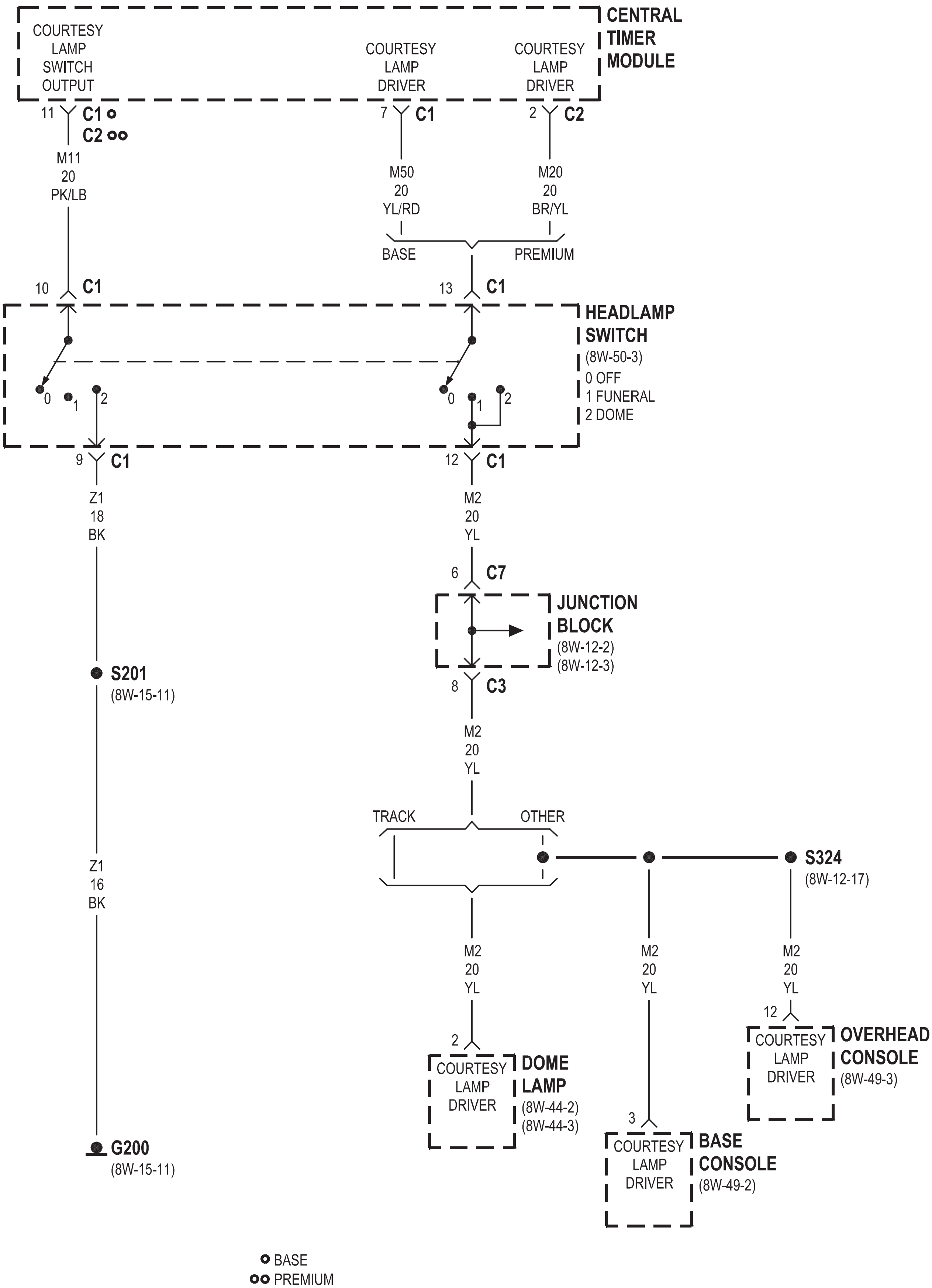

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 13 20A (8W-12-12)
10 C7
F35 18 RD
S256
(8W-12-12)
F35 18 RD
F35 18 RD
86
87
87A
DRIVER UNLOCK RELAY (IN FUSE/ RELAY BLOCK)
(8W-61-6)
85
30
P109 18 RD/BK
P59 16 DB
7 C2
DRIVER DOOR UNLOCK RELAY DRIVER
CENTRAL TIMER MODULE
CENTRAL TIMER MODULE
DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
9 C2
1 C2
P34 16 PK/BK
P33 16 OR/BK
S222
(8W-61-6)
P34 16 PK/BK
P34 16 PK/BK
14
16
9 C247
P59 16 DB
P34 16 PK/BK
P33 16 OR/BK
S340
(8W-61-6)
S339
(8W-61-6)
P33 16 OR/BK
4
3 C365
P34 16 PK/BK
P33 16 OR/BK
P34 16 PK/BK
P33 16 OR/BK
4
3 C366
P34 16 PK/BK
P33 16 OR/BK
4
5 C364
4
5 C361
P59 18 DB
P33 16 OR/BK
P34 18 PK/BK
P33 18 OR/BK
3
4
M
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-6)
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-6)
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-6)
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-6)


RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
20A
(8W-12-7)
4 C5
V6
18
DB
4
WIPER SWITCH
(8W-53-2)
(PART OF MULTI-FUNCTION SWITCH)
3 W/S WASH
0 WIPER-OFF
4 WIPER-LOW
5 WIPER-HIGH
WIPER SWITCH
0
5
4
3
WASHER SWITCH
DELAY
0
5
4
DELAY
3 2 1 6 7 8 9 5
V10
18
BR
V10
18
BR
V52
20
DG/RD
V51
20
WT
V45
18
VT
V49
18
RD/BK
V49
18
RD/BK
V45
18
VT
V48
16
RD/GY
S205
S204
22 C200
10 C1
14
3 C1
3
12 C1
CENTRAL TIMER MODULE
WASHER PUMP CONTROL
FRONT WIPER SWITCH MUX
INTERMITTENT WIPER MODE SENSE
V49
18
RD/BK
V45
18
VT
64 47 37 C200
V49
18
RD/BK
V45
18
VT
V48
18
RD/GY
V10
18
BR
1
WINDSHIELD WASHER PUMP
(8W-53-2)
M
2
Z1
18
BK
S170
(8W-15-2)
Z1
18
BK
G101
(8W-15-2)
A
TO WIPER RELAY (IN PDC)
(8W-45-14)
C
TO WIPER MOTOR
(8W-45-14)
B
TO WIPER MOTOR
(8W-45-14)
• BASE
•• PREMIUM



RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
20A
(8W-12-7)
12 C1
5 C1
13 C1
V6
18
DB
V6
18
DB
V6
18
DB
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-16)
7
8
9
FROM C200 (8W-45-13)
A
B
C
V5
18
DG/YL
V49
18
RD/BK
V5
18
DG/YL
V45
18
VT
V48
18
RD/GY
86
87
87A
30
WIPER RELAY (IN PDC)
(8W-53-3)
85
2
1
5
6
L
H
M
WIPER MOTOR
(8W-53-3)
4
V18
18
YL/DG
V5
18
DG/YL
Z1
18
BK
68
65
C200
S113
(8W-15-4)
BASE
OTHER
Z1
16
BK
Z1
12
BK
V18
16
YL/DG
V5
18
DG/YL
• 5
•• 4
C1
• 17
•• 11
C1
WIPER RELAY CONTROL
WIPER PARK SWITCH SENSE
CENTRAL TIMER MODULE
G103
(8W-15-4)
• BASE
•• PREMIUM


BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 20A (8W-12-5)
1 C6
F31 18 VT
S225
(8W-12-5)
F31 18 VT
F31 18 VT
12 C7
36 C200
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
S159
(8W-12-5)
F31 18 VT
42
39
HORN RELAY
(8W-41-2)
86
41
40
HEADLAMP FLASHER RELAY (IN PDC)
(8W-39-3)
7 C7
5 C6
85
X3 20 BK/RD
X2 16 DG/RD
35 C200
X2 18 DG/RD
G50 18 RD
S125
(8W-12-5)
X2 18 DG/RD
69 C200
S218
(8W-12-5)
2
HIGH NOTE HORN
(8W-41-2)
X2 18 DG/RD
G50 20 RD
2
LOW NOTE HORN
(8W-41-2)
X3 20 BK/RD
6 C2
18 C2
HEADLAMP FLASHER RELAY CONTROL
HORN RELAY CONTROL
CENTRAL TIMER MODULE



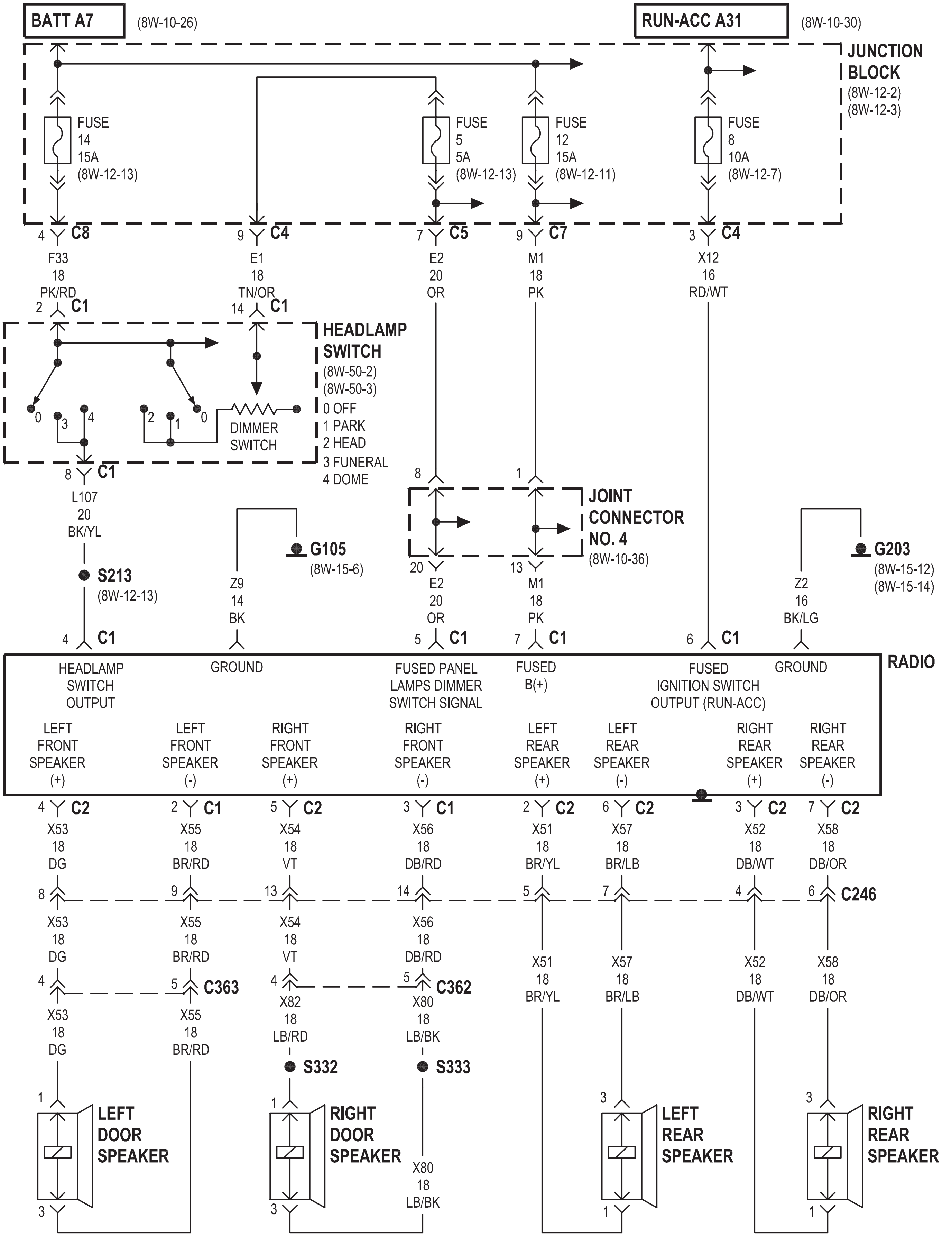
CENTRAL
TIMER
MODULE
COURTESY LAMP SWITCH OUTPUT
COURTESY LAMP DRIVER
COURTESY LAMP DRIVER
11 C1 C2
7 C1
2 C2
M11 20 PK/LB
M50 20 YL/RD
M20 20 BR/YL
BASE
PREMIUM
10 C1
13 C1
HEADLAMP
SWITCH
(8W-50-3)
0 OFF
1 FUNERAL
2 DOME
9 C1
12 C1
Z1 18 BK
M2 20 YL
6 C7
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
8 C3
S201
(8W-15-11)
M2 20 YL
TRACK
OTHER
S324
(8W-12-17)
Z1 16 BK
M2 20 YL
M2 20 YL
M2 20 YL
12
COURTESY LAMP DRIVER
OVERHEAD
CONSOLE
(8W-49-3)
2
COURTESY LAMP DRIVER
DOME
LAMP
(8W-44-2)
(8W-44-3)
3
COURTESY LAMP DRIVER
BASE
CONSOLE
(8W-49-2)
G200
(8W-15-11)
BASE
PREMIUM

8W-47 AUDIO SYSTEM

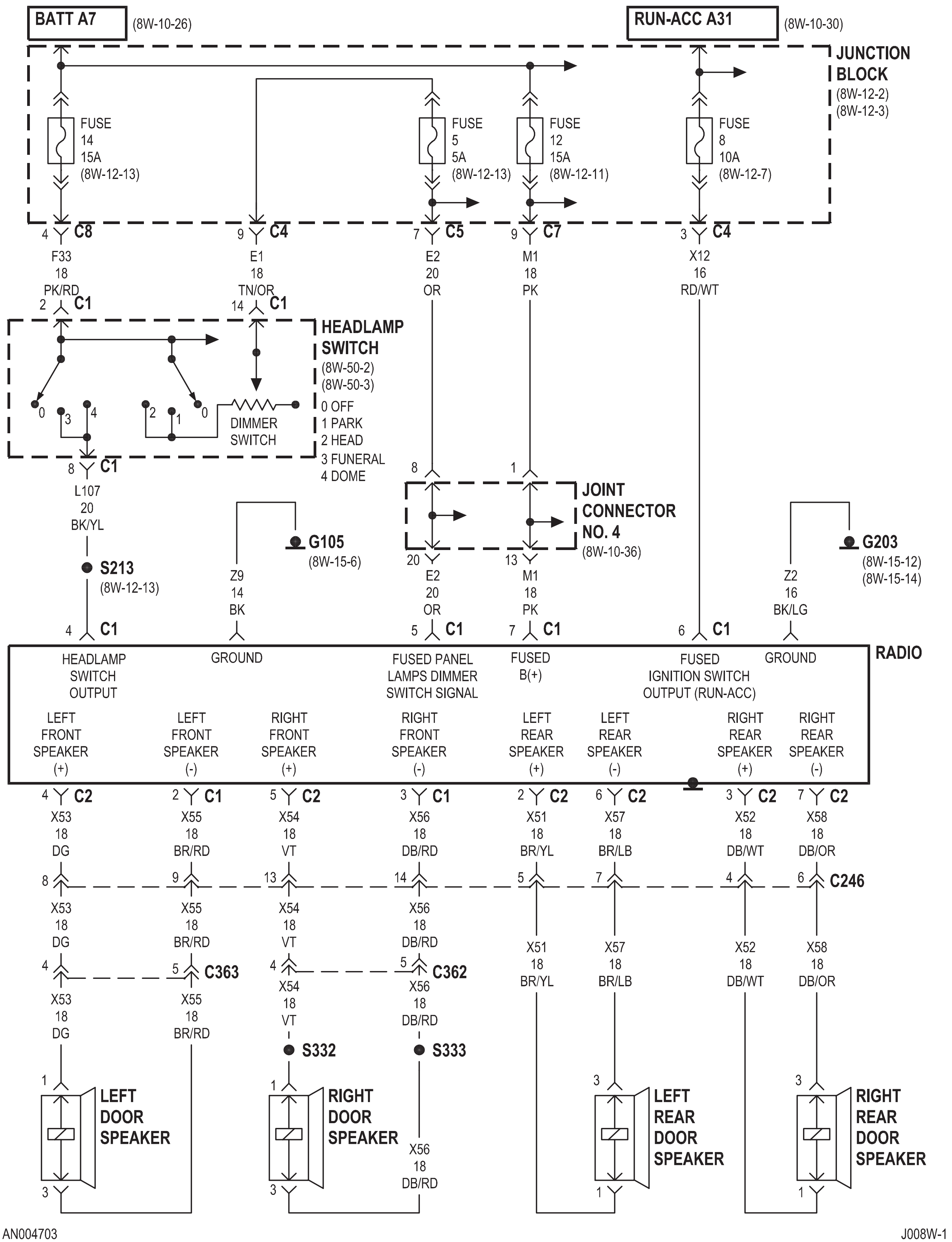
Component	Page
Central Timer Module	8W-47-6
Clockspring	8W-47-6
Fuse 1 (JB)	8W-47-5, 7, 8
Fuse 5 (JB)	8W-47-2, 3, 4
Fuse 8 (JB)	8W-47-2, 3, 4
Fuse 12 (JB)	8W-47-2, 3, 4
Fuse 14 (JB)	8W-47-2, 3, 4
G105	8W-47-2, 3, 4
G203	8W-47-2, 3, 4, 6, 7
Headlamp Switch	8W-47-2, 3, 4
Joint Connector No. 3	8W-47-6
Joint Connector No. 4	8W-47-2, 3, 4
Junction Block	8W-47-2, 3, 4, 5, 7, 8
Left Door Speaker	8W-47-2, 3

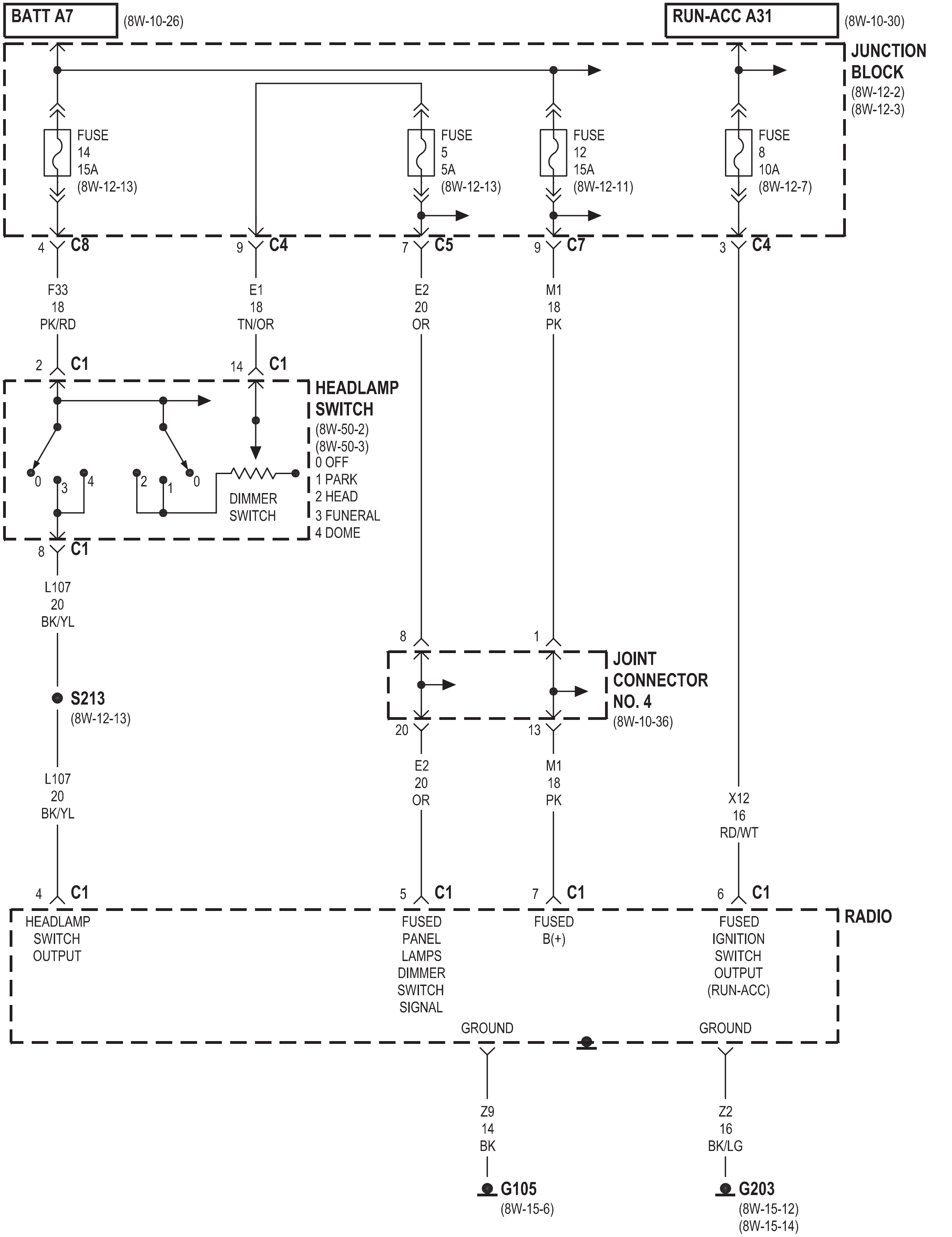
Component	Page
Left Door Tweeter	8W-47-5
Left Door Woofer	8W-47-5
Left Rear Door Speaker	8W-47-3, 8
Left Rear Speaker	8W-47-2, 7
Left Remote Radio Switch	8W-47-6
Power Amplifier	8W-47-5, 7, 8
Radio	8W-47-2, 3, 4, 5, 6, 7, 8
Right Door Speaker	8W-47-2, 3
Right Door Tweeter	8W-47-5
Right Door Woofer	8W-47-5
Right Rear Door Speaker	8W-47-3, 8
Right Rear Speaker	8W-47-2, 7
Right Remote Radio Switch	8W-47-6

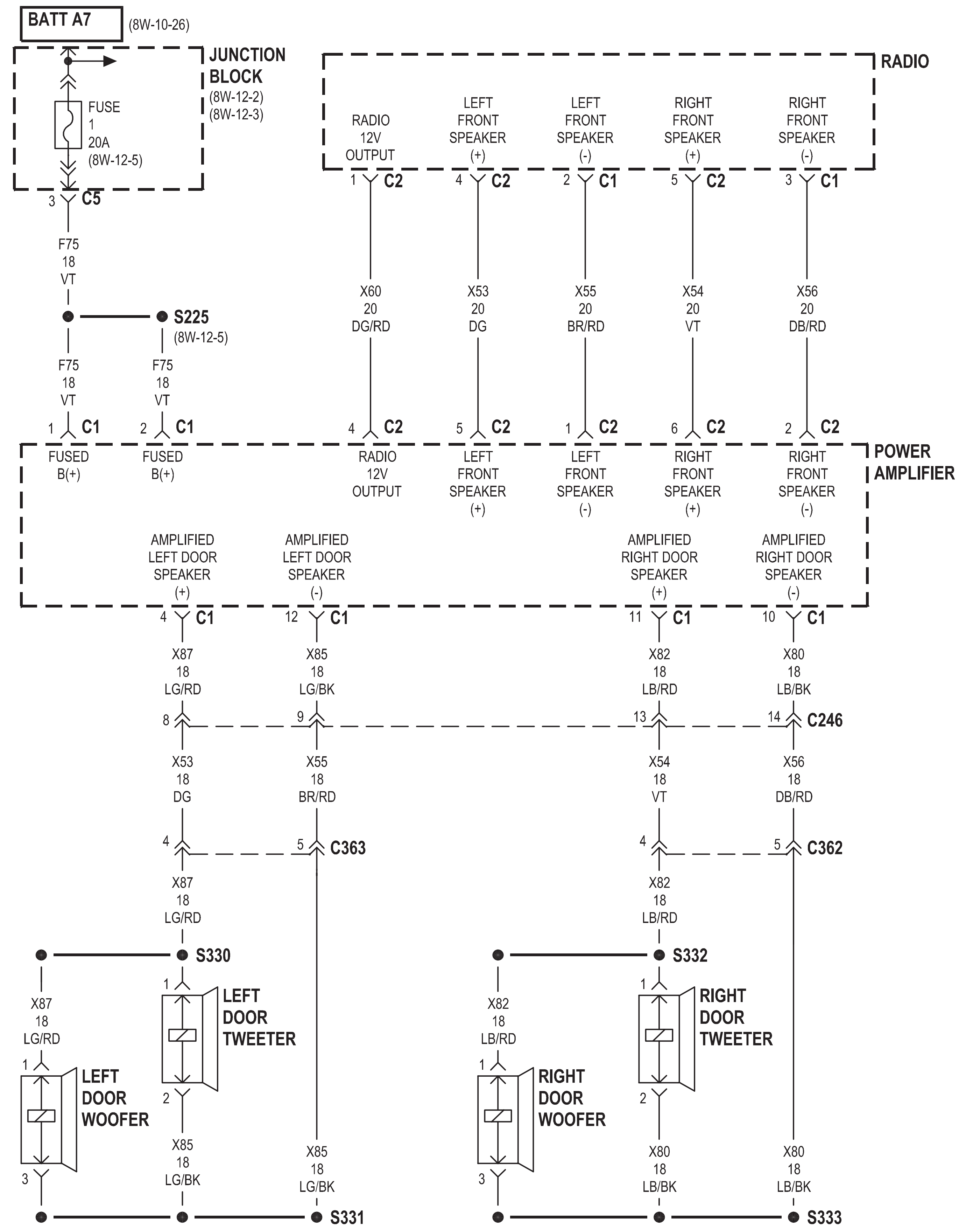
BASE 2 DOOR

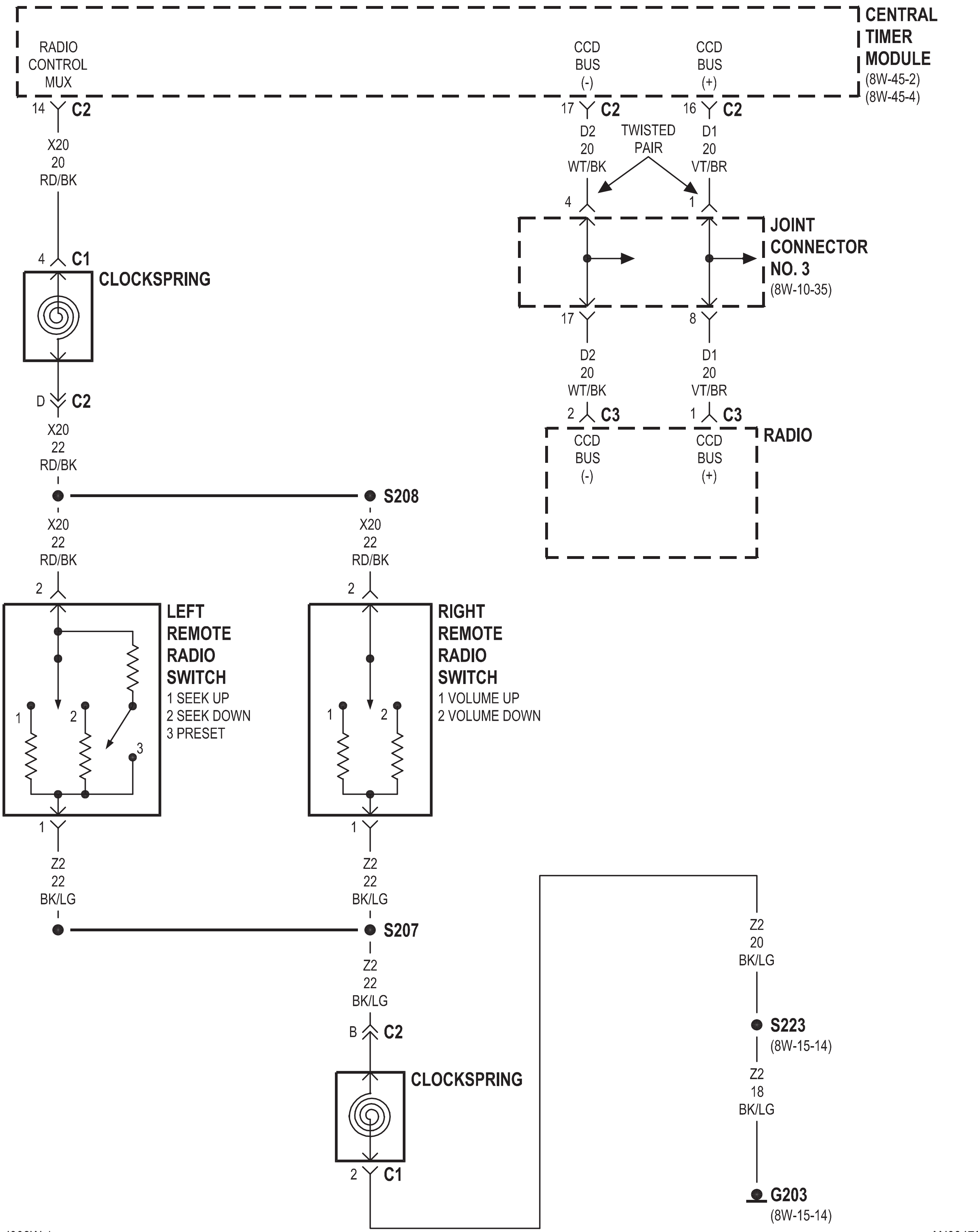

BATT A7
(8W-10-26)
RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 14 15A (8W-12-13)
FUSE 5 5A (8W-12-13)
FUSE 12 15A (8W-12-11)
FUSE 8 10A (8W-12-7)
C8 C4 C5 C7 C4
F33 18 PK/RD
E1 18 TN/OR
E2 20 OR
M1 18 PK
X12 16 RD/WT
HEADLAMP SWITCH
(8W-50-2)
(8W-50-3)
0 OFF
1 PARK
2 HEAD
3 FUNERAL
4 DOME
DIMMER SWITCH
L107 20 BK/YL
S213
(8W-12-13)
G105
(8W-15-6)
Z9 14 BK
JOINT CONNECTOR NO. 4
(8W-10-36)
G203
(8W-15-12)
(8W-15-14)
Z2 16 BK/LG
RADIO
HEADLAMP SWITCH OUTPUT
GROUND
FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
GROUND
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
X53 18 DG
X55 18 BR/RD
X54 18 VT
X56 18 DB/RD
X51 18 BR/YL
X57 18 BR/LB
X52 18 DB/WT
X58 18 DB/OR
C246
C363
C362
X82 18 LB/RD
X80 18 LB/BK
S332
S333
LEFT DOOR SPEAKER
RIGHT DOOR SPEAKER
LEFT REAR SPEAKER
RIGHT REAR SPEAKER

BASE 4 DOOR

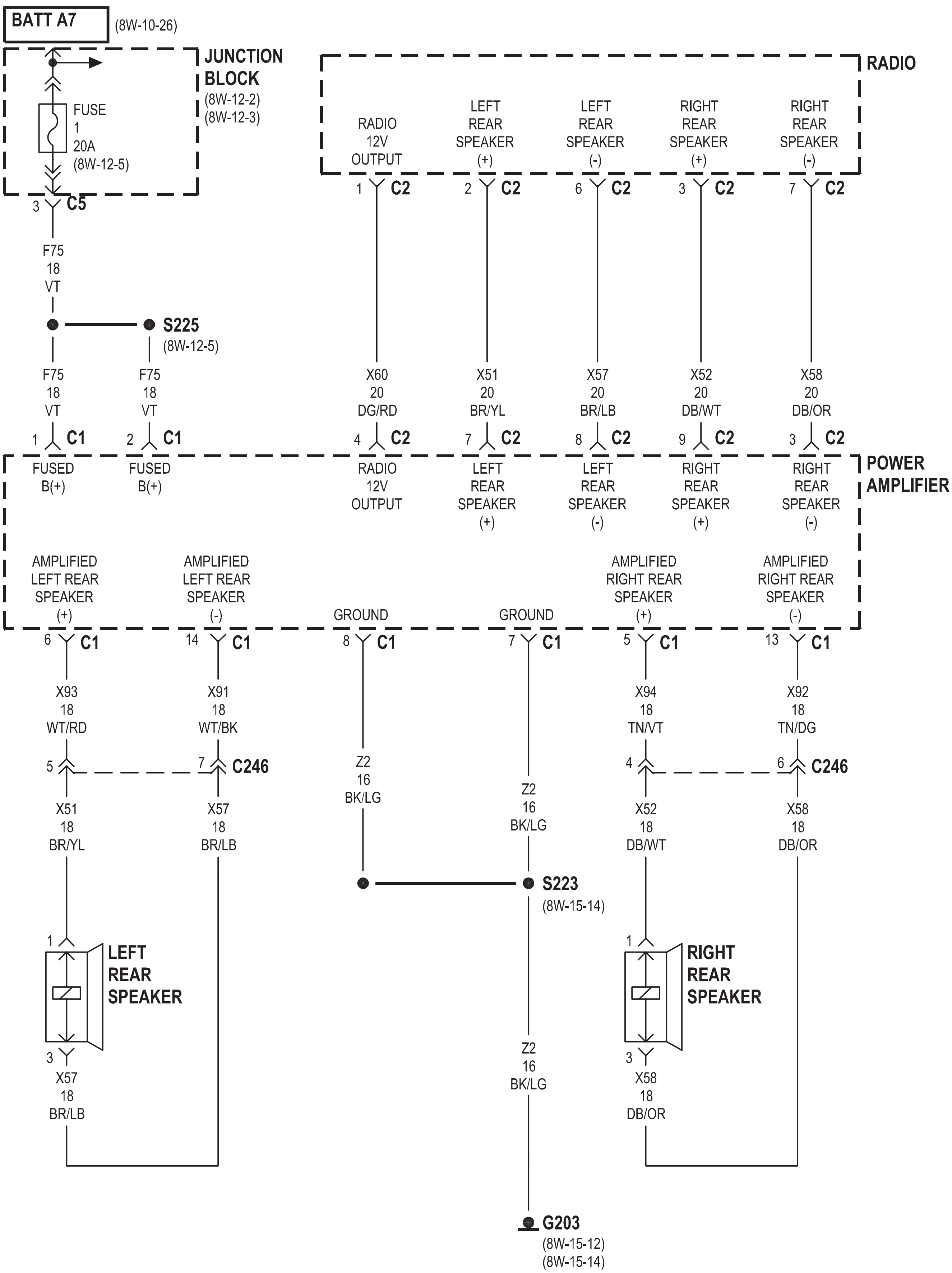

BATT A7
(8W-10-26)
RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 14 15A (8W-12-13)
FUSE 5 5A (8W-12-13)
FUSE 12 15A (8W-12-11)
FUSE 8 10A (8W-12-7)
4 C8
9 C4
7 C5
9 C7
3 C4
F33 18 PK/RD
E1 18 TN/OR
E2 20 OR
M1 18 PK
X12 16 RD/WT
2 C1
14 C1
HEADLAMP SWITCH
(8W-50-2)
(8W-50-3)
0 OFF
1 PARK
2 HEAD
3 FUNERAL
4 DOME
DIMMER SWITCH
8 C1
L107 20 BK/YL
S213
(8W-12-13)
G105
(8W-15-6)
Z9 14 BK
JOINT CONNECTOR NO. 4
(8W-10-36)
8
1
20
13
E2 20 OR
M1 18 PK
G203
(8W-15-12)
(8W-15-14)
Z2 16 BK/LG
4 C1
5 C1
7 C1
6 C1
RADIO
HEADLAMP SWITCH OUTPUT
GROUND
FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
GROUND
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
4 C2
2 C1
5 C2
3 C1
2 C2
6 C2
3 C2
7 C2
X53 18 DG
X55 18 BR/RD
X54 18 VT
X56 18 DB/RD
X51 18 BR/YL
X57 18 BR/LB
X52 18 DB/WT
X58 18 DB/OR
C246
C363
C362
S332
S333
LEFT DOOR SPEAKER
RIGHT DOOR SPEAKER
LEFT REAR DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
AN004703


BATT A7
(8W-10-26)
RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 14 15A (8W-12-13)
FUSE 5 5A (8W-12-13)
FUSE 12 15A (8W-12-11)
FUSE 8 10A (8W-12-7)
4 C8
9 C4
7 C5
9 C7
3 C4
F33 18 PK/RD
E1 18 TN/OR
E2 20 OR
M1 18 PK
2 C1
14 C1
HEADLAMP SWITCH
(8W-50-2)
(8W-50-3)
0 OFF
1 PARK
2 HEAD
3 FUNERAL
4 DOME
DIMMER SWITCH
8 C1
L107 20 BK/YL
S213
(8W-12-13)
L107 20 BK/YL
8
1
JOINT CONNECTOR NO. 4
(8W-10-36)
20
13
E2 20 OR
M1 18 PK
X12 16 RD/WT
4 C1
5 C1
7 C1
6 C1
RADIO
HEADLAMP SWITCH OUTPUT
FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
GROUND
GROUND
Z9 14 BK
Z2 16 BK/LG
G105
(8W-15-6)
G203
(8W-15-12)
(8W-15-14)
AN004704

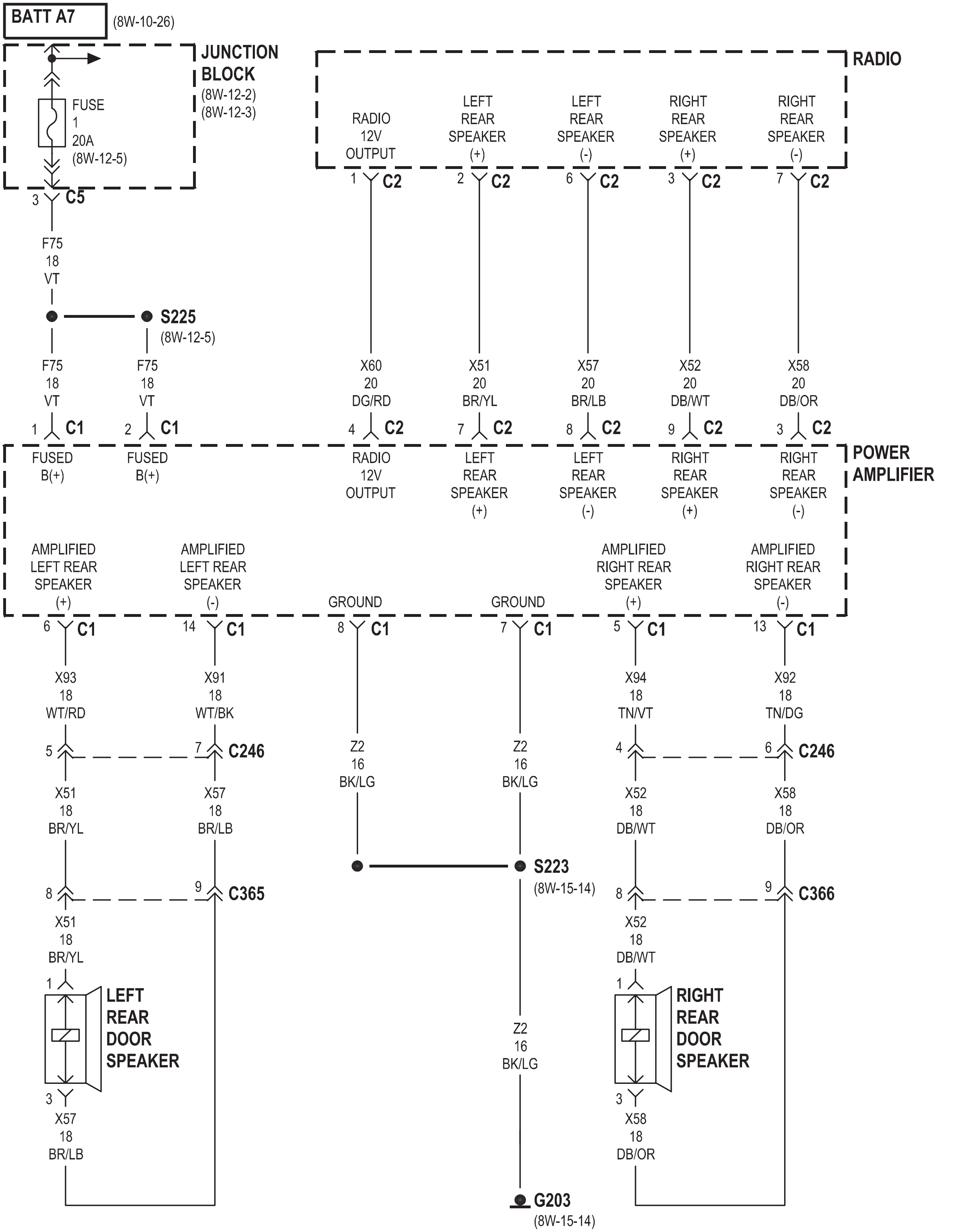

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 1 20A (8W-12-5)
3 C5
F75 18 VT
S225
(8W-12-5)
F75 18 VT
F75 18 VT
1 C1
2 C1
FUSED B(+)
FUSED B(+)
RADIO
RADIO 12V OUTPUT
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
1 C2
4 C2
2 C1
5 C2
3 C1
X60 20 DG/RD
X53 20 DG
X55 20 BR/RD
X54 20 VT
X56 20 DB/RD
4 C2
5 C2
1 C2
6 C2
2 C2
POWER AMPLIFIER
RADIO 12V OUTPUT
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
AMPLIFIED LEFT DOOR SPEAKER (+)
AMPLIFIED LEFT DOOR SPEAKER (-)
AMPLIFIED RIGHT DOOR SPEAKER (+)
AMPLIFIED RIGHT DOOR SPEAKER (-)
4 C1
12 C1
11 C1
10 C1
X87 18 LG/RD
X85 18 LG/BK
X82 18 LB/RD
X80 18 LB/BK
8
9
13
14 C246
X53 18 DG
X55 18 BR/RD
X54 18 VT
X56 18 DB/RD
4
5 C363
4
5 C362
X87 18 LG/RD
X82 18 LB/RD
S330
S332
X87 18 LG/RD
X82 18 LB/RD
1
2
LEFT DOOR TWEETER
RIGHT DOOR TWEETER
1
3
LEFT DOOR WOOFER
RIGHT DOOR WOOFER
X85 18 LG/BK
X85 18 LG/BK
X80 18 LB/BK
X80 18 LB/BK
S331
S333


CENTRAL TIMER MODULE
(8W-45-2)
(8W-45-4)
RADIO CONTROL MUX
CCD BUS (-)
CCD BUS (+)
14 C2
17 C2
16 C2
X20 20 RD/BK
D2 20 WT/BK
TWISTED PAIR
D1 20 VT/BR
4
1
JOINT CONNECTOR NO. 3
(8W-10-35)
17
8
D2 20 WT/BK
D1 20 VT/BR
2 C3
1 C3
RADIO
CCD BUS (-)
CCD BUS (+)
4 C1
CLOCKSPRING
D C2
X20 22 RD/BK
S208
X20 22 RD/BK
X20 22 RD/BK
2
2
LEFT REMOTE RADIO SWITCH
1 SEEK UP
2 SEEK DOWN
3 PRESET
RIGHT REMOTE RADIO SWITCH
1 VOLUME UP
2 VOLUME DOWN
1
1
Z2 22 BK/LG
Z2 22 BK/LG
S207
Z2 22 BK/LG
B C2
CLOCKSPRING
2 C1
Z2 20 BK/LG
S223
(8W-15-14)
Z2 18 BK/LG
G203
(8W-15-14)

MID-LEVEL/PREMIUM 2 DOOR



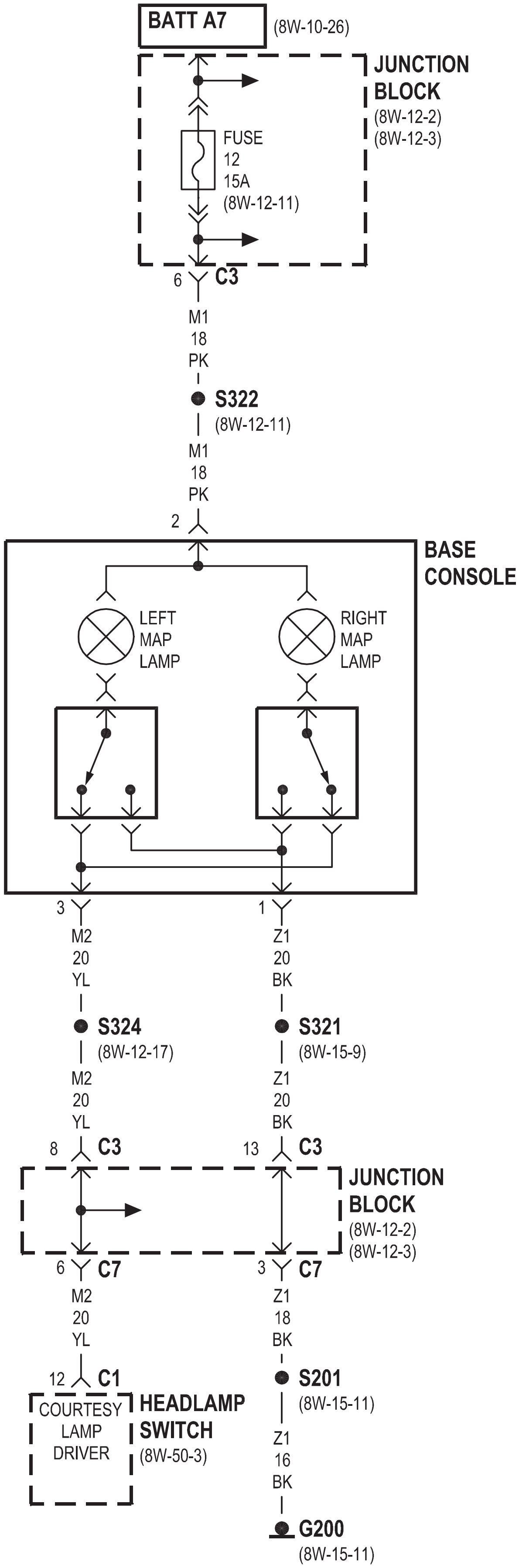
MID-LEVEL/PREMIUM 4 DOOR



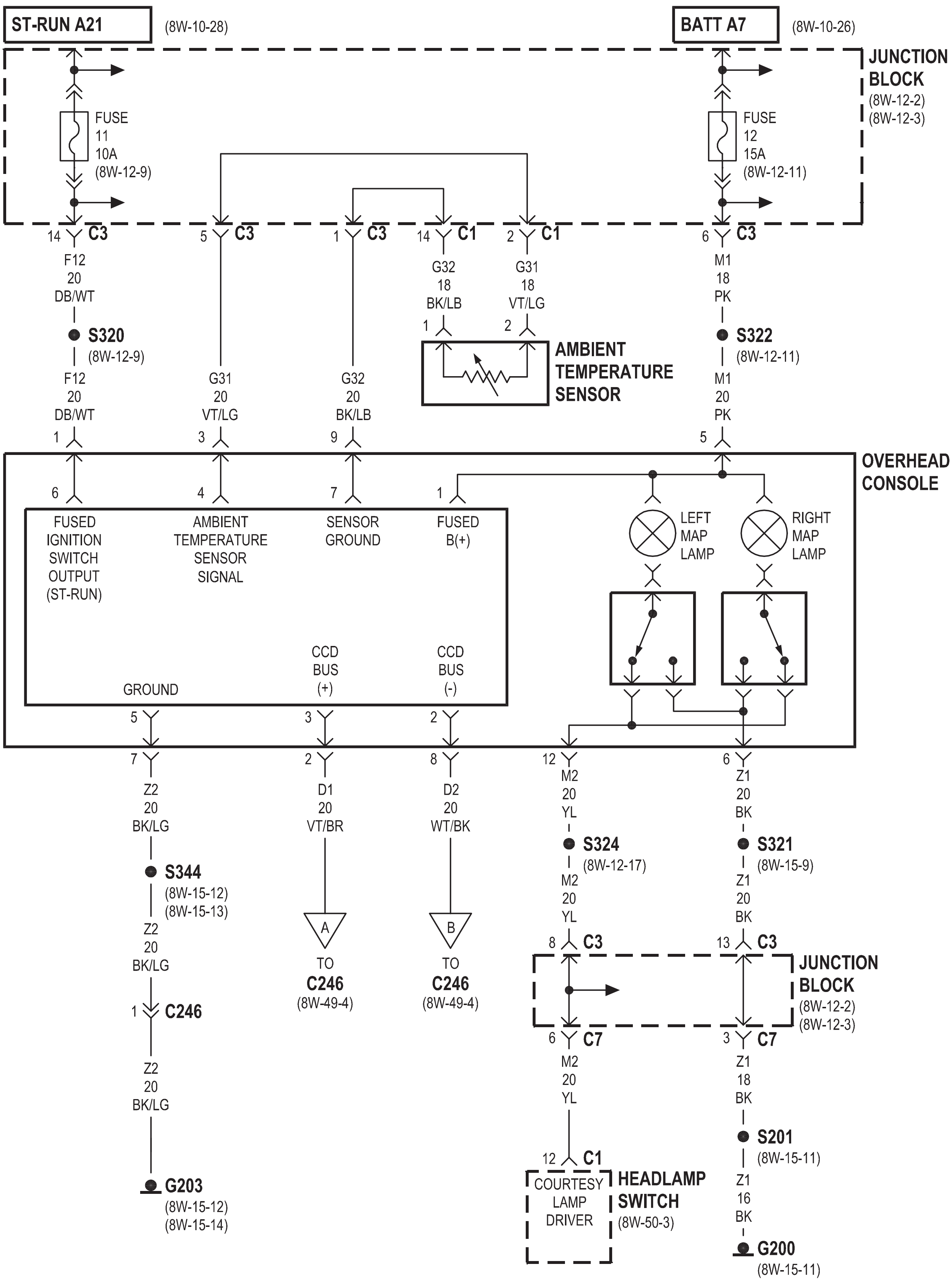
8W-49 OVERHEAD CONSOLE

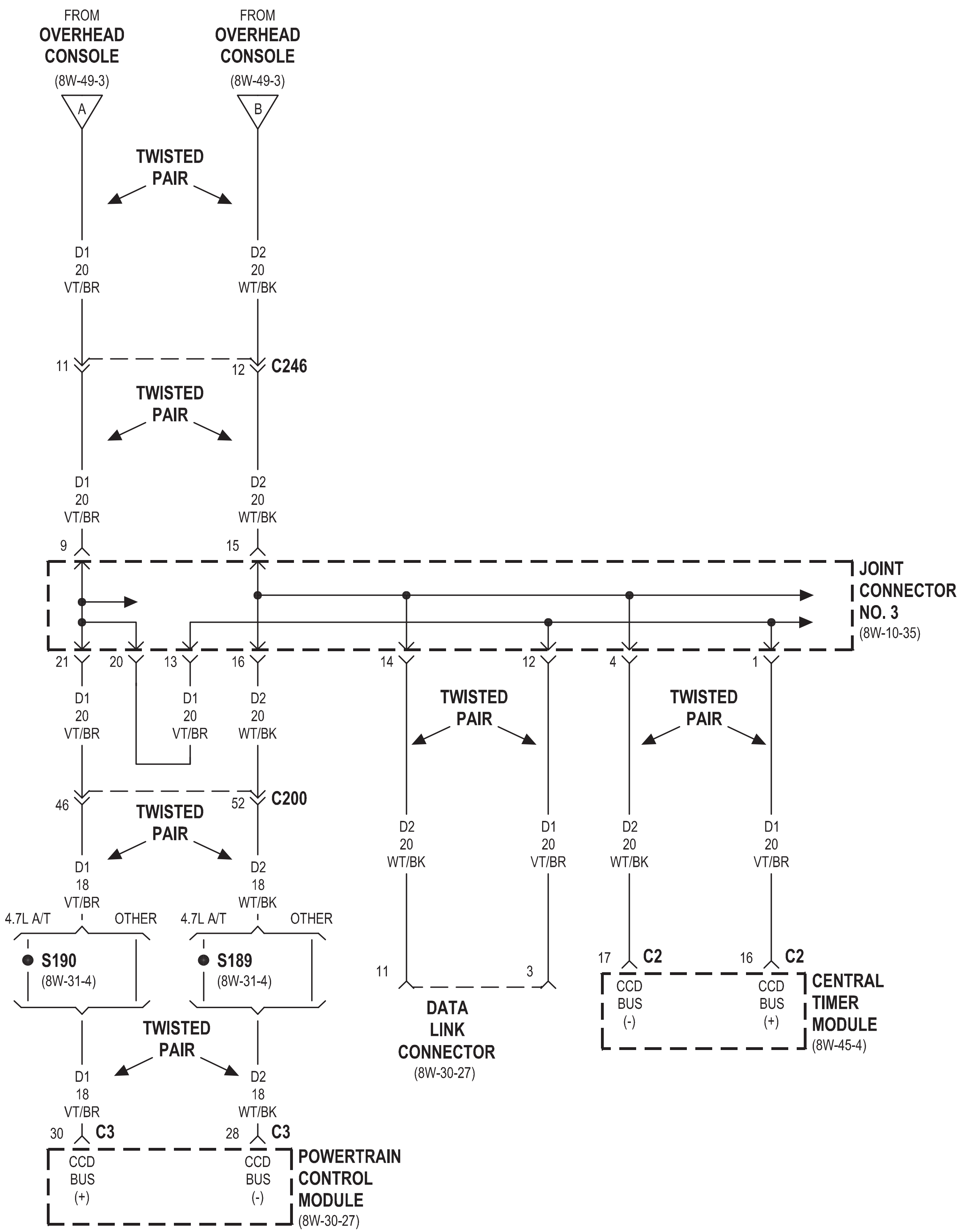
Component	Page
Ambient Temperature Sensor	8W-49-3
Base Console	8W-49-2
Central Timer Module	8W-49-4
Data Link Connector	8W-49-4
Fuse 11 (JB)	8W-49-3
Fuse 12 (JB)	8W-49-2, 3
G200	8W-49-2, 3
G203	8W-49-3
Headlamp Switch	8W-49-2, 3
Joint Connector No. 3	8W-49-4
Junction Block	8W-49-2, 3
Left Map Lamp	8W-49-2, 3
Overhead Console	8W-49-3
Powertrain Control Module	8W-49-4
Right Map Lamp	8W-49-2, 3

MIDLEVEL



BATT A7
(8W-10-26)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
15A
(8W-12-11)
6
C3
M1
18
PK
S322
(8W-12-11)
M1
18
PK
2
BASE
CONSOLE
LEFT
MAP
LAMP
RIGHT
MAP
LAMP
3
1
M2
20
YL
Z1
20
BK
S324
(8W-12-17)
S321
(8W-15-9)
M2
20
YL
Z1
20
BK
8
C3
13
C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
C7
3
C7
M2
20
YL
Z1
18
BK
12
C1
S201
(8W-15-11)
COURTESY
LAMP
DRIVER
HEADLAMP
SWITCH
(8W-50-3)
Z1
16
BK
G200
(8W-15-11)

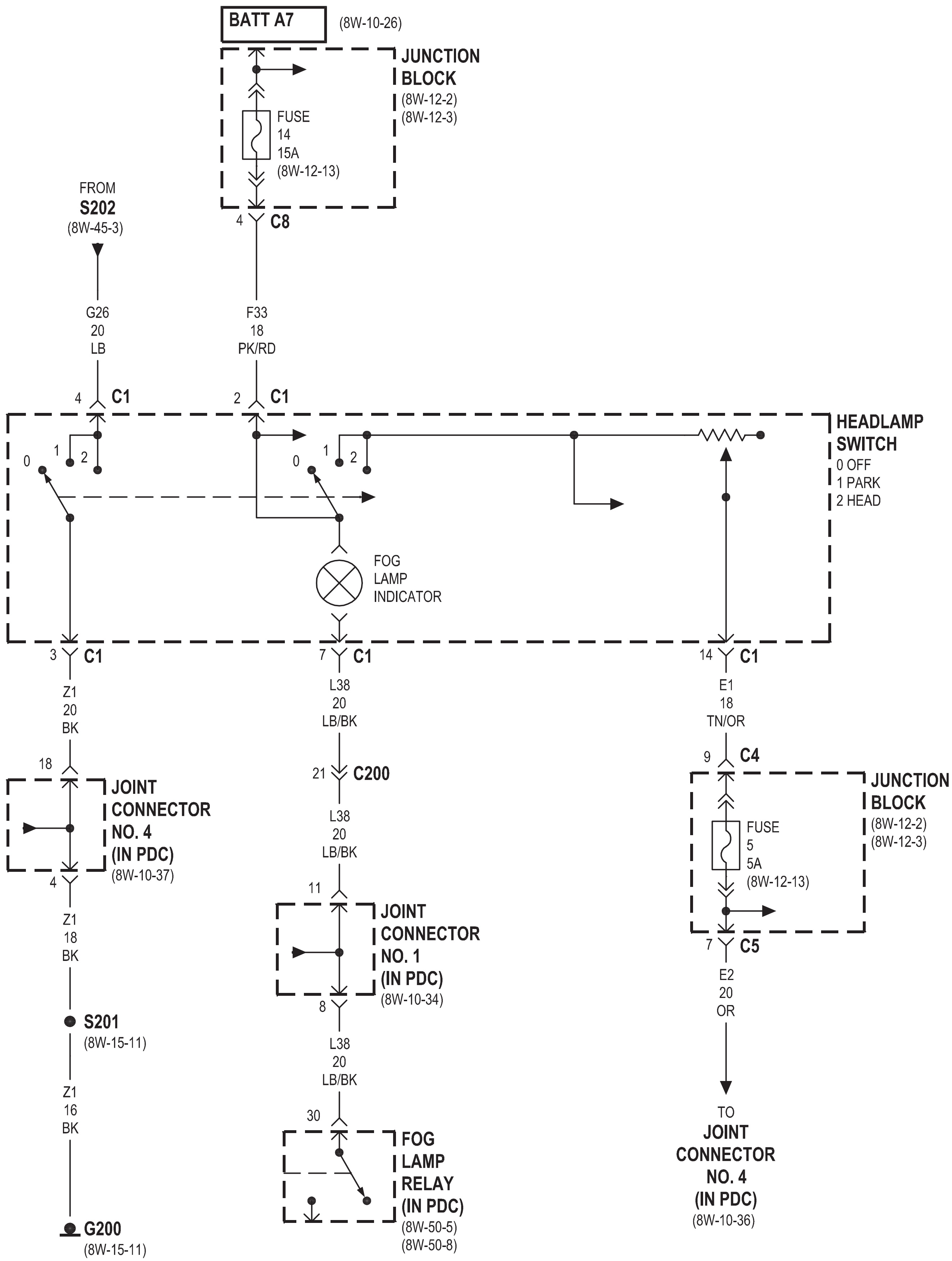

ST-RUN A21
(8W-10-28)
BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 11 10A (8W-12-9)
FUSE 12 15A (8W-12-11)
14 C3
5 C3
1 C3
14 C1
2 C1
6 C3
F12 20 DB/WT
G32 18 BK/LB
G31 18 VT/LG
M1 18 PK
S320 (8W-12-9)
AMBIENT TEMPERATURE SENSOR
S322 (8W-12-11)
F12 20 DB/WT
G31 20 VT/LG
G32 20 BK/LB
M1 20 PK
OVERHEAD CONSOLE
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
AMBIENT TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
FUSED B(+)
LEFT MAP LAMP
RIGHT MAP LAMP
GROUND
CCD BUS (+)
CCD BUS (-)
Z2 20 BK/LG
D1 20 VT/BR
D2 20 WT/BK
M2 20 YL
Z1 20 BK
S344 (8W-15-12) (8W-15-13)
S324 (8W-12-17)
S321 (8W-15-9)
A TO C246 (8W-49-4)
B TO C246 (8W-49-4)
8 C3
13 C3
JUNCTION BLOCK (8W-12-2) (8W-12-3)
6 C7
3 C7
1 C246
Z1 18 BK
S201 (8W-15-11)
Z1 16 BK
12 C1
COURTESY LAMP DRIVER
HEADLAMP SWITCH (8W-50-3)
G203 (8W-15-12) (8W-15-14)
G200 (8W-15-11)



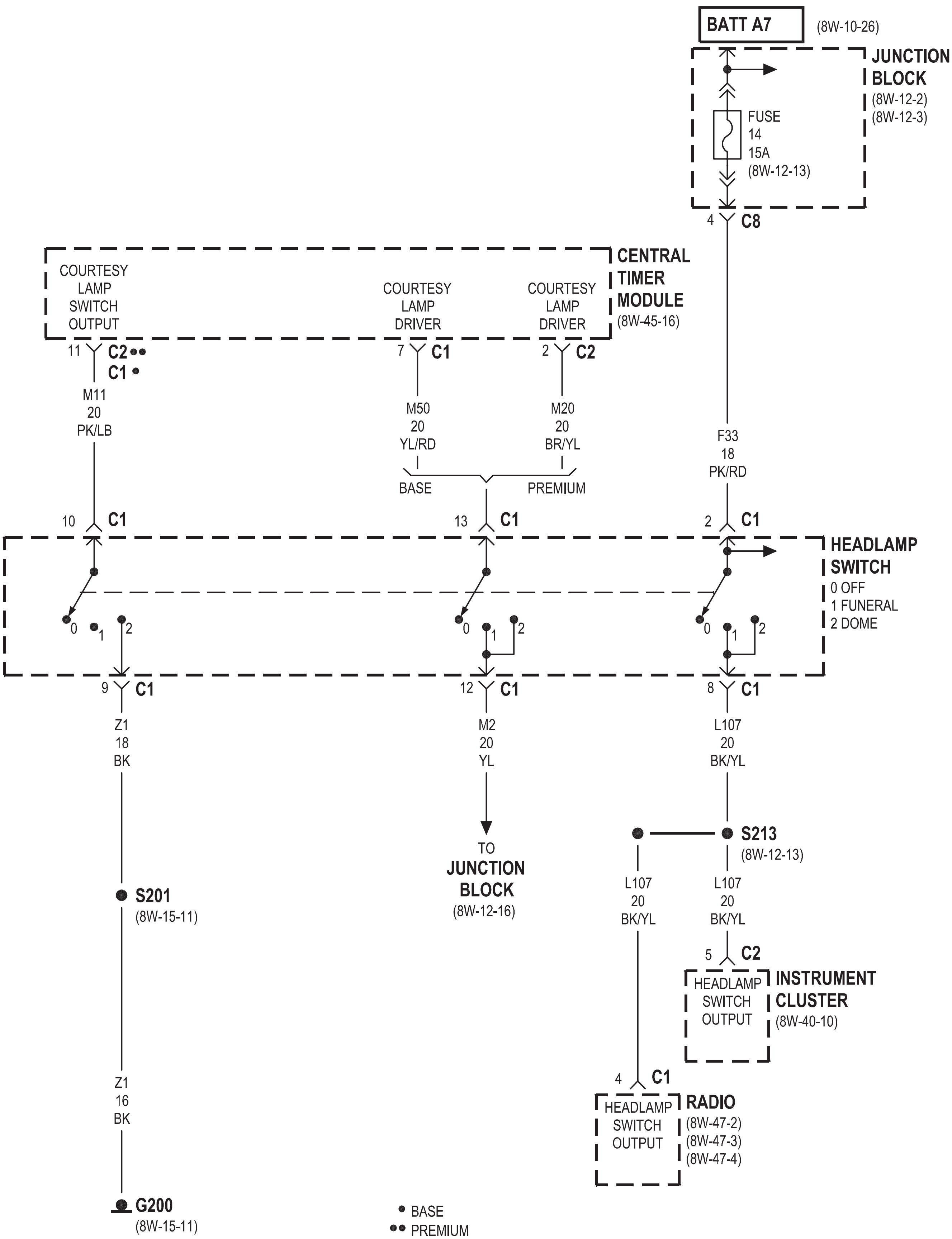
J008W-1 AN004904

8W-50 FRONT LIGHTING

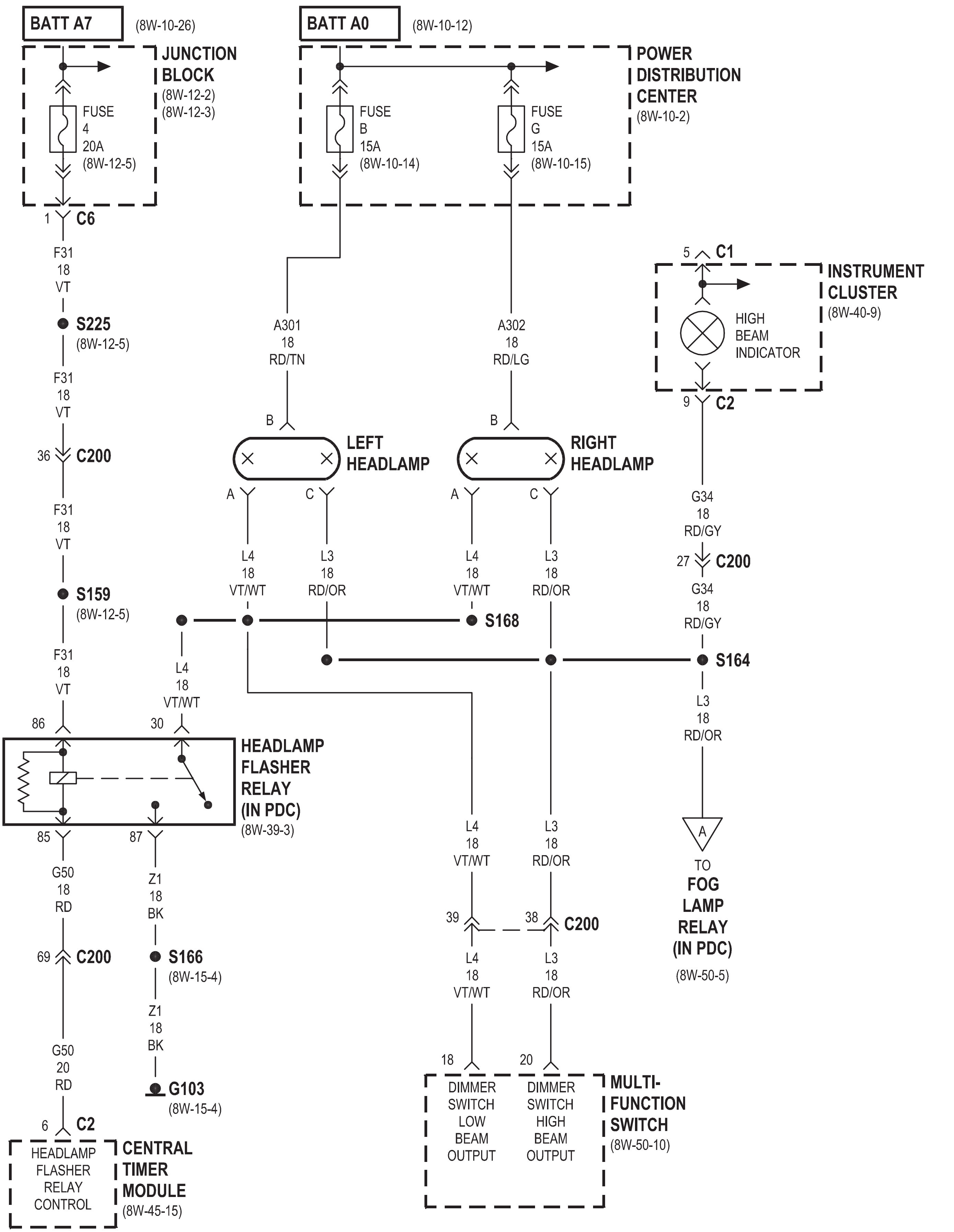
Component	Page
Cargo Lamp No. 1	8W-50-10
Cargo Lamp No. 2	8W-50-10
Central Timer Module	8W-50-3, 4, 6
Daytime Running Lamp Module	8W-50-6, 7, 8
Fog Lamp Indicator	8W-50-2
Fog Lamp Relay	8W-50-2, 5, 8
Fuse 2 (JB)	8W-50-7
Fuse 4 (JB)	8W-50-4, 6
Fuse 5 (JB)	8W-50-2
Fuse 14 (JB)	8W-50-2, 3
Fuse B (PDC)	8W-50-4, 6
Fuse C (PDC)	8W-50-5, 8
Fuse G (PDC)	8W-50-4, 6
G101	8W-50-9
G103	8W-50-4, 6, 7, 9
G200	8W-50-2, 3, 10
Headlamp Flasher Relay	8W-50-4, 6
Headlamp Switch	8W-50-2, 3, 5, 8, 9, 10
Instrument Cluster	8W-50-3, 4, 7
Joint Connector No. 1	8W-50-2, 5, 8, 9
Joint Connector No. 2	8W-50-9
Joint Connector No. 4	8W-50-2, 10
Junction Block	8W-50-2, 3, 4, 6, 7, 10
Left Fog Lamp	8W-50-5, 8
Left Front Park/Turn Signal Lamp No. 1	8W-50-9
Left Front Park/Turn Signal Lamp No. 2	8W-50-9
Left Front Side Marker Lamp	8W-50-9
Left Headlamp	8W-50-4, 6
Multi- Function Switch	8W-50-4, 6, 10
Park Brake Switch	8W-50-7
Power Distribution Center	8W-50-4, 5, 6, 8
Radio	8W-50-3
Right Fog Lamp	8W-50-5, 8
Right Front Park/Turn Signal Lamp No. 1	8W-50-9
Right Front Park/Turn Signal Lamp No. 2	8W-50-9
Right Front Side Marker Lamp	8W-50-9
Right Headlamp	8W-50-4, 6
Trailer Tow Relay	8W-50-9



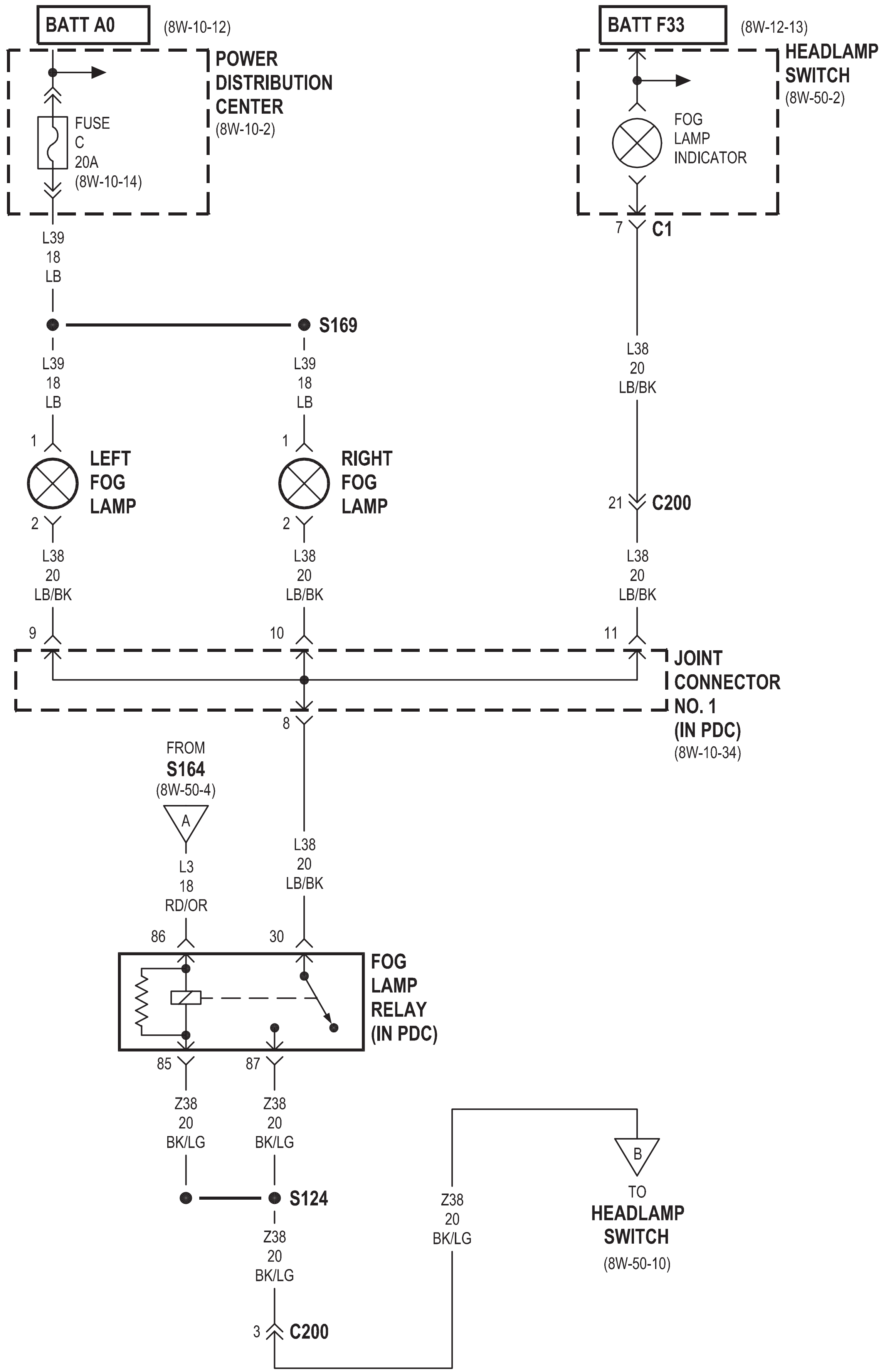
BATT A7
(8W-10-26)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
14
15A
(8W-12-13)
4 C8
FROM
S202
(8W-45-3)
G26
20
LB
F33
18
PK/RD
4 C1
2 C1
HEADLAMP
SWITCH
0 OFF
1 PARK
2 HEAD
0 1 2
0 1 2
FOG
LAMP
INDICATOR
3 C1
7 C1
14 C1
Z1
20
BK
L38
20
LB/BK
E1
18
TN/OR
18
JOINT
CONNECTOR
NO. 4
(IN PDC)
(8W-10-37)
4
21 C200
9 C4
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
5
5A
(8W-12-13)
7 C5
E2
20
OR
TO
JOINT
CONNECTOR
NO. 4
(IN PDC)
(8W-10-36)
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)
L38
20
LB/BK
11
JOINT
CONNECTOR
NO. 1
(IN PDC)
(8W-10-34)
8
L38
20
LB/BK
30
FOG
LAMP
RELAY
(IN PDC)
(8W-50-5)
(8W-50-8)



BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
14
15A
(8W-12-13)
4 C8
CENTRAL TIMER MODULE
(8W-45-16)
COURTESY LAMP SWITCH OUTPUT
COURTESY LAMP DRIVER
COURTESY LAMP DRIVER
11 C2 ●●
C1 ●
7 C1
2 C2
M11
20
PK/LB
M50
20
YL/RD
M20
20
BR/YL
BASE
PREMIUM
F33
18
PK/RD
10 C1
13 C1
2 C1
HEADLAMP SWITCH
0 OFF
1 FUNERAL
2 DOME
0 1 2
9 C1
12 C1
8 C1
Z1
18
BK
M2
20
YL
L107
20
BK/YL
TO JUNCTION BLOCK
(8W-12-16)
S213
(8W-12-13)
L107
20
BK/YL
S201
(8W-15-11)
5 C2
INSTRUMENT CLUSTER
(8W-40-10)
HEADLAMP SWITCH OUTPUT
Z1
16
BK
4 C1
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-4)
G200
(8W-15-11)
● BASE
●● PREMIUM

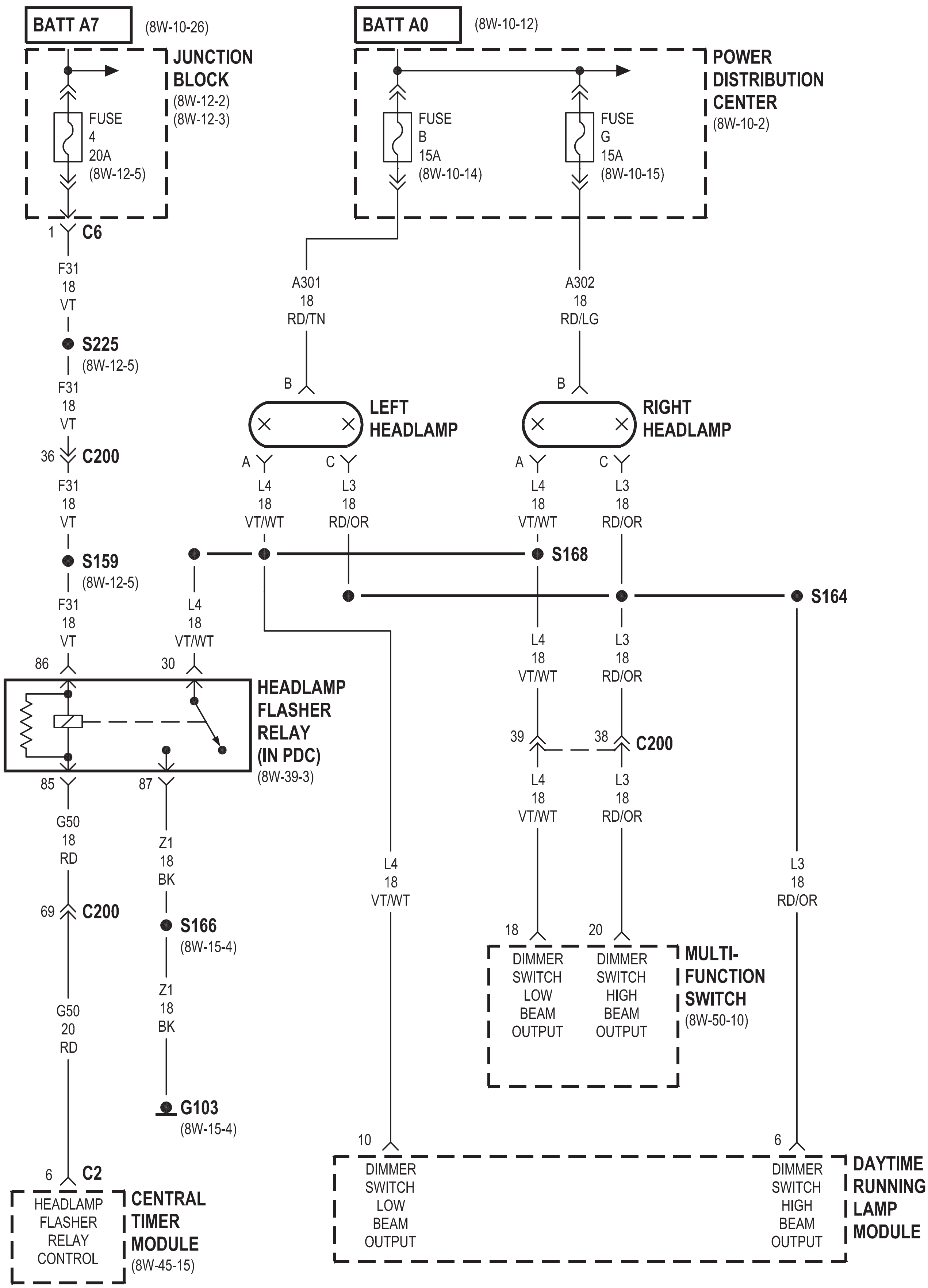

BATT A7
(8W-10-26)
BATT A0
(8W-10-12)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 20A (8W-12-5)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE B 15A (8W-10-14)
FUSE G 15A (8W-10-15)
C6
F31 18 VT
S225
(8W-12-5)
C200
S159
(8W-12-5)
A301 18 RD/TN
A302 18 RD/LG
LEFT HEADLAMP
RIGHT HEADLAMP
L4 18 VT/WT
L3 18 RD/OR
S168
S164
C1
INSTRUMENT CLUSTER
(8W-40-9)
HIGH BEAM INDICATOR
C2
G34 18 RD/GY
HEADLAMP FLASHER RELAY (IN PDC)
(8W-39-3)
G50 18 RD
Z1 18 BK
S166
(8W-15-4)
G103
(8W-15-4)
G50 20 RD
CENTRAL TIMER MODULE
(8W-45-15)
HEADLAMP FLASHER RELAY CONTROL
TO FOG LAMP RELAY (IN PDC)
(8W-50-5)
MULTI-FUNCTION SWITCH
(8W-50-10)
DIMMER SWITCH LOW BEAM OUTPUT
DIMMER SWITCH HIGH BEAM OUTPUT

FOG LAMPS EXCEPT DRL

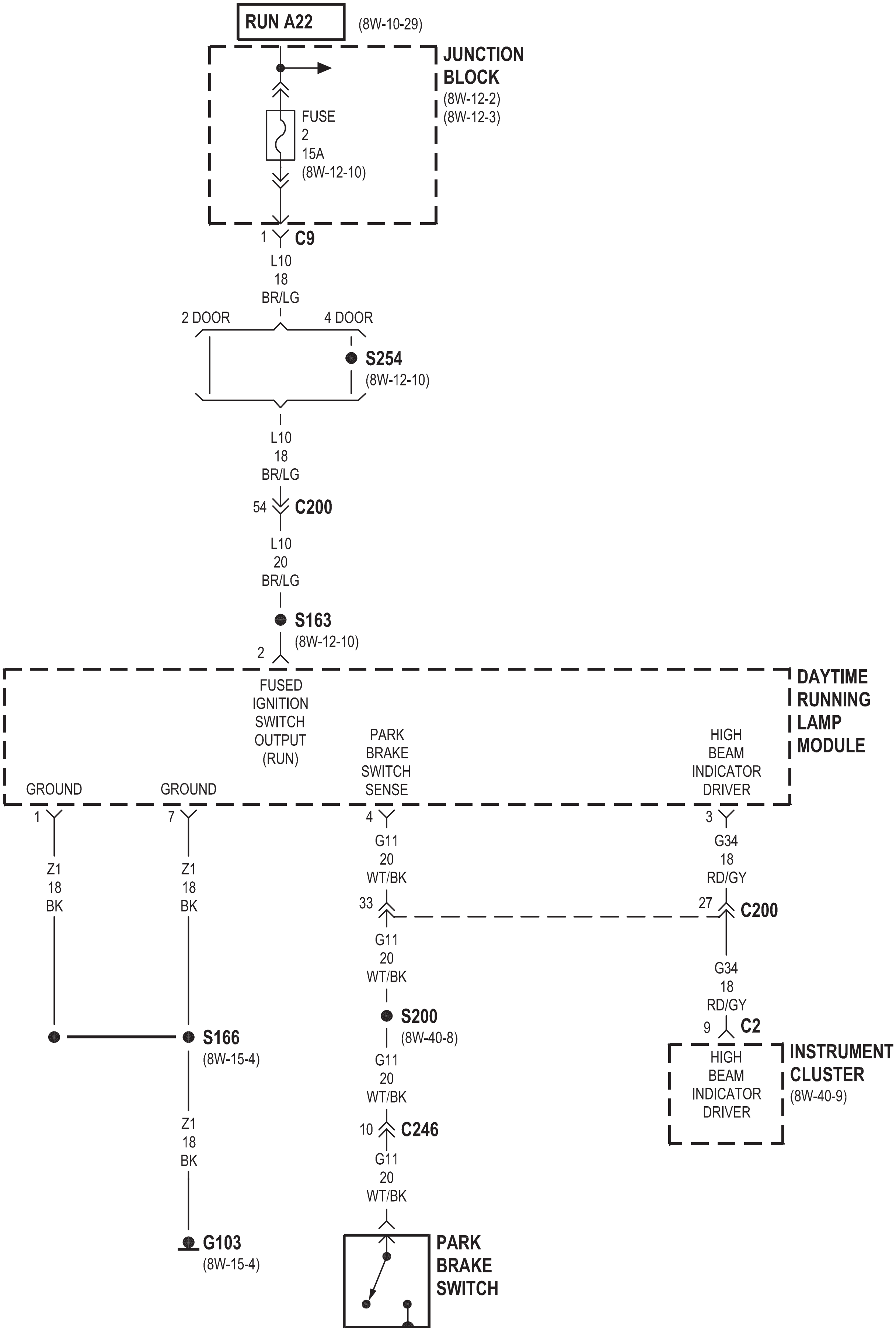


AN005005 J008W-1

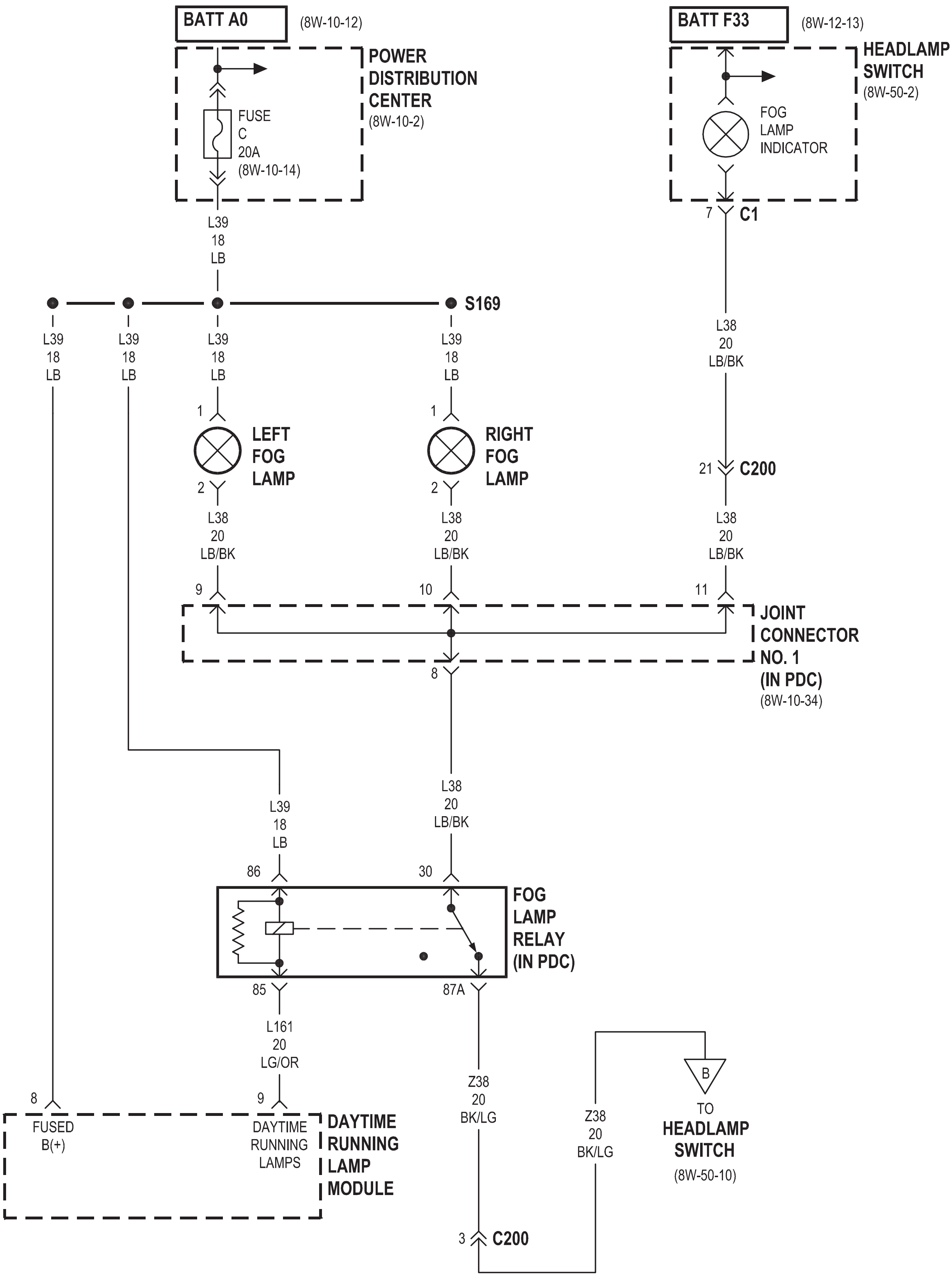
DRL

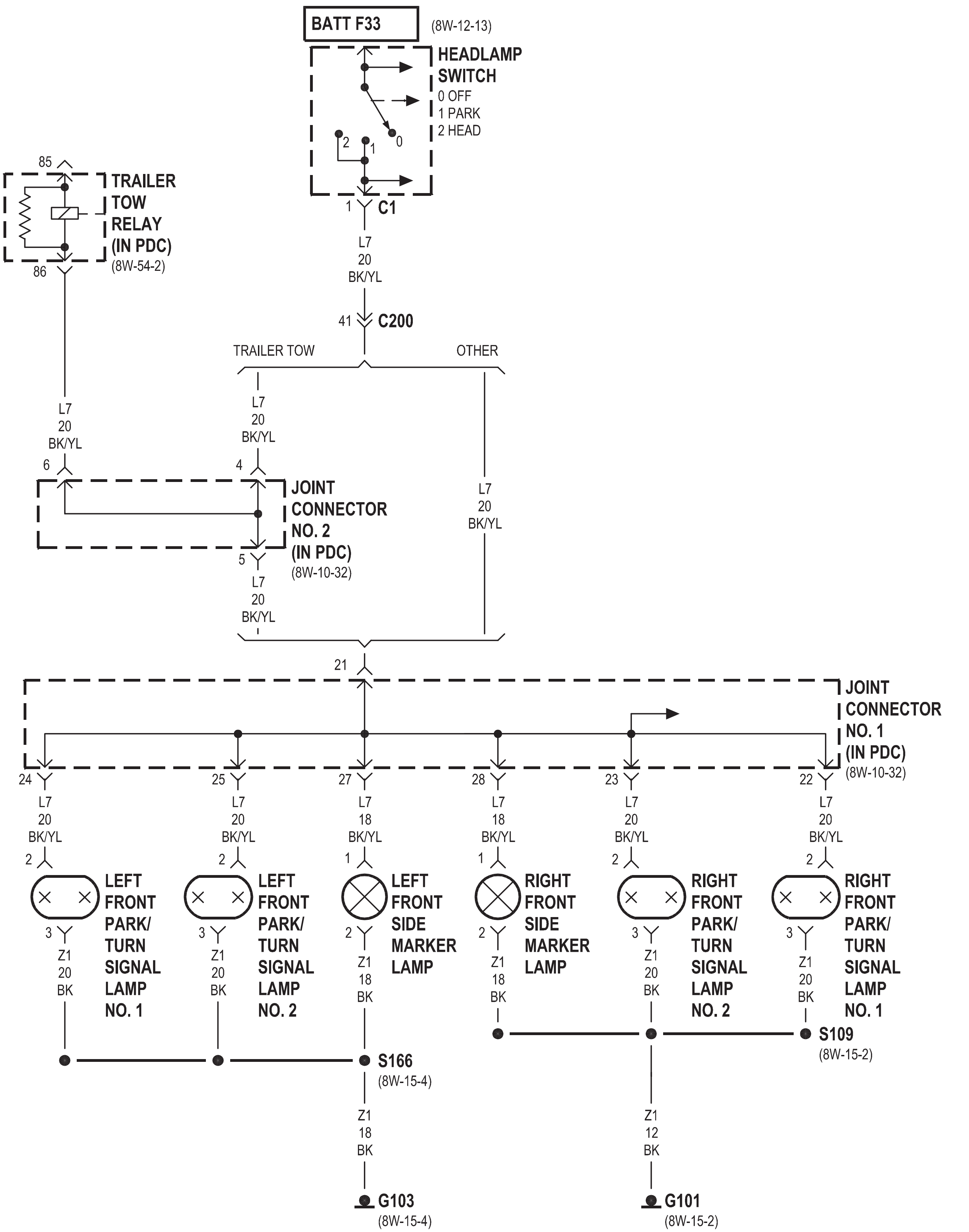

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 20A (8W-12-5)
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE B 15A (8W-10-14)
FUSE G 15A (8W-10-15)
1 C6
F31 18 VT
S225
(8W-12-5)
36 C200
S159
(8W-12-5)
A301 18 RD/TN
A302 18 RD/LG
B
LEFT HEADLAMP
RIGHT HEADLAMP
A
C
L4 18 VT/WT
L3 18 RD/OR
S168
S164
86
30
HEADLAMP FLASHER RELAY (IN PDC)
(8W-39-3)
85
87
G50 18 RD
Z1 18 BK
69 C200
S166
(8W-15-4)
G50 20 RD
G103
(8W-15-4)
39
38 C200
18
20
DIMMER SWITCH LOW BEAM OUTPUT
DIMMER SWITCH HIGH BEAM OUTPUT
MULTI-FUNCTION SWITCH
(8W-50-10)
6 C2
HEADLAMP FLASHER RELAY CONTROL
CENTRAL TIMER MODULE
(8W-45-15)
10
6
DAYTIME RUNNING LAMP MODULE

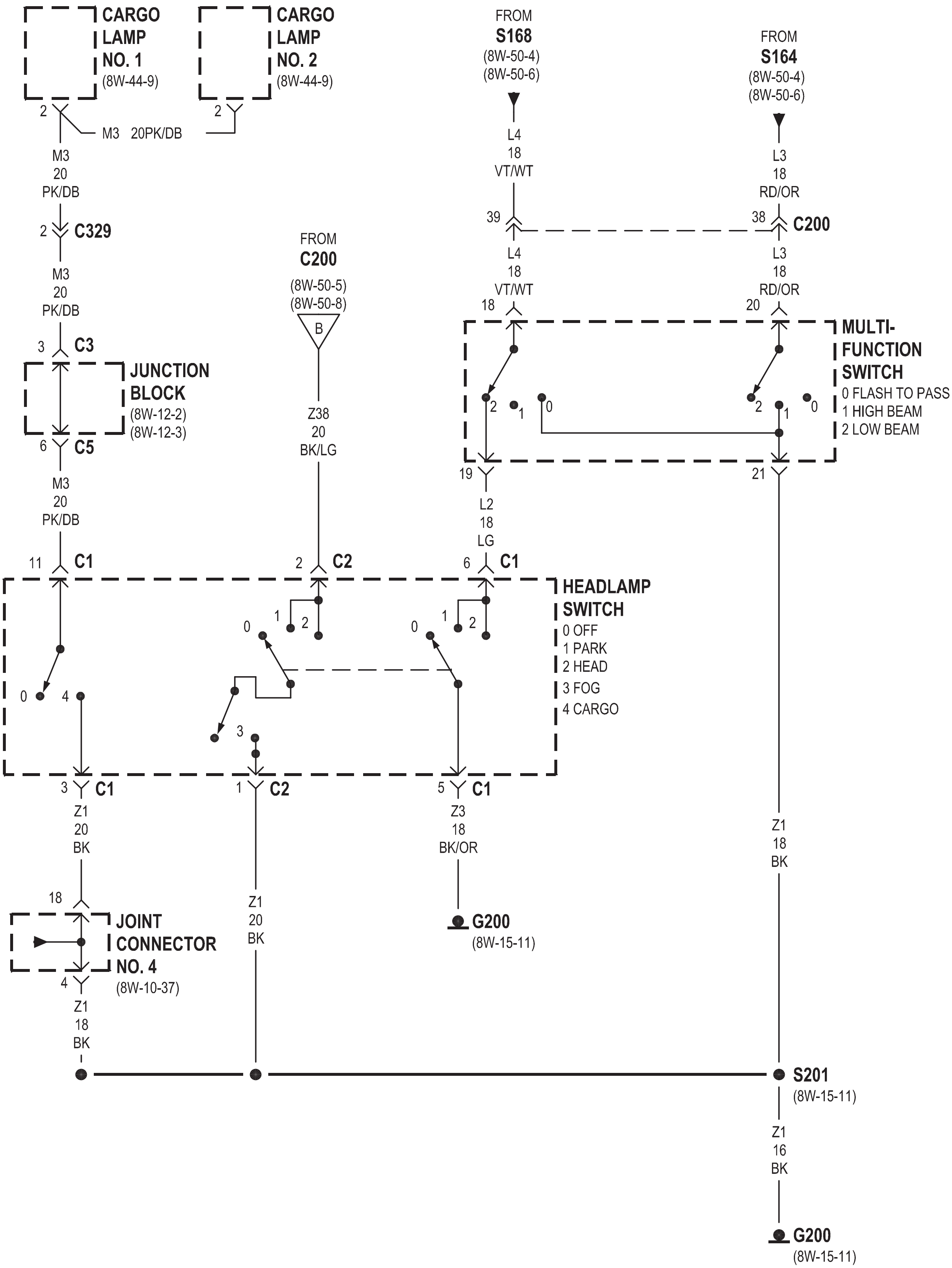
DRL


RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
2
15A
(8W-12-10)
1
C9
L10
18
BR/LG
2 DOOR
4 DOOR
S254
(8W-12-10)
L10
18
BR/LG
54
C200
L10
20
BR/LG
S163
(8W-12-10)
2
FUSED IGNITION SWITCH OUTPUT (RUN)
DAYTIME RUNNING LAMP MODULE
GROUND
GROUND
PARK BRAKE SWITCH SENSE
HIGH BEAM INDICATOR DRIVER
1
7
4
3
Z1
18
BK
Z1
18
BK
G11
20
WT/BK
G34
18
RD/GY
33
27
C200
G11
20
WT/BK
G34
18
RD/GY
S200
(8W-40-8)
9
C2
HIGH BEAM INDICATOR DRIVER
INSTRUMENT CLUSTER
(8W-40-9)
S166
(8W-15-4)
G11
20
WT/BK
Z1
18
BK
10
C246
G11
20
WT/BK
G103
(8W-15-4)
PARK BRAKE SWITCH

FOG LAMPS DRL

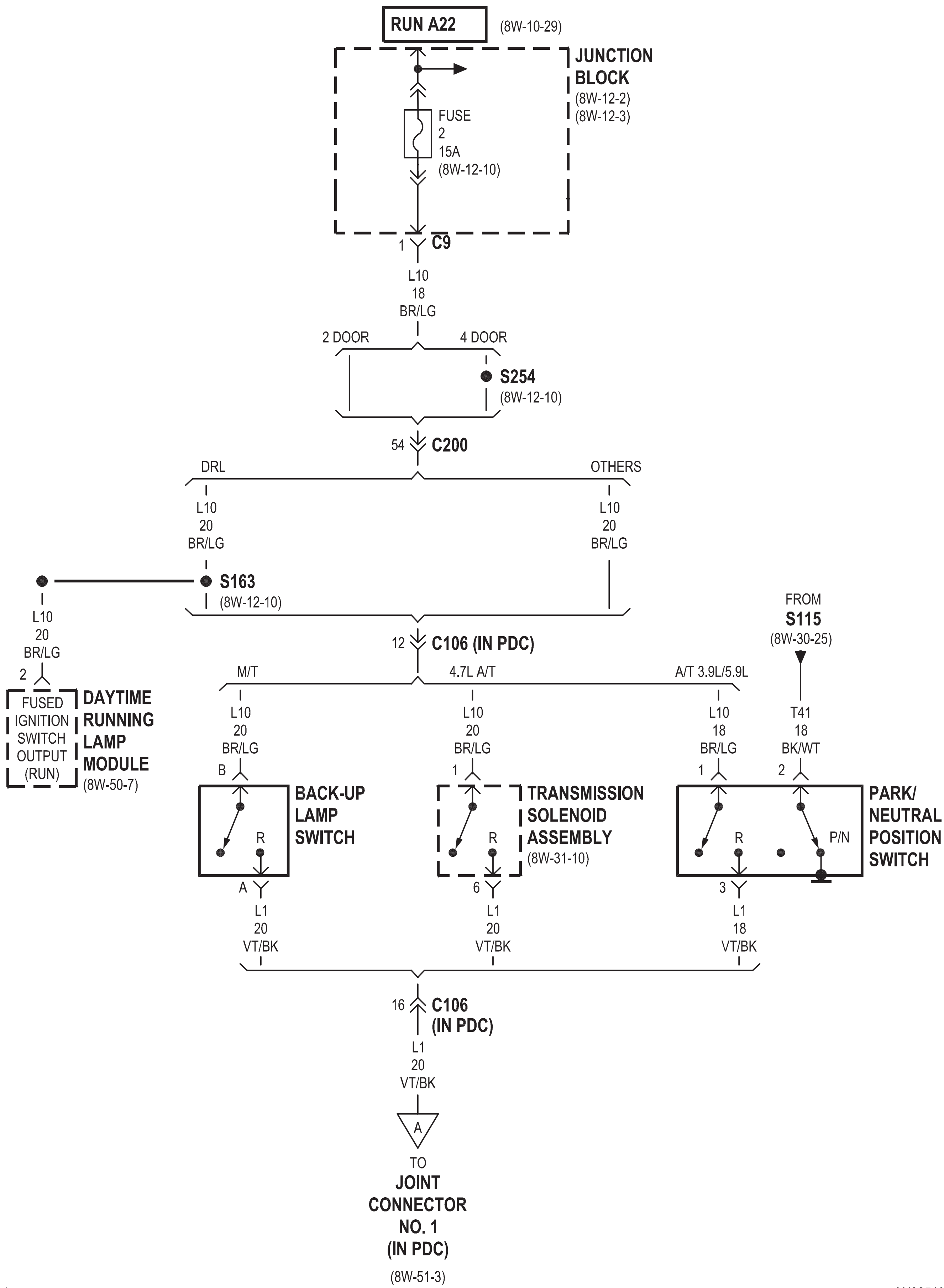


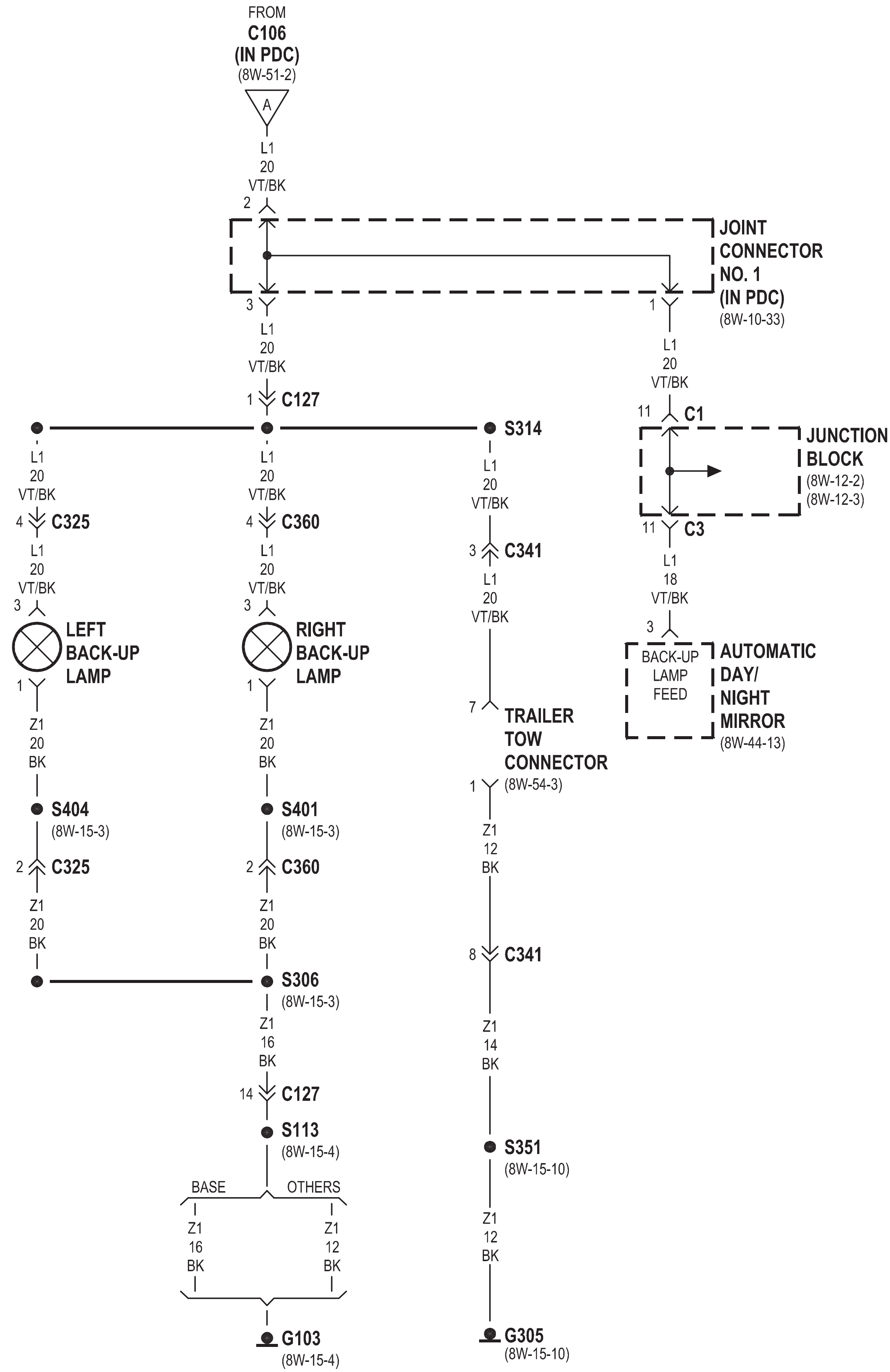

BATT F33
(8W-12-13)
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
C1
L7 20 BK/YL
41 C200
TRAILER TOW
OTHER
85
TRAILER TOW RELAY (IN PDC)
(8W-54-2)
86
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-32)
21
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-32)
L7 18 BK/YL
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 1
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 2
LEFT FRONT SIDE MARKER LAMP
RIGHT FRONT SIDE MARKER LAMP
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 2
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 1
Z1 20 BK
Z1 18 BK
S166
(8W-15-4)
S109
(8W-15-2)
Z1 12 BK
G103
(8W-15-4)
G101
(8W-15-2)

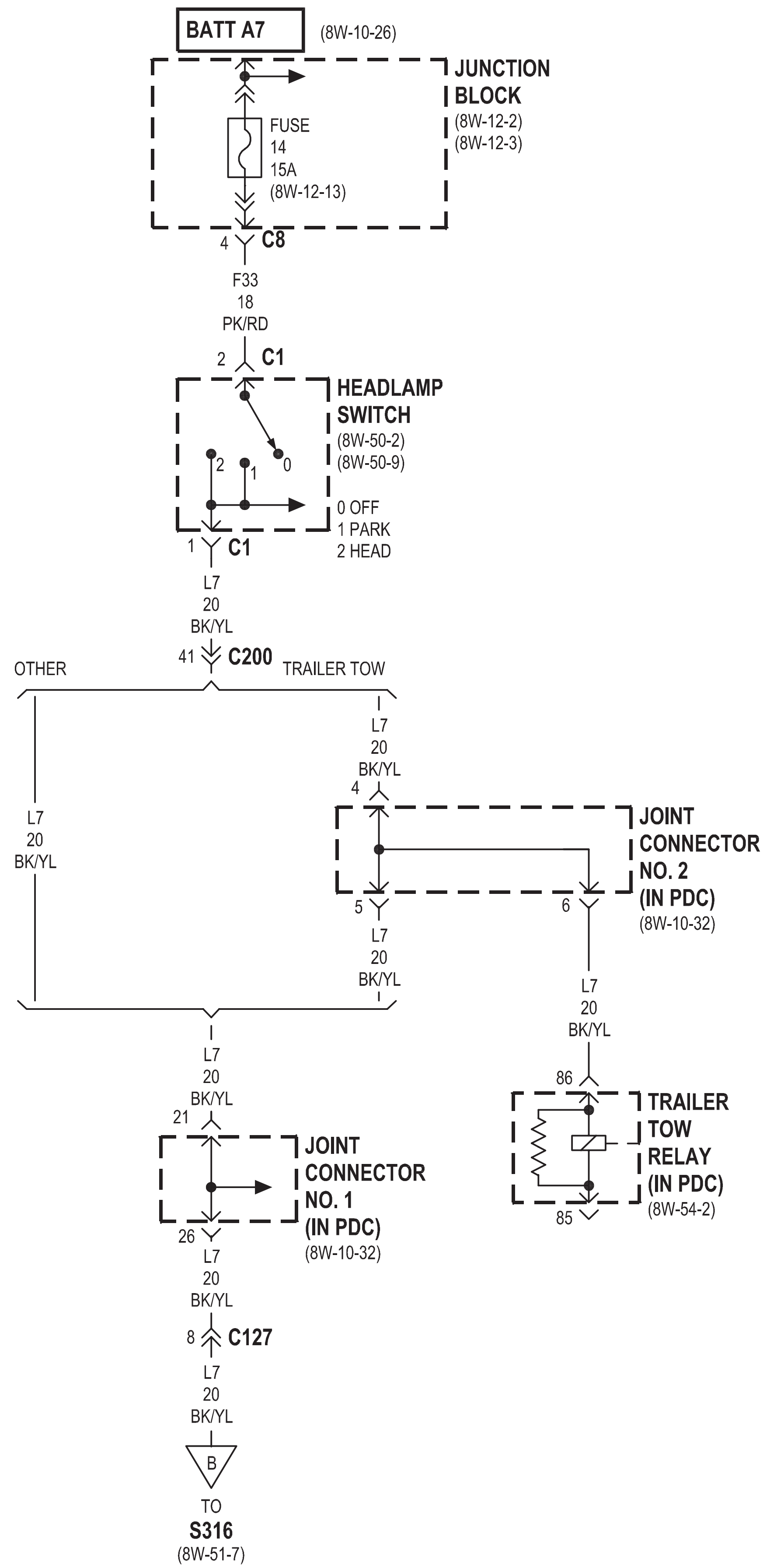

CARGO LAMP NO. 1 (8W-44-9)
CARGO LAMP NO. 2 (8W-44-9)
M3 20PK/DB
M3 20 PK/DB
C329
JUNCTION BLOCK (8W-12-2) (8W-12-3)
C3
C5
FROM C200 (8W-50-5) (8W-50-8)
B
Z38 20 BK/LG
FROM S168 (8W-50-4) (8W-50-6)
L4 18 VT/WT
FROM S164 (8W-50-4) (8W-50-6)
L3 18 RD/OR
C200
MULTI-FUNCTION SWITCH
0 FLASH TO PASS
1 HIGH BEAM
2 LOW BEAM
L2 18 LG
C1
C2
HEADLAMP SWITCH
0 OFF
1 PARK
2 HEAD
3 FOG
4 CARGO
Z1 20 BK
Z3 18 BK/OR
Z1 18 BK
JOINT CONNECTOR NO. 4 (8W-10-37)
G200 (8W-15-11)
S201 (8W-15-11)
Z1 16 BK

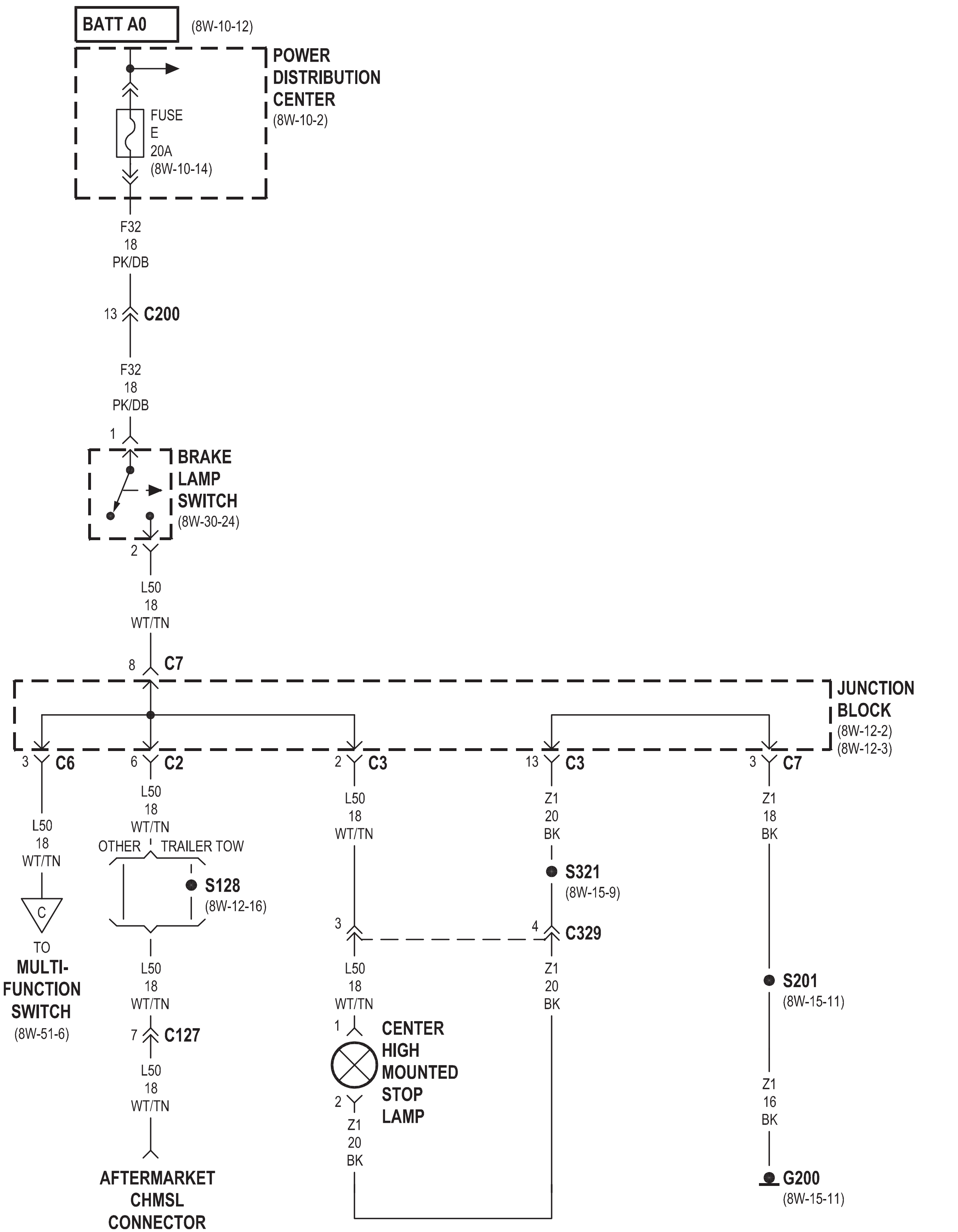
8W-51 REAR LIGHTING

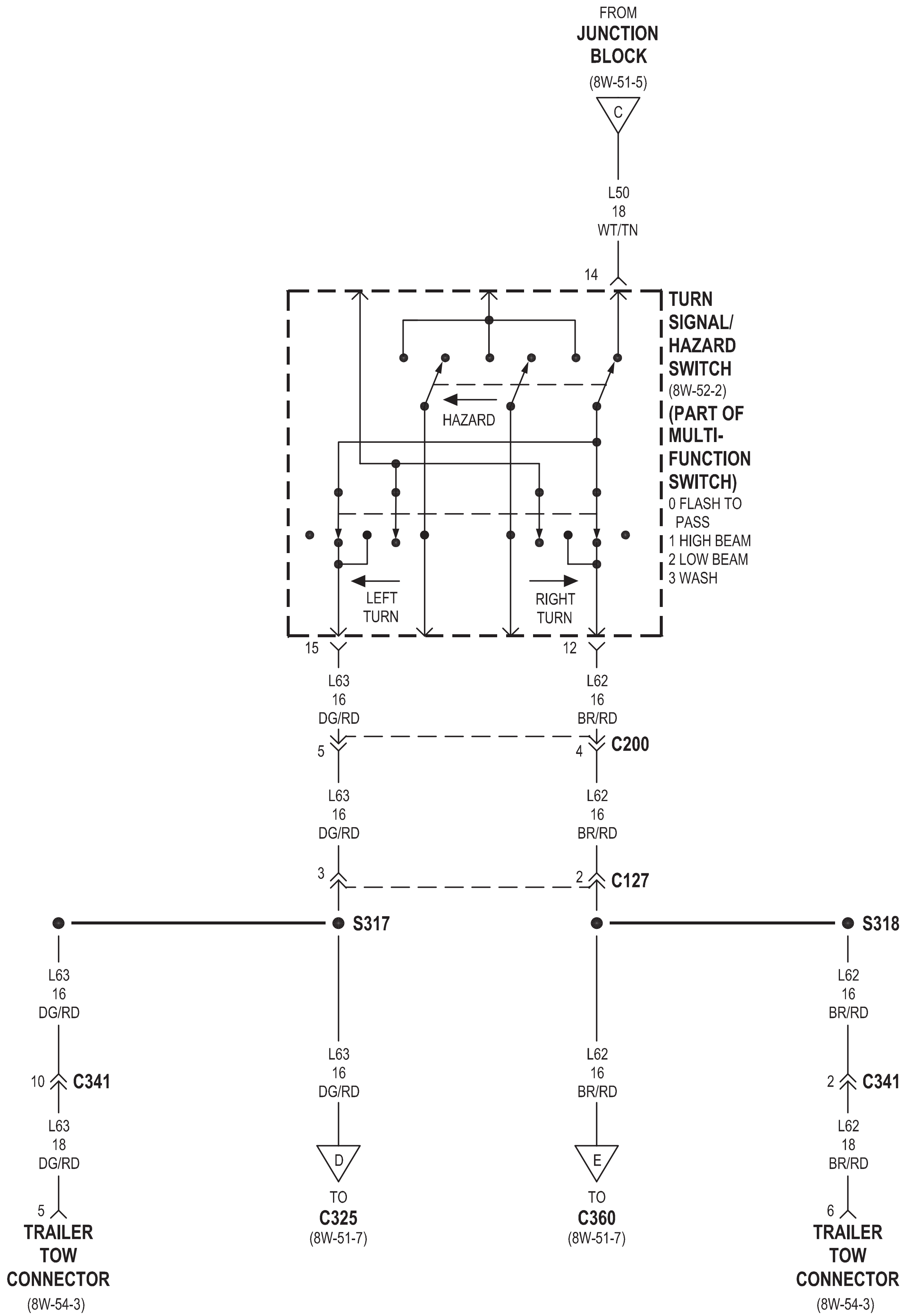
Component	Page
Aftermarket Chmsl Connector	8W-51-5
Automatic Day/Night Mirror	8W-51-3
Back-Up Lamp Switch	8W-51-2
Brake Lamp Switch	8W-51-5
Center High Mounted Stop Lamp	8W-51-5
Daytime Running Lamp Module	8W-51-2
Fuse 2 (JB)	8W-51-2
Fuse 14 (JB)	8W-51-4
Fuse E (PDC)	8W-51-5
G103	8W-51-3, 7
G200	8W-51-5
G305	8W-51-3
Headlamp Switch	8W-51-4
Joint Connector No. 1	8W-51-3, 4
Joint Connector No. 2	8W-51-4
Junction Block	8W-51-2, 3, 4, 5
Left Back-Up Lamp	8W-51-3
Left License Lamp	8W-51-7
Left Tail/Stop/Turn Signal Lamp	8W-51-7
License Lamp	8W-51-7
Park/Neutral Position Switch	8W-51-2
Power Distribution Center	8W-51-5
Right Back-Up Lamp	8W-51-3
Right License Lamp	8W-51-7
Right Tail/Stop/Turn Signal Lamp	8W-51-7
Trailer Tow Connector	8W-51-3, 6
Trailer Tow Relay	8W-51-4
Transmission Solenoid Assembly	8W-51-2
Turn Signal/Hazard Switch	8W-51-6


RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
2
15A
(8W-12-10)
1 C9
L10
18
BR/LG
2 DOOR
4 DOOR
S254
(8W-12-10)
54 C200
DRL
OTHERS
L10
20
BR/LG
L10
20
BR/LG
S163
(8W-12-10)
L10
20
BR/LG
2
FUSED IGNITION SWITCH OUTPUT (RUN)
DAYTIME RUNNING LAMP MODULE
(8W-50-7)
12 C106 (IN PDC)
FROM
S115
(8W-30-25)
M/T
4.7L A/T
A/T 3.9L/5.9L
L10
20
BR/LG
L10
20
BR/LG
L10
18
BR/LG
T41
18
BK/WT
B
1
1
2
BACK-UP LAMP SWITCH
R
A
TRANSMISSION SOLENOID ASSEMBLY
(8W-31-10)
R
6
PARK/ NEUTRAL POSITION SWITCH
R
P/N
3
L1
20
VT/BK
L1
20
VT/BK
L1
18
VT/BK
16 C106 (IN PDC)
L1
20
VT/BK
A
TO
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-51-3)

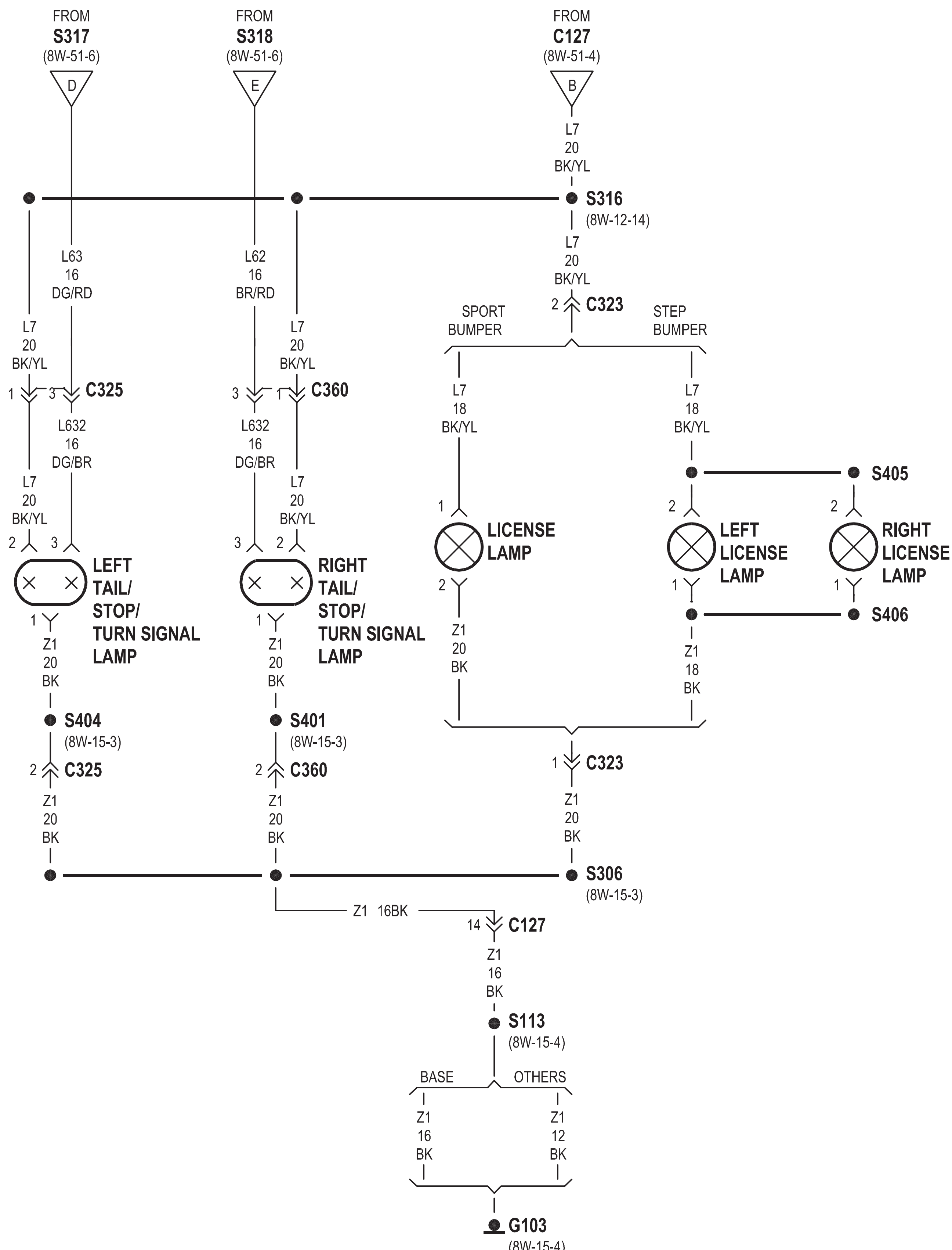

FROM
C106
(IN PDC)
(8W-51-2)
A
L1
20
VT/BK
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
C127
S314
C1
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
C3
L1
18
VT/BK
C325
C360
C341
LEFT BACK-UP LAMP
RIGHT BACK-UP LAMP
BACK-UP LAMP FEED
AUTOMATIC DAY/ NIGHT MIRROR
(8W-44-13)
TRAILER TOW CONNECTOR
(8W-54-3)
Z1
20
BK
S404
(8W-15-3)
S401
(8W-15-3)
Z1
12
BK
S306
(8W-15-3)
Z1
16
BK
Z1
14
BK
S113
(8W-15-4)
S351
(8W-15-10)
BASE
OTHERS
G103
(8W-15-4)
G305
(8W-15-10)


BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
14
15A
(8W-12-13)
4
C8
F33
18
PK/RD
2
C1
HEADLAMP SWITCH
(8W-50-2)
(8W-50-9)
2
1
0
0 OFF
1 PARK
2 HEAD
1
C1
L7
20
BK/YL
41
C200
OTHER
TRAILER TOW
4
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-32)
5
6
86
TRAILER TOW RELAY (IN PDC)
(8W-54-2)
85
21
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-32)
26
8
C127
B
TO
S316
(8W-51-7)


BATT A0
(8W-10-12)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
E
20A
(8W-10-14)
F32
18
PK/DB
13
C200
F32
18
PK/DB
1
BRAKE
LAMP
SWITCH
(8W-30-24)
2
L50
18
WT/TN
8
C7
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
3
C6
6
C2
2
C3
13
C3
3
C7
L50
18
WT/TN
OTHER
TRAILER TOW
S128
(8W-12-16)
C
TO
MULTI-
FUNCTION
SWITCH
(8W-51-6)
L50
18
WT/TN
7
C127
AFTERMARKET
CHMSL
CONNECTOR
Z1
20
BK
S321
(8W-15-9)
3
4
C329
1
CENTER
HIGH
MOUNTED
STOP
LAMP
2
Z1
18
BK
S201
(8W-15-11)
Z1
16
BK
G200
(8W-15-11)

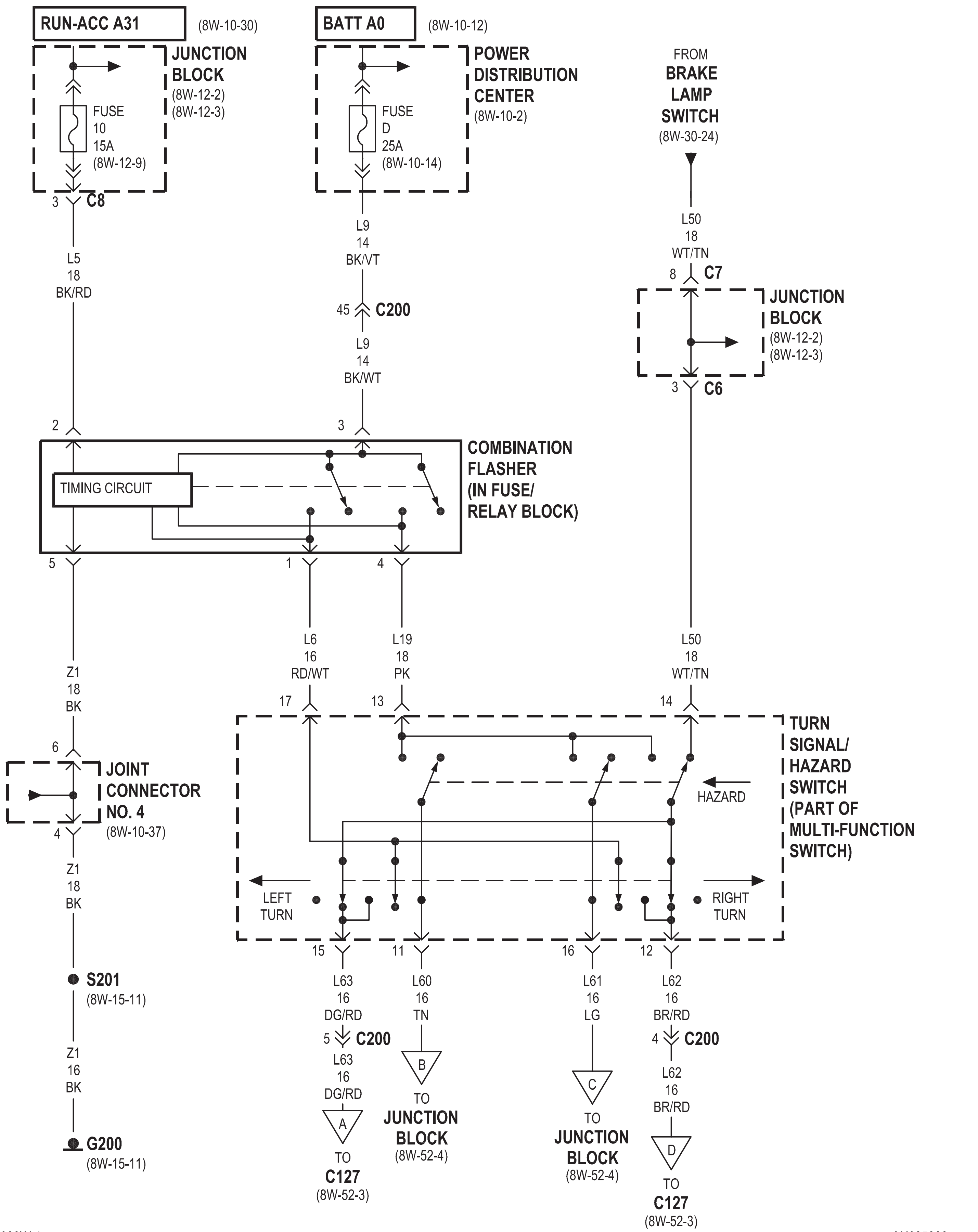


FROM
JUNCTION
BLOCK
(8W-51-5)
C
L50
18
WT/TN
14
TURN
SIGNAL/
HAZARD
SWITCH
(8W-52-2)
(PART OF
MULTI-
FUNCTION
SWITCH)
0 FLASH TO
PASS
1 HIGH BEAM
2 LOW BEAM
3 WASH
HAZARD
LEFT
TURN
RIGHT
TURN
15
12
L63
16
DG/RD
L62
16
BR/RD
5
4
C200
3
2
C127
S317
S318
10
C341
2
C341
L63
18
DG/RD
L62
18
BR/RD
5
6
D
E
TO
C325
(8W-51-7)
TO
C360
(8W-51-7)
TRAILER
TOW
CONNECTOR
(8W-54-3)

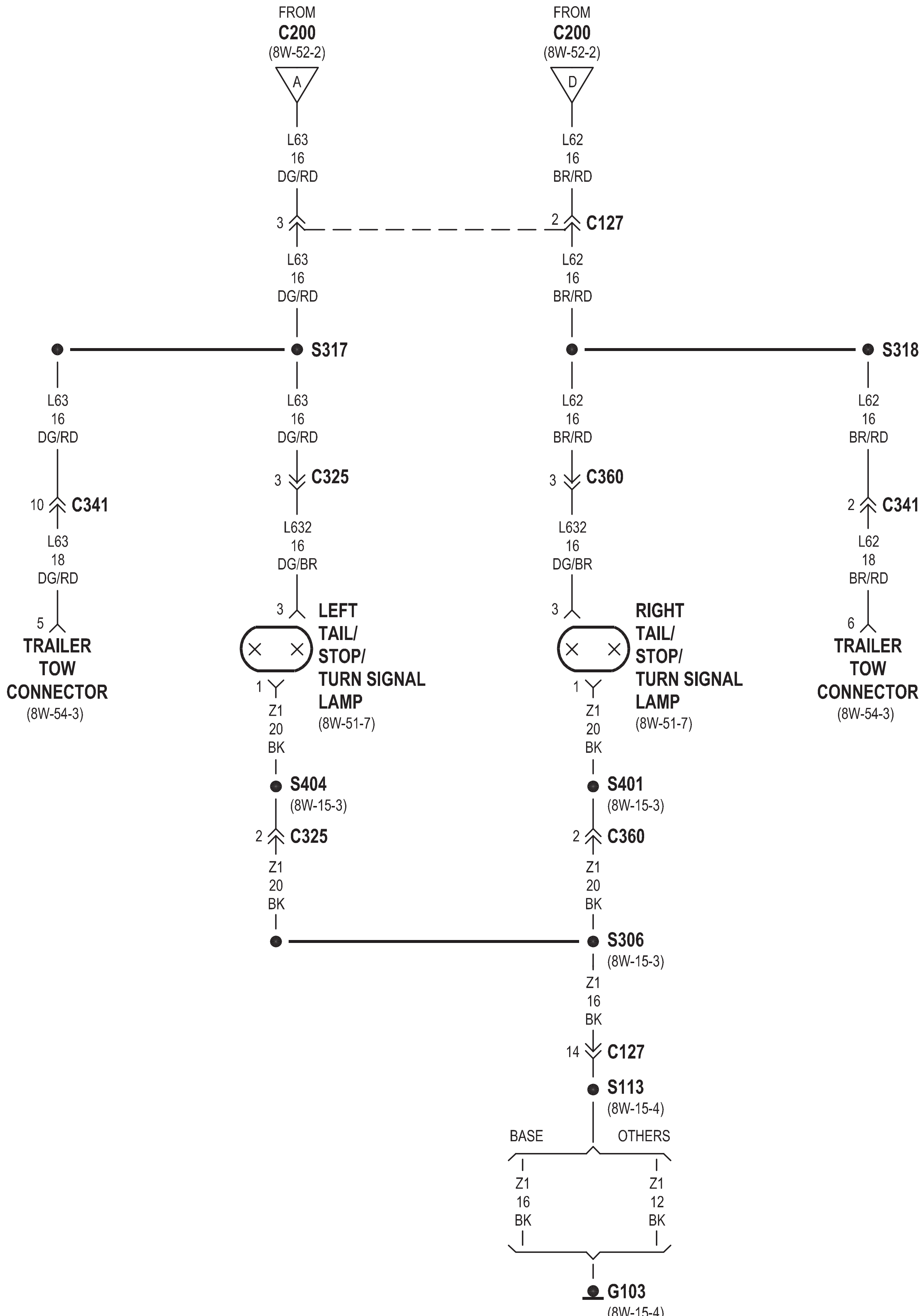

FROM
S317
(8W-51-6)
D
FROM
S318
(8W-51-6)
E
FROM
C127
(8W-51-4)
B
L7
20
BK/YL
S316
(8W-12-14)
L63
16
DG/RD
L62
16
BR/RD
C323
SPORT BUMPER
STEP BUMPER
C325
C360
L632
16
DG/BR
L7
18
BK/YL
S405
LICENSE LAMP
LEFT LICENSE LAMP
RIGHT LICENSE LAMP
S406
LEFT TAIL/ STOP/ TURN SIGNAL LAMP
RIGHT TAIL/ STOP/ TURN SIGNAL LAMP
Z1
20
BK
Z1
18
BK
S404
(8W-15-3)
S401
(8W-15-3)
S306
(8W-15-3)
Z1 16BK
C127
Z1
16
BK
S113
(8W-15-4)
BASE
OTHERS
Z1
12
BK
G103
(8W-15-4)

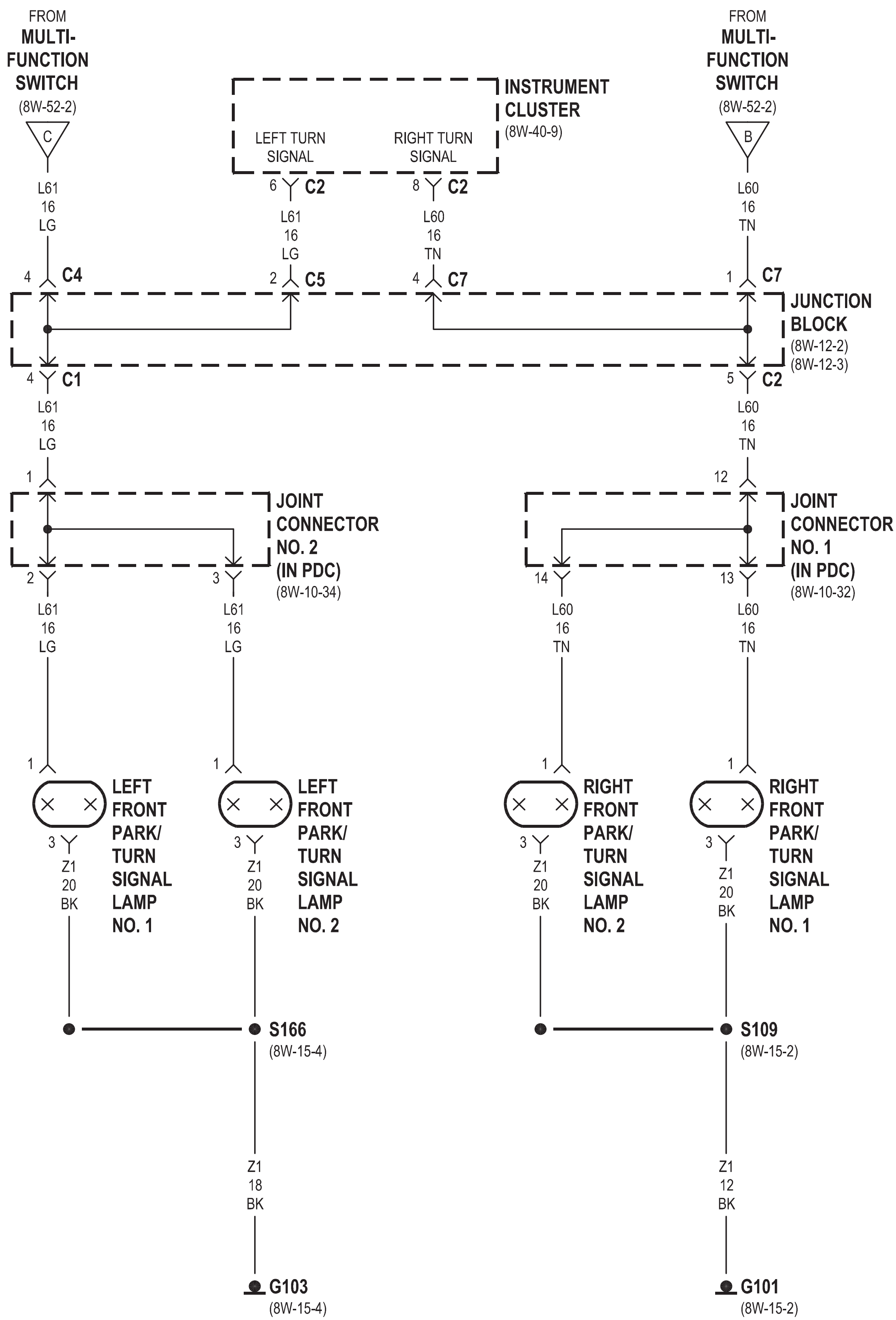
8W-52 TURN SIGNALS

Component	Page
Brake Lamp Switch	8W-52-2
Combination Flasher	8W-52-2
Fuse 10 (JB)	8W-52-2
Fuse D (PDC)	8W-52-2
G101	8W-52-4
G103	8W-52-3, 4
G200	8W-52-2
Instrument Cluster	8W-52-4
Joint Connector No. 1	8W-52-4
Joint Connector No. 2	8W-52-4
Joint Connector No. 4	8W-52-2
Junction Block	8W-52-2, 4
Left Front Park/Turn Signal Lamp No. 1	8W-52-4
Left Front Park/Turn Signal Lamp No. 2	8W-52-4
Left Tail/Stop/Turn Signal Lamp	8W-52-3
Power Distribution Center	8W-52-2
Right Front Park/Turn Signal Lamp No. 1	8W-52-4
Right Front Park/Turn Signal Lamp No. 2	8W-52-4
Right Tail/Stop/Turn Signal Lamp	8W-52-3
Trailer Tow Connector	8W-52-3
Turn Signal/Hazard Switch	8W-52-2



RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
10
15A
(8W-12-9)
3 C8
L5
18
BK/RD
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
D
25A
(8W-10-14)
L9
14
BK/VT
45 C200
L9
14
BK/WT
FROM BRAKE LAMP SWITCH
(8W-30-24)
L50
18
WT/TN
8 C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
3 C6
2
3
TIMING CIRCUIT
COMBINATION FLASHER (IN FUSE/ RELAY BLOCK)
5
1
4
Z1
18
BK
L6
16
RD/WT
L19
18
PK
L50
18
WT/TN
17
13
14
6
JOINT CONNECTOR NO. 4
(8W-10-37)
4
Z1
18
BK
TURN SIGNAL/ HAZARD SWITCH (PART OF MULTI-FUNCTION SWITCH)
HAZARD
LEFT TURN
RIGHT TURN
15
11
16
12
S201
(8W-15-11)
L63
16
DG/RD
5 C200
L63
16
DG/RD
A
TO C127
(8W-52-3)
L60
16
TN
B
TO JUNCTION BLOCK
(8W-52-4)
L61
16
LG
C
TO JUNCTION BLOCK
(8W-52-4)
L62
16
BR/RD
4 C200
L62
16
BR/RD
D
TO C127
(8W-52-3)
Z1
16
BK
G200
(8W-15-11)


FROM
C200
(8W-52-2)
A
L63
16
DG/RD
3
FROM
C200
(8W-52-2)
D
L62
16
BR/RD
2
C127
L63
16
DG/RD
L62
16
BR/RD
S317
S318
L63
16
DG/RD
10
C341
L63
18
DG/RD
5
TRAILER
TOW
CONNECTOR
(8W-54-3)
L63
16
DG/RD
3
C325
L632
16
DG/BR
3
LEFT
TAIL/
STOP/
TURN SIGNAL
LAMP
(8W-51-7)
1
Z1
20
BK
S404
(8W-15-3)
2
C325
Z1
20
BK
L62
16
BR/RD
3
C360
L632
16
DG/BR
3
RIGHT
TAIL/
STOP/
TURN SIGNAL
LAMP
(8W-51-7)
1
Z1
20
BK
S401
(8W-15-3)
2
C360
Z1
20
BK
L62
16
BR/RD
2
C341
L62
18
BR/RD
6
TRAILER
TOW
CONNECTOR
(8W-54-3)
S306
(8W-15-3)
Z1
16
BK
14
C127
S113
(8W-15-4)
BASE
OTHERS
Z1
16
BK
Z1
12
BK
G103
(8W-15-4)


FROM
MULTI-FUNCTION SWITCH
(8W-52-2)
C
L61 16 LG
4 C4
INSTRUMENT CLUSTER
(8W-40-9)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
6 C2
8 C2
L61 16 LG
L60 16 TN
2 C5
4 C7
FROM
MULTI-FUNCTION SWITCH
(8W-52-2)
B
L60 16 TN
1 C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
4 C1
5 C2
L61 16 LG
L60 16 TN
1
12
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-34)
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-32)
2
3
14
13
L61 16 LG
L61 16 LG
L60 16 TN
L60 16 TN
1
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 1
1
LEFT FRONT PARK/ TURN SIGNAL LAMP NO. 2
1
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 2
1
RIGHT FRONT PARK/ TURN SIGNAL LAMP NO. 1
3
Z1 20 BK
3
Z1 20 BK
3
Z1 20 BK
3
Z1 20 BK
S166
(8W-15-4)
S109
(8W-15-2)
Z1 18 BK
Z1 12 BK
G103
(8W-15-4)
G101
(8W-15-2)

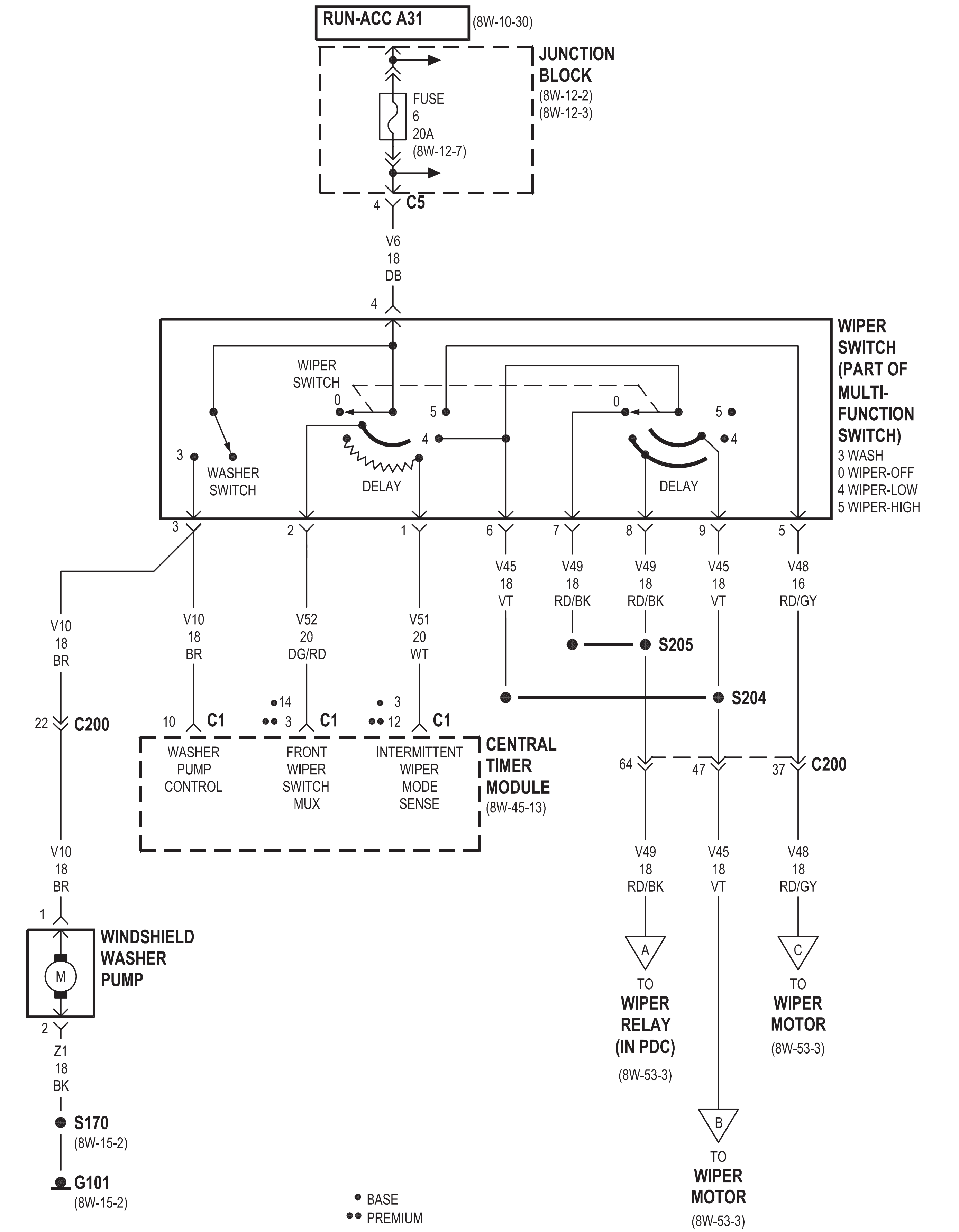
8W-53 WIPERS

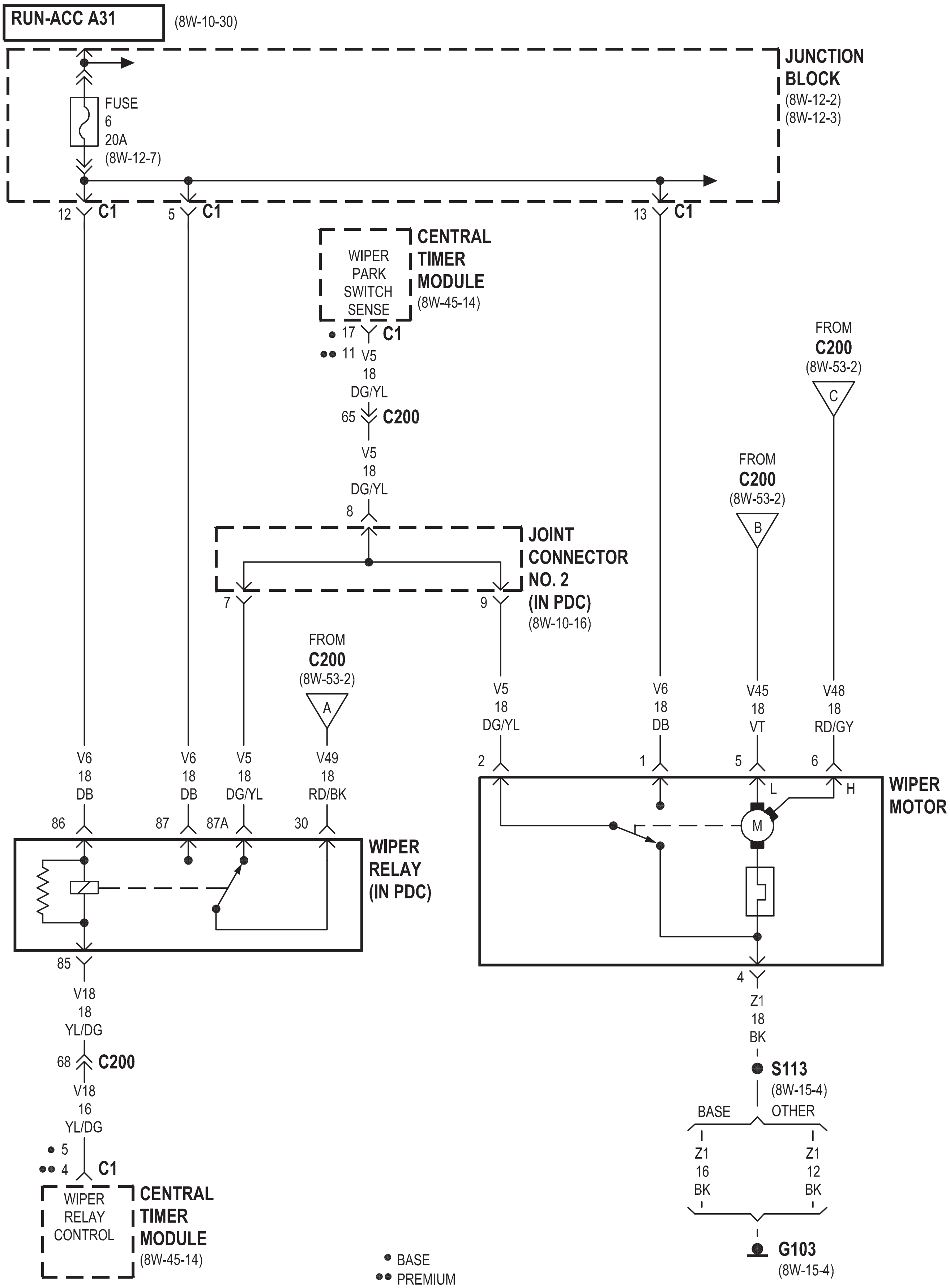
Component **Page**

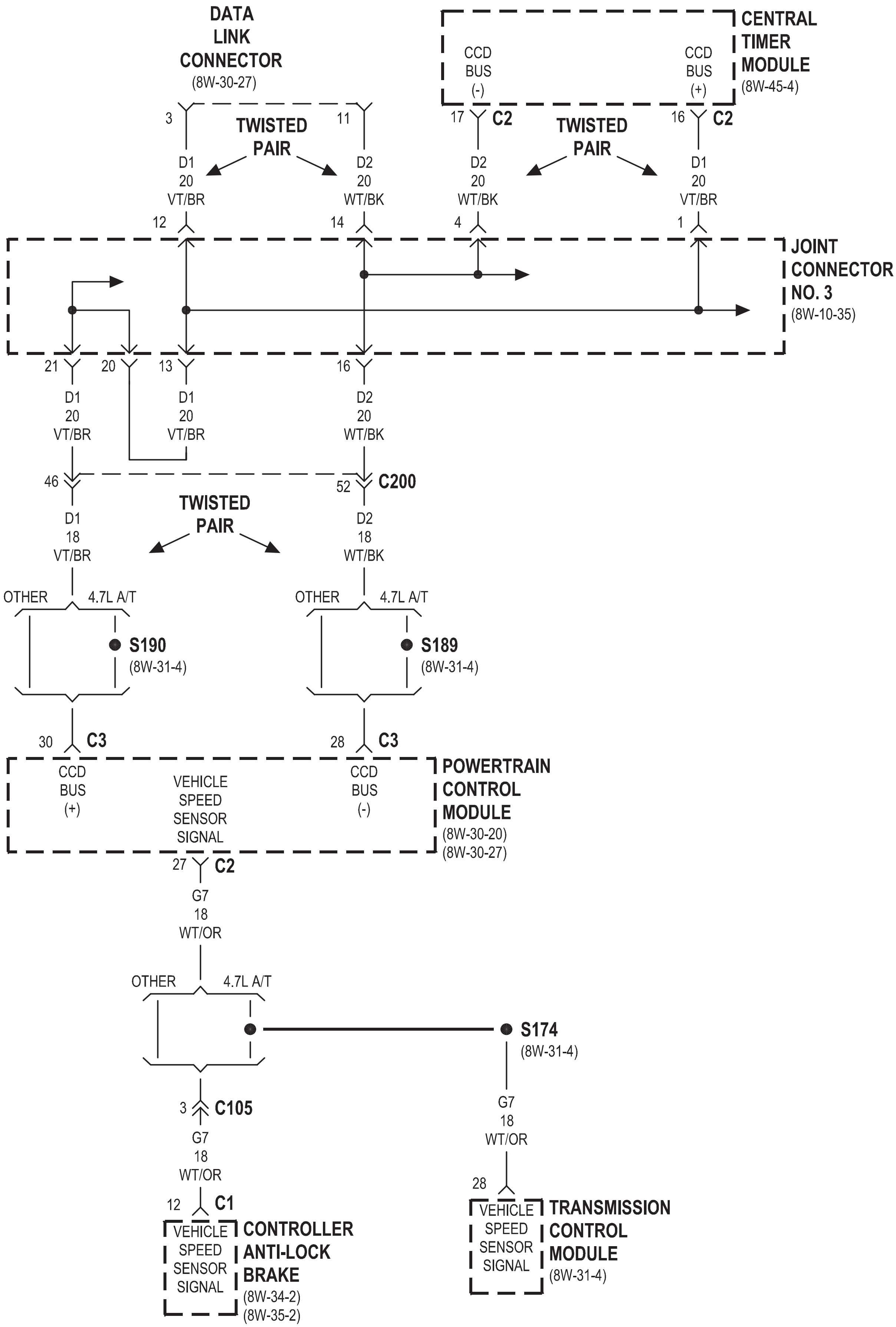
Central Timer Module 8W-53-2, 3, 4
Controller Anti-Lock Brake 8W-53-4
Data Link Connector 8W-53-4
Fuse 6 (JB) 8W-53-2, 3
G101 . . . . 8W-53-2
G103 . . . . 8W-53-3
Joint Connector No. 2 . . . . 8W-53-3
Joint Connector No. 3 . . . . 8W-53-4

Component **Page**

Junction Block 8W-53-2, 3
Powertrain Control Module 8W-53-4
Transmission Control Module 8W-53-4
Windshield Washer Pump 8W-53-2
Wiper Motor 8W-53-3
Wiper Relay 8W-53-3
Wiper Switch 8W-53-2

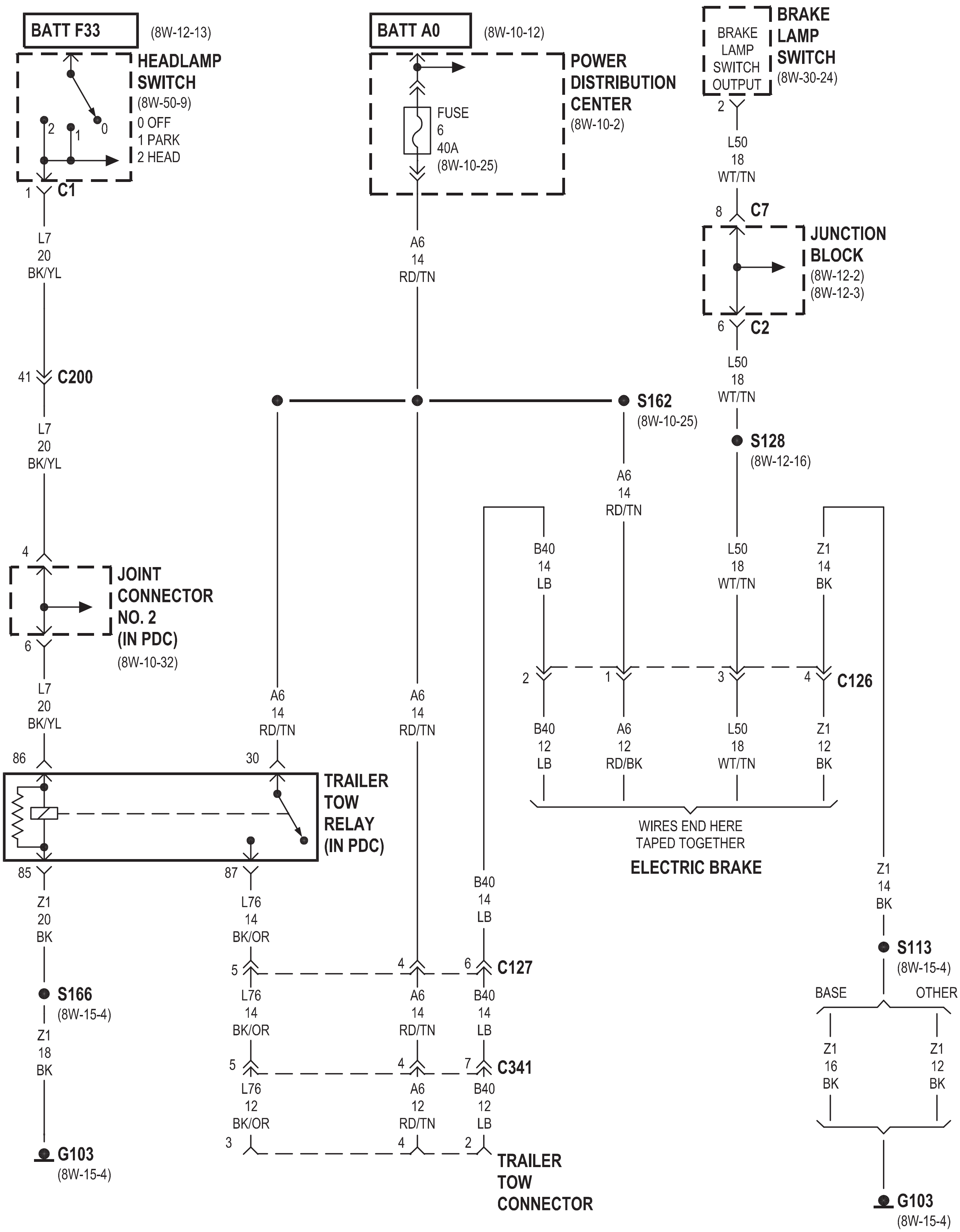

RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
20A
(8W-12-7)
4 C5
V6
18
DB
4
WIPER SWITCH (PART OF MULTI-FUNCTION SWITCH)
3 WASH
0 WIPER-OFF
4 WIPER-LOW
5 WIPER-HIGH
WIPER SWITCH
0
5
4
3
WASHER SWITCH
DELAY
0
5
4
DELAY
3
2
1
6
7
8
9
5
V10
18
BR
V10
18
BR
V52
20
DG/RD
V51
20
WT
V45
18
VT
V49
18
RD/BK
V49
18
RD/BK
V45
18
VT
V48
16
RD/GY
S205
S204
22 C200
10 C1
14
3 C1
3
12 C1
CENTRAL TIMER MODULE
(8W-45-13)
WASHER PUMP CONTROL
FRONT WIPER SWITCH MUX
INTERMITTENT WIPER MODE SENSE
64
47
37 C200
V10
18
BR
V49
18
RD/BK
V45
18
VT
V48
18
RD/GY
1
WINDSHIELD WASHER PUMP
M
2
Z1
18
BK
S170
(8W-15-2)
G101
(8W-15-2)
A
TO WIPER RELAY (IN PDC)
(8W-53-3)
C
TO WIPER MOTOR
(8W-53-3)
B
TO WIPER MOTOR
(8W-53-3)
BASE
PREMIUM

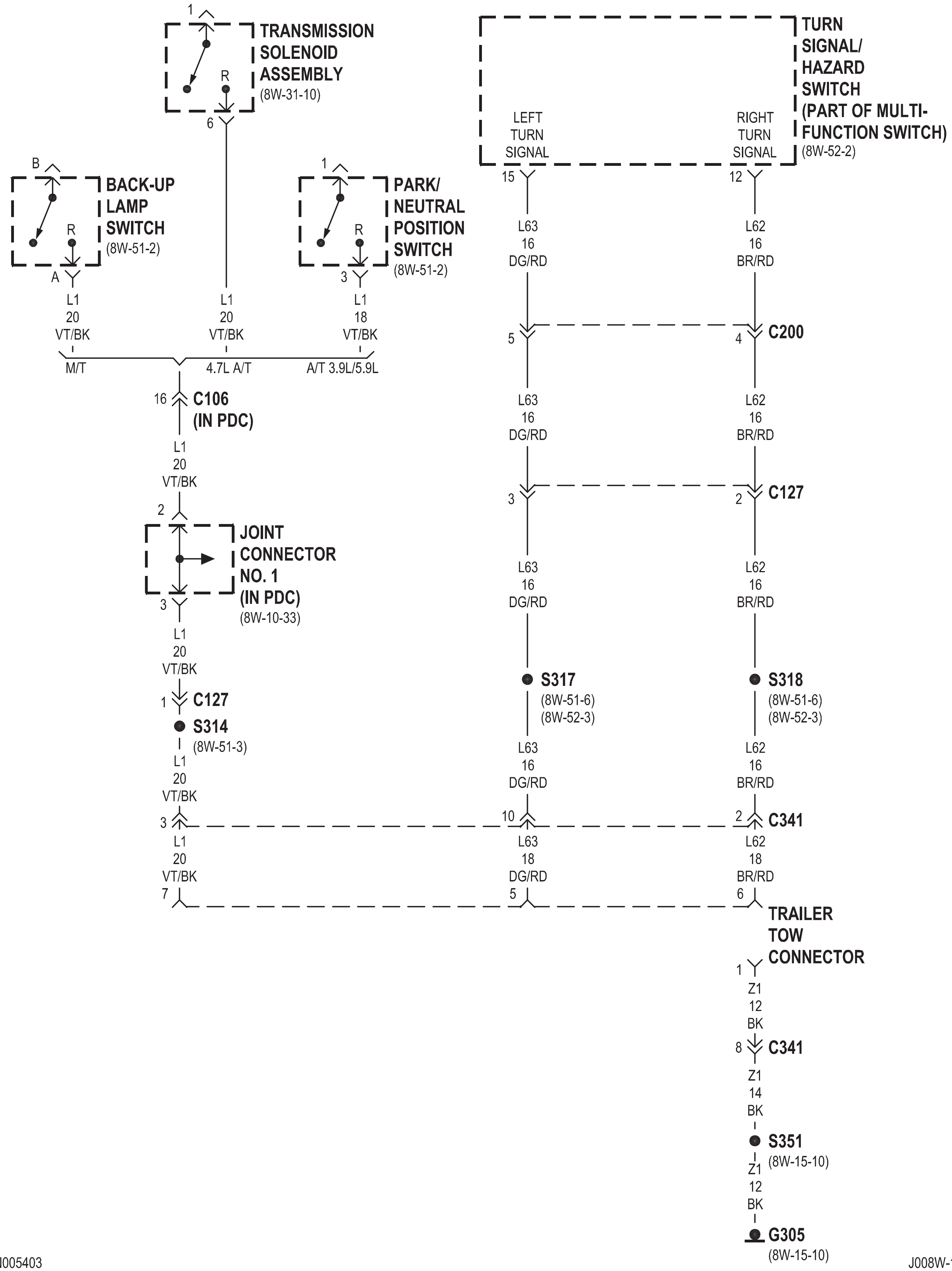

RUN-ACC A31
(8W-10-30)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
20A
(8W-12-7)
12 C1
5 C1
13 C1
CENTRAL TIMER MODULE
(8W-45-14)
WIPER PARK SWITCH SENSE
• 17 C1
•• 11
V5 18 DG/YL
65 C200
V5 18 DG/YL
8
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-16)
7
9
FROM C200 (8W-53-2)
A
B
C
V6 18 DB
V5 18 DG/YL
V49 18 RD/BK
V6 18 DB
V45 18 VT
V48 18 RD/GY
86
87
87A
30
WIPER RELAY (IN PDC)
85
2
1
5
6
L
H
M
WIPER MOTOR
4
V18 18 YL/DG
68 C200
V18 16 YL/DG
• 5
•• 4 C1
CENTRAL TIMER MODULE
WIPER RELAY CONTROL
(8W-45-14)
Z1 18 BK
S113
(8W-15-4)
BASE
OTHER
Z1 16 BK
Z1 12 BK
G103
(8W-15-4)
• BASE
•• PREMIUM


DATA
LINK
CONNECTOR
(8W-30-27)
CENTRAL
TIMER
MODULE
(8W-45-4)
CCD BUS (-)
CCD BUS (+)
3
11
17 C2
16 C2
TWISTED PAIR
D1 20 VT/BR
D2 20 WT/BK
D2 20 WT/BK
D1 20 VT/BR
12
14
4
1
JOINT
CONNECTOR
NO. 3
(8W-10-35)
21
20
13
16
D1 20 VT/BR
D1 20 VT/BR
D2 20 WT/BK
46
52 C200
TWISTED PAIR
D1 18 VT/BR
D2 18 WT/BK
OTHER
4.7L A/T
S190
(8W-31-4)
OTHER
4.7L A/T
S189
(8W-31-4)
30 C3
28 C3
CCD BUS (+)
VEHICLE SPEED SENSOR SIGNAL
CCD BUS (-)
POWERTRAIN
CONTROL
MODULE
(8W-30-20)
(8W-30-27)
27 C2
G7 18 WT/OR
OTHER
4.7L A/T
S174
(8W-31-4)
3 C105
G7 18 WT/OR
G7 18 WT/OR
12 C1
28
VEHICLE SPEED SENSOR SIGNAL
CONTROLLER
ANTI-LOCK
BRAKE
(8W-34-2)
(8W-35-2)
VEHICLE SPEED SENSOR SIGNAL
TRANSMISSION
CONTROL
MODULE
(8W-31-4)

8W-54 TRAILER TOW

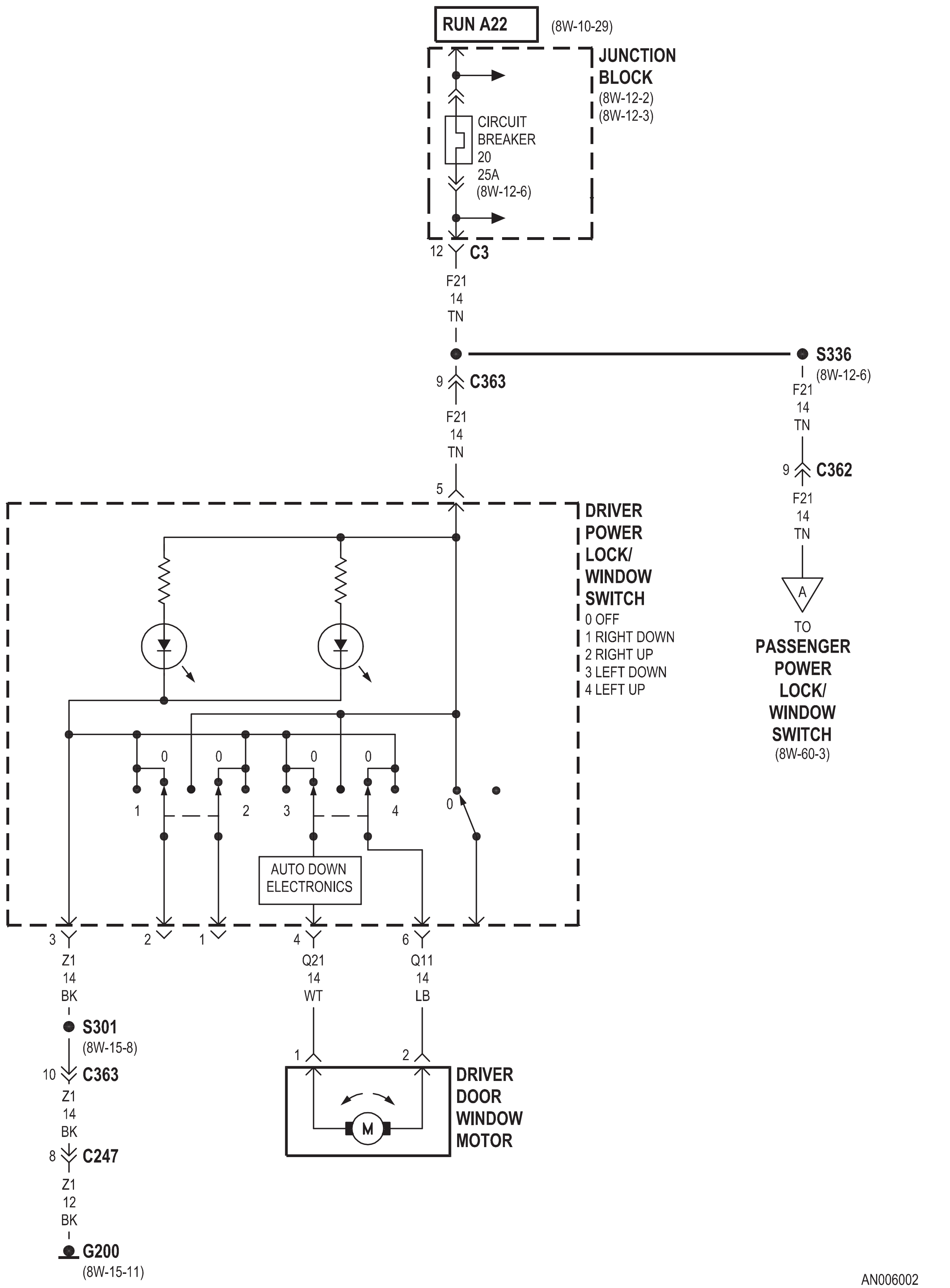
Component	Page
Back-Up Lamp Switch	8W-54-3
Brake Lamp Switch	8W-54-2
Electric Brake	8W-54-2
Fuse 6 (PDC)	8W-54-2
G103	8W-54-2
G305	8W-54-3
Headlamp Switch	8W-54-2
Joint Connector No. 1	8W-54-3
Joint Connector No. 2	8W-54-2
Junction Block	8W-54-2
Park/Neutral Position Switch	8W-54-3
Power Distribution Center	8W-54-2
Trailer Tow Connector	8W-54-2, 3
Trailer Tow Relay	8W-54-2
Transmission Solenoid Assembly	8W-54-3
Turn Signal/Hazard Switch	8W-54-3


BATT F33
(8W-12-13)
HEADLAMP SWITCH
(8W-50-9)
0 OFF
1 PARK
2 HEAD
C1
L7 20 BK/YL
C200
JOINT CONNECTOR NO. 2 (IN PDC)
(8W-10-32)
BATT A0
(8W-10-12)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 40A (8W-10-25)
A6 14 RD/TN
S162
(8W-10-25)
BRAKE LAMP SWITCH OUTPUT
BRAKE LAMP SWITCH
(8W-30-24)
L50 18 WT/TN
C7
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
C2
S128
(8W-12-16)
B40 14 LB
Z1 14 BK
C126
B40 12 LB
A6 12 RD/BK
L50 18 WT/TN
Z1 12 BK
WIRES END HERE TAPED TOGETHER
ELECTRIC BRAKE
TRAILER TOW RELAY (IN PDC)
Z1 20 BK
L76 14 BK/OR
C127
C341
L76 12 BK/OR
A6 12 RD/TN
B40 12 LB
TRAILER TOW CONNECTOR
S166
(8W-15-4)
Z1 18 BK
G103
(8W-15-4)
S113
(8W-15-4)
BASE
OTHER
Z1 16 BK
Z1 12 BK
G103
(8W-15-4)

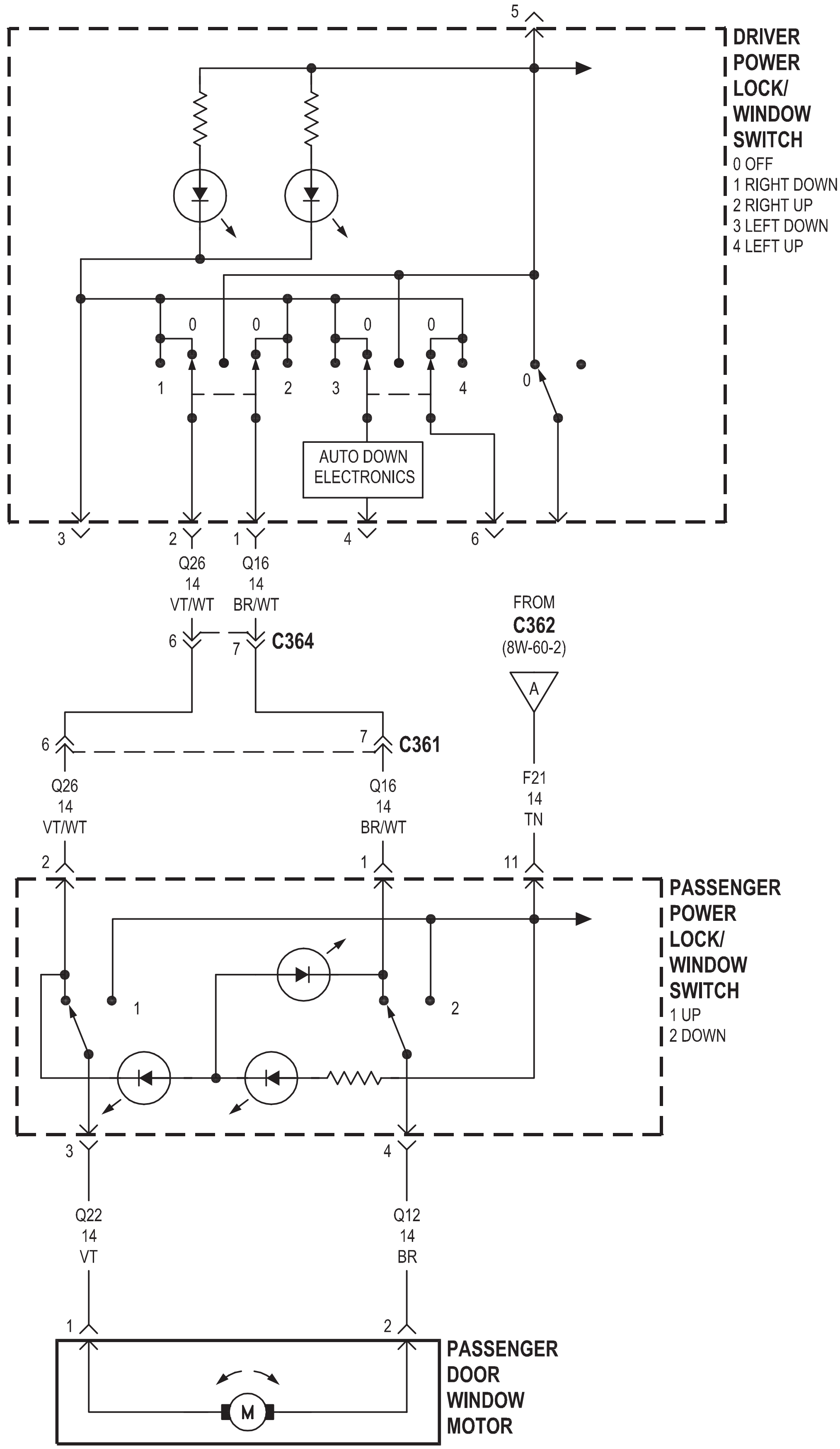

TRANSMISSION SOLENOID ASSEMBLY
(8W-31-10)
BACK-UP LAMP SWITCH
(8W-51-2)
PARK/ NEUTRAL POSITION SWITCH
(8W-51-2)
TURN SIGNAL/ HAZARD SWITCH (PART OF MULTI-FUNCTION SWITCH)
(8W-52-2)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
L1 20 VT/BK
L1 18 VT/BK
M/T
4.7L A/T
A/T 3.9L/5.9L
C106 (IN PDC)
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
C127
S314
(8W-51-3)
L63 16 DG/RD
L62 16 BR/RD
C200
S317
(8W-51-6)
(8W-52-3)
S318
(8W-51-6)
(8W-52-3)
C341
L63 18 DG/RD
L62 18 BR/RD
TRAILER TOW CONNECTOR
Z1 12 BK
Z1 14 BK
S351
(8W-15-10)
G305
(8W-15-10)

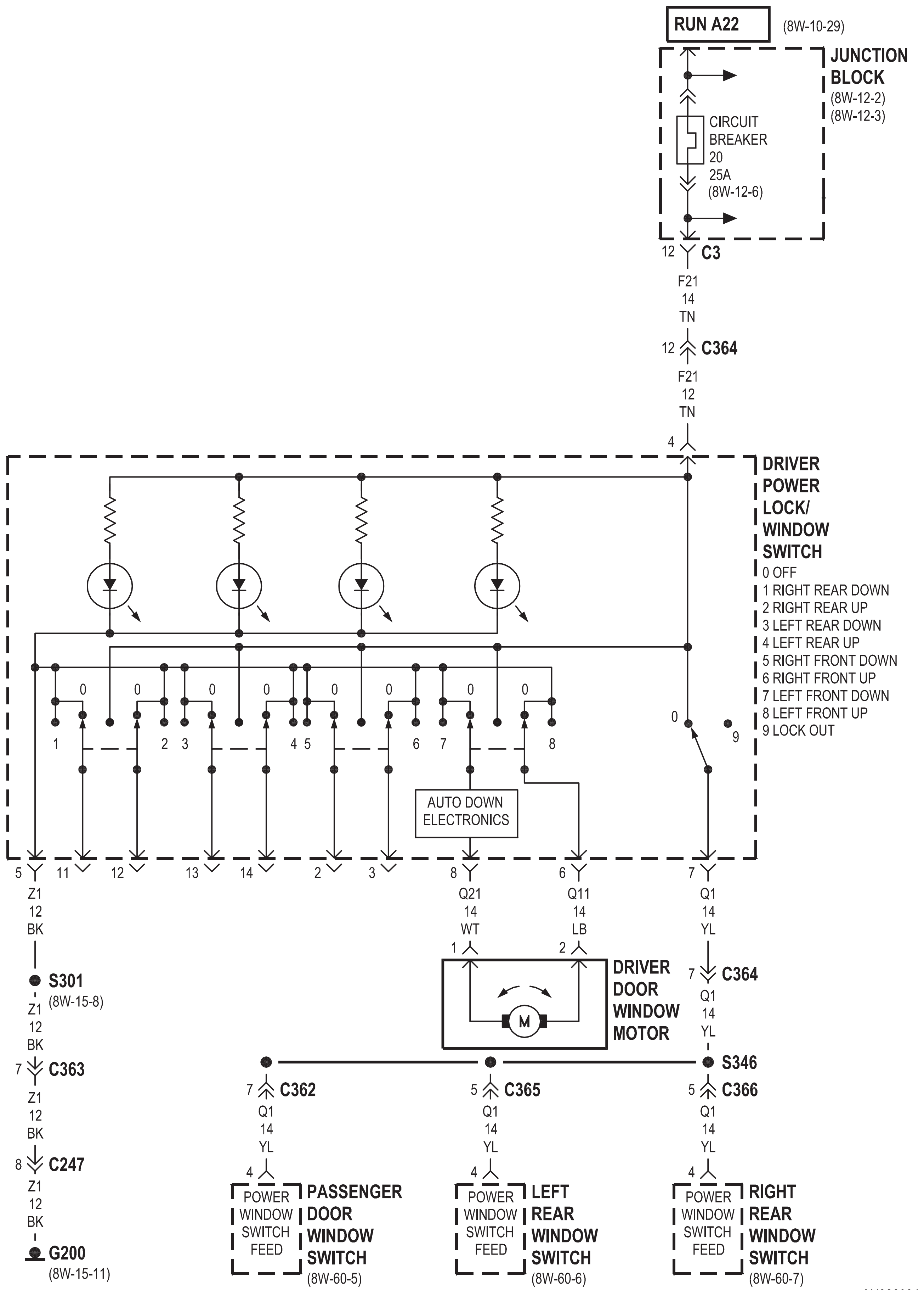
8W-60 POWER WINDOWS

Component	Page
Circuit Breaker 20 (JB)	8W-60-2, 4
Driver Door Window Motor	8W-60-2, 4
Driver Power Lock/Window Switch	8W-60-2, 3, 4, 5, 6, 7
G200	8W-60-2, 4
Junction Block	8W-60-2, 4
Left Rear Window Motor	8W-60-6
Left Rear Window Switch	8W-60-4, 6
Passenger Door Window Motor	8W-60-3, 5
Passenger Door Window Switch	8W-60-4, 5
Passenger Power Lock/Window Switch	8W-60-2, 3
Right Rear Window Motor	8W-60-7
Right Rear Window Switch	8W-60-4, 7

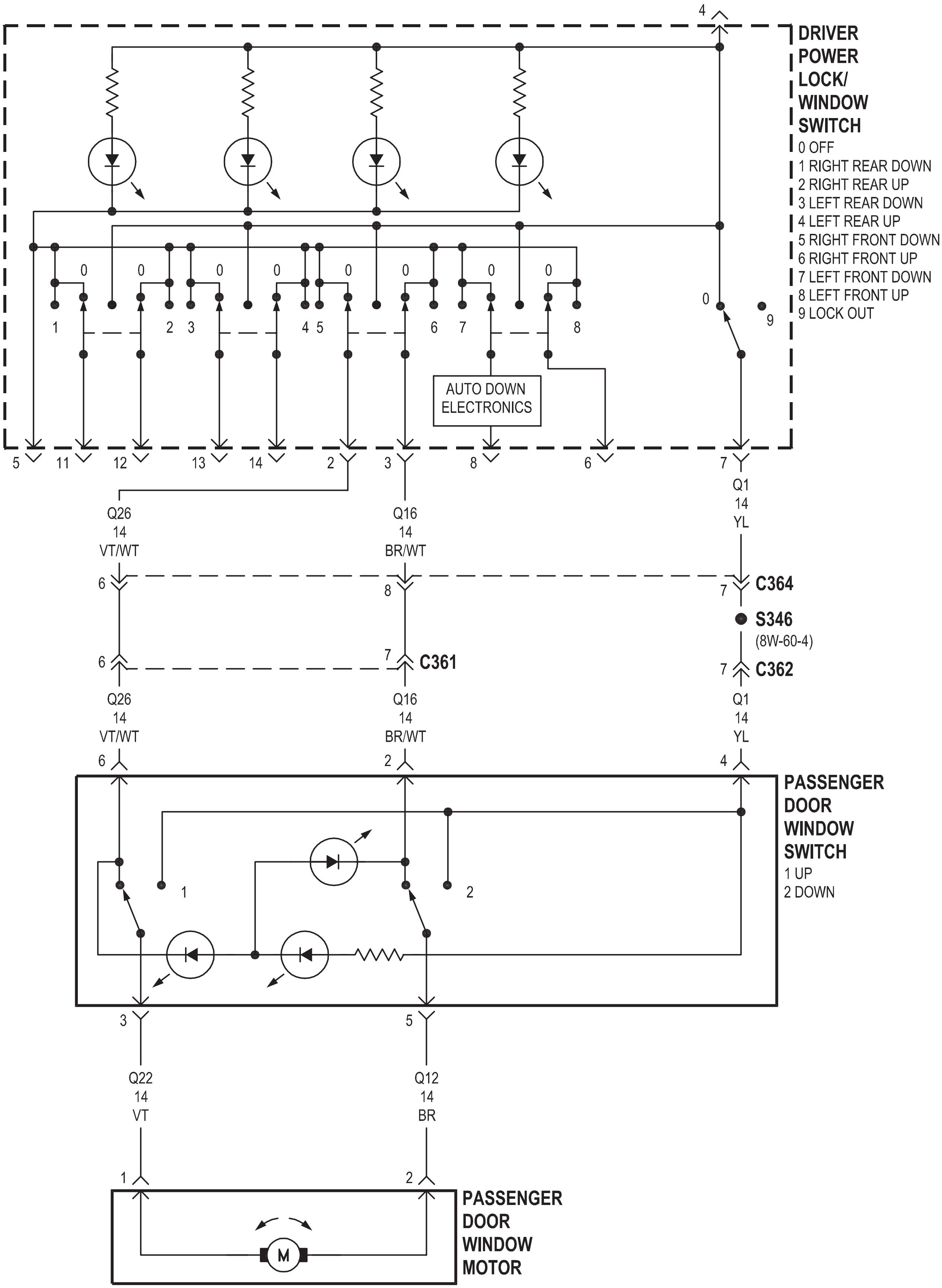

RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER
20
25A
(8W-12-6)
12
C3
F21
14
TN
S336
(8W-12-6)
9
C363
F21
14
TN
F21
14
TN
9
C362
F21
14
TN
5
A
TO PASSENGER POWER LOCK/ WINDOW SWITCH
(8W-60-3)
DRIVER POWER LOCK/ WINDOW SWITCH
0 OFF
1 RIGHT DOWN
2 RIGHT UP
3 LEFT DOWN
4 LEFT UP
0
0
0
0
1
2
3
4
0
AUTO DOWN ELECTRONICS
3
2
1
4
6
Z1
14
BK
Q21
14
WT
Q11
14
LB
S301
(8W-15-8)
10
C363
Z1
14
BK
8
C247
Z1
12
BK
G200
(8W-15-11)
1
2
DRIVER DOOR WINDOW MOTOR
M

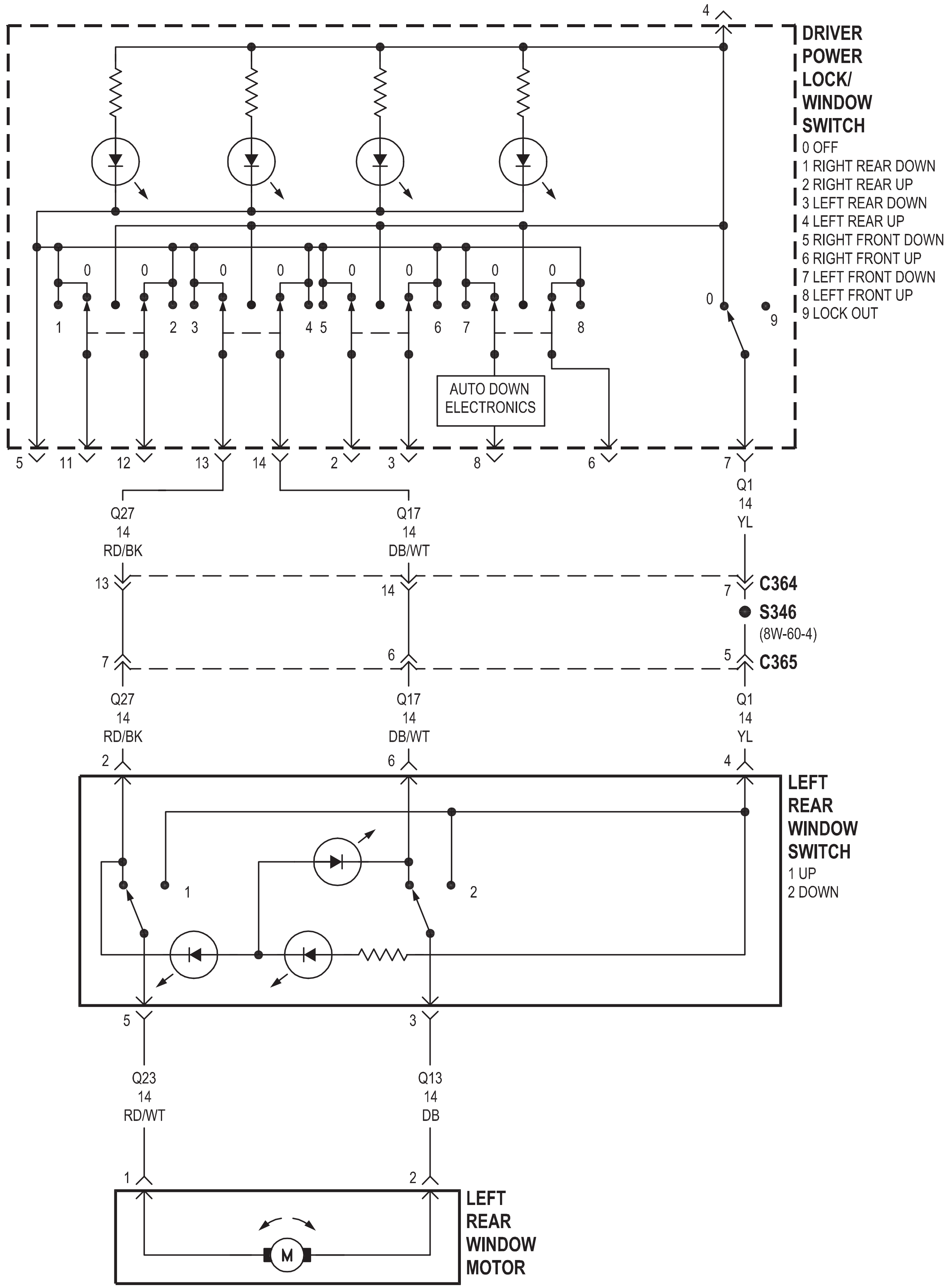
2 DOOR


5
DRIVER
POWER
LOCK/
WINDOW
SWITCH
0 OFF
1 RIGHT DOWN
2 RIGHT UP
3 LEFT DOWN
4 LEFT UP
0
0
0
0
1
2
3
4
0
AUTO DOWN
ELECTRONICS
3
2
1
4
6
Q26
14
VT/WT
Q16
14
BR/WT
FROM
C362
(8W-60-2)
A
6
7
C364
6
7
C361
Q26
14
VT/WT
Q16
14
BR/WT
F21
14
TN
2
1
11
PASSENGER
POWER
LOCK/
WINDOW
SWITCH
1 UP
2 DOWN
1
2
3
4
Q22
14
VT
Q12
14
BR
1
2
M
PASSENGER
DOOR
WINDOW
MOTOR

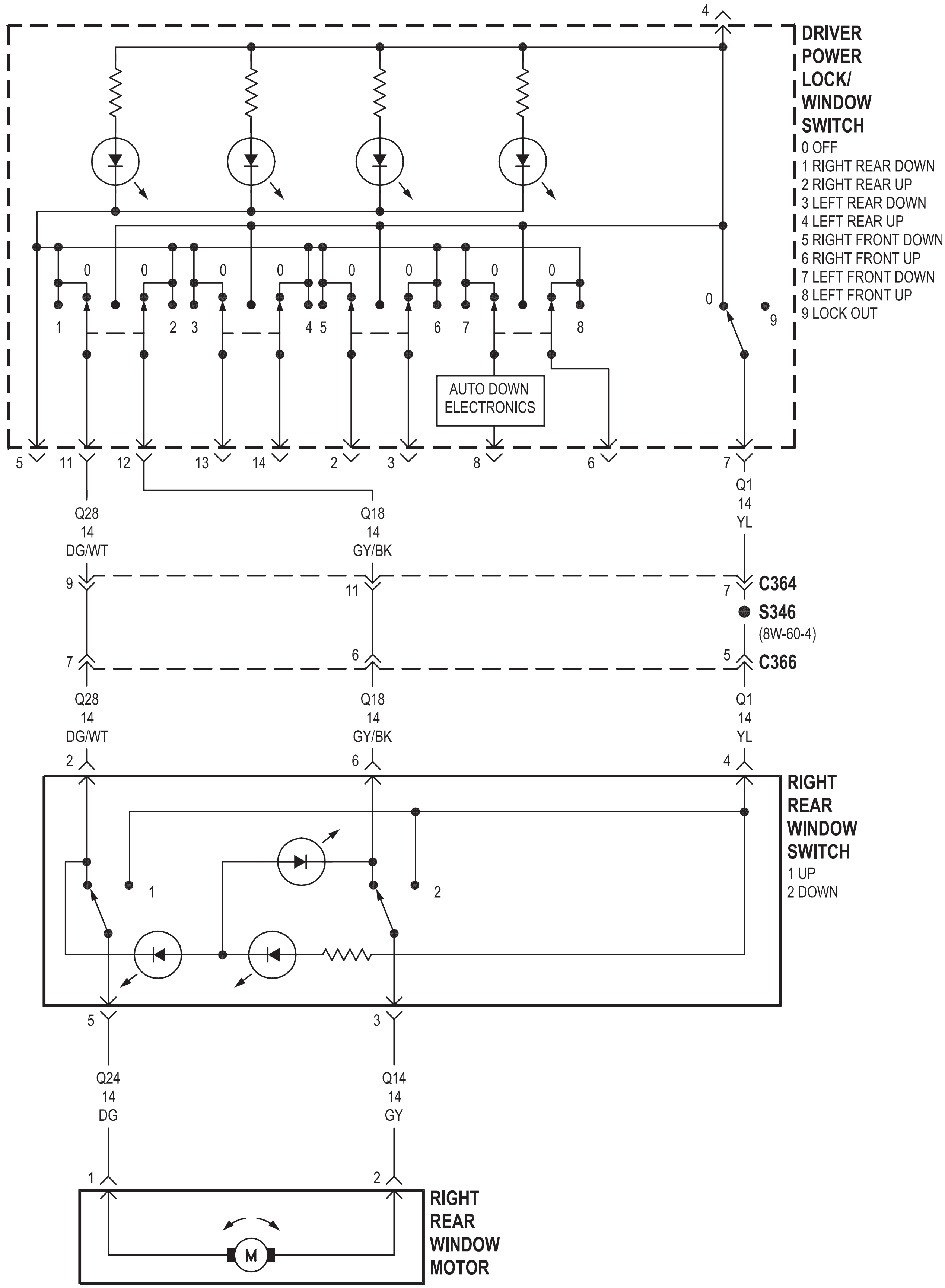

RUN A22
(8W-10-29)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER 20 25A (8W-12-6)
12 C3
F21 14 TN
12 C364
F21 12 TN
4
DRIVER POWER LOCK/ WINDOW SWITCH
0 OFF
1 RIGHT REAR DOWN
2 RIGHT REAR UP
3 LEFT REAR DOWN
4 LEFT REAR UP
5 RIGHT FRONT DOWN
6 RIGHT FRONT UP
7 LEFT FRONT DOWN
8 LEFT FRONT UP
9 LOCK OUT
AUTO DOWN ELECTRONICS
5 11 12 13 14 2 3 8 6 7
Z1 12 BK
Q21 14 WT
Q11 14 LB
Q1 14 YL
DRIVER DOOR WINDOW MOTOR
M
S301
(8W-15-8)
C363
C247
G200
(8W-15-11)
C364
S346
C362
C365
C366
POWER WINDOW SWITCH FEED
PASSENGER DOOR WINDOW SWITCH
(8W-60-5)
LEFT REAR WINDOW SWITCH
(8W-60-6)
RIGHT REAR WINDOW SWITCH
(8W-60-7)

4 DOOR


DRIVER POWER LOCK/ WINDOW SWITCH
0 OFF
1 RIGHT REAR DOWN
2 RIGHT REAR UP
3 LEFT REAR DOWN
4 LEFT REAR UP
5 RIGHT FRONT DOWN
6 RIGHT FRONT UP
7 LEFT FRONT DOWN
8 LEFT FRONT UP
9 LOCK OUT
AUTO DOWN ELECTRONICS
Q26 14 VT/WT
Q16 14 BR/WT
Q1 14 YL
C364
S346
(8W-60-4)
C361
C362
PASSENGER DOOR WINDOW SWITCH
1 UP
2 DOWN
Q22 14 VT
Q12 14 BR
PASSENGER DOOR WINDOW MOTOR
M

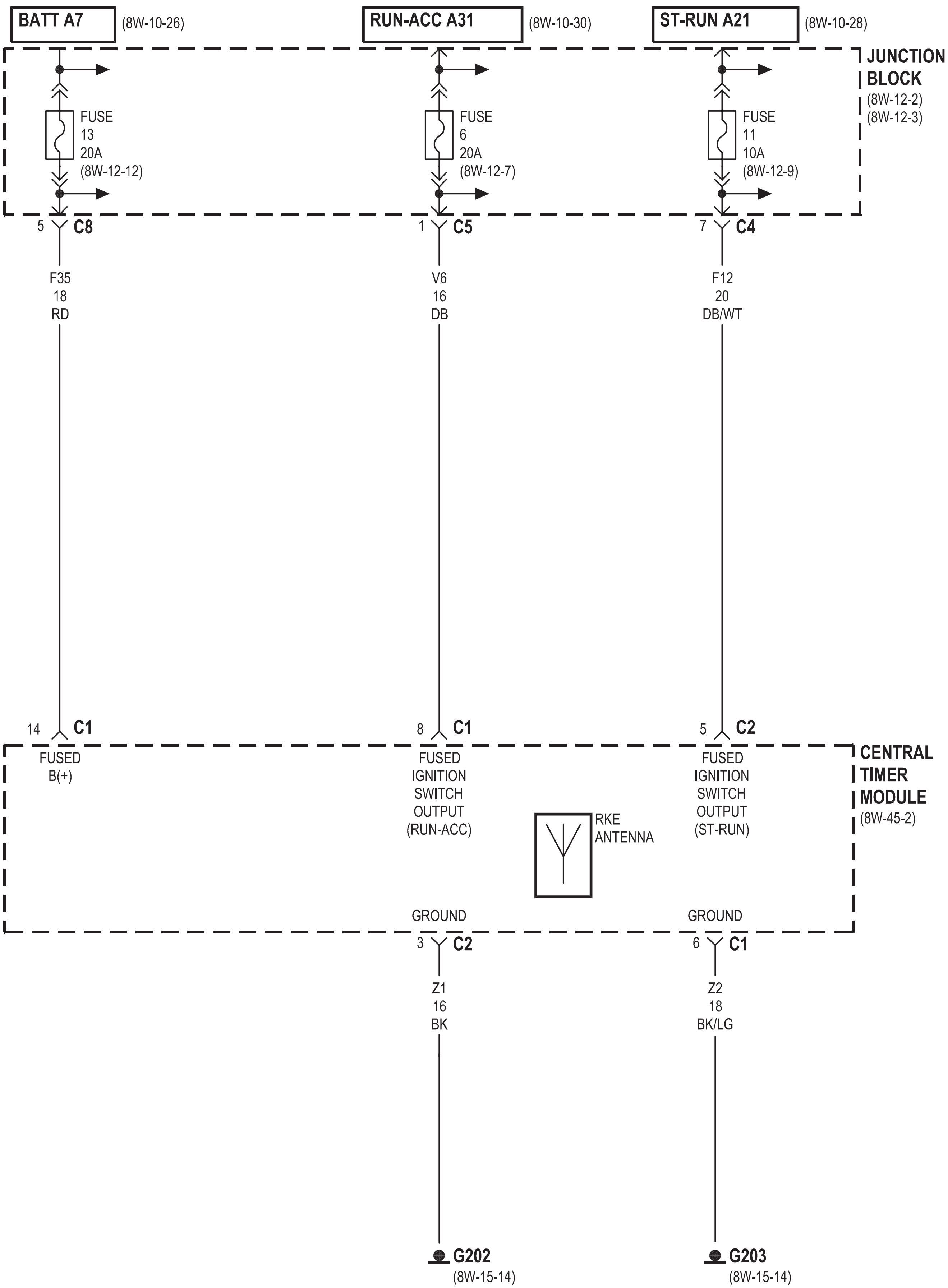

4
DRIVER
POWER
LOCK/
WINDOW
SWITCH
0 OFF
1 RIGHT REAR DOWN
2 RIGHT REAR UP
3 LEFT REAR DOWN
4 LEFT REAR UP
5 RIGHT FRONT DOWN
6 RIGHT FRONT UP
7 LEFT FRONT DOWN
8 LEFT FRONT UP
9 LOCK OUT
AUTO DOWN
ELECTRONICS
5 11 12 13 14 2 3 8 6 7
Q27
14
RD/BK
Q17
14
DB/WT
Q1
14
YL
C364
S346
(8W-60-4)
C365
LEFT
REAR
WINDOW
SWITCH
1 UP
2 DOWN
Q23
14
RD/WT
Q13
14
DB
LEFT
REAR
WINDOW
MOTOR
M

4 DOOR

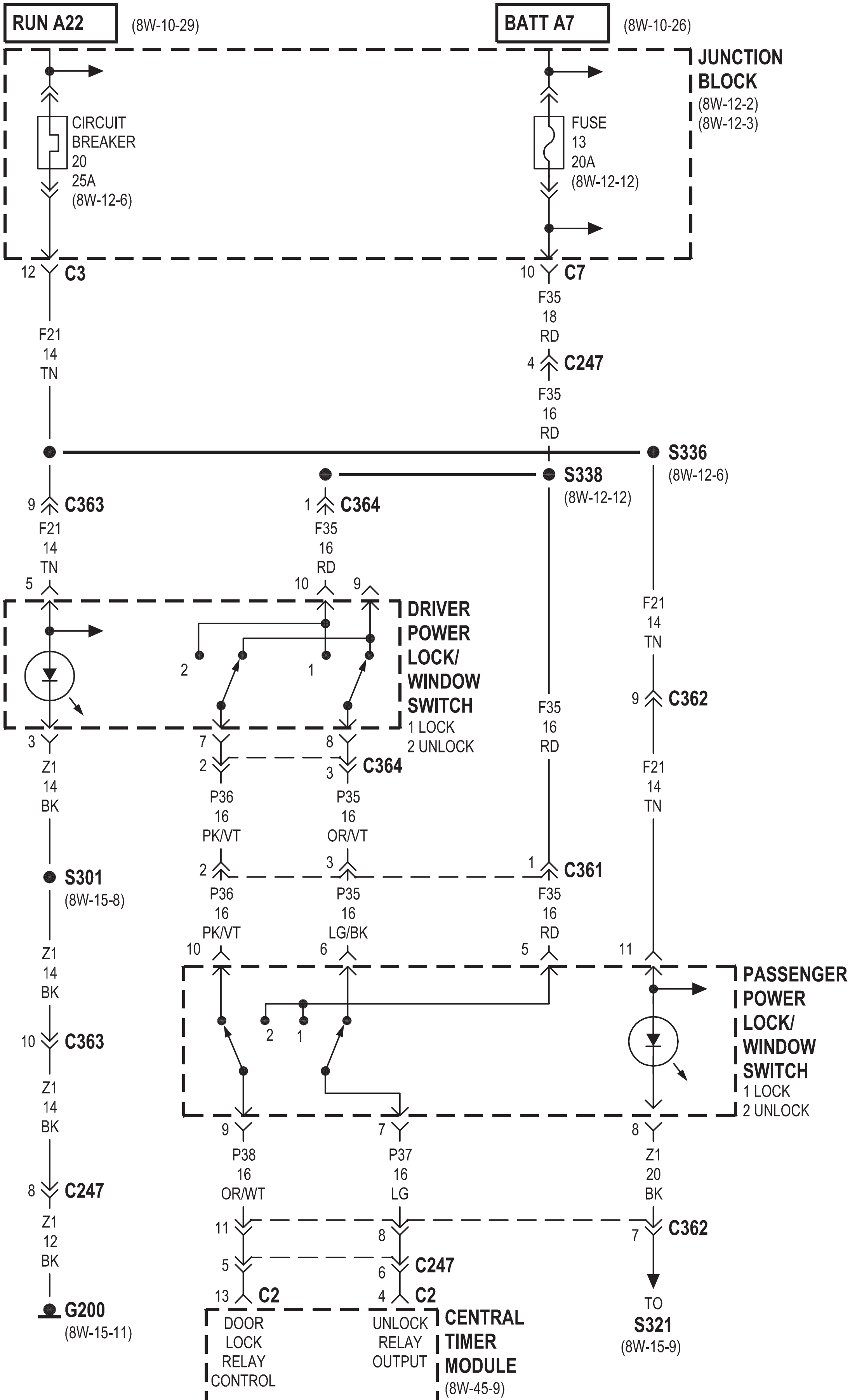

DRIVER
POWER
LOCK/
WINDOW
SWITCH
0 OFF
1 RIGHT REAR DOWN
2 RIGHT REAR UP
3 LEFT REAR DOWN
4 LEFT REAR UP
5 RIGHT FRONT DOWN
6 RIGHT FRONT UP
7 LEFT FRONT DOWN
8 LEFT FRONT UP
9 LOCK OUT
AUTO DOWN
ELECTRONICS
Q28
14
DG/WT
Q18
14
GY/BK
Q1
14
YL
C364
S346
(8W-60-4)
C366
RIGHT
REAR
WINDOW
SWITCH
1 UP
2 DOWN
Q24
14
DG
Q14
14
GY
RIGHT
REAR
WINDOW
MOTOR
M

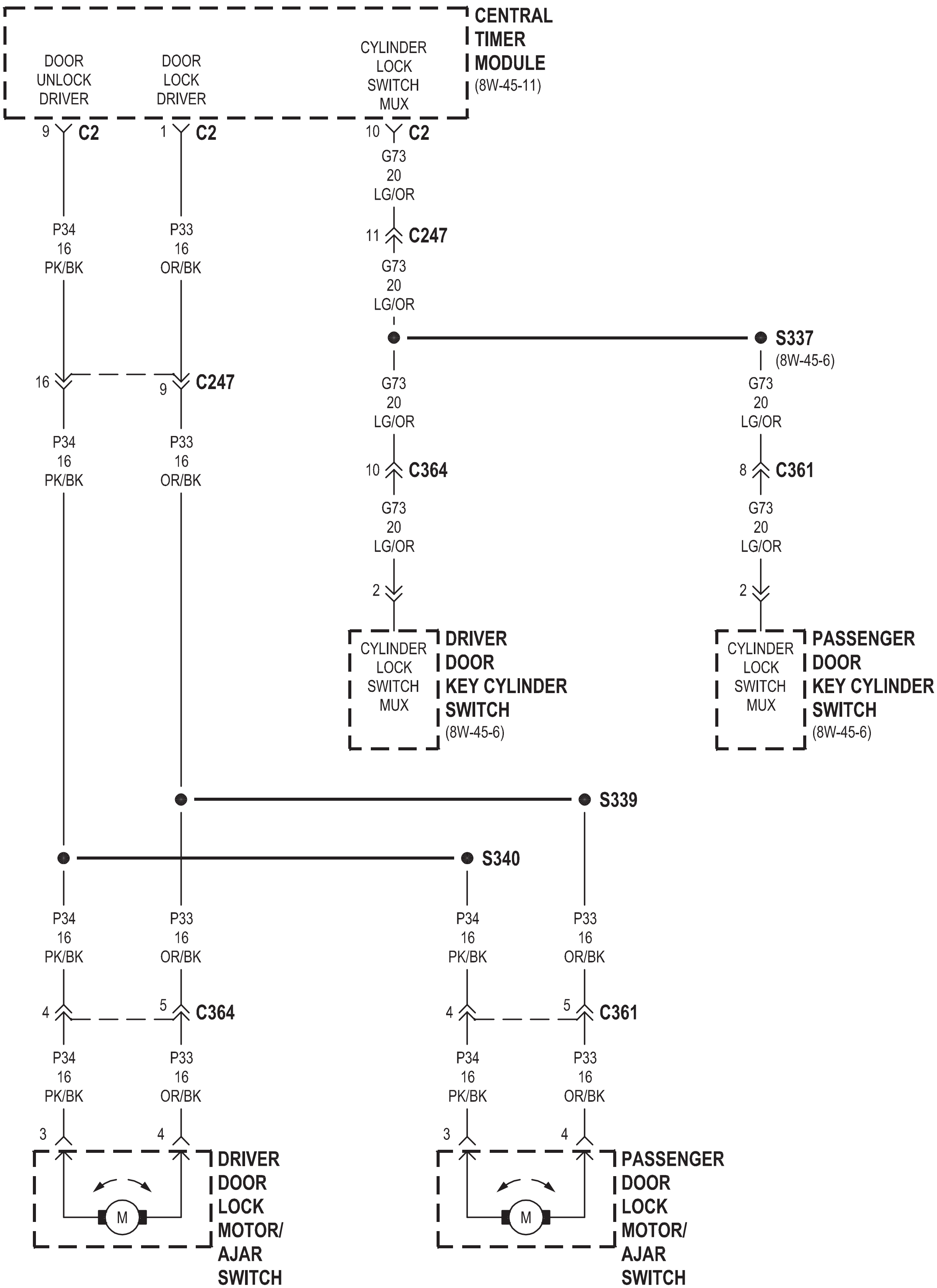
8W-61 POWER DOOR LOCKS

Component	Page
Central Timer Module	8W-61-2, 3, 4, 5, 6
Circuit Breaker 20 (JB)	8W-61-3, 5
Driver Door Key Cylinder Switch	8W-61-4
Driver Door Lock Motor/Ajar Switch	8W-61-4, 6
Driver Power Lock/Window Switch	8W-61-3, 5
Driver Unlock Relay	8W-61-6
Fuse 11 (JB)	8W-61-2
Fuse 13 (JB)	8W-61-2, 3, 5, 6
Fuse 2 (JB)	8W-61-5
Fuse 6 (JB)	8W-61-2
G200	8W-61-3, 5
G202	8W-61-2
G203	8W-61-2
Junction Block	8W-61-2, 3, 5, 6
Left Rear Door Lock Motor/Ajar Switch	8W-61-6
Passenger Door Key Cylinder Switch	8W-61-4
Passenger Door Lock Motor/Ajar Switch	8W-61-4, 6
Passenger Door Lock Switch	8W-61-5
Passenger Power Lock/Window Switch	8W-61-3
Right Rear Door Lock Motor/Ajar Switch	8W-61-6
RKE Antenna	8W-61-2

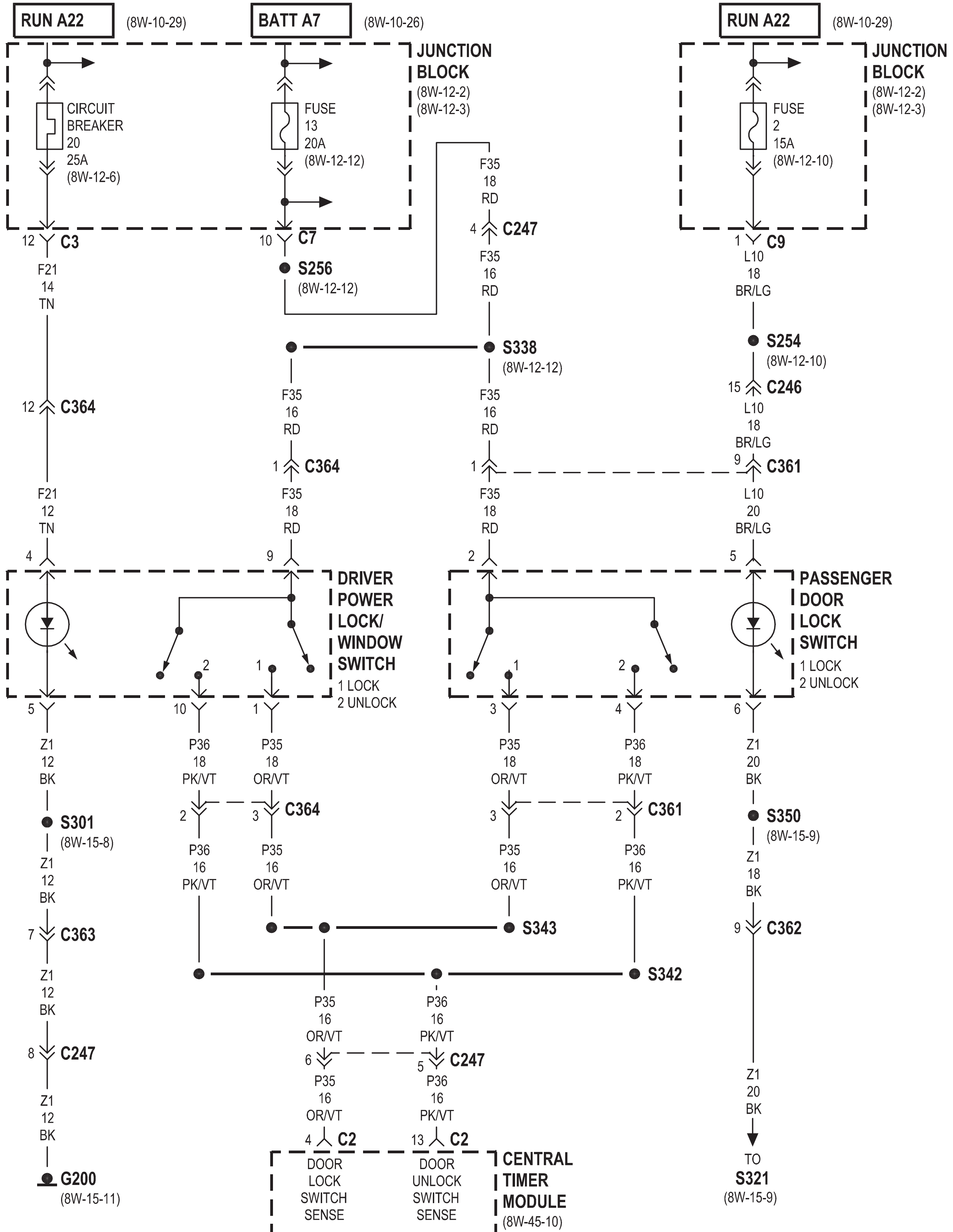

BATT A7
(8W-10-26)
RUN-ACC A31
(8W-10-30)
ST-RUN A21
(8W-10-28)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
13
20A
(8W-12-12)
FUSE
6
20A
(8W-12-7)
FUSE
11
10A
(8W-12-9)
5 C8
1 C5
7 C4
F35
18
RD
V6
16
DB
F12
20
DB/WT
14 C1
8 C1
5 C2
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
CENTRAL TIMER MODULE
(8W-45-2)
RKE ANTENNA
GROUND
GROUND
3 C2
6 C1
Z1
16
BK
Z2
18
BK/LG
G202
(8W-15-14)
G203
(8W-15-14)

2 DOOR


RUN A22
(8W-10-29)
BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER 20 25A (8W-12-6)
FUSE 13 20A (8W-12-12)
C3
C7
F21 14 TN
F35 18 RD
C247
F35 16 RD
S336
(8W-12-6)
S338
(8W-12-12)
C363
C364
DRIVER POWER LOCK/ WINDOW SWITCH
1 LOCK
2 UNLOCK
C362
Z1 14 BK
P36 16 PK/VT
P35 16 OR/VT
C361
S301
(8W-15-8)
P35 16 LG/BK
PASSENGER POWER LOCK/ WINDOW SWITCH
1 LOCK
2 UNLOCK
P38 16 OR/WT
P37 16 LG
Z1 20 BK
Z1 12 BK
G200
(8W-15-11)
C2
DOOR LOCK RELAY CONTROL
UNLOCK RELAY OUTPUT
CENTRAL TIMER MODULE
(8W-45-9)
TO S321
(8W-15-9)

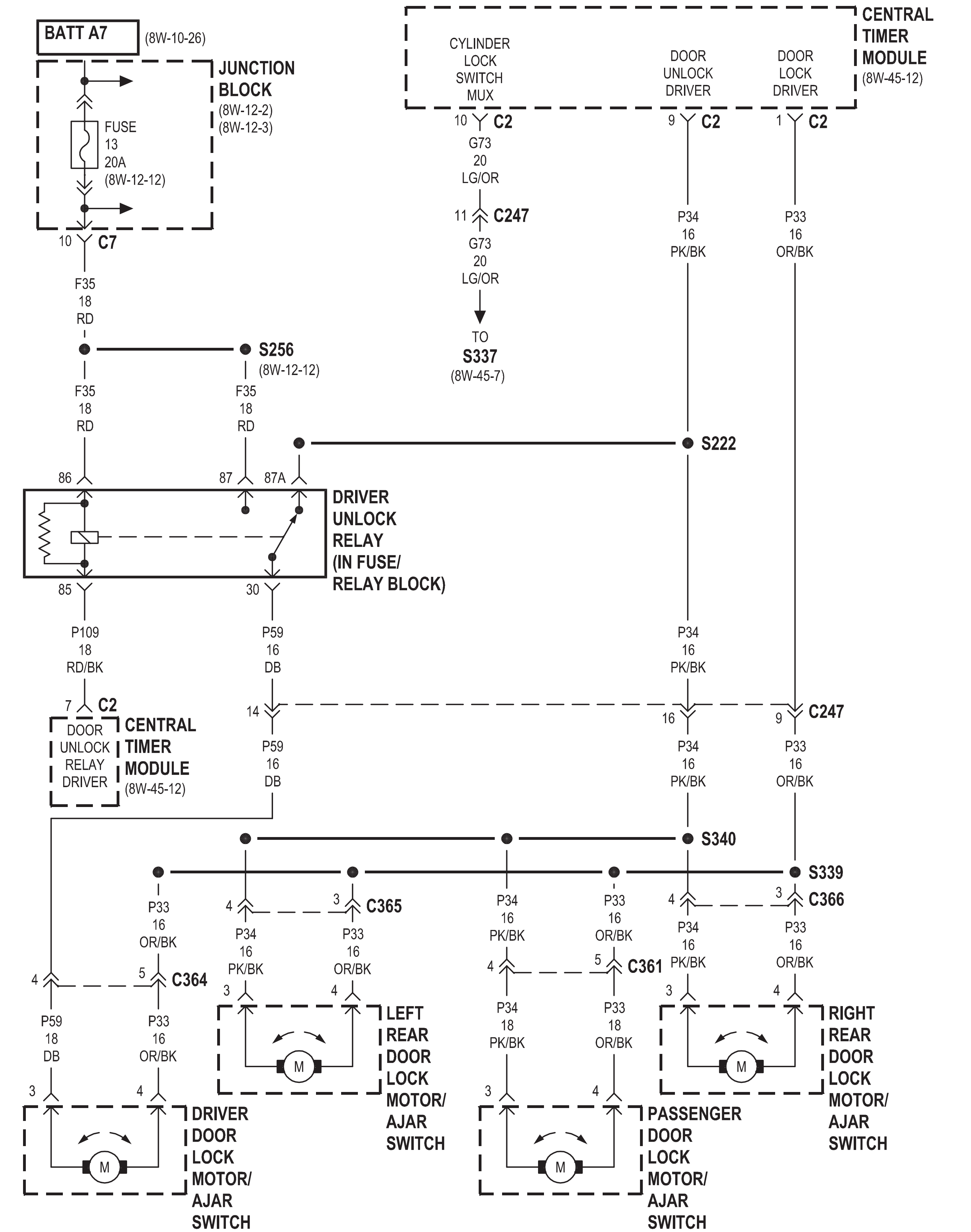

CENTRAL
TIMER
MODULE
(8W-45-11)
DOOR
UNLOCK
DRIVER
DOOR
LOCK
DRIVER
CYLINDER
LOCK
SWITCH
MUX
9 C2
1 C2
10 C2
G73
20
LG/OR
11 C247
P34
16
PK/BK
P33
16
OR/BK
S337
(8W-45-6)
16
9 C247
10 C364
8 C361
2
DRIVER
DOOR
KEY CYLINDER
SWITCH
(8W-45-6)
PASSENGER
DOOR
KEY CYLINDER
SWITCH
(8W-45-6)
S339
S340
4
5 C364
5 C361
3
4
M
DRIVER
DOOR
LOCK
MOTOR/
AJAR
SWITCH
PASSENGER
DOOR
LOCK
MOTOR/
AJAR
SWITCH

8W-61 POWER DOOR LOCKS
4 DOOR



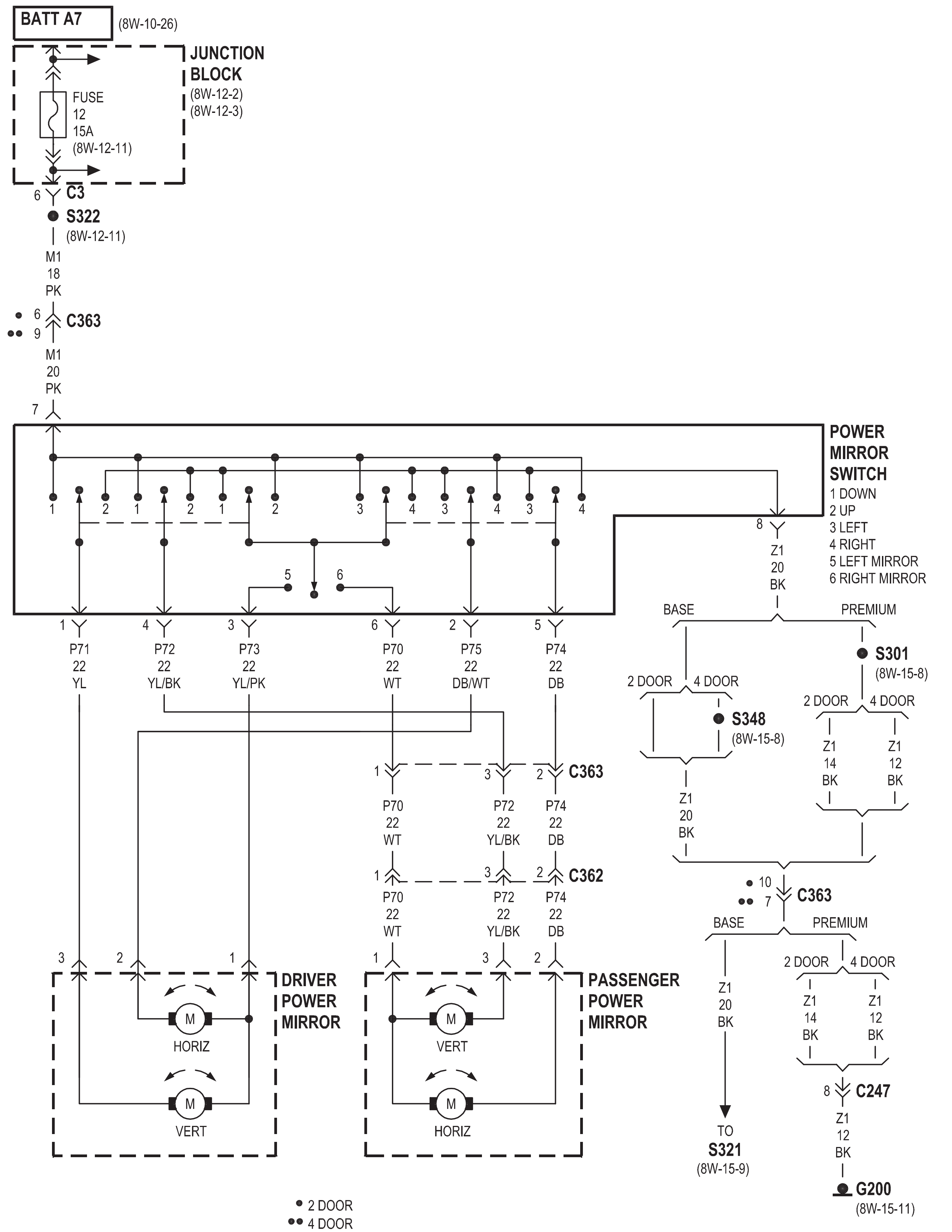
AN006105 J008W-1

4 DOOR


BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 13 20A (8W-12-12)
10 C7
F35 18 RD
S256
(8W-12-12)
F35 18 RD
F35 18 RD
CENTRAL TIMER MODULE
(8W-45-12)
CYLINDER LOCK SWITCH MUX
DOOR UNLOCK DRIVER
DOOR LOCK DRIVER
10 C2
9 C2
1 C2
G73 20 LG/OR
11 C247
G73 20 LG/OR
TO S337
(8W-45-7)
P34 16 PK/BK
P33 16 OR/BK
S222
86
87
87A
DRIVER UNLOCK RELAY (IN FUSE/ RELAY BLOCK)
85
30
P109 18 RD/BK
7 C2
DOOR UNLOCK RELAY DRIVER
CENTRAL TIMER MODULE
(8W-45-12)
P59 16 DB
14
16
9 C247
P59 16 DB
P34 16 PK/BK
P33 16 OR/BK
S340
S339
P33 16 OR/BK
4
5 C364
P59 18 DB
P33 16 OR/BK
3
4
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
4
3 C365
P34 16 PK/BK
P33 16 OR/BK
3
4
LEFT REAR DOOR LOCK MOTOR/ AJAR SWITCH
P34 16 PK/BK
P33 16 OR/BK
4
5 C361
P34 18 PK/BK
P33 18 OR/BK
3
4
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
4
3 C366
P34 16 PK/BK
P33 16 OR/BK
3
4
RIGHT REAR DOOR LOCK MOTOR/ AJAR SWITCH
M

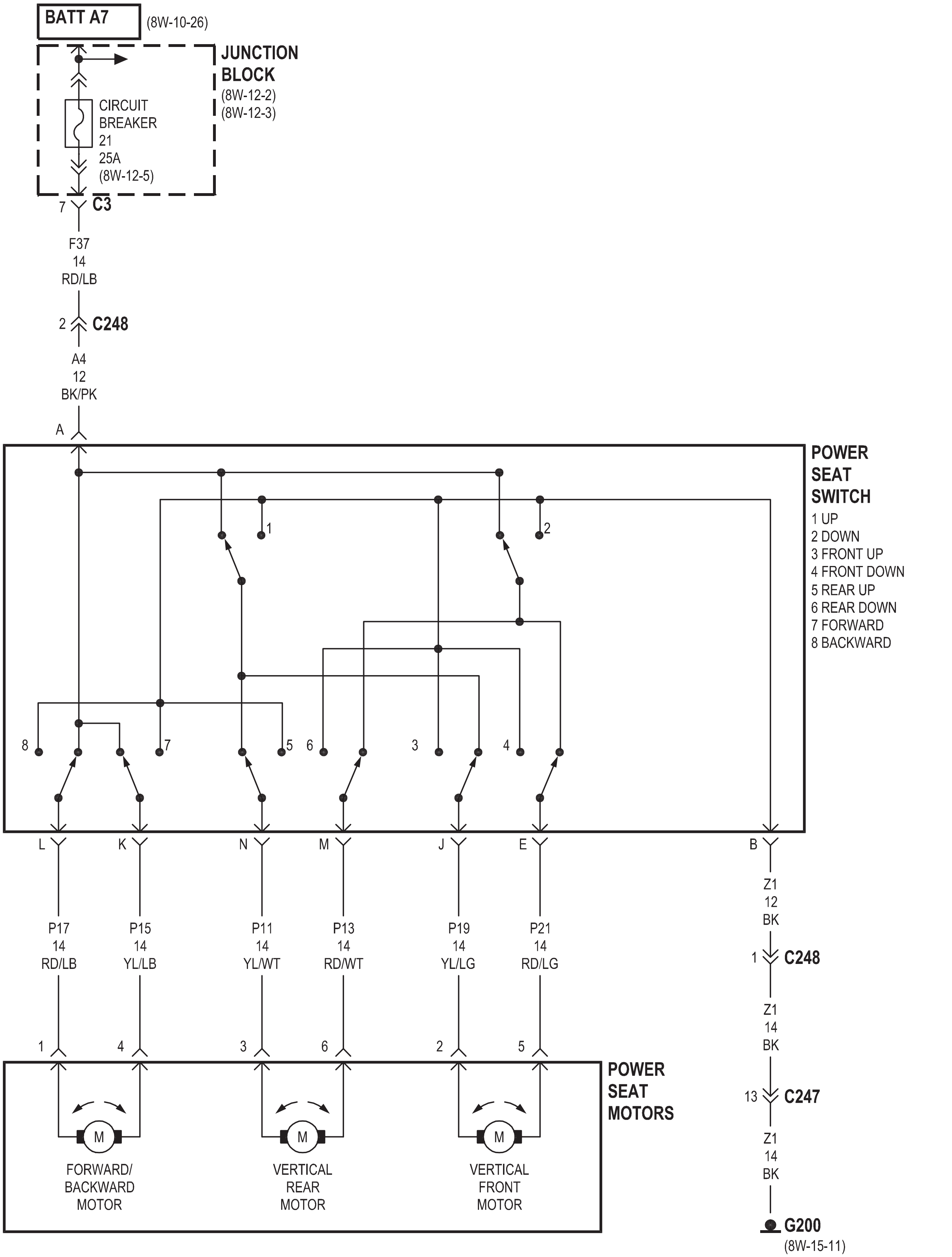
8W-62 POWER MIRRORS

Component	Page
Driver Power Mirror	8W-62-2
Fuse 12 (JB)	8W-62-2
G200	8W-62-2
Junction Block	8W-62-2
Passenger Power Mirror	8W-62-2
Power Mirror Switch	8W-62-2


BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
15A
(8W-12-11)
C3
S322
(8W-12-11)
M1
18
PK
C363
M1
20
PK
POWER MIRROR SWITCH
1 DOWN
2 UP
3 LEFT
4 RIGHT
5 LEFT MIRROR
6 RIGHT MIRROR
Z1
20
BK
BASE
PREMIUM
P71
22
YL
P72
22
YL/BK
P73
22
YL/PK
P70
22
WT
P75
22
DB/WT
P74
22
DB
2 DOOR
4 DOOR
S301
(8W-15-8)
S348
(8W-15-8)
Z1
14
BK
Z1
12
BK
C363
C362
DRIVER POWER MIRROR
PASSENGER POWER MIRROR
HORIZ
VERT
M
TO
S321
(8W-15-9)
C247
G200
(8W-15-11)
2 DOOR
4 DOOR

8W-63 POWER SEAT

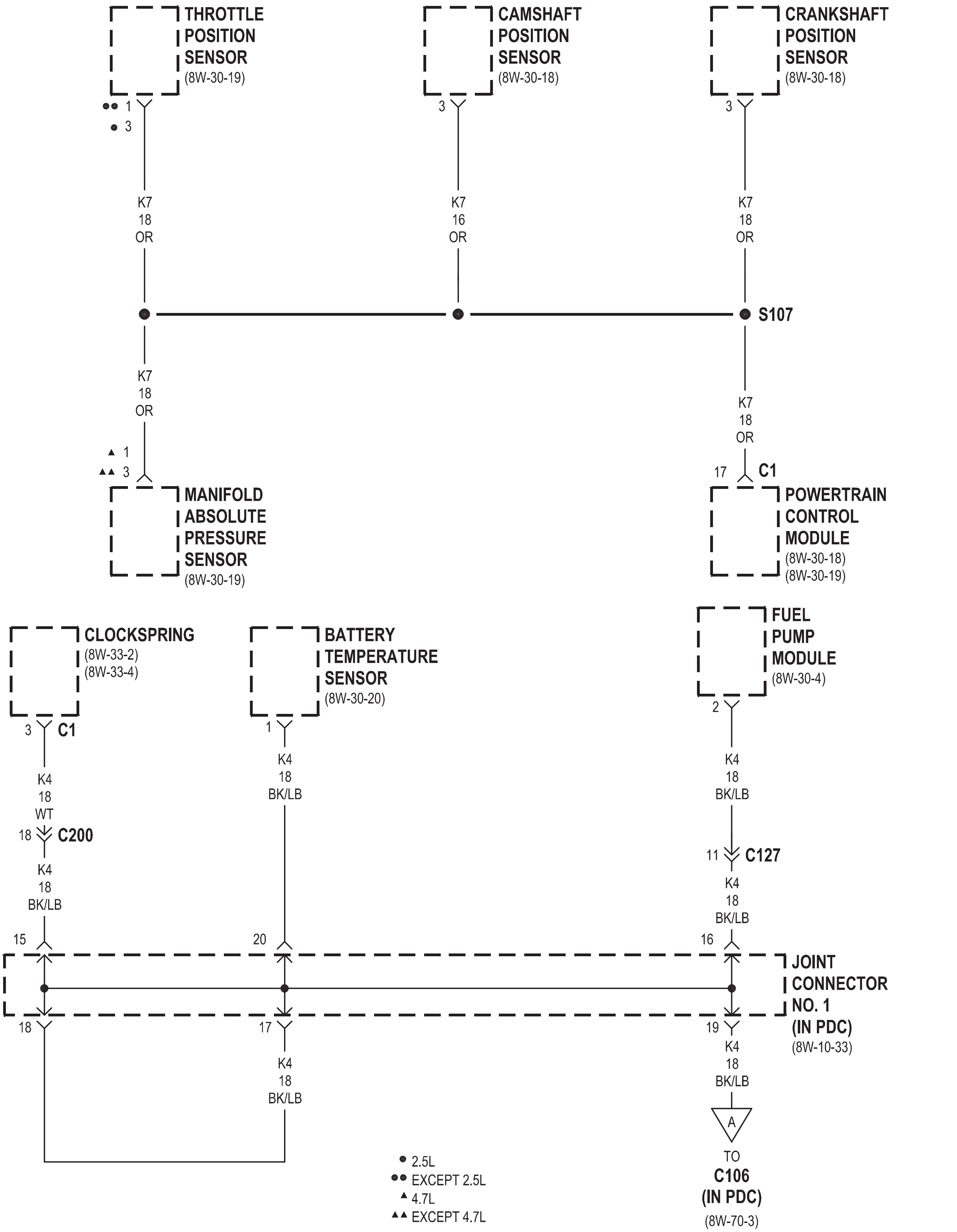
Component	Page
Circuit Breaker 21	8W-63-2
G200	8W-63-2
Junction Block	8W-63-2
Power Seat Motors	8W-63-2
Power Seat Switch	8W-63-2

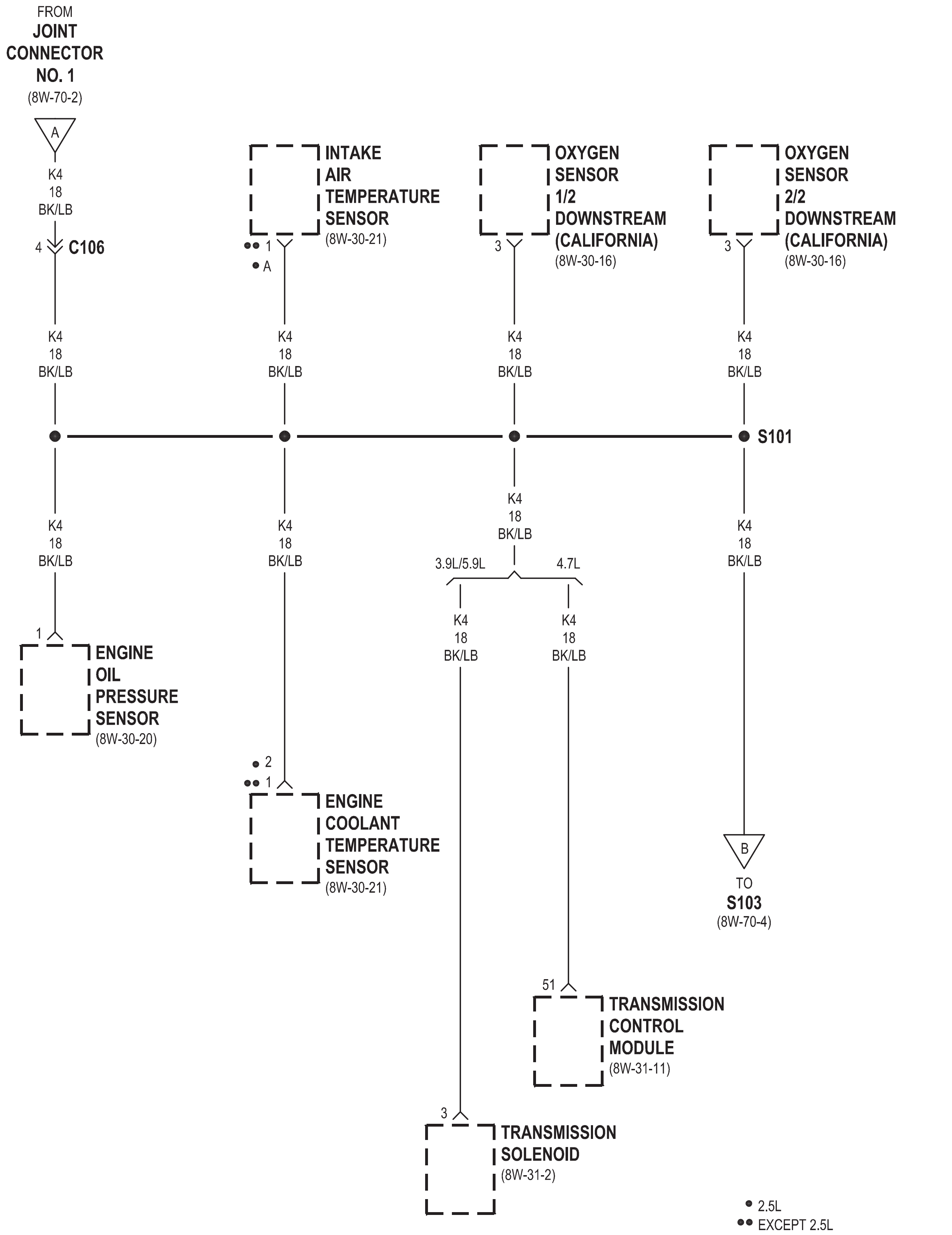

BATT A7
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER 21 25A (8W-12-5)
7 C3
F37 14 RD/LB
2 C248
A4 12 BK/PK
A
POWER SEAT SWITCH
1 UP
2 DOWN
3 FRONT UP
4 FRONT DOWN
5 REAR UP
6 REAR DOWN
7 FORWARD
8 BACKWARD
L K N M J E B
P17 14 RD/LB
P15 14 YL/LB
P11 14 YL/WT
P13 14 RD/WT
P19 14 YL/LG
P21 14 RD/LG
Z1 12 BK
1 C248
Z1 14 BK
13 C247
Z1 14 BK
G200
(8W-15-11)
POWER SEAT MOTORS
M
FORWARD/ BACKWARD MOTOR
VERTICAL REAR MOTOR
VERTICAL FRONT MOTOR

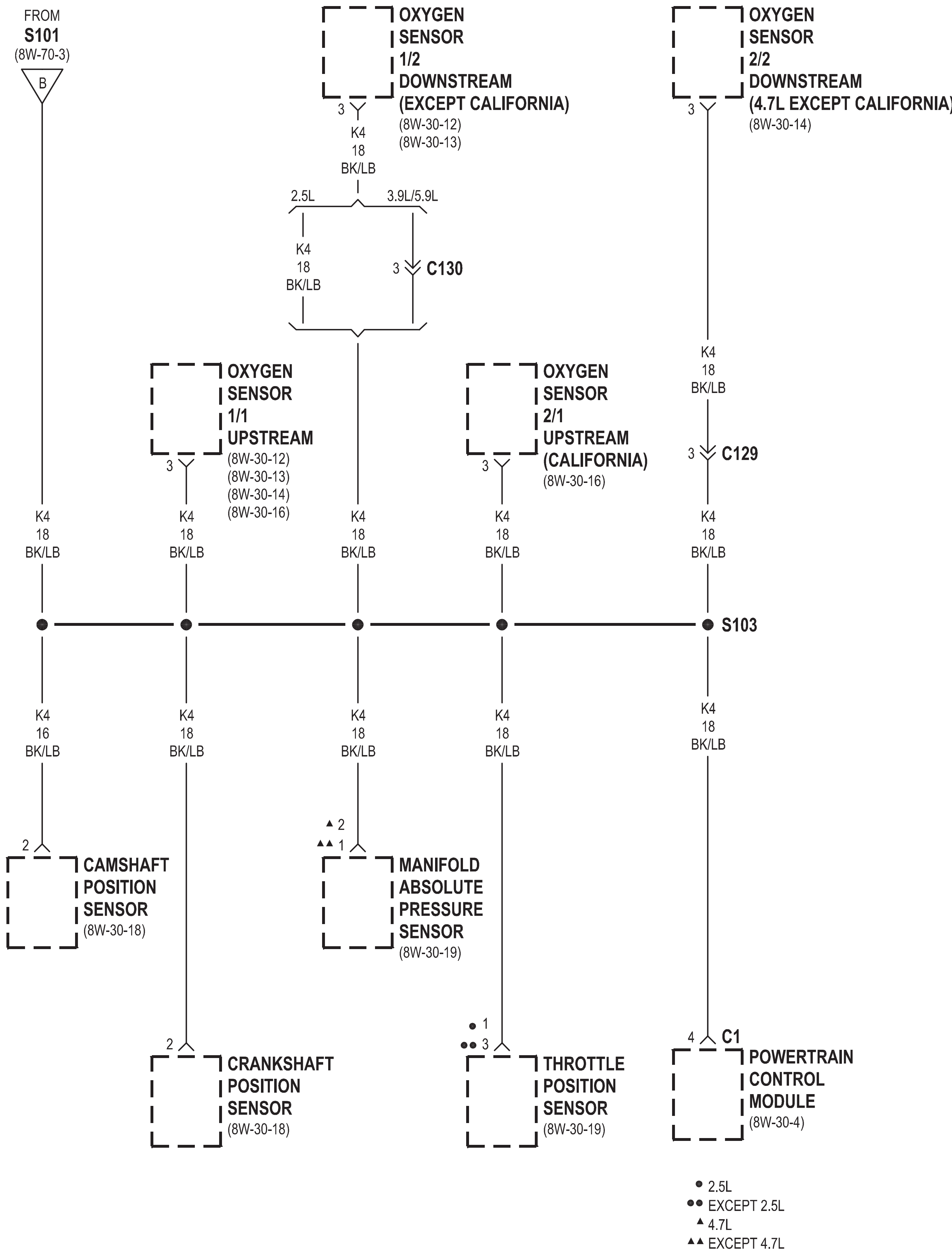
8W-70 SPLICE INFORMATION

Component	Page
S101	8W-70-3
S103	8W-70-4
S105	8W-15-7
S106	8W-10-18, 19
S107	8W-70-2
S108	8W-15-6
S109	8W-15-2
S110	8W-10-19
S113	8W-15-4
S115	8W-30-25
S124	8W-50-5
S125	8W-12-5
S127	8W-15-5
S128	8W-51-5
S129	8W-10-17
S156	8W-31-3
S159	8W-12-5
S161	8W-10-27
S162	8W-10-25
S163	8W-12-10
S164	8W-50-4, 6
S166	8W-15-4
S168	8W-50-4, 6
S169	8W-10-14
S170	8W-15-2
S171	8W-30-17
S172	8W-10-18, -19, 20
S173	8W-30-19
S174	8W-31-4
S175	8W-10-15
S176	8W-15-7
S177	8W-30-18
S178	8W-31-9
S179	8W-10-23
S180	8W-10-23
S181	8W-10-20, 21
S182	8W-10-22
S183	8W-10-22
S184	8W-10-31
S185	8W-12-9
S186	8W-30-17
S187	8W-10-15
S188	8W-10-23
S189	8W-31-4
S190	8W-31-4
S191	8W-30-28
S200	8W-40-8
S201	8W-15-11
S202	8W-45-3
S204	8W-45-13
S205	8W-12-7
S207	8W-47-6

Component	Page
S208	8W-47-6
S213	8W-12-13
S214	8W-15-11
S217	8W-42-6
S218	8W-12-5
S221	8W-42-4, 5
S222	8W-11-7
S223	8W-15-14
S225	8W-12-5
S252	8W-12-8
S253	8W-10-28
S254	8W-12-10
S256	8W-12-12
S257	8W-10-24
S258	8W-12-6
S259	8W-10-15
S260	8W-10-24
S261	8W-31-5
S301	8W-15-8
S306	8W-15-3
S314	8W-51-3
S316	8W-12-14
S317	8W-51-6
S318	8W-51-6
S320	8W-12-9
S321	8W-15-9
S322	8W-12-11
S324	8W-12-17
S330	8W-47-5
S331	8W-47-5
S332	8W-47-2, -3, 5
S333	8W-47-2, -3, 5
S336	8W-12-6
S337	8W-45-6, 7
S338	8W-12-12
S339	8W-11-7
S340	8W-11-7
S341	8W-11-4
S342	8W-45-10
S343	8W-45-10
S344	8W-15-12, 13
S345	8W-45-5, 8
S346	8W-60-4
S347	8W-15-13
S348	8W-15-8
S349	8W-15-13
S350	8W-15-9
S351	8W-15-10
S401	8W-15-3
S404	8W-15-3
S405	8W-12-14
S406	8W-15-3


THROTTLE POSITION SENSOR
(8W-30-19)
CAMSHAFT POSITION SENSOR
(8W-30-18)
CRANKSHAFT POSITION SENSOR
(8W-30-18)
●● 1
● 3
3
3
K7
18
OR
K7
16
OR
K7
18
OR
S107
K7
18
OR
K7
18
OR
▲ 1
▲▲ 3
17
C1
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-19)
POWERTRAIN CONTROL MODULE
(8W-30-18)
(8W-30-19)
CLOCKSPRING
(8W-33-2)
(8W-33-4)
BATTERY TEMPERATURE SENSOR
(8W-30-20)
FUEL PUMP MODULE
(8W-30-4)
3
C1
1
2
K4
18
WT
K4
18
BK/LB
K4
18
BK/LB
18
C200
11
C127
K4
18
BK/LB
K4
18
BK/LB
15
20
16
JOINT CONNECTOR NO. 1 (IN PDC)
(8W-10-33)
18
17
19
K4
18
BK/LB
K4
18
BK/LB
A
TO
C106
(IN PDC)
(8W-70-3)
● 2.5L
●● EXCEPT 2.5L
▲ 4.7L
▲▲ EXCEPT 4.7L


FROM
JOINT CONNECTOR NO. 1
(8W-70-2)
A
K4 18 BK/LB
4 C106
INTAKE AIR TEMPERATURE SENSOR
(8W-30-21)
1
A
OXYGEN SENSOR 1/2 DOWNSTREAM (CALIFORNIA)
(8W-30-16)
3
OXYGEN SENSOR 2/2 DOWNSTREAM (CALIFORNIA)
(8W-30-16)
3
K4 18 BK/LB
S101
3.9L/5.9L
4.7L
1
ENGINE OIL PRESSURE SENSOR
(8W-30-20)
2
1
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-21)
B
TO
S103
(8W-70-4)
51
TRANSMISSION CONTROL MODULE
(8W-31-11)
3
TRANSMISSION SOLENOID
(8W-31-2)
• 2.5L
•• EXCEPT 2.5L


FROM
S101
(8W-70-3)
B
OXYGEN SENSOR 1/2 DOWNSTREAM (EXCEPT CALIFORNIA)
(8W-30-12)
(8W-30-13)
OXYGEN SENSOR 2/2 DOWNSTREAM (4.7L EXCEPT CALIFORNIA)
(8W-30-14)
K4 18 BK/LB
2.5L
3.9L/5.9L
C130
C129
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-12)
(8W-30-13)
(8W-30-14)
(8W-30-16)
OXYGEN SENSOR 2/1 UPSTREAM (CALIFORNIA)
(8W-30-16)
S103
K4 16 BK/LB
CAMSHAFT POSITION SENSOR
(8W-30-18)
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-19)
CRANKSHAFT POSITION SENSOR
(8W-30-18)
THROTTLE POSITION SENSOR
(8W-30-19)
C1
POWERTRAIN CONTROL MODULE
(8W-30-4)
● 2.5L
●● EXCEPT 2.5L
▲ 4.7L
▲▲ EXCEPT 4.7L

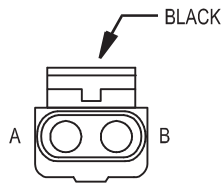
8W-80 CONNECTOR PIN-OUTS

Component	Page
4WD Switch	8W-80-4
A/C Compressor Clutch	8W-80-4
A/C- Heater Control	8W-80-4
A/C High Pressure Switch	8W-80-4
A/C Low Pressure Switch	8W-80-5
Airbag Control Module	8W-80-5
Ambient Temperature Sensor	8W-80-5
Ash Receiver Lamp	8W-80-6
Automatic Day/Night Mirror	8W-80-6
Back-Up Lamp Switch	8W-80-6
Base Console	8W-80-6
Battery Temperature Sensor	8W-80-6
Blower Motor	8W-80-7
Blower Motor Relay	8W-80-7
Blower Resistor Block	8W-80-7
Brake Lamp Switch	8W-80-7
Brake Pressure Switch	8W-80-7
C105	8W-80-8
C106	8W-80-8
C111	8W-80-8
C126	8W-80-8
C127	8W-80-9
C128	8W-80-9
C129	8W-80-9
C130	8W-80-9
C200	8W-80-10, 11
C246	8W-80-12
C247	8W-80-12
C248	8W-80-13
C323	8W-80-13
C325	8W-80-13
C329	8W-80-13
C341	8W-80-13
C360	8W-80-14
C361	8W-80-14
C362	8W-80-15
C363	8W-80-15, 16
C364	8W-80-16
C365	8W-80-17
Camshaft Position Sensor	8W-80-17
Capacitor No. 1	8W-80-18
Capacitor No. 2	8W-80-18
Cargo Lamp No. 1	8W-80-18
Cargo Lamp No. 2	8W-80-18
Center High Mounted Stop Lamp	8W-80-18
Central Timer Module	8W-80-19, 20
Cigar Lighter	8W-80-20
ClockSpring	8W-80-20, 21
Clutch Interlock Switch	8W-80-21
Clutch Interlock Switch Jumper	8W-80-21
Coil On Plug No. 1	8W-80-22
Coil On Plug No. 2	8W-80-22
Coil On Plug No. 3	8W-80-22
Coil On Plug No. 4	8W-80-22
Coil On Plug No. 5	8W-80-23
Coil On Plug No. 6	8W-80-23
Coil On Plug No. 7	8W-80-23
Coil On Plug No. 8	8W-80-23
Controller Anti-Lock Brake	8W-80-24
Crankshaft Position Sensor	8W-80-24
Data Link Connector	8W-80-25
Daytime Running Lamp Module	8W-80-25
Dome Lamp	8W-80-25
Driver Door Ajar Switch	8W-80-21
Driver Airbag	8W-80-26
Driver Door Key Cylinder Switch	8W-80-26
Driver Door Lock/Motor Ajar Switch	8W-80-26
Driver Door Window Motor	8W-80-27
Driver Power Lock/Window Switch	8W-80-27
Driver Power Mirror	8W-80-27
Engine Coolant Temperature Sensor	8W-80-28
Engine Oil Pressure Sensor	8W-80-28
Fuel Injector No. 1	8W-80-29
Fuel Injector No. 2	8W-80-29
Fuel Injector No. 3	8W-80-29, 30
Fuel Injector No. 4	8W-80-30
Fuel Injector No. 5	8W-80-30
Fuel Injector No. 6	8W-80-31
Fuel Injector No. 7	8W-80-31
Fuel Injector No. 8	8W-80-31
Fuel Pump Module	8W-80-32

Component	Page
Generator	8W-80-32
Glove Box Lamp	8W-80-32
Headlamp Switch	8W-80-32, 33
Heater Control	8W-80-4
High Note Horn	8W-80-33
Idle Air Control Motor	8W-80-33
Ignition Coil	8W-80-34
Ignition Switch	8W-80-34
Input Speed Sensor	8W-80-34
Instrument Cluster	8W-80-35
Intake Air Temperature Sensor	8W-80-35
Joint Connector No. 1	8W-80-36
Joint Connector No. 2	8W-80-37
Joint Connector No. 3	8W-80-38
Joint Connector No. 4	8W-80-38
Junction Block	8W-80-39, 40, 41
Key-In Switch	8W-80-41
Leak Detection Pump	8W-80-42
Left Back-Up Lamp	8W-80-42
Left Door Speaker	8W-80-42
Left Door Tweeter	8W-80-43
Left Door Woofer	8W-80-43
Left Fog Lamp	8W-80-43
Left Front Park/Turn Signal Lamp No. 1	8W-80-43
Left Front Park/Turn Signal Lamp No. 2	8W-80-44
Left Front Side Marker Lamp	8W-80-44
Left Front Wheel Speed Sensor	8W-80-44
Left Headlamp	8W-80-44
Left License Lamp	8W-80-45
Left Rear Door Ajar Switch	8W-80-45
Left Rear Door Lock Motor/Ajar Switch	8W-80-45
Left Rear Door Speaker	8W-80-45
Left Rear Speaker	8W-80-45
Left Rear Window Motor	8W-80-46
Left Rear Window Switch	8W-80-46

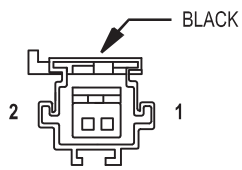
Component	Page
Left Remote Radio Switch	8W-80-46
Left Speed Control Switch	8W-80-46
Left Tail/Stop/Turn Signal Lamp	8W-80-46
License Lamp	8W-80-47
Line Pressure Sensor	8W-80-47
Low Note Horn	8W-80-47
Manifold Absolute Pressure Sensor	8W-80-47
Multi- Function Switch	8W-80-48
Output Speed Sensor	8W-80-49
Overdrive Switch	8W-80-49
Overhead Console	8W-80-50
Oxygen Sensor 1/1 Upstream	8W-80-50
Oxygen Sensor 1/2 Downstream	8W-80-51
Oxygen Sensor 2/1 Upstream	8W-80-51
Oxygen Sensor 2/2 Downstream	8W-80-52
Park/Neutral Position Switch	8W-80-52
Passenger Airbag	8W-80-53
Passenger Airbag On/Off Switch	8W-80-53
Passenger Door Ajar Switch	8W-80-53
Passenger Door Key Cylinder Switch	8W-80-53
Passenger Door Lock Motor/Ajar Switch	8W-80-54
Passenger Door Lock Switch	8W-80-54
Passenger Door Window Motor	8W-80-54
Passenger Door Window Switch	8W-80-54
Passenger Power Lock/Window Switch	8W-80-55
Passenger Power Mirror	8W-80-55
Power Amplifier	8W-80-55
Power Mirror Switch	8W-80-56
Power Outlet	8W-80-56
Power Seat Motors	8W-80-56
Power Seat Switch	8W-80-56
Power Steering Pressure Switch	8W-80-56, 57
Powertrain Control Module	8W-80-57, 58, 59, 60, 61
PRNDL	8W-80-62
Proportional Purge Solenoid	8W-80-62

Component	Page
Radiator Fan Motor	8W-80-62
Radio	8W-80-63
Rear Wheel Speed Sensor	8W-80-63
Rear Window Defogger Switch	8W-80-63
Right Back-Up Lamp	8W-80-64
Right Door Speaker	8W-80-64
Right Door Tweeter	8W-80-64
Right Door Woofer	8W-80-64
Right Fog Lamp	8W-80-65
Right Front Park/Turn Signal Lamp No. 1	8W-80-65
Right Front Park/Turn Signal Lamp No. 2	8W-80-65
Right Front Side Marker Lamp	8W-80-65
Right Front Wheel Speed Sensor	8W-80-65
Right Headlamp	8W-80-66
Right License Lamp	8W-80-66
Right Rear Door Ajar Switch	8W-80-66
Right Rear Door Lock Motor/Ajar Switch	8W-80-66
Right Rear Door Speaker	8W-80-66
Right Rear Speaker	8W-80-66
Right Rear Window Motor	8W-80-67
Right Rear Window Switch	8W-80-67
Right Remote Radio Switch	8W-80-67
Right Speed Control Switch	8W-80-67
Right Tail/Stop/Turn Signal Lamp	8W-80-67
Seat Belt Switch	8W-80-68
Shift Bezel Lamp	8W-80-68
Throttle Position Sensor	8W-80-68
Trailer Tow Connector	8W-80-68
Transmission Control Module	8W-80-69, 70
Transmission Solenoid	8W-80-70
Transmission Solenoid Assembly	8W-80-71
Underhood Lamp/Switch	8W-80-71
Vehicle Speed Control Servo	8W-80-72
Washer Fluid Level Sensor	8W-80-72
Windshield Washer Pump	8W-80-72
Wiper Motor	8W-80-72



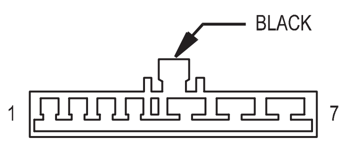
4WD SWITCH

CAV	CIRCUIT	FUNCTION
A	Z1 20BK	GROUND
B	G107 20BK/RD	4WD SWITCH SENSE



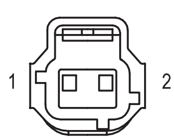
A/C COMPRESSOR CLUTCH (EXCEPT 2.5L)

CAV	CIRCUIT	FUNCTION
1	C3 18DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z1 18BK	GROUND



A/C-HEATER CONTROL OR HEATER CONTROL

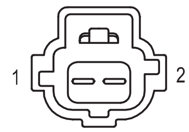
CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS FEED
2	C90 20LG/WT	A/C SELECT INPUT
3	C4 16TN	BLOWER MOTOR LOW DRIVER
4	C5 14LG/YL	BLOWER MOTOR M1 DRIVER
5	C6 14LB	BLOWER MOTOR M2 DRIVER
6	C7 10BK/TN	BLOWER MOTOR HIGH DRIVER
7	Z1 10BK	GROUND



A/C HIGH PRESSURE SWITCH

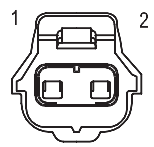
CAV	CIRCUIT	FUNCTION
1	C90 18LG ●●	A/C SELECT INPUT
1	C90 20LG/WT ●	A/C SELECT INPUT
2	C22 18DB/WT	A/C SELECT INPUT

● EXCEPT 4.7L
●● 4.7L



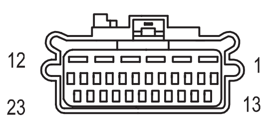
A/C LOW PRESSURE SWITCH (4.7L)

CAV	CIRCUIT	FUNCTION
1	C20 18BR	A/C SWITCH SENSE
2	C22 18DB/WT	PRESSURE SWITCH OUTPUT



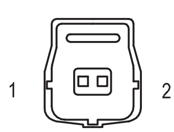
A/C LOW PRESSURE SWITCH (EXCEPT 4.7L)

CAV	CIRCUIT	FUNCTION
1	C20 20BR	A/C SWITCH SENSE
2	C22 18DB/WT	PRESSURE SWITCH OUTPUT



AIRBAG CONTROL MODULE

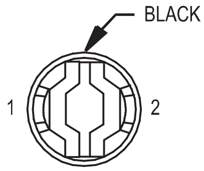
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	Z6 18BK/PK	GROUND
5	R43 18BK/LB	DRIVER AIRBAG LINE 1
6	R45 18DG/LB	DRIVER AIRBAG LINE 2
7	R142 18BR/YL •	PASSENGER AIRBAG SQUIB LINE 1
	R42 18BK/YL ••	PASSENGER AIRBAG LINE 1
8	R144 18VT/YL •	PASSENGER AIRBAG SQUIB LINE 2
	R44 18DG/YL ••	PASSENGER AIRBAG LINE 2
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-
14	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
15	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	D1 18VT/BR	CCD BUS(+)
22	D2 18 WT/BK	CCD BUS(-)
23	-	-



AMBIENT TEMPERATURE SENSOR

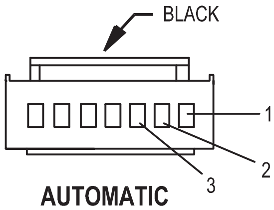
CAV	CIRCUIT	FUNCTION
1	G32 18BK/LB	SENSOR GROUND
2	G31 18VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL

• 2 DOOR
•• 4 DOOR



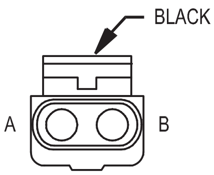
ASH RECEIVER LAMP

CAV	CIRCUIT	FUNCTION
1	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
2	Z1 20BK	GROUND



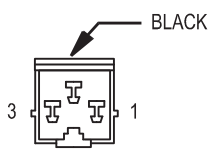
AUTOMATIC DAY/NIGHT MIRROR

CAV	CIRCUIT	FUNCTION
1	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	Z1 20BK	GROUND
3	L1 18VT/BK	BACK-UP LAMP FEED



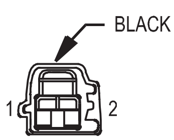
BACK-UP LAMP SWITCH (M/T)

CAV	CIRCUIT	FUNCTION
A	L1 20VT/BK	BACK-UP LAMP FEED
B	L10 20BR/LG	FUSED IGNITION SWITCH OUTPUT (RUN)



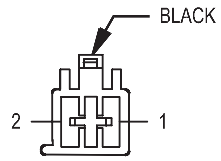
BASE CONSOLE

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M1 18PK	FUSED B(+)
3	M2 20YL	COURTESY LAMPS DRIVER



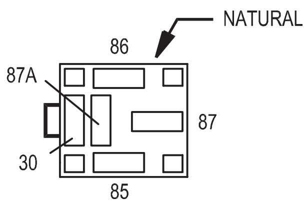
BATTERY TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL



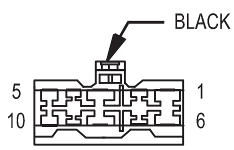
BLOWER MOTOR

CAV	CIRCUIT	FUNCTION
1	C1 10DG	BLOWER MOTOR FEED
2	H6 10GY	BLOWER MOTOR GROUND



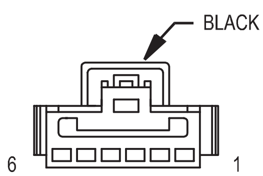
BLOWER MOTOR RELAY

CAV	CIRCUIT	FUNCTION
30	H6 10GY	BLOWER MOTOR GROUND
85	C90 20LG/WT	A/C SELECT INPUT
86	F25 20TN/LG	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
87	C7 10BK/TN	BLOWER MOTOR HIGH DRIVER
87A	C116 12LG/WT	HIGH SPEED RELAY OUTPUT



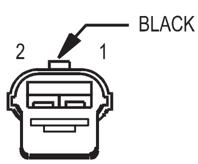
BLOWER RESISTOR BLOCK

CAV	CIRCUIT	FUNCTION
1	C5 14LG/YL	BLOWER MOTOR M1 DRIVER
2	-	-
3	C116 12LG/WT	HIGH SPEED RELAY OUTPUT
4	-	-
5	C4 16TN	BLOWER MOTOR LOW DRIVER
6	C7 10BK/TN	BLOWER MOTOR HIGH DRIVER
7	-	-
8	-	-
9	-	-
10	C6 14LB	BLOWER MOTOR M2 DRIVER



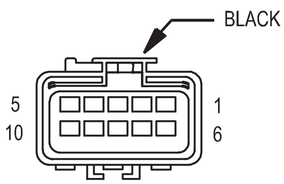
BRAKE LAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	F32 18PK/DB	FUSED B (+)
2	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
3	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
4	V32 20YL/RD	SPEED CONTROL POWER SUPPLY
5	Z1 20BK	GROUND
6	K29 20WT/PK	BRAKE SWITCH SENSE



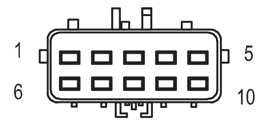
BRAKE PRESSURE SWITCH

CAV	CIRCUIT	FUNCTION
1	B10 20BR/WT	BRAKE PRESSURE SWITCH SENSE
2	Z1 20BK	GROUND



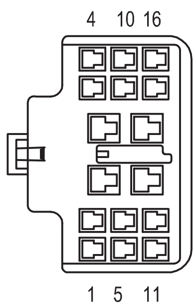
C105

CAV	CIRCUIT
1	K30 18PK ■
	T15 18LG ▲
2	T16 18RD ▲■
3	G7 18WT/OR
4	C20 20BR ●■
4	C20 18BR ▲
5	K52 18PK/BK
6	K125 18WT/DB
7	F84 18YL/WT ▲
8	A142 16DG/OR
9	F142 18OR/DG ▽▽
	F342 18DG/RD ◆
10	F242 18DG/PK ◆



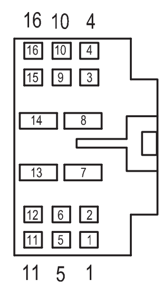
C105

CAV	CIRCUIT
1	K30 18PK ▲▲
	T15 18LG ▽
2	T16 16RD ●●
3	G7 18WT/OR
4	C20 18BR
5	K52 18PK/BK
6	K125 18WT/DB
7	F84 18YL/WT ▲
8	A142 14DG/OR
9	F142 18OR/DG ▽▽
	F342 18DG/RD ◆
10	F242 18DG/PK ◆



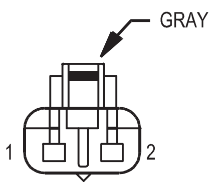
C106

CAV	CIRCUIT
1	C24 18DB/PK ■■
2	C3 18DB/BK
3	T41 18BK/WT
4	K4 18BK/LB
5	G107 20BK/RD ▲■
6	K125 18WT/DB
7	A142 14DG/OR ●■
	A142 16DG/OR ▲
8	Z12 16BK/TN
9	F12 18DB/WT
10	A81 18DG/RD ▽
11	C90 20LG/WT ●■
	C90 18LG ▲
12	L10 20BR/LG ◆◆▲
	L10 18BR/LG ▲▲
13	A14 16RD/WT
14	A41 14DB/YL ▽
15	F18 18LG/BK
16	L1 20VT/BK ◆◆▲
	L1 18VT/BK ▲▲



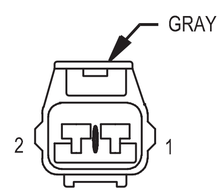
C106

CAV	CIRCUIT
1	C24 20DB/PK ■■
2	C3 18DB/BK
3	T41 18BK/WT
4	K4 18BK/LB
5	G107 20BK/RD ■■■
6	K125 18WT/DB
7	A142 14DG/OR
8	Z12 16BK/TN
9	F12 18DB/WT
10	A81 18DG/RD
11	C90 20LG/WT
12	L10 20BR/LG
13	A14 16RD/WT
14	A41 14DB/YL ▽
15	F18 20LG/BK
16	L1 20VT/BK



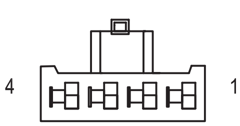
C111

CAV	CIRCUIT
1	M1 18PK
2	Z1 18BK



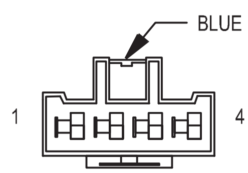
C111

CAV	CIRCUIT
1	M1 18PK
2	Z1 18BK



C126
(TRAILER TOW)

CAV	CIRCUIT
1	A6 12RD/BK
2	B40 12LB
3	L50 18WT/TN
4	Z1 12BK



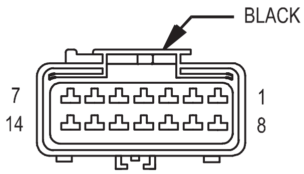
C126
(TRAILER TOW)

CAV	CIRCUIT
1	A6 14RD/TN
2	B40 14LB
3	L50 18WT/TN
4	Z1 14BK

■■■ 4WD
■■ EXCEPT 2.5L
■ 3.9L/5.9L

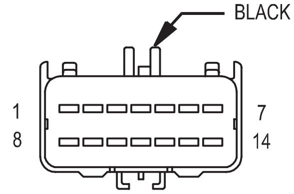
● 2.5L
●● A/T
▲ 4.7L
▲▲ A/T EXCEPT 4.7L

▽ A/T 4.7L
▽▽ EXCEPT 4.7L CALIFORNIA
◆ 4.7L CALIFORNIA
◆◆ M/T



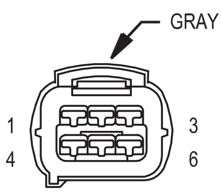
C127

CAV	CIRCUIT
1	L1 20VT/BK
2	L62 16BR/RD
3	L63 16DG/RD
4	A6 14RD/TN ●
5	L76 14BK/OR ●
6	B40 14LB ●
7	L50 18WT/TN
8	L7 20BK/YL
9	B113 20RD/VT
10	B114 20WT/VT
11	K4 18BK/LB
12	G4 18DB
13	A61 16DG/BK
14	Z1 16BK



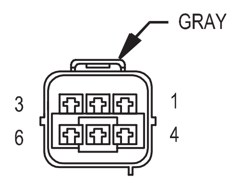
C127

CAV	CIRCUIT
1	L1 20VT/BK
2	L62 16BR/RD
3	L63 16DG/RD
4	A6 14RD/TN
5	L76 14BK/OR
6	B40 14LB
7	L50 18WT/TN
8	L7 20BK/YL
9	B113 20RD/VT
10	B114 20WT/VT
11	K4 18BK/LB
12	G4 18DB
13	A61 16DG/BK
14	Z1 16BK



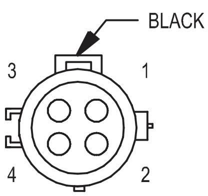
C128

CAV	CIRCUIT
1	D1 18VT/BR
2	D2 18WT/BK
3	D21 20PK
4	T10 18YL/DG
5	T6 18OR/WT
6	D22 20PK/BK



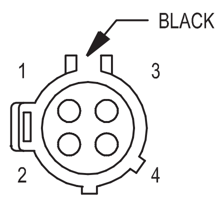
C128

CAV	CIRCUIT
1	D1 18VT/BR
2	D2 18WT/BK
3	D21 20PK/DB
4	T10 18YL/DG
5	T6 18OR/WT
6	D22 20PK/BK



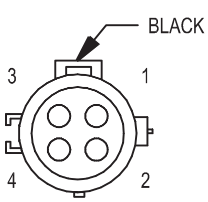
C129
(4.7L EXCEPT CALIFORNIA)

CAV	CIRCUIT
1	F142 18OR/DG
2	Z1 18BK
3	K4 18BK/LB
4	K141 18TN/WT



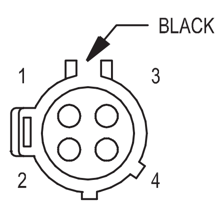
C129
(4.7L EXCEPT CALIFORNIA)

CAV	CIRCUIT
1	F142 18OR/DG
2	Z1 18BK
3	K4 18BK/LB
4	K141 18TN/WT



C130
(3.9L/5.9L)

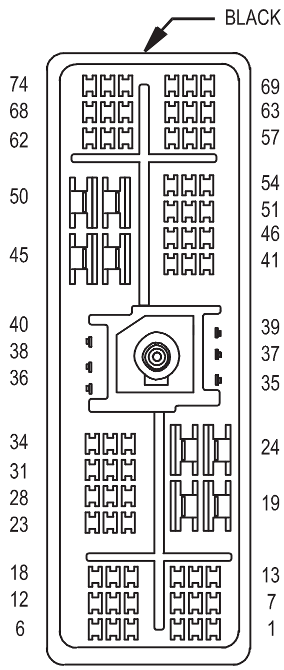
CAV	CIRCUIT
1	F142 18OR/DG
2	Z1 18BK
3	K4 18BK/LB
4	K341 18OR/BK



C130
(3.9L/5.9L)

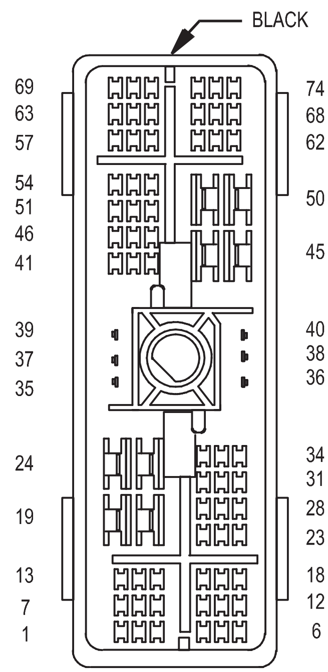
CAV	CIRCUIT
1	F142 18OR/DG
2	Z1 18BK
3	K4 18BK/LB
4	K141 18TN/WT

● TRAILER TOW



C200

CAV	CIRCUIT
1	-
2	V32 18YL/RD ●●
3	Z38 20BK/LG
4	L62 16BR/RD
5	L63 16DG/RD
6	C90 18LG/WT
7	V37 18RD/LG ●●
8	C90 20LG/WT
9	F18 20LG/BK
10	G107 20BK/RD ▲
11	V30 20DB/RD ▲▲
12	-
13	F32 18PK/DB
14	-
15	Z12 16BK/TN
16	-
17	-
18	K4 18BK/LB
19	-
20	-
21	L38 20LB/BK
22	V10 18BR
23	D21 18PK/DB
24	A1 12RD
25	A2 12PK/BK
26	-
27	G34 18RD/GY
28	-
29	D22 20PK/BK ■
30	D20 18LG
31	F12 18DB/WT
32	F24 20RD/DG
33	G11 20WT/BK ■■
34	A81 18DG/RD
35	X2 18DG/RD
36	F31 18VT
37	V48 18RD/GY
38	L3 18RD/OR
39	L4 18VT/WT
40	A41 14DB/YL
41	L7 20BK/YL
42	-



C200

CAV	CIRCUIT
1	-
2	V32 20YL/RD
3	Z38 20BK/LG ●
4	L62 16BR/RD
5	L63 16DG/RD
6	C90 20LG/WT
7	V37 18RD/LG
8	C90 20LG/WT
9	F18 20LG/BK
10	G107 20BK/RD
11	V30 20DB/RD
12	-
13	F32 18PK/DB
14	-
15	Z12 16BK/TN
16	-
17	-
18	K4 18WT
19	-
20	-
21	L38 20LB/BK ●
22	V10 18BR
23	D21 20PK/DB
24	A1 12RD
25	A2 12PK/BK
26	-
27	G34 18RD/GY
28	-
29	D22 20PK/BK
30	D20 20LG
31	F12 20DB/WT
32	F24 18RD/DG
33	G11 20WT/BK
34	A81 18DG/RD
35	X2 16DG/RD
36	F31 18VT
37	V48 16RD/GY
38	L3 18RD/OR
39	L4 18VT/WT
40	A41 14YL
41	L7 20BK/YL
42	-

● FOG LAMPS
●● EXCEPT 2.5L
▲ 4WD
▲▲ SPEED CONTROL
■ 4.7L
■■ DRL

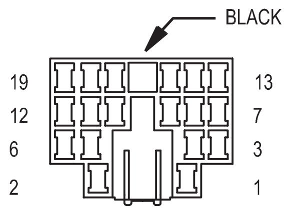
(CONTINUED ON NEXT PAGE)

(CONTINUED)

CAV	CIRCUIT
43	-
44	A4 12BK/PK
45	L9 14BK/VT
46	D1 18VT/BR
47	V45 18VT
48	-
49	-
50	C1 12DG
51	Z2 18BK/LG
52	D2 18WT/BK
53	F24 18RD/DG
54	L10 20BR/LG
55	-
56	G29 18BK/TN
57	-
58	-
59	-
60	-
61	-
62	-
63	-
64	V49 18RD/BK
65	V5 18DG/YL
66	-
67	-
68	V18 18YL/DG
69	G50 18RD
70	F84 18YL/WT •
71	T6 18OR/WT • •
72	D2 18WT/BK
73	D1 18VT/BR
74	K29 20WT/PK

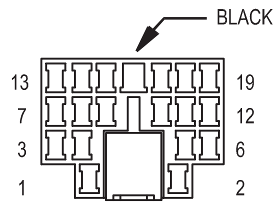
CAV	CIRCUIT
43	-
44	A4 12BK/PK
45	L9 14BK/WT
46	D1 20VT/BR
47	V45 18VT
48	-
49	-
50	C1 10DG
51	Z2 20BK/LG
52	D2 20WT/BK
53	F24 18RD/DG
54	L10 18BR/LG
55	-
56	G29 18BK/TN
57	-
58	-
59	-
60	-
61	-
62	-
63	-
64	V49 18RD/BK
65	V5 18DG/YL
66	-
67	-
68	V18 16YL/DG
69	G50 20RD
70	F84 18YL/WT
71	T6 20OR/WT
72	D2 20WT/BK
73	D1 20VT/BR
74	K29 20WT/PK

• A/T, 2.5L M/T
• • EXCEPT 2.5L



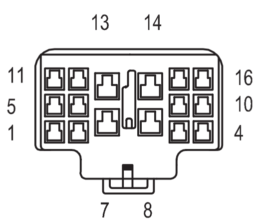
C246

CAV	CIRCUIT	
1	Z2 20BK/LG	
2	G13 20DB/RD	
3	G16 20BK/LB	
4	X52 18DB/WT	●
	X94 18TN/VT	●●
5	X51 18BR/YL	●
	X93 18WT/RD	●●
6	X58 18DB/OR	●
	X92 18TN/DG	●●
7	X57 18BR/LB	●
	X91 18WT/BK	●●
8	X53 18DG	●
	X87 18LG/RD	●●
9	X55 18BR/RD	●
	X85 18LG/BK	●●
10	G11 20WT/BK	
11	D1 20VT/BR	▲
12	D2 20WT/BK	▲
13	X54 18VT	●
	X82 18LB/RD	●●
14	X56 18DB/RD	●
	X80 18LB/BK	●●
15	L10 18BR/LG	▲▲
16	Z1 14BK	
17	-	
18	G74 20TN/RD	
19	-	



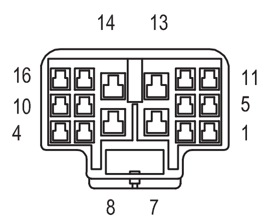
C246

CAV	CIRCUIT	
1	Z2 20BK/LG	
2	G13 20DB/RD	
3	G16 20BK/LB	
4	X52 18DB/WT	
5	X51 18BR/YL	
6	X58 18DB/OR	
7	X57 18BR/LB	
8	X53 18DG	
9	X55 18BR/RD	
10	G11 20WT/BK	
11	D1 20VT/BR	
12	D2 20WT/BK	
13	X54 18VT	
14	X56 18DB/RD	
15	L10 18BR/LG	■■■
16	-	
17	-	
18	G74 18TN/RD	
19	-	



C247

CAV	CIRCUIT	
1	F121 20TN/BK	▽
2	-	
3	-	
4	F35 18RD	◆◆
5	P36 16PK/VT	▲▲
	P38 16OR/WT	■■
6	P35 16OR/VT	▲▲
	P37 16LG	■■
7	C15 12BK/WT	◆
8	Z1 12BK	
9	P33 16OR/BK	
10	-	
11	G73 20LG/OR	
12	-	
13	Z1 14BK	▽▽
14	P59 16DB	
15	-	
16	P34 16PK/BK	



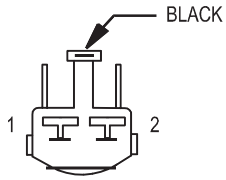
C247

CAV	CIRCUIT	
1	F121 20TN/BK	▽
2	-	
3	-	
4	F35 16RD	
5	P36 16PK/VT	■■■
	P38 16OR/WT	■■
6	P35 16OR/VT	■■■
	P37 16LG	■■
7	C15 12BK/WT	■■■
8	Z1 14BK	■■
	Z1 12BK	■■■
9	P33 16OR/BK	
10	-	
11	G73 20LG/OR	
12	-	
13	Z1 14BK	▽▽
14	P59 16DB	■■■
15	-	
16	P34 16PK/BK	

● STANDARD RADIO
●● PREMIUM RADIO
▲ EXCEPT BASE CTM
▲▲ 4 DOOR POWER LOCK
▽ HEATED MIRRORS
▽▽ POWER SEATS
◆ REAR WINDOW DEFOGGER
◆◆ POWER LOCKS
●●● STANDARD CAB
▲▲▲ EXTENDED CAB
■■ 2 DOOR
■■■ 4 DOOR

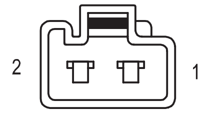
J008W-1

AN008012



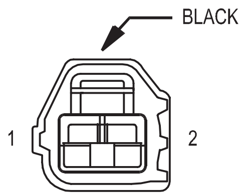
C248

CAV	CIRCUIT
1	Z1 14BK
2	F37 14RD/LB



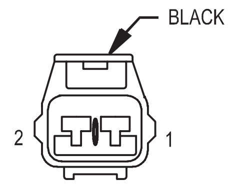
C248

CAV	CIRCUIT
1	Z1 12BK
2	A4 12BK/PK



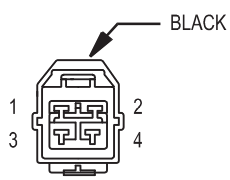
C323

CAV	CIRCUIT
1	Z1 20BK
2	L7 20BK/YL



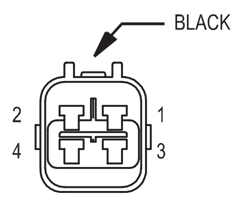
C323

CAV	CIRCUIT
1	Z1 20BK ●
	Z1 18BK ●●
2	L7 18BK/YL



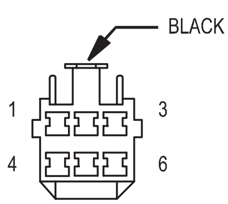
C325

CAV	CIRCUIT
1	L7 20BK/YL
2	Z1 20BK
3	L632 16DG/BR
4	L1 20VT/BK



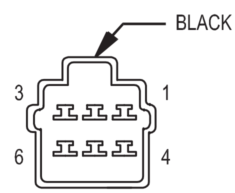
C325

CAV	CIRCUIT
1	L7 20BK/YL
2	Z1 20BK
3	L63 16DG/RD
4	L1 20VT/BK



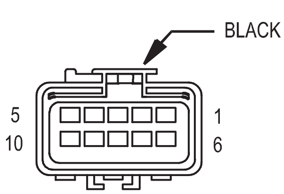
C329

CAV	CIRCUIT
1	M1 18PK
2	M3 20PK/DB
3	L50 18WT/TN
4	Z1 20BK
5	-
6	-



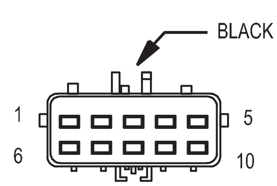
C329

CAV	CIRCUIT
1	M1 20PK ■
2	M3 20PK/DB ■
3	L50 18WT/TN
4	Z1 20BK
5	-
6	-



C341

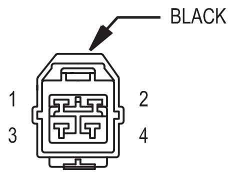
CAV	CIRCUIT
1	-
2	L62 16BR/RD
3	L1 20VT/BK
4	A6 14RD/TN
5	L76 14BK/OR
6	-
7	B40 14LB
8	Z1 14BK
9	Z1 14BK
10	L63 16DG/RD



C341

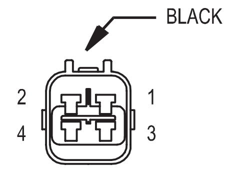
CAV	CIRCUIT
1	-
2	L62 18BR/RD
3	L1 20VT/BK
4	A6 12RD/TN
5	L76 12BK/OR
6	-
7	B40 12LB
8	Z1 12BK
9	-
10	L63 18DG/RD

● SPORT BUMPER
●● STEP BUMPER
■ CARGO LAMPS



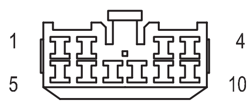
C360

CAV	CIRCUIT
1	L7 20BK/YL
2	Z1 20BK
3	L632 16DG/BR
4	L1 20VT/BK



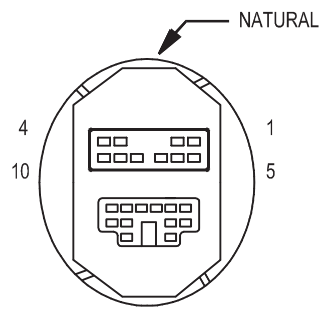
C360

CAV	CIRCUIT
1	L7 20BK/YL
2	Z1 20BK
3	L62 16BR/RD
4	L1 20VT/BK



C361
(2-DOOR)
(POWER WINDOWS/LOCKS)

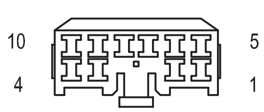
CAV	CIRCUIT
1	F35 16RD
2	P36 16PK/VT
3	P35 16OR/VT
4	P34 16PK/BK
5	P33 16OR/BK
6	Q26 14VT/WT
7	Q16 14BR/WT
8	G73 20LG/OR
9	-
10	-



C361
(2-DOOR)
(POWER WINDOWS/LOCKS)

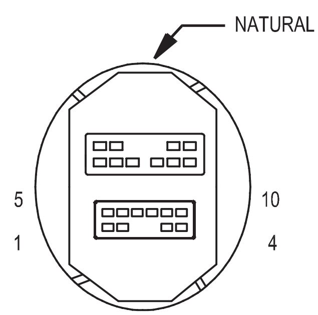
CAV	CIRCUIT
1	F35 16RD
2	P36 16PK/VT
3	P35 16LG/BK
4	P34 16PK/BK
5	P33 16OR/BK
6	Q26 14VT/WT
7	Q16 14BR/WT
8	G73 20LG/OR ◆
9	-
10	-

CAV	CIRCUIT
1	F35 16RD
2	P36 16PK/VT
3	P35 16OR/VT
4	P34 16PK/BK
5	P33 16OR/BK
6	Q26 14VT/WT
7	Q16 14BR/WT
8	G73 20LG/OR ◆
9	L10 18BR/LG
10	-



C361
(4-DOOR)

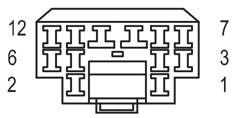
(POWER WINDOWS/LOCKS)



C361
(4-DOOR)
(POWER WINDOWS/LOCKS)

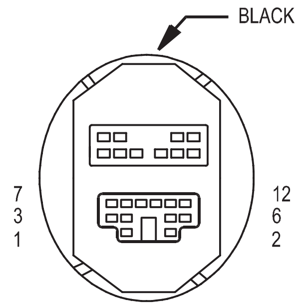
CAV	CIRCUIT
1	F35 18RD
2	P36 18PK/VT
3	P35 18OR/VT
4	P34 18PK/BK
5	P33 18OR/BK
6	Q26 14VT/WT
7	Q16 14BR/WT
8	G73 20LG/OR ◆
9	L10 20BR/LG
10	-

◆ VTSS



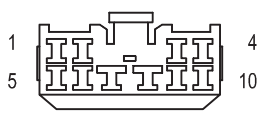
C362
(2-DOOR)

CAV	CIRCUIT
1	P70 22WT
2	P74 22DB
3	P72 22YL/BK
4	X54 18VT
5	X56 18DB/RD
6	G74 18TN/RD
7	Z1 20BK
8	P37 16LG ●
9	F21 14TN ●
10	-
11	P38 16OR/WT ●
12	Z2 20BK/LG



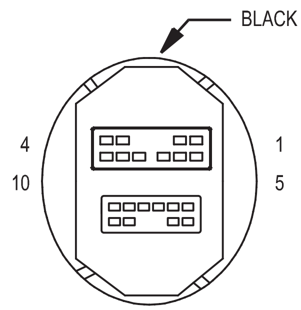
C362
(2-DOOR)

CAV	CIRCUIT
1	P70 22WT
2	P74 22DB
3	P72 22YL/BK
4	X82 18LB/RD
5	X80 18LB/BK
6	G74 18TN/RD
7	Z1 20BK ●
8	P37 16LG ●
9	F21 14TN ●
10	-
11	P38 16OR/WT ●
12	Z2 20BK/LG



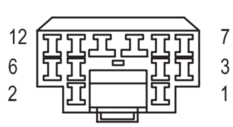
C362
(4-DOOR)

CAV	CIRCUIT
1	P70 22WT
2	P74 22DB
3	P72 22YL/BK
4	X54 18VT
5	X56 18DB/RD
6	G74 18TN/RD
7	Q1 14YL ●
8	F121 20TN/BK ▲▲
9	Z1 20BK
10	Z2 20BK/LG



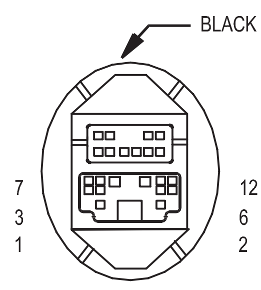
C362
(4-DOOR)

CAV	CIRCUIT
1	P70 22WT
2	P74 22DB
3	P72 22YL/BK
4	X54 18VT ■
	X82 18LB/RD ■■
5	X56 18DB/RD ■
	X80 18LB/BK ■■
6	G74 18TN/RD ●●
	G74 20TN/RD ●
7	Q1 14YL ●
8	F121 20TN/BK ▲▲
9	Z1 18BK
10	Z2 20BK/LG



C363
(2-DOOR)

CAV	CIRCUIT
1	P70 22WT
2	P74 22DB
3	P72 22YL/BK
4	X53 18DG
5	X55 18BR/RD
6	M1 18PK
7	G16 20BK/LB
8	Z2 20BK/LG
9	F21 14TN ●
10	Z1 14BK ●
	Z1 20BK ●●

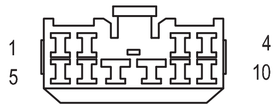


C363
(2-DOOR)

CAV	CIRCUIT
1	P70 22WT ▲▲
2	P74 22DB ▲▲
3	P72 22YL/BK ▲▲
4	X53 18DG ■
	X87 18LG/RD ■■
5	X55 18BR/RD ■
	X85 18LG/BK ■■
6	M1 20PK ▲
7	G16 20BK/LB
8	Z2 20 BK/LG
9	F21 14TN ●
10	Z1 14BK ●
	Z1 20BK ●●

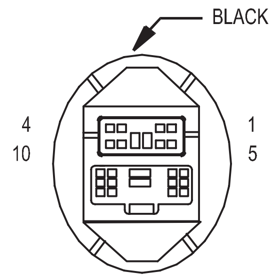
● POWER WINDOWS/LOCKS
●● EXCEPT POWER WINDOWS/LOCKS
▲▲ HEATED MIRRORS
▲ POWER MIRRORS
■ STANDARD RADIO
■■ PREMIUM RADIO

AN008015 J008W-1



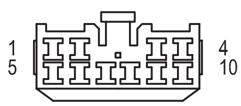
C363
(4-DOOR)

CAV	CIRCUIT
1	P70 22WT
2	P74 22DB
3	P72 22YL/BK
4	X53 18DG
5	X55 18BR/RD
6	G16 20BK/LB
7	Z1 12BK ●
	Z1 20BK ●●
8	F121 20TN/BK ▲▲
9	M1 18PK
10	Z2 20BK/LG



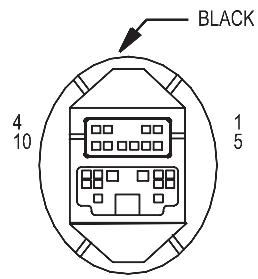
C363
(4-DOOR)

CAV	CIRCUIT
1	P70 22WT ▲
2	P74 22DB ▲
3	P72 22YL/BK ▲
4	X53 18DG ■
	X87 18LG/RD ■■
5	X55 18BR/RD ■
	X85 18LG/BK ■■
6	G16 20BK/LB
7	Z1 12BK ●
	Z1 20BK ▲
8	F121 20TN/BK ▲▲
9	M1 20PK ▲
10	Z2 20BK/LG



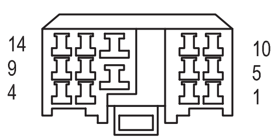
C364
(2-DOOR)
(POWER WINDOWS/LOCKS)

CAV	CIRCUIT
1	F35 16RD
2	P36 16PK/VT
3	P35 16OR/VT
4	P34 16PK/BK
5	P33 16OR/BK
6	Q26 14VT/WT
7	Q16 14BR/WT
8	-
9	G73 20LG/OR
10	-



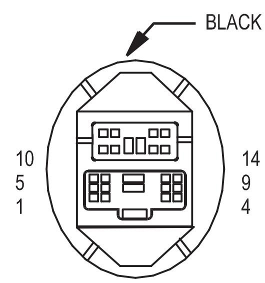
C364
(2-DOOR)
(POWER WINDOWS/LOCKS)

CAV	CIRCUIT
1	F35 16RD
2	P36 16PK/VT
3	P35 16OR/VT
4	P34 16PK/BK
5	P33 16OR/BK
6	Q26 14VT/WT
7	Q16 14BR/WT
8	-
9	G73 20LG/OR ◆
10	-



C364
(4-DOOR)
(POWER WINDOWS/LOCKS)

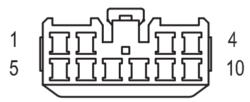
CAV	CIRCUIT
1	F35 16RD
2	P36 16PK/VT
3	P35 16OR/VT
4	P59 16DB
5	P33 16OR/BK
6	Q26 14VT/WT
7	Q1 14YL
8	Q16 14BR/WT
9	Q28 14DG/WT
10	G73 20LG/OR
11	Q18 14GY/BK
12	F21 14TN
13	Q27 14RD/BK
14	Q17 14DB/WT



C364
(4-DOOR)
(POWER WINDOWS/LOCKS)

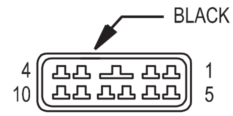
CAV	CIRCUIT
1	F35 18RD
2	P36 18PK/VT
3	P35 18OR/VT
4	P59 18DB
5	P33 16OR/BK
6	Q26 14VT/WT
7	Q1 14YL
8	Q16 14BR/WT
9	Q28 14DG/WT
10	G73 20LG/OR ◆
11	Q18 14GY/BK
12	F21 12TN
13	Q27 14RD/BK
14	Q17 14DB/WT

● POWER WINDOWS/LOCKS
●● EXCEPT POWER WINDOWS/LOCKS
▲ POWER MIRRORS
▲▲ HEATED MIRRORS
■ STANDARD RADIO
■■ PREMIUM RADIO
◆ VTSS



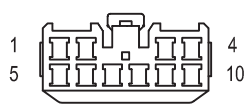
C365

CAV	CIRCUIT	
1	Z2 20BK/LG	
2	G74 18TN/RD	
3	P33 16OR/BK	
4	P34 16PK/BK	
5	Q1 14YL	•
6	Q17 14DB/WT	•
7	Q27 14RD/BK	•
8	X51 18BR/YL	
9	X57 18BR/LB	
10	-	



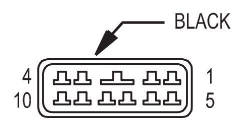
C365

CAV	CIRCUIT	
1	Z2 20BK/LG	
2	G74 18TN/RD	
3	P33 16OR/BK	•
4	P34 16PK/BK	•
5	Q1 14YL	
6	Q17 14DB/WT	
7	Q27 14RD/BK	
8	X51 18BR/YL	
9	X57 18BR/LB	
10	-	



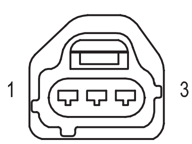
C366

CAV	CIRCUIT	
1	Z2 20BK/LG	
2	G74 18TN/RD	
3	P33 16OR/BK	
4	P34 16PK/BK	
5	Q1 14YL	•
6	Q18 14GY/BK	•
7	Q28 14DG/WT	
8	X52 18DB/WT	
9	X58 18DB/OR	
10	-	



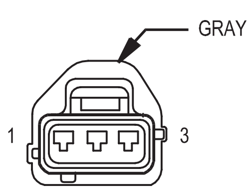
C366

CAV	CIRCUIT	
1	Z2 20BK/LG	
2	G74 18TN/RD	
3	P33 16OR/BK	•
4	P34 16PK/BK	•
5	Q1 14YL	
6	Q18 14GY/BK	
7	Q28 14DG/WT	
8	X52 18DB/WT	
9	X58 18DB/OR	
10	-	



CAMSHAFT POSITION SENSOR (4.7L)

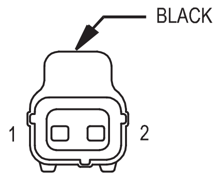
CAV	CIRCUIT	FUNCTION
1	K44 16TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
2	K4 16BK/LB	SENSOR GROUND
3	K7 16OR	5V SUPPLY



CAMSHAFT POSITION SENSOR (EXCEPT 4.7L)

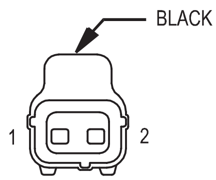
CAV	CIRCUIT	FUNCTION
1	K44 16TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
2	K4 16BK/LB	SENSOR GROUND
3	K7 16OR	5V SUPPLY

• POWER WINDOWS/LOCKS



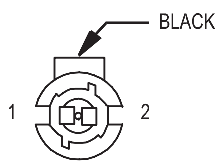
CAPACITOR NO.1

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	-	-



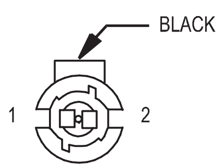
CAPACITOR NO.2

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	-	-



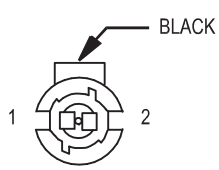
CARGO LAMP
NO. 1

CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
	M1 20PK	FUSED B(+)
2	M3 20PK/DB	CARGO LAMP DRIVER
	M3 20PK/DB	CARGO LAMP DRIVER



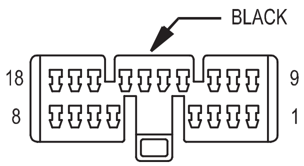
CARGO LAMP
NO. 2

CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	M3 20PK/DB	CARGO LAMP DRIVER



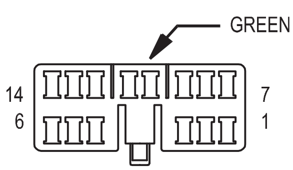
CENTER HIGH MOUNTED
STOP LAMP

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
2	Z1 20BK	GROUND



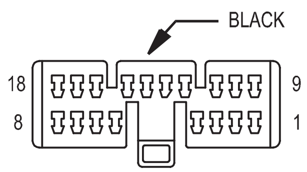
CENTRAL TIMER MODULE - C1 (BASE)

CAV	CIRCUIT	FUNCTION
1	G16 20BK/LB	DRIVER DOOR AJAR SWITCH SENSE
2	G74 20TN/RD	DOOR AJAR SWITCH SENSE
3	V51 20WT	INTERMITTENT WIPER MODE SENSE
4	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
5	V18 16YL/DG	WIPER RELAY CONTROL
6	Z1 18BK	GROUND
7	M50 20YL/RD	COURTESY LAMP DRIVER
8	Z2 18BK/LG	GROUND
9	G26 20LB	KEY-IN IGNITION SWITCH SENSE
10	V10 18BR	WASHER PUMP CONTROL
11	M11 20PK/LB	COURTESY LAMP SWITCH OUTPUT
12	G10 20LG/OR	TONE REQUEST SIGNAL
13	-	-
14	V52 20DG/RD	FRONT WIPER SWITCH MUX
15	-	-
16	-	-
17	V5 18DG/YL	WIPER PARK SWITCH SENSE
18	F35 18RD	FUSED B(+)



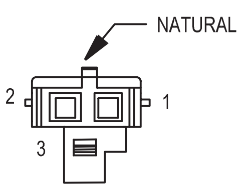
CENTRAL TIMER MODULE - C1 (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	G16 20BK/LB	DRIVER DOOR AJAR SWITCH SENSE
2	G10 20LG/OR	TONE REQUEST SIGNAL
3	V52 20DG/RD	FRONT WIPER SWITCH MUX
4	V18 16YL/DG	WIPER RELAY CONTROL
5	G74 20TN/RD	DOOR AJAR SWITCH SENSE
6	Z2 18BK/LG	GROUND
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	G26 20LB	KEY-IN IGNITION SWITCH SENSE
10	V10 18BR	WASHER PUMP CONTROL
11	V5 18DG/YL	WIPER PARK SWITCH SENSE
12	V51 20WT	INTERMITTENT WIPER MODE SENSE
13	-	-
14	F35 18RD	FUSED B(+)



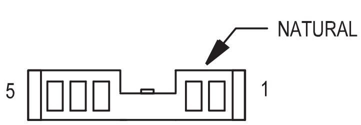
CENTRAL TIMER MODULE - C2

CAV	CIRCUIT		FUNCTION
1	P33 16OR/BK		DOOR LOCK DRIVER
2	M20 20BR/YL		COURTESY LAMP DRIVER
3	Z1 16BK		GROUND
4	P37 16LG	●	UNLOCK RELAY OUTPUT
	P35 16OR/VT	●●	DOOR LOCK SWITCH SENSE
5	F12 20DB/WT		FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	G50 20RD		HEADLAMP FLASHER RELAY CONTROL
7	P109 18RD/BK		DRIVER DOOR UNLOCK RELAY DRIVER
8	G69 20BK/OR		VTSS INDICATOR DRIVER
9	P34 16PK/BK		DOOR UNLOCK DRIVER
10	G73 20LG/OR		CYLINDER LOCK SWITCH MUX
11	M11 20PK/LB		COURTESY LAMP SWITCH OUTPUT
12	-		-
13	P38 16OR/WT	●	DOOR LOCK RELAY CONTROL
	P36 16PK/VT	●●	DOOR UNLOCK SWITCH SENSE
14	X20 20RD/BK	■	RADIO CONTROL MUX
15	-		-
16	D1 20VT/BR		CCD BUS (+)
17	D2 20WT/BK		CCD BUS (-)
18	X3 20BK/RD		HORN RELAY CONTROL



CIGAR LIGHTER

CAV	CIRCUIT	FUNCTION
1	F30 16RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	-	-
3	Z1 14BK	GROUND

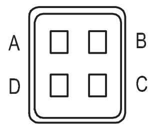


CLOCKSPRING - C1

CAV	CIRCUIT		FUNCTION
1	V37 18RD/LG		SPEED CONTROL SWITCH SIGNAL
2	Z2 20BK/LG	■	GROUND
3	K4 18WT		SENSOR GROUND
4	X20 20RD/BK	■	RADIO CONTROL MUX
5	X3 20BK/RD		HORN RELAY CONTROL

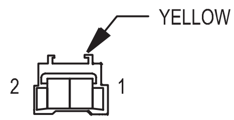
● 2 DOOR
●● 4 DOOR

■ REMOTE RADIO



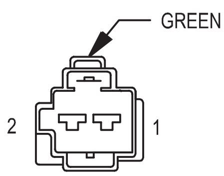
CLOCKSPRING - C2

CAV	CIRCUIT	FUNCTION
A	V37 22DG/RD	SPEED CONTROL SWITCH SIGNAL
B	Z2 22BK/LG	SENSOR GROUND
C	K4 22WT	GROUND
D	X20 22RD/BK	RADIO CONTROL MUX



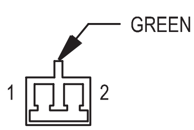
CLOCKSPRING - C3

CAV	CIRCUIT	FUNCTION
1	R43 18BK/LB	DRIVER AIRBAG LINE 1
2	R45 18DG/LB	DRIVER AIRBAG LINE 2



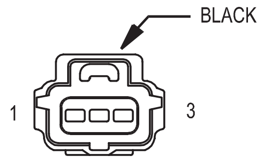
CLUTCH INTERLOCK SWITCH (M/T)

CAV	CIRCUIT	FUNCTION
1	A41 14DB/YL	IGNITION SWITCH OUTPUT (START)
2	A41 14DB/YL	IGNITION SWITCH OUTPUT (START)



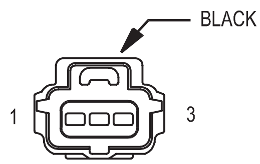
CLUTCH INTERLOCK SWITCH JUMPER (A/T)

CAV	CIRCUIT	FUNCTION
1	T141 14YL	IGNITION SWITCH OUTPUT (START)
2	T141 14YL	IGNITION SWITCH OUTPUT (START)



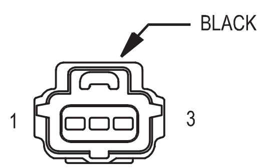
COIL ON PLUG NO. 1 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K19 16BK/GY	COIL ON PLUG NO. 1 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



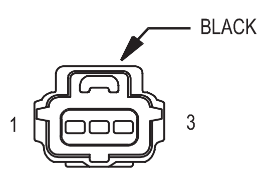
COIL ON PLUG NO. 2 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K92 16TN/PK	COIL ON PLUG NO. 2 DRIVER
2	A142 16 DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



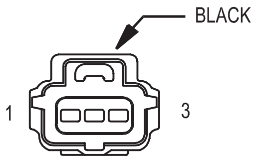
COIL ON PLUG NO. 3 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K93 16TN/OR	COIL ON PLUG NO. 3 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



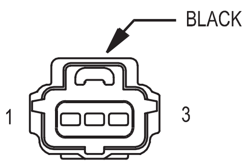
COIL ON PLUG NO. 4 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K94 16TN/LG	COIL ON PLUG NO. 4 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



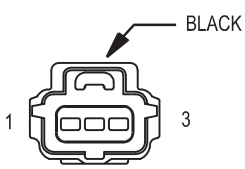
COIL ON PLUG NO. 5 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K95 16TN/DG	COIL ON PLUG NO. 5 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



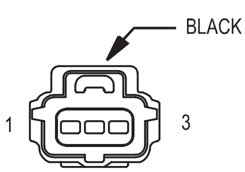
COIL ON PLUG NO. 6 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K96 16TN/LB	COIL ON PLUG NO. 6 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



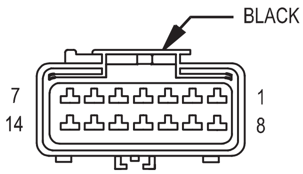
COIL ON PLUG NO. 7 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K17 16DB/TN	COIL ON PLUG NO. 7 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



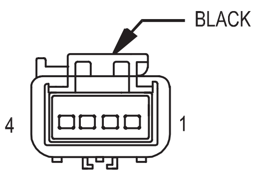
COIL ON PLUG NO. 8 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K18 16DB/GY	COIL ON PLUG NO. 8 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



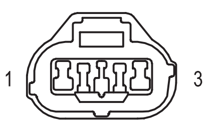
CONTROLLER ANTI-LOCK BRAKE-C1

CAV	CIRCUIT	FUNCTION
1	B113 20RD/VT	REAR WHEEL SPEED SENSOR (+)
2	G107 20BK/RD ●	4WD SWITCH SENSE
3	D1 18VT/BR	CCD BUS (+)
4	A20 20RD/DB	FUSED B(+)
5	-	-
6	Z22 12BK/PK ▼	GROUND
7	A10 14RD/DG	FUSED B(+)
8	B114 20WT/VT	REAR WHEEL SPEED SENSOR (-)
9	K29 18WT/PK	BRAKE SWITCH SENSE
10	D2 18WT/BK	CCD BUS (-)
11	B10 20BR/WT	BRAKE PRESSURE SWITCH SENSE
12	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
13	Z22 12BK/PK	GROUND
14	A10 14RD/DG ▼	FUSED B(+)



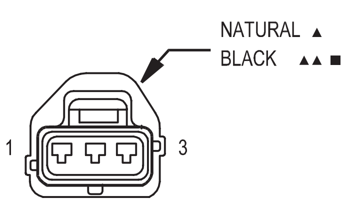
CONTROLLER ANTI-LOCK BRAKE-C2

CAV	CIRCUIT	FUNCTION
1	B9 20RD	LEFT FRONT WHEEL SPEED SENSOR (+)
2	B8 20RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
3	B6 20WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
4	B7 20WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



CRANKSHAFT POSITION SENSOR (4.7L)

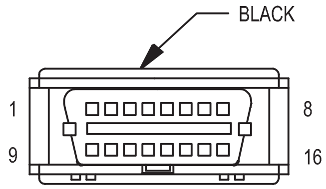
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5V SUPPLY



CRANKSHAFT POSITION SENSOR (EXCEPT 4.7L)

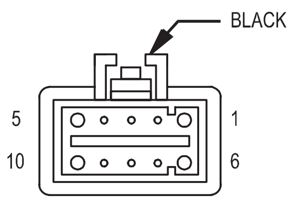
CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 18OR	5V SUPPLY

▼ ABS
● A/T
■ 2.5L
▲ M/T 3.9L/5.9L
▲▲ A/T 3.9L/5.9L



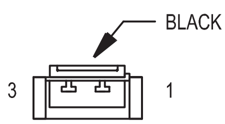
DATA LINK CONNECTOR

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	D1 20VT/BR	CCD BUS B(+)
4	Z11 18BK/WT	GROUND
5	Z12 16BK/TN	GROUND
6	D20 20LG	SCI RECEIVE
7	D21 20PK/DB	SCI TRANSMIT
8	-	-
9	-	-
10	-	-
11	D2 20WT/BK	CCD BUS B(-)
12	-	-
13	-	-
14	D22 20PK/BK	SCI RECEIVE
15	-	-
16	M1 18PK	FUSED B (+)



DAYTIME RUNNING LAMP MODULE

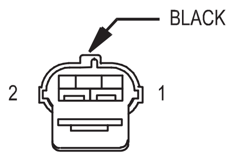
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L10 20BR/LG	FUSED IGNITION SWITCH OUTPUT(RUN)
3	G34 18RD/GY	HIGH BEAM INDICATOR DRIVER
4	G11 20WT/BK	PARK BRAKE SWITCH SENSE
5	-	-
6	L3 18RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
7	Z1 18BK	GROUND
8	L39 18LB	FUSED B(+)
9	L161 20LG/OR	DAYTIME RUNNING LAMPS
10	L4 18VT/WT	DIMMER SWITCH LOW BEAM OUTPUT



DOME LAMP

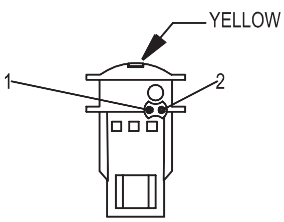
CAV	CIRCUIT	FUNCTION
1	Z1 20BK ■	GROUND
2	M2 20YL	COURTESY LAMPS DRIVER
3	M1 18PK	FUSED B(+)

■ MIDLEVEL/PREMIUM



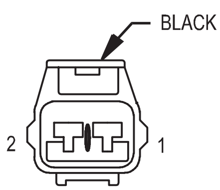
DRIVER DOOR AJAR SWITCH (EXCEPT POWER WINDOWS/LOCKS)

CAV	CIRCUIT	FUNCTION
1	G16 20BK/LB	DRIVER DOOR AJAR SWITCH SENSE
2	Z2 20BK/LG	GROUND



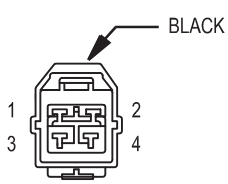
DRIVER AIRBAG

CAV	CIRCUIT	FUNCTION
1	BK	DRIVER AIRBAG LINE 2
2	BK	DRIVER AIRBAG LINE 1



DRIVER DOOR KEY CYLINDER SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/LG	GROUND
2	G73 20LG/OR	DOOR KEY CYLINDER SWITCH SENSE

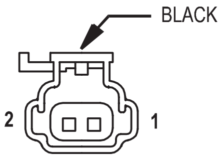


DRIVER DOOR LOCK/MOTOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G16 20BK/LB	DRIVER DOOR AJAR SWITCH SENSE
2	Z2 20BK/LG	GROUND
3	P34 16PK/BK ●	DOOR UNLOCK DRIVER
3	P59 18DB ●●	DRIVER DOOR UNLOCK DRIVER
4	P33 16OR/BK	DOOR LOCK DRIVER

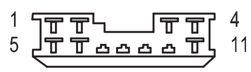
● 2 DOOR
●● 4 DOOR

J008W-1 AN008026



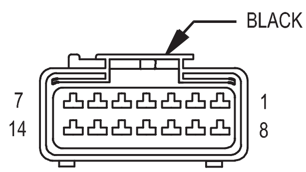
DRIVER DOOR WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q21 14WT	DRIVER WINDOW DRIVER DOWN
2	Q11 14LB	DRIVER WINDOW DRIVER UP



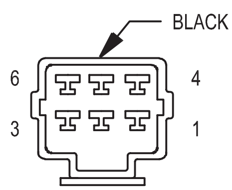
DRIVER POWER LOCK/WINDOW SWITCH (2-DOOR)

CAV	CIRCUIT	FUNCTION
1	Q16 14BR/WT	MASTER WINDOW SWITCH PASSENGER UP
2	Q26 14VT/WT	MASTER WINDOW SWITCH PASSENGER DOWN
3	Z1 14BK	GROUND
4	Q21 14WT	DRIVER WINDOW DRIVER DOWN
5	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
6	Q11 14LB	DRIVER WINDOW DRIVER UP
7	P36 16PK/VT	DOOR UNLOCK SWITCH SENSE
8	P35 16OR/VT	DOOR LOCK SWITCH SENSE
9	-	-
10	F35 16RD	FUSED B(+)



DRIVER POWER LOCK/WINDOW SWITCH (4-DOOR)

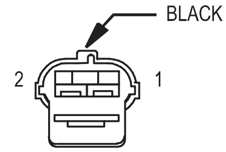
CAV	CIRCUIT	FUNCTION
1	P35 18OR/VT	DOOR LOCK SWITCH SENSE
2	Q26 14VT/WT	MASTER WINDOW SWITCH PASSENGER DOWN
3	Q16 14BR/WT	MASTER WINDOW SWITCH PASSENGER UP
4	F21 12TN	FUSED IGNITION SWITCH OUTPUT (RUN)
5	Z1 12BK	GROUND
6	Q11 14LB	DRIVER WINDOW DRIVER UP
7	Q1 14YL	POWER WINDOW SWITCH FEED
8	Q21 14WT	DRIVER WINDOW DRIVER DOWN
9	F35 18RD	FUSED B(+)
10	P36 18PK/VT	DOOR UNLOCK SWITCH SENSE
11	Q28 14DG/WT	MASTER WINDOW SWITCH RIGHT REAR DOWN
12	Q18 14GY/BK	MASTER WINDOW SWITCH RIGHT REAR UP
13	Q27 14RD/BK	MASTER WINDOW SWITCH LEFT REAR DOWN
14	Q17 14DB/WT	MASTER WINDOW SWITCH LEFT REAR UP



DRIVER POWER MIRROR

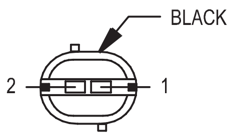
CAV	CIRCUIT	FUNCTION
1	P73 22YL/PK	DRIVER MIRROR RIGHT/DOWN MOVEMENT
2	P75 22DB/WT	DRIVER MIRROR UP MOVEMENT
3	P71 22YL	DRIVER MIRROR LEFT MOVEMENT
4	-	-
5	Z1 18BK ●	GROUND
6	F121 20TN/BK ●	FUSED REAR WINDOW DEFOGGER SWITCH OUTPUT

● 4 DOOR



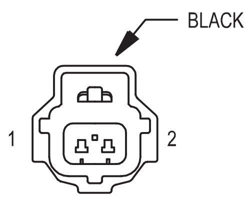
ENGINE COOLANT TEMPERATURE SENSOR (2.5L)

CAV	CIRCUIT	FUNCTION
1	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND



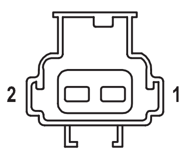
ENGINE COOLANT TEMPERATURE SENSOR (3.9L/5.9L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



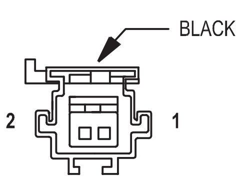
ENGINE COOLANT TEMPERATURE SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



ENGINE OIL PRESSURE SENSOR (4.7L)

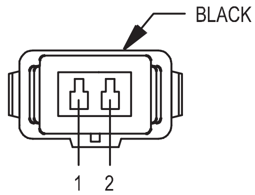
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL



ENGINE OIL PRESSURE SENSOR (EXCEPT 4.7L)

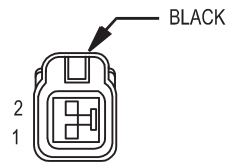
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	G60 16GY/YL ••	ENGINE OIL PRESSURE SENSOR SIGNAL
	G60 18GY/YL •	ENGINE OIL PRESSURE SENSOR SIGNAL

• 2.5L
•• 3.9L/5.9L



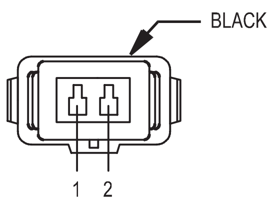
FUEL INJECTOR NO. 1 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



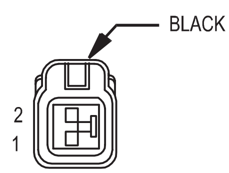
FUEL INJECTOR NO. 1 (3.9L/4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER



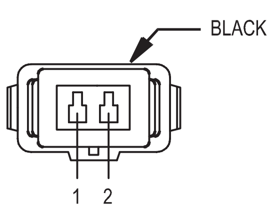
FUEL INJECTOR NO. 2 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



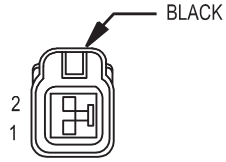
FUEL INJECTOR NO. 2 (3.9L/4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K12 18TN	FUEL INJECTOR NO. 2 DRIVER



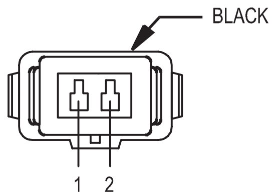
FUEL INJECTOR NO. 3 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



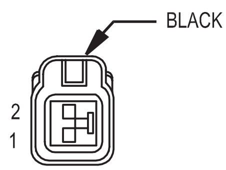
FUEL INJECTOR NO. 3 (3.9L/4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER



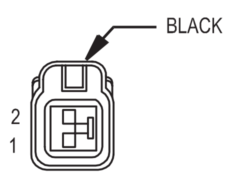
FUEL INJECTOR NO. 4 (2.5L)

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
2	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



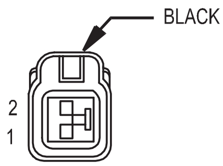
FUEL INJECTOR NO. 4 (3.9L/4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER



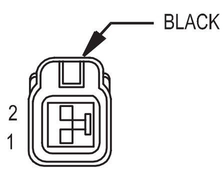
FUEL INJECTOR NO. 5 (3.9L/4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K38 18GY	FUEL INJECTOR NO. 5 DRIVER



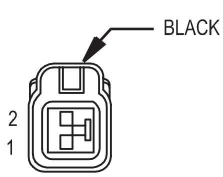
FUEL INJECTOR
NO. 6
(3.9L/4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER



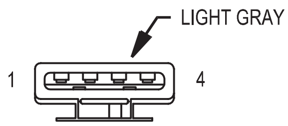
FUEL INJECTOR
NO. 7
(4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K26 18VT	FUEL INJECTOR NO. 7 DRIVER



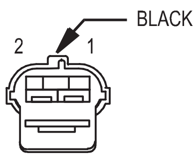
FUEL INJECTOR
NO. 8
(4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K28 18GY/LB	FUEL INJECTOR NO. 8 DRIVER



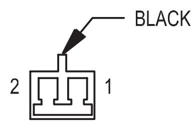
FUEL PUMP MODULE

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	K4 18BK/LB	SENSOR GROUND
3	G4 18DB	FUEL LEVEL SENSOR SIGNAL
4	A61 16DG/BK	FUEL PUMP RELAY OUTPUT



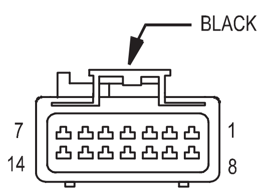
GENERATOR

CAV	CIRCUIT	FUNCTION
1	K125 18WT/DB	GENERATOR SOURCE
2	K20 18DG	GENERATOR FIELD



GLOVE BOX LAMP

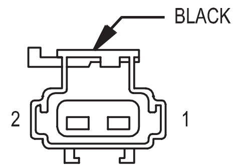
CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	Z1 20BK	GROUND



HEADLAMP SWITCH - C1

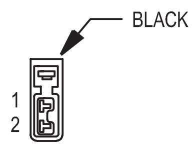
CAV	CIRCUIT	FUNCTION
1	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
2	F33 18PK/RD	FUSED B (+)
3	Z1 20BK	GROUND
4	G26 20LB	KEY-IN IGNITION SWITCH SENSE
5	Z3 18BK/OR	GROUND
6	L2 18LG	HEADLAMP DIMMER SWITCH OUTPUT
7	L38 20LB/BK ▲	FOG LAMP FEED
8	L107 20BK/YL	HEADLAMP SWITCH OUTPUT
9	Z1 18BK	GROUND
10	M11 20PK/LB	COURTESY LAMP SWITCH OUTPUT
11	M3 20PK/DB	CARGO LAMP DRIVER
12	M2 20YL	COURTESY LAMPS SWITCH OUTPUT
13	M20 20BR/YL ●	COURTESY LAMP DRIVER
13	M50 20YL/RD ●●	COURTESY LAMP DRIVER
14	E1 18TN/OR	PANEL LAMPS DIMMER SWITCH SIGNAL

● PREMIUM
●● BASE
▲ FOG LAMPS



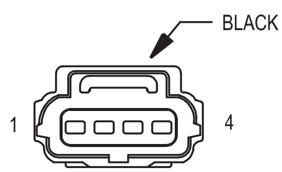
HEADLAMP SWITCH - C2

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	Z38 20BK/LG	GROUND



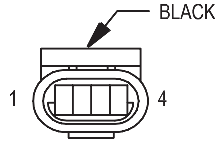
HIGH NOTE HORN

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT



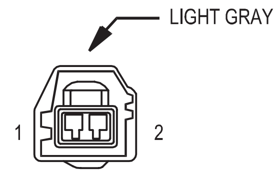
IDLE AIR CONTROL MOTOR (2.5L/4.7L)

CAV	CIRCUIT	FUNCTION
1	K39 18GY/RD	IDLE AIR CONTROL NO. 4 DRIVER
2	K60 18YL/BK	IDLE AIR CONTROL NO. 3 DRIVER
3	K40 18BR/WT	IDLE AIR CONTROL NO. 2 DRIVER
4	K59 18VT/BK	IDLE AIR CONTROL NO. 1 DRIVER



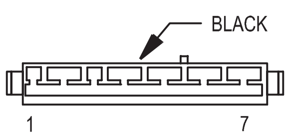
IDLE AIR CONTROL MOTOR (3.9L/5.9L)

CAV	CIRCUIT	FUNCTION
1	K39 18GY/RD	IDLE AIR CONTROL NO. 4 DRIVER
2	K60 18YL/BK	IDLE AIR CONTROL NO. 3 DRIVER
3	K40 18BR/WT	IDLE AIR CONTROL NO. 2 DRIVER
4	K59 18VT/BK	IDLE AIR CONTROL NO. 1 DRIVER



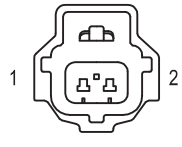
IGNITION COIL
(EXCEPT 4.7L)

CAV	CIRCUIT	FUNCTION
1	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K19 16BK/GY	IGNITION COIL NO.1 DRIVER



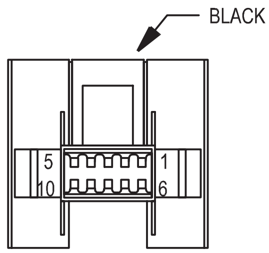
IGNITION SWITCH

CAV	CIRCUIT	FUNCTION
1	A41 14YL	IGNITION SWITCH OUTPUT (START)
2	A21 12DB	IGNITION SWITCH OUTPUT (ST-RUN)
3	-	-
4	A2 12PK/BK	FUSED (B+)
5	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
6	A31 12BK/WT	IGNITION SWITCH OUTPUT (RUN-ACC)
7	A1 12RD	FUSED (B+)



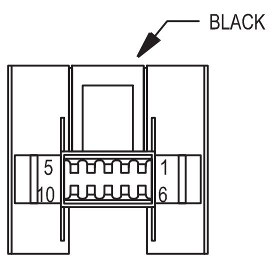
INPUT
SPEED
SENSOR
(4.7L A/T)

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL



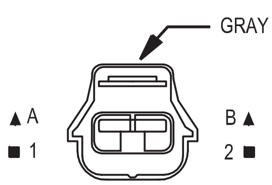
INSTRUMENT CLUSTER - C1

CAV	CIRCUIT	FUNCTION
1	G69 20BK/OR ●	CYLINDER LOCK SWITCH MUX
2	F15 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
3	G11 20WT/BK	PARK BRAKE SWITCH SENSE
4	Z2 20BK/LG	GROUND
5	Z1 20BK	GROUND
6	F84 18YL/WT	FUSED B(+)
7	A81 18DG/RD	IGNITION SWITCH OUTPUT (ST-RUN-OFF)
8	-	-
9	D2 20WT/BK	CCD BUS (-)
10	D1 20VT/BR	CCD BUS (+)



INSTRUMENT CLUSTER - C2

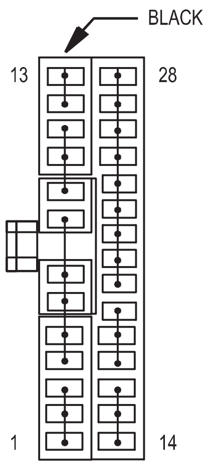
CAV	CIRCUIT	FUNCTION
1	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
2	G29 18BK/TN	LOW WASHER FLUID SENSE
3	G13 20DB/RD	SEAT BELT INDICATOR DRIVER
4	-	-
5	L107 20BK/YL	HEADLAMP SWITCH OUTPUT
6	L61 16LG	LEFT TURN SIGNAL
7	G10 20LG/OR	TONE REQUEST SIGNAL
8	L60 16TN	RIGHT TURN SIGNAL
9	G34 18RD/GY	HIGH BEAM INDICATOR DRIVER
10	G107 20BK/RD	4WD SWITCH SENSE



INTAKE AIR TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
A	K4 18BK/LB ▲	SENSOR GROUND
B	K21 18BK/RD ▲	INTAKE AIR TEMPERATURE SIGNAL
1	K4 18BK/LB ■	SENSOR GROUND
2	K21 18BK/RD ■	INTAKE AIR TEMPERATURE SIGNAL

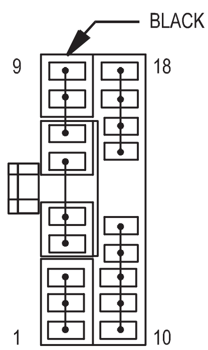
● POWER OPTIONS
▲ 2.5L
■ EXCEPT 2.5L



JOINT CONNECTOR NO. 1 (IN PDC)

CAV	CIRCUIT	FUNCTION
1	L1 20VT/BK	BACK-UP LAMP FEED
2	L1 20VT/BK	BACK-UP LAMP FEED
3	L1 20VT/BK	BACK-UP LAMP FEED
4	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
5	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
7	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
8	L38 20LB/BK	FOG LAMP CONTROL
9	L38 20LB/BK	FOG LAMP CONTROL
10	L38 20LB/BK	FOG LAMP CONTROL
11	L38 20LB/BK	FOG LAMP CONTROL
12	L60 16TN	RIGHT TURN SIGNAL
13	L60 16TN	RIGHT TURN SIGNAL
14	L60 16TN	RIGHT TURN SIGNAL
15	K4 18BK/LB	SENSOR GROUND
16	K4 18BK/LB	SENSOR GROUND
17	K4 18BK/LB	SENSOR GROUND
18	K4 18BK/LB	SENSOR GROUND
19	K4 18BK/LB	SENSOR GROUND
20	K4 18BK/LB	SENSOR GROUND
21	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
22	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
23	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
24	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
25	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
26	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
27	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
28	L7 18BK/YL	HEADLAMP SWITCH OUTPUT

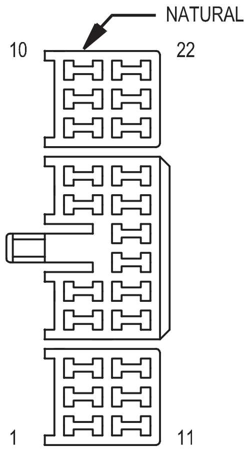
J008W-1 AN008036



JOINT CONNECTOR
NO. 2
(IN PDC)

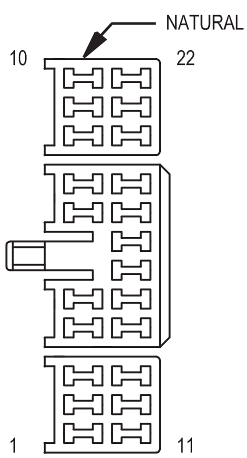
CAV	CIRCUIT		FUNCTION
1	L61 16LG		LEFT TURN SIGNAL
2	L61 16LG		LEFT TURN SIGNAL
3	L61 16LG		LEFT TURN SIGNAL
4	L7 20BK/YL	●	HEADLAMP SWITCH OUTPUT
5	L7 20BK/YL	●	HEADLAMP SWITCH OUTPUT
6	L7 20BK/YL	●	HEADLAMP SWITCH OUTPUT
7	V5 18DG/YL		WIPER PARK SWITCH SENSE
8	V5 18DG/YL		WIPER PARK SWITCH SENSE
9	V5 18DG/YL		WIPER PARK SWITCH SENSE
10	A14 16RD/WT		FUSED B(+)
11	A14 16RD/WT		FUSED B(+)
12	A14 16RD/WT		FUSED B(+)
13	A142 14DG/OR	▲	AUTOMATIC SHUT DOWN RELAY OUTPUT
	A16 12GY	●●	FUSED B(+)
14	A142 14DG/OR	▲	AUTOMATIC SHUT DOWN RELAY OUTPUT
	A16 12GY	●●	FUSED B(+)
15	A142 14DG/OR	▲	AUTOMATIC SHUT DOWN RELAY OUTPUT
	A16 12GY	●●	FUSED B(+)
16	K29 20WT/PK		BRAKE SWITCH SENSE
17	K29 18WT/PK		BRAKE SWITCH SENSE
18	K29 18WT/PK		BRAKE SWITCH SENSE

● TRAILER TOW
●● CALIFORNIA
▲ EXCEPT CALIFORNIA



JOINT CONNECTOR NO. 3

CAV	CIRCUIT		FUNCTION
1	D1 20VT/BR	●	CCD BUS (+)
2	D1 20VT/BR		CCD BUS (+)
3	D1 20VT/BR		CCD BUS (+)
4	D2 20WT/BK	●	CCD BUS (-)
5	D2 20WT/BK		CCD BUS (-)
6	D2 20WT/BK		CCD BUS (-)
7	D2 18WT/BK		CCD BUS (-)
8	D1 20VT/BR	●●	CCD BUS (+)
9	D1 20VT/BR	▲	CCD BUS (+)
10	-		-
11	D1 18VT/BR		CCD BUS (+)
12	D1 20VT/BR		CCD BUS (+)
13	D1 20VT/BR		CCD BUS (+)
14	D2 20WT/BK		CCD BUS (-)
15	D2 20WT/BK	▲	CCD BUS (-)
16	D2 20WT/BK		CCD BUS (-)
17	D2 20WT/BK	●●	CCD BUS (-)
18	-		-
19	-		-
20	D1 20VT/BR		CCD BUS (+)
21	D1 20VT/BR		CCD BUS (+)
22	-		-

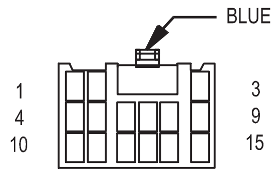


JOINT CONNECTOR NO. 4

CAV	CIRCUIT		FUNCTION
1	M1 18PK		FUSED B (+)
2	-		-
3	M1 18PK		FUSED B (+)
4	Z1 18BK		GROUND
5	Z1 20BK		GROUND
6	Z1 18BK		GROUND
7	Z1 20BK		GROUND
8	E2 20OR		FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
9	E2 20OR		FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
10	E2 20OR	▲▲	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
11	M1 18PK		FUSED B (+)
12	-		-
13	M1 18PK		FUSED B (+)
14	Z11 18BK/WT		GROUND
15	Z1 20BK		GROUND
16	-		-
17	Z1 20BK		GROUND
18	Z1 20BK		GROUND
19	Z1 20BK	▲▲	GROUND
20	E2 20OR		FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
21	E2 20OR		FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
22	E2 20OR	■	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL

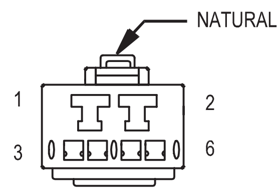
● POWER OPTIONS
●● REMOTE RADIO
▲ EXCEPT BASE CTM
▲▲ LIGHT PACKAGE
■ REAR WINDOW DEFOGGER

J008W-1 AN008038



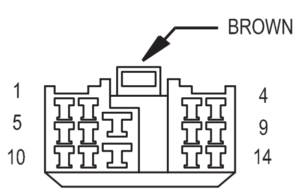
JUNCTION BLOCK - C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	G31 18VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
3	A20 20RD/DB	FUSED IGNITION SWITCH OUTPUT (RUN)
4	L61 16LG	LEFT TURN SIGNAL
5	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
6	-	-
7	-	-
8	-	-
9	-	-
10	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
11	L1 20VT/BK	BACK-UP LAMP FEED
12	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
13	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
14	G32 18BK/LB	SENSOR GROUND
15	-	-



JUNCTION BLOCK - C2

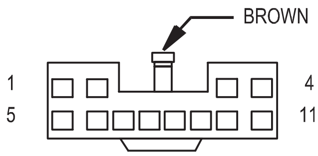
CAV	CIRCUIT	FUNCTION
1	A7 12 RD/BK	FUSED B(+)
2	-	-
3	-	-
4	M1 18PK	FUSED B (+)
5	L60 16TN	RIGHT TURN SIGNAL
6	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT



JUNCTION BLOCK - C3

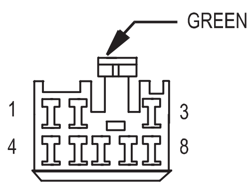
CAV	CIRCUIT	FUNCTION
1	G32 20BK/LB ●	SENSOR GROUND
2	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
3	M3 20PK/DB	CARGO LAMP DRIVER
4	-	-
5	G31 20VT/LG ●	AMBIENT TEMPERATURE SENSOR SIGNAL
6	M1 18PK	FUSED B(+)
7	F37 14RD/LB ▲	FUSED HEADLAMP SWITCH OUTPUT
8	M2 20YL	COURTESY LAMPS DRIVER
9	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
10	-	-
11	L1 18VT/BK ●	BACK-UP LAMP FEED
12	F21 14TN ■	FUSED IGNITION SWITCH OUTPUT (RUN)
13	Z1 20BK	GROUND
14	F12 20DB/WT ●	FUSED IGNITION SWITCH OUTPUT (ST-RUN)

● OVERHEAD CONSOLE
▲ POWER SEATS
■ POWER LOCKS/WINDOWS



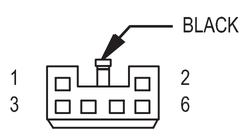
JUNCTION
BLOCK - C4

CAV	CIRCUIT	FUNCTION
1	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
3	X12 16RD/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
4	L61 16LG	LEFT TURN SIGNAL
5	-	-
6	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
7	F12 20DB/WT ●	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
8	-	-
9	E1 18TN/0R	PANEL LAMPS DIMMER SWITCH SIGNAL
10	-	-
11	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)



JUNCTION
BLOCK - C5

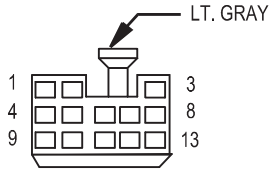
CAV	CIRCUIT	FUNCTION
1	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	L61 16LG	LEFT TURN SIGNAL
3	F75 18VT	FUSED B(+)
4	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
5	-	-
6	M3 20PK/DB	CARGO LAMP DRIVER
7	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
8	F15 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)



JUNCTION
BLOCK - C6

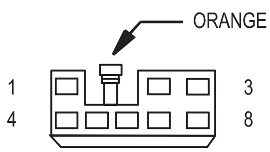
CAV	CIRCUIT	FUNCTION
1	F31 18VT	FUSED (B+)
2	-	-
3	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
4	-	-
5	X2 16DG/RD	HORN RELAY OUTPUT
6	F24 18RD/DG	FUSED IGNITION SWITCH OUTPUT (RUN)

● POWER OPTIONS



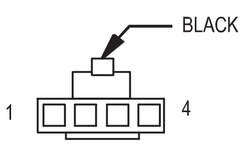
JUNCTION BLOCK - C7

CAV	CIRCUIT	FUNCTION
1	L60 16TN	RIGHT TURN SIGNAL
2	-	-
3	Z1 18BK	GROUND
4	L60 16TN	RIGHT TURN SIGNAL
5	-	-
6	M2 20YL	COURTESY LAMP DRIVER
7	X3 20BK/RD	HORN RELAY CONTROL
8	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
9	M1 18PK	FUSED B(+)
10	F35 18RD	FUSED B(+)
11	-	-
12	F31 18VT	FUSED B(+)
13	-	-



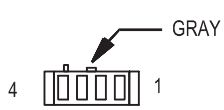
JUNCTION BLOCK - C8

CAV	CIRCUIT	FUNCTION
1	F30 16RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	-	-
3	L5 18BK/RD	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
4	F33 18PK/RD	FUSED B(+)
5	F35 18RD	FUSED B(+)
6	-	-
7	-	-
8	-	-



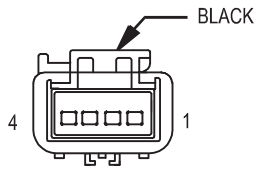
JUNCTION BLOCK - C9

CAV	CIRCUIT	FUNCTION
1	L10 18BR/LG	FUSED IGNITION SWITCH OUTPUT (RUN)
2	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
3	A21 12DB	IGNITION SWITCH OUTPUT (ST-RUN)
4	A31 12BK/WT	IGNITION SWITCH OUTPUT (RUN-ACC)



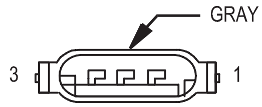
KEY-IN SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G26 20LB	KEY-IN IGNITION SWITCH SENSE
3	-	-
4	-	-



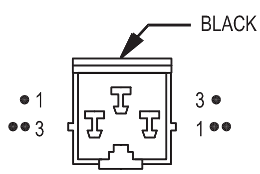
LEAK DETECTION PUMP

CAV	CIRCUIT	FUNCTION
1	-	-
2	K125 18WT/DB	GENERATOR SOURCE
3	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
4	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE



LEFT BACK-UP LAMP

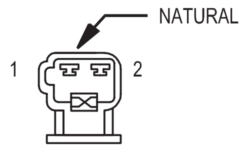
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	-	-
3	L1 20VT/BK	BACK-UP LAMP FEED



LEFT DOOR SPEAKER (STANDARD)

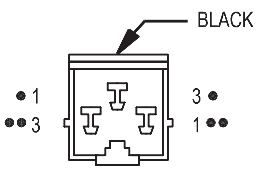
CAV	CIRCUIT	FUNCTION
1	X53 18DG	LEFT FRONT SPEAKER (+)
2	-	-
3	X55 18BR/RD	LEFT FRONT SPEAKER (-)

• 2-DOOR
•• 4-DOOR



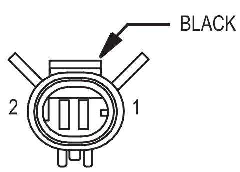
LEFT DOOR TWEETER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X87 18LG/RD	AMPLIFIED LEFT DOOR SPEAKER (+)
2	X85 18LG/BK	AMPLIFIED LEFT DOOR SPEAKER (-)



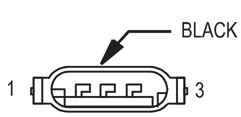
LEFT DOOR WOOFER (PREMIUM)

CAV	CIRCUIT	FUNCTION
1	X87 18LG/RD	AMPLIFIED LEFT DOOR SPEAKER (+)
2	-	-
3	X85 18LG/BK	AMPLIFIED LEFT DOOR SPEAKER (-)



LEFT FOG LAMP

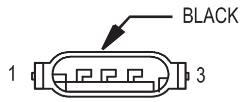
CAV	CIRCUIT	FUNCTION
1	L39 18LB	FUSED B(+)
2	L38 20LB/BK	FOG LAMP CONTROL



LEFT FRONT PARK/TURN SIGNAL LAMP NO. 1

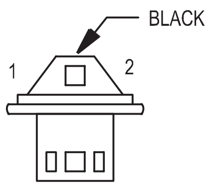
CAV	CIRCUIT	FUNCTION
1	L61 16LG	LEFT TURN SIGNAL
2	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
3	Z1 20BK	GROUND

• 2-DOOR
•• 4-DOOR



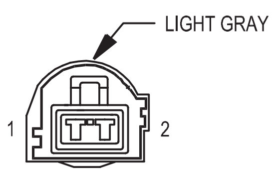
LEFT FRONT PARK/TURN SIGNAL LAMP NO. 2

CAV	CIRCUIT	FUNCTION
1	L61 16LG	LEFT TURN SIGNAL
2	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
3	Z1 20BK	GROUND



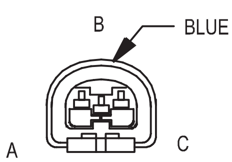
LEFT FRONT SIDE MARKER LAMP

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



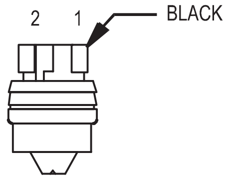
LEFT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B8 20RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 20RD	LEFT FRONT WHEEL SPEED SENSOR (+)



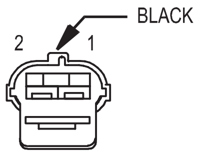
LEFT HEADLAMP

CAV	CIRCUIT	FUNCTION
A	L4 18VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
B	A301 18RD/TN	FUSED B(+)
C	L3 18RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT



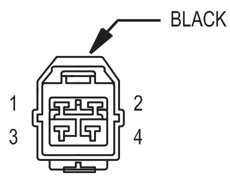
LEFT LICENSE LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT



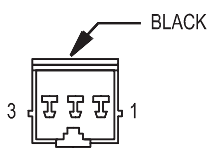
LEFT REAR DOOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G74 18TN/RD	DOOR AJAR SWITCH SENSE
2	Z2 20BK/LG	GROUND



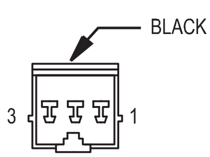
LEFT REAR DOOR LOCK MOTOR/AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G74 18TN/RD	DOOR AJAR SWITCH SENSE
2	Z2 20BK/LG	GROUND
3	P34 16PK/BK	DOOR UNLOCK DRIVER
4	P33 16OR/BK	DOOR LOCK DRIVER



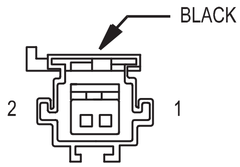
LEFT REAR DOOR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X51 18BR/YL	LEFT REAR SPEAKER (+)
2	-	-
3	X57 18BR/LB	LEFT REAR SPEAKER (-)



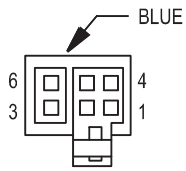
LEFT REAR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X51 18BR/YL	LEFT REAR SPEAKER (+)
2	-	-
3	X57 18BR/LB	LEFT REAR SPEAKER (-)



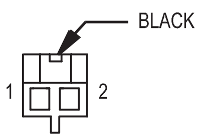
LEFT REAR WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q23 14RD/WT	LEFT REAR WINDOW DRIVER DOWN
2	Q13 14DB	LEFT REAR WINDOW DRIVER UP



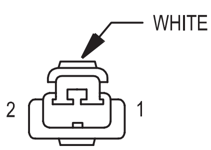
LEFT REAR WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	-	-
2	Q27 14RD/BK	LEFT REAR WINDOW DRIVER DOWN
3	Q13 14DB	LEFT REAR WINDOW DRIVER UP
4	Q1 14YL	POWER WINDOW SWITCH FEED
5	Q23 14RD/WT	LEFT REAR WINDOW DRIVER DOWN
6	Q17 14DB/WT	LEFT REAR WINDOW DRIVER UP



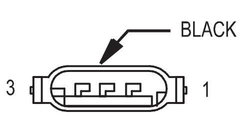
LEFT REMOTE RADIO SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 22BK/LG	GROUND
2	X20 22RD/BK	RADIO CONTROL MUX



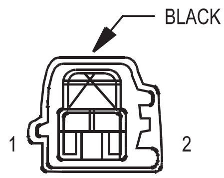
LEFT SPEED CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	K4 22WT	SENSOR GROUND
2	V37 22DG/RD	SPEED CONTROL SWITCH SIGNAL
	V37 22DG/RD	SPEED CONTROL SWITCH SIGNAL



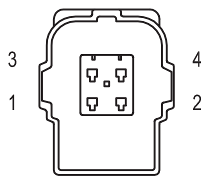
LEFT TAIL/ STOP/TURN SIGNAL LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
3	L632 16DG/BR	LEFT REAR TURN SIGNAL



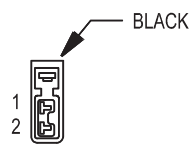
LICENSE LAMP

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 20BK	GROUND



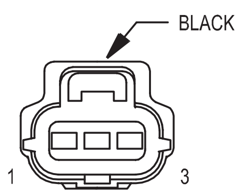
LINE PRESSURE SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	Z14 18BK/YL	GROUND
2	T38 18DB	5V SUPPLY
3	T30 18VT/LB	LINE PRESSURE SENSOR SIGNAL
4	-	-



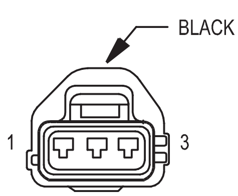
LOW NOTE HORN

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT



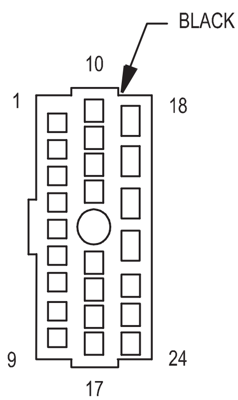
MANIFOLD ABSOLUTE PRESSURE SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	K7 18OR	5V SUPPLY
2	K4 18BK/LB	SENSOR GROUND
3	K1 18DG/RD	MAP SENSOR SIGNAL



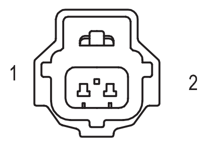
MANIFOLD ABSOLUTE PRESSURE SENSOR (EXCEPT 4.7L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K1 18DG/RD	MAP SENSOR SIGNAL
3	K7 18OR	5V SUPPLY



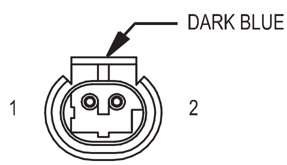
MULTI-FUNCTION SWITCH

CAV	CIRCUIT	FUNCTION
1	V51 20WT	INTERMITTENT WIPER MODE SENSE
2	V52 20DG/RD	FRONT WIPER SWITCH MUX
3	V10 18BR	WASHER PUMP CONTROL
	V10 18BR	WASHER PUMP CONTROL
4	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
5	V48 16RD/GY	DRIVER WIPER ARM SIGNAL
6	V45 18VT	DRIVER WIPER ARM SIGNAL
7	V49 18RD/BK	DRIVER LOW SPEED WIPER MOTOR DRIVER
8	V49 18RD/BK	DRIVER LOW SPEED WIPER MOTOR DRIVER
9	V45 18VT	DRIVER WIPER ARM SIGNAL
10	-	-
11	L60 16TN	RIGHT TURN SIGNAL
12	L62 16BR/RD	RIGHT TURN SIGNAL
13	L19 18PK	HAZARD FLASHER SIGNAL
14	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
15	L63 16DG/RD	LEFT TURN SIGNAL
16	L61 16LG	LEFT TURN SIGNAL
17	L6 16RD/WT	FLASHER OUTPUT
18	L4 18VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
19	L2 18LG	HEADLAMP RELAY OUTPUT
20	L3 18RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
21	Z1 18BK	GROUND
22	-	-
23	-	-
24	-	-



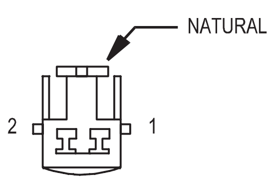
OUTPUT SPEED SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL



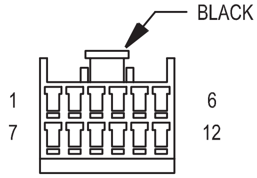
OUTPUT SPEED SENSOR (EXCEPT 4.7L)

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL



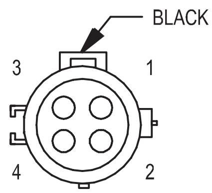
OVERDRIVE SWITCH

CAV	CIRCUIT	FUNCTION
1	T6 20OR/WT	TRANSMISSION OVERDRIVE SWITCH SENSE
2	Z1 20BK	GROUND



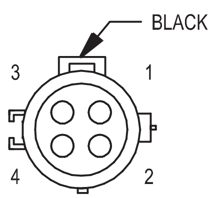
OVERHEAD CONSOLE

CAV	CIRCUIT	FUNCTION
1	F12 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	D1 20VT/BR	CCD BUS (+)
3	G31 20VT/LG	AMBIENT TEMPERATURE SENSOR SIGNAL
4	-	-
5	M1 20PK	FUSED B(+)
6	Z1 20BK	GROUND
7	Z2 20BK/LG	GROUND
8	D2 20WT/BK	CCD BUS (-)
9	G32 20BK/LB	SENSOR GROUND
10	-	-
11	-	-
12	M2 20YL	COURTESY LAMPS DRIVER



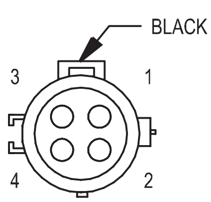
OXYGEN SENSOR 1/1 UPSTREAM (EXCEPT 4.7L)

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K141 18TN/WT	OXYGEN SENSOR 1/1 SIGNAL



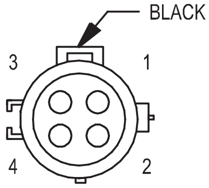
OXYGEN SENSOR 1/1 UPSTREAM (4.7L CALIFORNIA)

CAV	CIRCUIT	FUNCTION
1	F342 18DG/RD	OXYGEN SENSOR UPSTREAM HEATER RELAY OUTPUT
2	Z11 18BK/WT	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K241 18LG/RD	OXYGEN SENSOR 1/1 SIGNAL



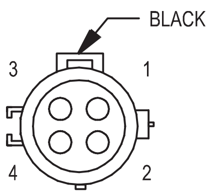
OXYGEN SENSOR 1/1 UPSTREAM (4.7L EXCEPT CALIFORNIA)

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	Z11 18BK/WT	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K241 18LG/RD	OXYGEN SENSOR 1/1 SIGNAL



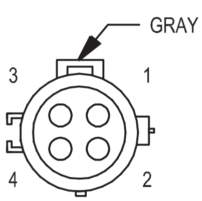
OXYGEN SENSOR 1/2 DOWNSTREAM (EXCEPT 4.7L)

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K341 18OR/BK ●	OXYGEN SENSOR 1/2 SIGNAL
4	K141 18TN/WT ●●	OXYGEN SENSOR 1/2 SIGNAL



OXYGEN SENSOR 1/2 DOWNSTREAM (4.7L CALIFORNIA)

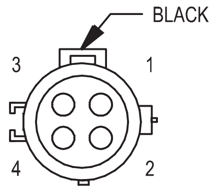
CAV	CIRCUIT	FUNCTION
1	F242 18DG/PK	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
2	Z11 18BK/WT	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K141 18TN/WT	OXYGEN SENSOR 1/2 SIGNAL



OXYGEN SENSOR 2/1 UPSTREAM (4.7L CALIFORNIA)

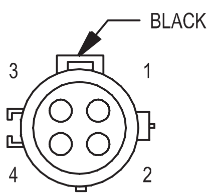
CAV	CIRCUIT	FUNCTION
1	F342 18DG/RD	OXYGEN SENSOR UPSTREAM HEATER RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K441 18OR/TN	OXYGEN SENSOR 2/1 SIGNAL

● 2.5L
●● 3.9L/5.9L



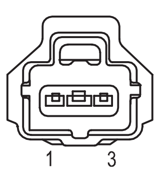
OXYGEN SENSOR 2/2 DOWNSTREAM (4.7L CALIFORNIA)

CAV	CIRCUIT	FUNCTION
1	F242 18DG/PK	OXYGEN SENSOR DOWNSTREAM HEATER RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K341 18PK/WT	OXYGEN SENSOR 2/2 SIGNAL



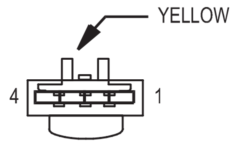
OXYGEN SENSOR 2/2 DOWNSTREAM (4.7L EXCEPT CALIFORNIA)

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K141 18TN/WT	OXYGEN SENSOR 2/2 SIGNAL



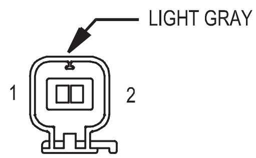
PARK/NEUTRAL POSITION SWITCH (3.9L A/T, 5.9L A/T)

CAV	CIRCUIT	FUNCTION
1	L10 18BR/LG	FUSED IGNITION SWITCH OUTPUT(RUN)
2	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
3	L1 18VT/BK	BACK-UP LAMP FEED



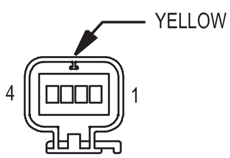
PASSENGER AIRBAG

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	R44 18DG/YL	PASSENGER AIRBAG LINE 2
4	R42 18BK/YL	PASSENGER AIRBAG LINE 1



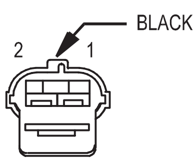
PASSENGER AIRBAG ON/OFF SWITCH-C1

CAV	CIRCUIT	FUNCTION
1	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	Z6 18BK/PK	GROUND



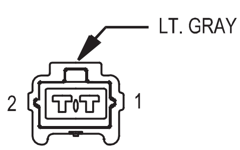
PASSENGER AIRBAG ON/OFF SWITCH-C2

CAV	CIRCUIT	FUNCTION
1	R142 18BR/YL	PASSENGER AIRBAG SQUIB LINE 1
2	R144 18VT/YL	PASSENGER AIRBAG SQUIB LINE 2
3	R42 18BK/YL	PASSENGER AIRBAG LINE 1
4	R44 18DG/YL	PASSENGER AIRBAG LINE 2



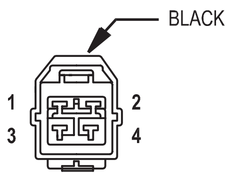
PASSSENGER DOOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G74 18TN/RD	PASSENGER DOOR AJAR SWITCH SENSE
2	Z2 20BK/LG	GROUND



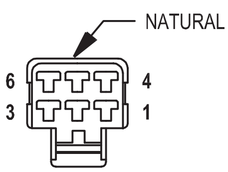
PASSENGER DOOR KEY CYLINDER SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/LG	GROUND
2	G73 20LG/OR	CYLINDER LOCK SWITCH MUX



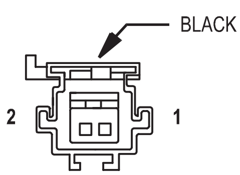
PASSENGER DOOR LOCK MOTOR/AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G74 20TN/RD ●●	DOOR AJAR SWITCH SENSE
1	G74 18TN/RD ●	DOOR AJAR SWITCH SENSE
2	Z2 20BK/LG	GROUND
3	P34 18PK/BK ●●	DOOR UNLOCK DRIVER
3	P34 16PK/BK ●	DOOR UNLOCK DRIVER
4	P33 18OR/BK ●●	DOOR LOCK DRIVER
4	P33 16OR/BK ●	DOOR LOCK DRIVER



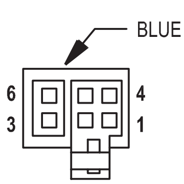
PASSENGER DOOR LOCK SWITCH (4 DOOR)

CAV	CIRCUIT	FUNCTION
1	-	-
2	F35 18RD	FUSED B(+)
3	P35 18OR/VT	DOOR LOCK SWITCH SENSE
4	P36 18PK/VT	DOOR UNLOCK SWITCH SENSE
5	L10 20BR/LG	FUSED IGNITION SWITCH OUTPUT (RUN)
6	Z1 20BK	GROUND



PASSENGER DOOR WINDOW MOTOR

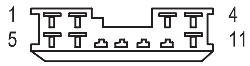
CAV	CIRCUIT	FUNCTION
1	Q22 14VT	PASSENGER WINDOW DRIVER DOWN
2	Q12 14BR	PASSENGER WINDOW DRIVER UP



PASSENGER DOOR WINDOW SWITCH (4 DOOR)

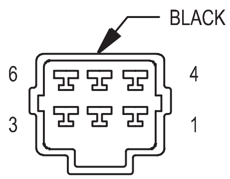
CAV	CIRCUIT	FUNCTION
1	-	-
2	Q16 14BR/WT	MASTER WINDOW SWITCH PASSENGER UP
3	Q22 14VT	PASSENGER WINDOW DRIVER DOWN
4	Q1 14YL	POWER WINDOW SWITCH FEED
5	Q12 14BR	PASSENGER WINDOW DRIVER UP
6	Q26 14VT/WT	MASTER WINDOW SWITCH PASSENGER DOWN

● 2 DOOR
●● 4 DOOR



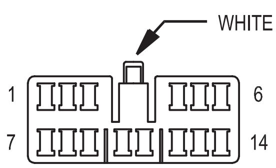
PASSENGER POWER LOCK/WINDOW SWITCH (2 DOOR)

CAV	CIRCUIT	FUNCTION
1	Q16 14BR/WT	MASTER WINDOW SWITCH PASSENGER UP
2	Q26 14VT/WT	MASTER WINDOW SWITCH PASSENGER DOWN
3	Q22 14VT	PASSENGER WINDOW DRIVER DOWN
4	Q12 14BR	PASSENGER WINDOW DRIVER UP
5	F35 16RD	FUSED B(+)
6	P35 16LG/BK	DOOR LOCK SWITCH SENSE
7	P37 16LG	UNLOCK RELAY OUTPUT
8	Z1 20BK	GROUND
9	P38 16OR/WT	DOOR LOCK RELAY CONTROL
10	P36 16PK/VT	DOOR UNLOCK SWITCH SENSE
11	F21 14TN	FUSED REAR WINDOW DEFOGGER SWITCH OUTPUT



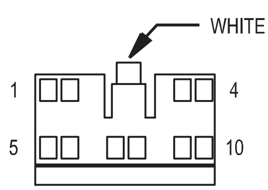
PASSENGER POWER MIRROR

CAV	CIRCUIT	FUNCTION
1	P70 22WT	PASSENGER MIRROR RIGHT/DOWN MOVEMENT
2	P74 22DB	PASSENGER MIRROR LEFT MOVEMENT
3	P72 22YL/BK	PASSENGER MIRROR UP MOVEMENT
4	-	-
5	Z1 18BK ●	GROUND
6	F121 20TN/BK ●	FUSED REAR WINDOW DEFOGGER SWITCH OUTPUT



POWER AMPLIFIER-C1

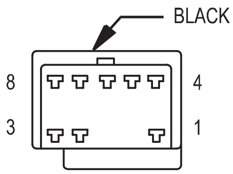
CAV	CIRCUIT	FUNCTION
1	F75 18VT	FUSED B (+) POWER AMPLIFIER
2	F75 18VT	FUSED B (+) POWER AMPLIFIER
3	-	-
4	X87 18LG/RD	AMPLIFIED LEFT DOOR SPEAKER (+)
5	X94 18TN/VT	AMPLIFIED RIGHT REAR SPEAKER (+)
6	X93 18WT/RD	AMPLIFIED LEFT REAR SPEAKER (+)
7	Z2 16BK/LG	GROUND
8	Z2 16BK/LG	GROUND
9	-	-
10	X80 18LB/BK	AMPLIFIED RIGHT DOOR SPEAKER (-)
11	X82 18LB/RD	AMPLIFIED RIGHT DOOR SPEAKER (+)
12	X85 18LG/BK	AMPLIFIED LEFT DOOR SPEAKER (-)
13	X92 18TN/DG	AMPLIFIED RIGHT REAR SPEAKER (-)
14	X91 18WT/BK	AMPLIFIED LEFT REAR SPEAKER(-)



POWER AMPLIFIER-C2

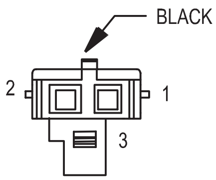
CAV	CIRCUIT	FUNCTION
1	X55 20BR/RD	LEFT FRONT SPEAKER(-)
2	X56 20DB/RD	RIGHT FRONT SPEAKER(-)
3	X58 20DB/OR	RIGHT REAR SPEAKER(-)
4	X60 20DG/RD	RADIO 12V OUTPUT
5	X53 20DG	LEFT FRONT SPEAKER(+)
6	X54 20VT	RIGHT FRONT SPEAKER(+)
7	X51 20BR/YL	LEFT REAR SPEAKER(+)
8	X57 20BR/LB	LEFT REAR SPEAKER(-)
9	X52 20DB/WT	RIGHT REAR SPEAKER(+)
10	-	-

● 4 DOOR



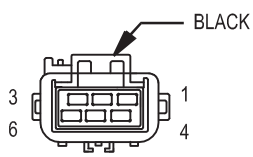
POWER MIRROR SWITCH

CAV	CIRCUIT	FUNCTION
1	P71 22YL	LEFT POWER MIRROR LEFT MOVEMENT
2	P75 22DB/WT	LEFT POWER MIRROR UP MOVEMENT
3	P73 22YL/PK	LEFT POWER MIRROR RIGHT/DOWN MOVEMENT
4	P72 22YL/BK	RIGHT POWER MIRROR UP MOVEMENT
5	P74 22DB	RIGHT POWER MIRROR LEFT MOVEMENT
6	P70 22WT	RIGHT MIRROR RIGHT/DOWN MOVEMENT
7	M1 20PK	FUSED B(+)
8	Z1 20BK	GROUND



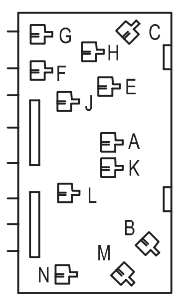
POWER OUTLET

CAV	CIRCUIT	FUNCTION
1	F70 14PK/BK	FUSED B(+)
2	-	-
3	Z1 14BK	GROUND



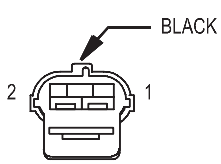
POWER SEAT MOTORS

CAV	CIRCUIT	FUNCTION
1	P17 14RD/LB	SEAT HORIZONTAL REARWARD SWITCH SENSE
2	P19 14YL/LG	SEAT FRONT UP SWITCH SENSE
3	P11 14YL/WT	SEAT REAR UP SWITCH SENSE
4	P15 14YL/LB	SEAT HORIZONTAL FORWARD SWITCH SENSE
5	P21 14RD/LG	SEAT FRONT DOWN SWITCH SENSE
6	P13 14RD/WT	SEAT REAR DOWN SWITCH SENSE



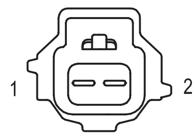
POWER SEAT SWITCH

CAV	CIRCUIT	FUNCTION
A	A4 12BK/PK	FUSED (B+)
B	Z1 12BK	GROUND
C	-	-
D	-	-
E	P21 14RD/LG	SEAT FRONT DOWN SWITCH SENSE
F	-	-
G	-	-
H	-	-
I	-	-
J	P19 14YL/LG	SEAT FRONT UP SWITCH SENSE
K	P15 14YL/LB	SEAT HORIZONTAL FORWARD SWITCH SENSE
L	P17 14RD/LB	SEAT HORIZONTAL REARWARD SWITCH SENSE
M	P13 14RD/WT	SEAT REAR DOWN SWITCH SENSE
N	P11 14YL/WT	SEAT REAR UP SWITCH SENSE



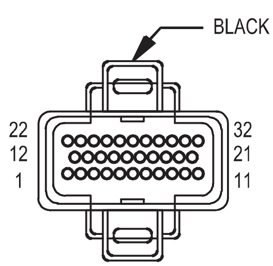
POWER STEERING PRESSURE SWITCH (2.5L)

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	K10 18DB/OR	POWER STEERING PRESSURE SWITCH SENSE



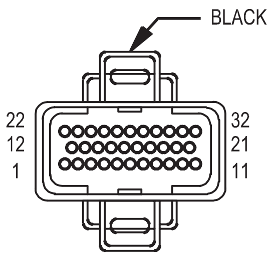
POWER STEERING PRESSURE SWITCH (4.7L)

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	K10 18DB/OR	POWER STEERING PRESSURE SWITCH SENSE



POWERTRAIN CONTROL MODULE-C1 (2.5L)

CAV	CIRCUIT	FUNCTION
1	-	-
2	F18 18LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
3	-	-
4	K4 18BK/LB	SENSOR GROUND
5	-	-
6	-	-
7	K19 16BK/GY	IGNITION COIL NO. 1 DRIVER
8	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
9	-	-
10	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
12	K10 18DB/OR	POWER STEERING PRESSURE SWITCH SENSE
13	-	-
14	-	-
15	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL
16	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR	5V SUPPLY
18	K44 16TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
19	K39 18GY/RD	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
21	-	-
22	A14 16RD/WT	FUSED B(+)
23	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
24	K141 18TN/WT	OXYGEN SENSOR 1/1 SIGNAL
25	K341 18OR/BK	OXYGEN SENSOR 1/2 SIGNAL
26	-	-
27	K1 18DG/RD	MAP SENSOR SIGNAL
28	-	-
29	-	-
30	-	-
31	Z12 14BK/TN	GROUND
32	Z12 14BK/TN	GROUND

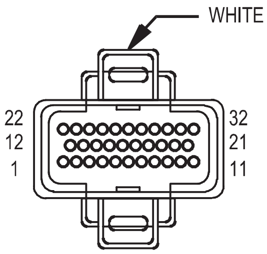


POWERTRAIN CONTROL MODULE-C1 (3.9L/4.7L/5.9L)

CAV	CIRCUIT		FUNCTION
1	K93 16TN/OR	▲	COIL ON PLUG NO. 3 DRIVER
2	F18 18LG/BK		FUSED IGNITION SWITCH OUTPUT (ST-RUN)
3	K94 16TN/LG	▲	COIL ON PLUG NO. 4 DRIVER
4	K4 18BK/LB		SENSOR GROUND
5	K96 16TN/LB	▲	COIL ON PLUG NO. 6 DRIVER
6	T41 18BK/WT	●	PARK/NEUTRAL POSITION SWITCH SENSE
7	K19 16BK/GY		COIL ON PLUG NO. 1 DRIVER
8	K24 18GY/BK		CRANKSHAFT POSITION SENSOR SIGNAL
9	K18 16DB/GY	▲	COIL ON PLUG NO. 8 DRIVER
10	K60 18YL/BK		IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT		IDLE AIR CONTROL NO. 3 DRIVER
12	K10 18DB/OR	▲	POWER STEERING PRESSURE SWITCH SENSE
13	-		-
14	-		-
15	K21 18BK/RD		INTAKE AIR TEMPERATURE SIGNAL
16	K2 18TN/BK		ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR		5V SUPPLY
18	K44 16TN/YL		CAMSHAFT POSITION SENSOR SIGNAL
19	K39 18GY/RD		IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK		IDLE AIR CONTROL NO. 4 DRIVER
21	K95 16TN/DG	▲	COIL ON PLUG NO. 5 DRIVER
22	A14 16RD/WT		FUSED B(+)
23	K22 18OR/DB		THROTTLE POSITION SENSOR SIGNAL
24	K141 18TN/WT	●●	OXYGEN SENSOR 1/1 SIGNAL
24	K241 18LG/RD	▲	OXYGEN SENSOR 1/1 SIGNAL
25	K341 18OR/BK	●●	OXYGEN SENSOR 1/1 SIGNAL
25	K141 18TN/WT	▲	OXYGEN SENSOR 2/2 SIGNAL
26	K441 18OR/TN	▲▲	OXYGEN SENSOR 2/1 SIGNAL
27	K1 18DG/RD		MAP SENSOR SIGNAL
28	-		-
29	K341 18PK/WT	▲▲	OXYGEN SENSOR 2/2 SIGNAL
30	-		-
31	Z12 14BK/TN		GROUND
32	Z12 14BK/TN		GROUND

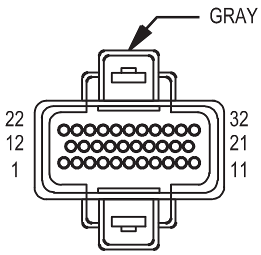
● A/T
●● 3.9L/5.9L
▲ 4.7L
▲▲ 4.7L CALIFORNIA

J008W-1 AN008058



POWERTRAIN CONTROL MODULE-C2 (2.5L)

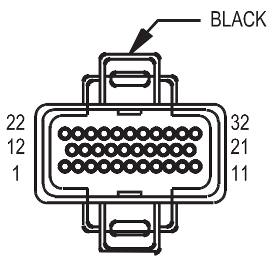
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	-	-
7	-	-
8	-	-
9	-	-
10	K20 18DG	GENERATOR FIELD
11	-	-
12	-	-
13	-	-
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
24	-	-
25	-	-
26	-	-
27	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-



POWERTRAIN CONTROL MODULE-C2 (3.9L/4.7L/5.9L)

CAV	CIRCUIT	FUNCTION
1	T54 18VT ●	TRANSMISSION TEMPERATURE SENSOR SIGNAL
2	K26 18VT ▲ ■	FUEL INJECTOR NO. 7 DRIVER
3	-	-
4	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
7	K17 16DB/TN ■	COIL ON PLUG NO. 7 DRIVER
8	T7 18PK ● ●	GOVERNOR PRESSURE SOLENOID CONTROL
9	K92 16TN/PK ■	COIL ON PLUG NO. 2 DRIVER
10	K20 18DG	GENERATOR FIELD
11	K54 18OR/BK ● ●	TORQUE CONVERTOR CLUTCH SOLENOID CONTROL
12	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
13	K28 18GY/LB ■ ▲	FUEL INJECTOR NO. 8 DRIVER
14	-	-
15	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	C24 18DB/PK	RADIATOR FAN RELAY CONTROL
18	-	-
19	-	-
20	-	-
21	T60 18BR ● ●	OVERDRIVE SOLENOID CONTROL
22	-	
23	G60 16GY/YL ■	ENGINE OIL PRESSURE SIGNAL
23	G60 18GY/YL ■ ■	ENGINE OIL PRESSURE SIGNAL
24	-	-
25	T13 18DB/BK ● ●	SPEED SENSOR GROUND
26	-	-
27	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
28	T14 18LG/WT ● ●	OUTPUT SPEED SENSOR SIGNAL
29	T25 18LG/RD ● ●	GOVERNOR PRESSURE SIGNAL
30	K30 18PK ■ ■	TRANSMISSION CONTROL RELAY CONTROL
31	K6 18VT/WT ● ●	5V SUPPLY
32	-	-

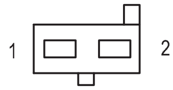
▲ 5.9L
● A/T
● ● A/T 3.9L/5.9L
■ 4.7L
■ ■ 3.9L/5.9L



POWERTRAIN CONTROL MODULE-C3

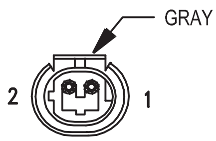
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	C27 18DB/PK ●	RADIATOR FAN RELAY CONTROL
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD ▲	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD ▲	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	-	-
8	A145 18DG/WT ▲▲	OXYGEN SENSOR UPSTREAM HEATER RELAY CONTROL
9	A141 18DG/BK ▲▲	OXYGEN SENSOR DOWNSTREAM HEATER RELAY CONTROL
10	K106 18WT/DG ■	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18YL/RD ●●	SPEED CONTROL POWER SUPPLY
12	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
13	T10 18YL/DG ◇	TORQUE MANAGEMENT REQUEST SENSE
	T6 18OR/WT ■■	TRANSMISSION OVERDRIVE SWITCH SENSE
14	K107 18OR ■	LEAK DETECTION PUMP SWITCH SENSE
15	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
16	-	-
17	-	-
18	-	-
19	K151 18LB/OR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
21	-	-
22	C20 18BR	A/C SWITCH SENSE
23	C90 18LG/WT	A/C SELECT INPUT
24	K29 18WT/PK	BRAKE SWITCH SENSE
25	K125 18WT/DB	GENERATOR SOURCE
26	G4 18DB	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK/DB	SCI TRANSMIT
28	D2 18WT/BK	CCD BUS(-)
29	D20 18LG	SCI RECEIVE
30	D1 18VT/BR	CCD BUS(+)
31	-	-
32	V37 18RD/LG ▲	SPEED CONTROL SWITCH SIGNAL

● 2.5L
●● EXCEPT 2.5L
▲ SPEED CONTROL
▲▲ CALIFORNIA
■ LEAK DETECTION
■■ 3.9L/5.9L
◇ 4.7L



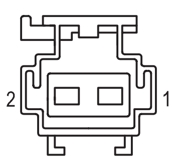
PRNDL

CAV	CIRCUIT	FUNCTION
1	F84 18YL/WT	FUSED B(+)
2	A81 18DG/RD	IGNITION SWITCH OUTPUT (ST-RUN-OFF)



PROPORTIONAL PURGE SOLENOID

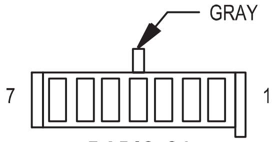
CAV	CIRCUIT		FUNCTION
1	K52 18PK/BK	●●	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
	F12 18DB/WT	●	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	F12 18DB/WT	●●	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
	K52 18PK/BK	●	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL



RADIATOR FAN MOTOR

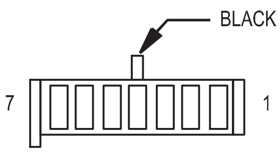
CAV	CIRCUIT		FUNCTION
1	C25 12LG	●	RADIATOR FAN RELAY OUTPUT
	C23 12DG	●●	RADIATOR FAN RELAY OUTPUT
2	Z1 12BK		GROUND

● 2.5L
●● 3.9L/4.7L/5.9L



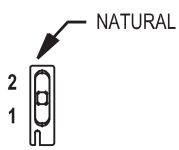
RADIO-C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	X55 18BR/RD •	LEFT FRONT SPEAKER (-)
2	X55 20BR/RD ••	LEFT FRONT SPEAKER (-)
3	X56 18DB/RD •	RIGHT FRONT SPEAKER (-)
3	X56 20DB/RD ••	RIGHT FRONT SPEAKER (-)
4	L107 20BK/YL	HEADLAMP SWITCH OUTPUT
5	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
6	X12 16RD/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
7	M1 18PK	FUSED B(+)



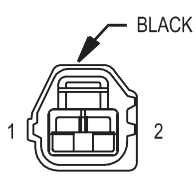
RADIO-C2

CAV	CIRCUIT	FUNCTION
1	X60 20DG/RD ••	RADIO 12V OUTPUT
2	X51 18BR/YL •	LEFT REAR SPEAKER (+)
	X51 20BR/YL ••	LEFT REAR SPEAKER (+)
3	X52 18DB/WT •	RIGHT REAR SPEAKER (+)
	X52 20DB/WT ••	RIGHT REAR SPEAKER (+)
4	X53 18DG •	LEFT FRONT SPEAKER (+)
	X53 20DG ••	LEFT FRONT SPEAKER (+)
5	X54 18VT •	RIGHT FRONT SPEAKER (+)
	X54 20VT ••	RIGHT FRONT SPEAKER (+)
6	X57 18BR/LB •	LEFT REAR SPEAKER (-)
	X57 20BR/LB ••	LEFT REAR SPEAKER (-)
7	X58 18DB/OR •	RIGHT REAR SPEAKER (-)
	X58 20DB/OR ••	RIGHT REAR SPEAKER (-)



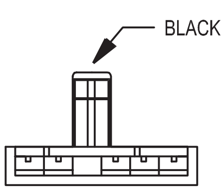
RADIO-C3

CAV	CIRCUIT	FUNCTION
1	D1 20VT/BR	CCD BUS (+)
2	D2 20WT/BK	CCD BUS (-)



REAR WHEEL SPEED SENSOR

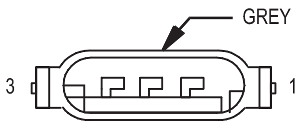
CAV	CIRCUIT	FUNCTION
1	B114 20WT/VT	REAR WHEEL SPEED SENSOR (-)
2	B113 20RD/VT	REAR WHEEL SPEED SENSOR (+)



REAR WINDOW DEFOGGER SWITCH

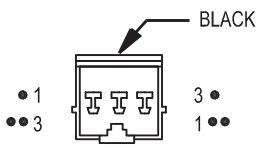
CAV	CIRCUIT	FUNCTION
1	E2 20OR	PANEL LAMPS DRIVER
2	Z1 18BK	GROUND
3	F24 18RD/DG	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
4	A4 12BK/PK	FUSED B(+)
5	C15 12BK/WT	REAR WINDOW DEFOGGER SWITCH OUTPUT

• STANDARD RADIO
•• PREMIUM RADIO



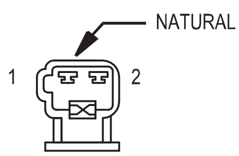
RIGHT BACK-UP LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	-	-
3	L1 20VT/BK	BACK-UP LAMP FEED



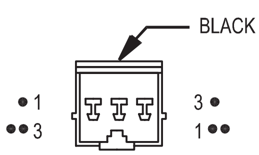
RIGHT DOOR SPEAKER (STANDARD)

CAV	CIRCUIT	FUNCTION
1	X54 18VT ••	RIGHT FRONT SPEAKER (+)
1	X82 18LB/RD •	RIGHT FRONT SPEAKER (+)
2	-	-
3	X56 18DB/RD ••	RIGHT FRONT SPEAKER (-)
3	X80 18LB/BK •	RIGHT FRONT SPEAKER (-)



RIGHT DOOR TWEETER (PREMIUM)

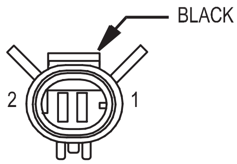
CAV	CIRCUIT	FUNCTION
1	X82 18LB/RD	AMPLIFIED RIGHT DOOR SPEAKER(+)
2	X80 18LB/BK	AMPLIFIED RIGHT DOOR SPEAKER (-)



RIGHT DOOR WOOFER (PREMIUM)

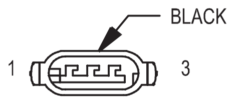
CAV	CIRCUIT	FUNCTION
1	X82 18LB/RD	AMPLIFIED RIGHT DOOR SPEAKER (+)
2	-	-
3	X80 18LB/BK	AMPLIFIED RIGHT DOOR SPEAKER (-)

• 2-DOOR
•• 4-DOOR



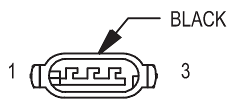
RIGHT FOG LAMP

CAV	CIRCUIT	FUNCTION
1	L39 18LB	FUSED B(+)
2	L38 20LB/BK	FOG LAMP CONTROL



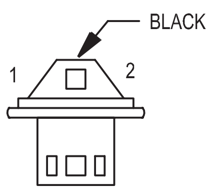
RIGHT FRONT PARK/TURN SIGNAL LAMP NO.1

CAV	CIRCUIT	FUNCTION
1	L60 16TN	RIGHT TURN SIGNAL
2	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
3	Z1 20BK	GROUND



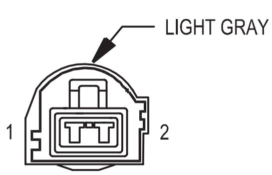
RIGHT FRONT PARK/TURN SIGNAL LAMP NO.2

CAV	CIRCUIT	FUNCTION
1	L60 16TN	RIGHT TURN SIGNAL
2	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
3	Z1 20BK	GROUND



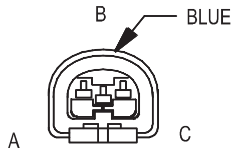
RIGHT FRONT SIDE MARKER LAMP

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



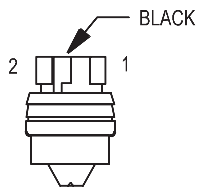
RIGHT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B6 20WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 20WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



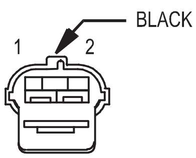
RIGHT HEADLAMP

CAV	CIRCUIT	FUNCTION
A	L4 18VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
B	A302 18RD/LG	FUSED B(+)
C	L3 18RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT



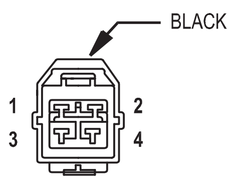
RIGHT LICENSE LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT



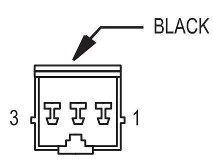
RIGHT REAR DOOR AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G74 18TN/RD	DOOR AJAR SWITCH SENSE
2	Z2 20BK/LG	GROUND



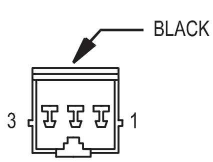
RIGHT REAR DOOR LOCK MOTOR/AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/LG	GROUND
2	G74 18TN/RD	DOOR AJAR SWITCH SENSE
3	P34 16PK/BK	DOOR UNLOCK DRIVER
4	P33 16OR/BK	DOOR LOCK DRIVER



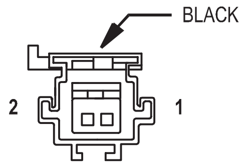
RIGHT REAR DOOR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X52 18DB/WT	RIGHT REAR SPEAKER (+)
2	-	-
3	X58 18DB/OR	RIGHT REAR SPEAKER (-)



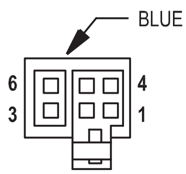
RIGHT REAR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X52 18DB/WT	RIGHT REAR SPEAKER (+)
2	-	-
3	X58 18DB/OR	RIGHT REAR SPEAKER (-)



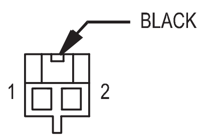
RIGHT REAR
WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q24 14DG	RIGHT REAR WINDOW DRIVER DOWN
2	Q14 14GY	RIGHT REAR WINDOW DRIVER UP



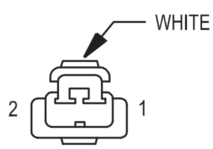
RIGHT REAR
WINDOW
SWITCH

CAV	CIRCUIT	FUNCTION
1	-	-
2	Q28 14DG/WT	MASTER WINDOW SWITCH RIGHT REAR DOWN
3	Q14 14GY	RIGHT REAR WINDOW DRIVER UP
4	Q1 14YL	POWER WINDOW SWITCH FEED
5	Q24 14DG	RIGHT REAR WINDOW DRIVER DOWN
6	Q18 14 GY/BK	MASTER WINDOW SWITCH RIGHT REAR UP



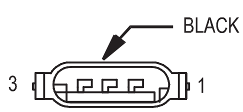
RIGHT REMOTE
RADIO SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 22BK/LG	GROUND
2	X20 22RD/BK	RADIO CONTROL MUX



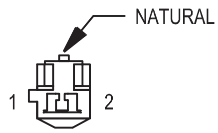
RIGHT SPEED
CONTROL SWITCH

CAV	CIRCUIT	FUNCTION
1	K4 22WT	SENSOR GROUND
	K4 22WT	SENSOR GROUND
2	V37 22DG/RD	SPEED CONTROL SWITCH SIGNAL



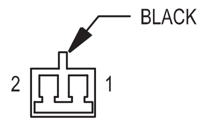
RIGHT TAIL/
STOP/TURN
SIGNAL LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L7 20BK/YL	HEADLAMP SWITCH OUTPUT
3	L632 16DG/BR	RIGHT REAR TURN SIGNAL



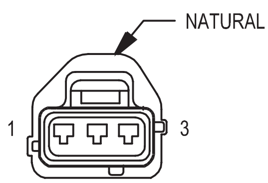
SEAT BELT SWITCH

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/LG ▲	GROUND
2	G13 20DB/RD ▲	SEAT BELT INDICATOR DRIVER
1	G13 20DB/RD ▲▲	SEAT BELT INDICATOR DRIVER
2	Z2 20BK/LG ▲▲	GROUND



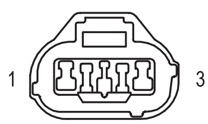
SHIFT BEZEL LAMP

CAV	CIRCUIT	FUNCTION
1	E2 20OR	FUSED PANEL LAMPS DIMMER SWITCH SIGNAL
2	Z1 20BK	GROUND



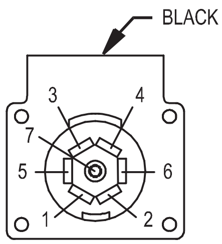
THROTTLE POSITION SENSOR (EXCEPT 4.7L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB ●	SENSOR GROUND
1	K7 18OR ●●	5V SUPPLY
2	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K7 18OR ●	5V SUPPLY
3	K4 18BK/LB ●●	SENSOR GROUND



THROTTLE POSITION SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	K7 18OR	5V SUPPLY
2	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



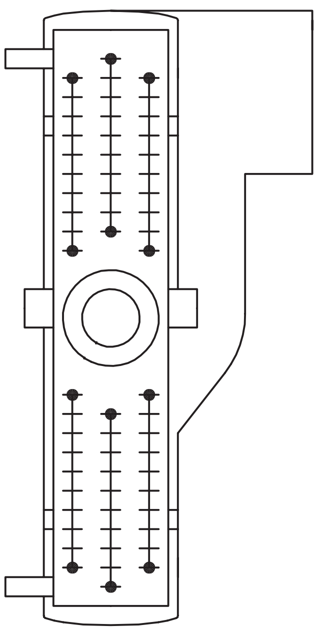
TRAILER TOW CONNECTOR

CAV	CIRCUIT	FUNCTION
1	Z1 12BK	GROUND
2	B40 12LB	TRAILER TOW BRAKE B(+)
3	L76 12BK/OR	TRAILER TOW RELAY OUTPUT
4	A6 12RD/TN	FUSED B(+)
5	L63 18DG/RD	LEFT TURN SIGNAL
6	L62 18BR/RD	RIGHT TURN SIGNAL
7	L1 20VT/BK	BACK-UP LAMP FEED

▲ 2 DOOR
▲▲ 4 DOOR

● 2.5L
●● 3.9L/5.9L

J008W-1 AN008068



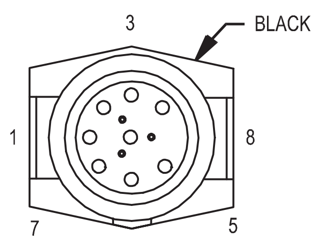
TRANSMISSION CONTROL MODULE (4.7L)

CAV	CIRCUIT	FUNCTION
1	T1 18BR/BK	TRS T1 SENSE
2	T4 18LG/RD	TRS T2 SENSE
3	T3 18VT	TRS T3 SENSE
4	D2 18WT/BK	CCD BUS (-)
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 20PK	SCI TRANSMIT
8	A41 14DB/YL	IGNITION SWITCH OUTPUT (ST)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	A81 18DG/RD	IGNITION SWITCH OUTPUT (ST-RUN-OFF)
12	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	T15 18LG	TRANSMISSION RELAY CONTROL
16	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T118 18PK/BK	PRESSURE CONTROL SOLENOID CONTROL
19	T119 18YL/RD	2C SOLENOID CONTROL
20	T150 18LG/BK	LR/CC SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
29	T29 18BR/RD	UNDERDRIVE PRESSURE SWITCH SENSE
30	T30 18VT/LB	LINE PRESSURE SENSOR SIGNAL
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
37	Z13 16BK/RD	GROUND
38	T38 18DB	5V SUPPLY
39	Z13 16BK/RD	GROUND
40	T140 18DB/RD	MS SOLENOID CONTROL

(CONTINUED ON NEXT PAGE)

(CONTINUED)

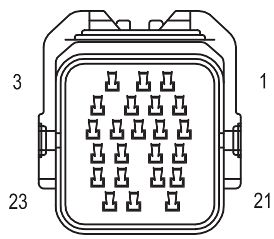
CAV	CIRCUIT	FUNCTION
41	T43 16RD/BK	TRS T41 SENSE
42	T42 18VT/WT	TRS T42 SENSE
43	D1 18VT/BR	CCD BUS (+)
44	-	-
45	-	-
46	D22 20PK/BK	SCI RECEIVE
47	T47 18YL/BK	2C PRESSURE SWITCH SENSE
48	T48 18LB/BK	4C PRESSURE SWITCH SENSE
49	T6 18OR/WT	TRANSMISSION OVERDRIVE SWITCH SENSE
50	T50 18DG	LR PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z14 18BK/YL	GROUND
54	T54 20VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	T59 18PK	UNDERDRIVE SOLENOID CONTROL
56	F84 18YL/WT	FUSED B(+)
57	Z13 16BK/RD	GROUND
58	-	-
59	T159 18LB/RD	4C SOLENOID CONTROL
60	T60 18BR	OVERDRIVE SOLENOID CONTROL



TRANSMISSION SOLENOID (3.9L/5.9L)

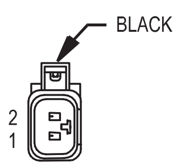
CAV	CIRCUIT	FUNCTION
1	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
2	K6 18VT/WT	5V SUPPLY
3	K4 18BK/LB	SENSOR GROUND
4	T25 18LG/RD	GOVERNOR PRESSURE SIGNAL
5	T7 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
6	T60 18BR	OVERDRIVE SOLENOID CONTROL
7	K54 18OR/BK	TORQUE CONVERTOR CLUTCH SOLENOID CONTROL
8	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL

J008W-1 AN008070



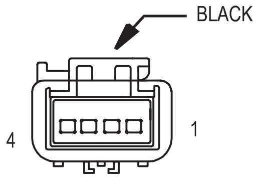
TRANSMISSION SOLENOID ASSEMBLY (4.7L)

CAV	CIRCUIT	FUNCTION
1	L10 20BR/LG	FUSED IGNITION SWITCH OUTPUT (RUN)
2	T150 18LG/BK	LR/CC PRESSURE SWITCH SENSE
3	T41 18BK/WT	PARK/NEUTRAL POSITION SWITCH SENSE
4	T43 16RD/BK	TRS T41 SENSE
5	T42 18VT/WT	TRS T42 SENSE
6	L1 20VT/BK	BACK-UP LAMP FEED
7	T60 18BR	OVERDRIVE SOLENOID CONTROL
8	T3 18VT	TRS T3 SENSE
9	T1 18BR/BK	TRS T1 SENSE
10	T16 18RD	TRANSMISSION CONTROL RELAY OUTPUT
11	T48 18LB/BK	4C PRESSURE SWITCH SENSE
12	T118 18PK/BK	PRESSURE CONTROL SOLENOID CONTROL
13	T4 18LG/RD	TRS T2 SENSE
14	T50 18DG	LOW/REVERSE PRESSURE SWITCH SENSE
15	T47 18YL/BK	2C PRESSURE SWITCH SENSE
16	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
17	T59 18PK	UNDERDRIVE SOLENOID CONTROL
18	T29 18BR/RD	UNDERDRIVE PRESSURE SWITCH SENSE
19	T159 18LB/RD	4C SOLENOID CONTROL
20	T119 18YL/RD	2C SOLENOID CONTROL
21	T140 18DB/RD	MS SOLENOID CONTROL
22	T13 18DB/BK	SPEED SENSOR GROUND
23	T54 20VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL



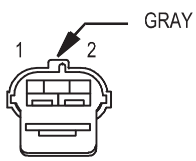
UNDERHOOD LAMP/ SWITCH

CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	Z1 18BK	GROUND



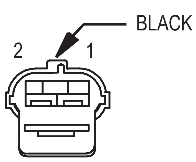
VEHICLE SPEED CONTROL SERVO (EXCEPT 2.5L)

CAV	CIRCUIT	FUNCTION
1	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE LAMP SWITCH OUTPUT
4	Z1 20BK	GROUND



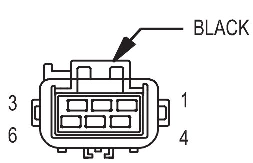
WASHER FLUID LEVEL SENSOR

CAV	CIRCUIT	FUNCTION
1	G29 18BK/TN	LOW WASHER FLUID SWITCH SENSE
2	Z1 18BK	GROUND



WINDSHIELD WASHER PUMP

CAV	CIRCUIT	FUNCTION
1	V10 18BR	WASHER PUMP CONTROL
2	Z1 18BK	GROUND



WIPER MOTOR

CAV	CIRCUIT	FUNCTION
1	V6 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V5 18DG/YL	WIPER PARK SWITCH SENSE
3	-	-
4	Z1 18BK	GROUND
5	V45 18VT	DRIVER WIPER ARM SIGNAL
6	V48 18RD/GY	DRIVER WIPER ARM SIGNAL

8W-90 CONNECTOR LOCATIONS

DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying component and connector locations in the vehicle. A connector index is provided. Use the wiring diagrams in each section for connector number identification. Refer to the index for the proper figure number.

CONNECTOR/GROUND LOCATIONS

For items that are not shown in this section N/S is placed in the Fig. column.

Connector Name/Number	Color	Location	Fig.
4WD Switch	BK	Left Side of Transfer Case	19, 20, 21
A/C Compressor Clutch	BK	Side of A/C Compressor, Rear of A/C Compressor	9, 10, 13, 16
A/C Heater Control	BK	At HVAC Control	25, 27
A/C High Pressure Switch		Left Side of Compressor	9, 10, 13
A/C Low Pressure Switch		Right Rear of Engine Compartment	18
Airbag Control Module	BK	Lower Center of Instrument Panel	25, 28
Ambient Air Temperature Sensor		Radiator Top Support	1
Ash Receiver Lamp	BK	Upper Center of Instrument Panel	25, 27
Automatic Day/Night Mirror	BK	Top of Windshield	32
Back-Up Lamp Switch	BK	Side of Transmission	19, 20
Base Console		Headliner	N/S
Battery Temperature Sensor	BK	At Battery	2
Blower Motor	BK	Upper Center of Instrument Panel	20
Blower Motor Relay	NAT	Upper Center of Instrument Panel	N/S
Blower Resistor Block	BK	Upper Center of Instrument Panel	27
Brake Lamp Switch	BK	Lower Left of Instrument Panel	25

Connector Name/Number	Color	Location	Fig.
Brake Pressure Switch	BK	At Anti-Lock Brake Controller	2, 3
C105	BK	Right Fender Side Shield	7
C106		Left Fender Side Shield	N/S
C111	GY	Left Inner Fender	4
C126	BL	Lower Left of Instrument Panel	5
C127	BK	Left Inner Fender	4, 35
C128	GY	Near Powertrain Control Module-C3 4.7L	N/S
C129	BK	Near 4WD Switch	N/S
C130	BK	Top of Transmission	21
C182	BK	Top of Transmission	19, 21
C200	BK	Lower Left of Instrument Panel	5, 6, 25
C246	BK	Lower Left of Instrument Panel	25, 32, 34
C247	BK	Lower Left of Instrument Panel	25, 32, 34
C248	BK	Under Driver Seat	34
C323	BK	Rear of Frame	35
C325	BK	At Tail Lamp	35, 36
C329	BK	Near Cargo Lamps	N/S
C341	BK	Trailer Tow Wiring	N/S
C360	BK	Left Inner Fender	N/S
C361	NAT	Near Right Front Door Hinge	30, 34

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
C362		Near Right Front Door Hinge	30, 34
C363		Near Left Front Door Hinge	30, 34
C364	NAT	Near Left Front Door Hinge	30, 34
C365		Near Left Rear Door Hinge	31,
C366		Near Right Rear Door Hinge	34
Camshaft Position Sensor	GY	At Distributor, Right Front of Engine	9, 12, 17
Capacitor No.1	BK	Left Side of Engine	15
Capacitor No.2	BK	Right Side of Engine	16
Cargo Lamp No. 1	BK	At Lamp	N/S
Cargo Lamp No. 2	BK	At Lamp	N/S
Center High Mounted Stop Lamp	BK	Headliner	33
Center High Mounted Stop Lamp Jumper	BK	Under Brake Booster	4
Central Timer Module-C1 (Base)	GN	Right Side of Instrument Panel	26
Central Timer Module-C1 (Premium)	GN	Right Side of Instrument Panel	26
Central Timer Module-C1 (Base)	BK	Right Side of Instrument Panel	26
Central Timer Module-C2	BK	Right Side of Instrument Panel	26
Cigar Lighter	NAT	Upper Center of Instrument Panel	27
Clockspring No.1-C1	NAT	Steering Column	28
Clockspring No.1-C2		Steering Column	N/S
Clockspring No.2	BK	Steering Column	N/S
Clutch Interkock Switch	BK	Left Side of Instrument Panel	6

Connector Name/Number	Color	Location	Fig.
Clutch Interlock Switch Jumper	GN	Left Side of Instrument Panel	6
Coil On Plug No.1	BK	Left Side of Engine	15
Coil On Plug No.2	BK	Right Side of Engine	16
Coil On Plug No.3	BK	Left Side of Engine	15
Coil On Plug No.4	BK	Right Side of Engine	16
Coil On Plug No.5	BK	Left Side of Engine	15
Coil On Plug No.6	BK	Right Side of Engine	16
Coil On Plug No.7	BK	Left Side of Engine	15
Coil On Plug No.8	BK	Right Side of Engine	16
Controller Anti-Lock Brake C1	BK	At Anti-Lock Brake Controller	2, 3
Controller Anti-Lock Brake C2	BK	At Anti-Lock Brake Controller	2
Crankshaft Position Sensor	BK	Rear of Engine	8, 12, 16
Data Link Connector	BK	Lower Left of Instrument Panel	25, 32
Daytime Running Lamp Module	BK	Left Front Inner Fender	2
Dome Lamp	BK	Headliner	N/S
Driver Door Ajar Switch	BK	Driver Door Jamb	30
Driver Airbag	YL	Steering Column	N/S
Driver Door Key Cylinder Switch	BK	Driver Door	30
Driver Door Lock Motor/Ajar Switch	BK	Driver Door	30
Driver Door Window Motor	BK	Driver Door	30
Driver Power Lock/Window Switch	BK	Driver Door	30
Driver Power Mirror	BK	Driver Door	30

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Engine Coolant Temperature Sensor	BK	At Thermostat Housing	8, 12, 17
Fuel Injector No. 1	BK	At Injector	8, 10, 13, 15
Fuel Injector No. 2	BK	At Injector	8, 11, 14, 16
Fuel Injector No. 3	BK	At Injector	8, 10, 13, 15
Fuel Injector No. 4	BK	At Injector	8, 11, 14, 16
Fuel Injector No. 5	BK	At Injector	10, 13, 15
Fuel Injector No. 6	BK	At Injector	11, 14, 16
Fuel Injector No. 7	BK	At Injector	13, 15
Fuel Injector No. 8	BK	At Injector	14, 16
Fuel Pump Module	LTGY	At Fuel Tank	35
G101		Right Front Inner Fender	1
G102		Left Inner Fender	4
G103		Near Battery	2
G104		RWAL Ground	3
G105		Top Rear of Valve Cover, Right Front of Engine	8, 17
G106		Left Front Inner Fender	2
G107		Top Rear of Valve Cover Left Front of Engine	7, 18
G110		Left Front Inner Fender	2
G111		Engine Ground	15
G200		Lower Left of Instrument Panel	25
G201		Lower Center of Instrument Panel	25, 28
G202		Right Side of Instrument Panel	25, 28
G203		Right Side Instrument Panel	N/S

Connector Name/Number	Color	Location	Fig.
G205		Right Side Instrument Panel	26
G305		Frame Ground Left Fender	4
Generator	BK	At Generator	9, 11, 14, 15
Glove Box Lamp	BK	Upper Center of Instrument Panel	27
Headlamp Switch-C1	BK	Left Side of Instrument Panel	25
Headlamp Switch-C2		Left Side of Instrument Panel	25
Heater Control	BK	At HVAC Control	N/S
High Note Horn		Left Front Inner Fender	1
Idle Air Control Motor	BK	At Throttle Body	8, 10 , 13, 15
Ignition Coil	BK	Near Distributor, Right Front of Engine	9, 11, 14
Ignition Switch	BK	Steering Column	28
Input Speed Sensor		Left Side of Transmission	22, 23
Instrument Cluster-C1	BK	At Instrument Cluster	25
Instrument Cluster-C2	BK	At Instrument Cluster	25
Intake Air Temperature Sensor	GY	At Throttle Body, Right Top of Intake Manifold	8, 11, 14, 15
Joint Connector No. 1	BK	Power Distribution Center	N/S
Joint Connector No. 2	BK	Power Distribution Center	N/S
Joint Connector No. 3	NAT	Left Side Instrument Panel	25
Joint Connector No. 4	NAT	Near Steering Column	25
Junction Block-C1	BL	At Junction Block	5
Junction Block-C2	NAT	At Junction Block	5
Junction Block-C3	BN	At Junction Block	34

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Junction Block-C4	BN	At Junction Block	29
Junction Block-C5	GN	At Junction Block	29
Junction Block-C6	BK	At Junction Block	29
Junction Block-C7	LTGY	At Junction Block	29
Junction Block-C8	OR	At Junction Block	29
Junction Block-C9	BK	At Junction Block	29
Key-in Switch	GY	Steering Column	28
Leak Detection Pump	BK	Near Battery	2
Left Back-Up Lamp	BK	At Lamp	36
Left Door Speaker	BK	Left Door	30
Left Door Tweeter	BK	Left Door	N/S
Left Door Woofer	BK	Left Door	30
Left Fog Lamp	BK	At Lamp	1
Left Front Park/Turn Signal Lamp No.1	BK	At Lamp	N/S
Left Front Park/Turn Signal Lamp No.2	BK	At Lamp	N/S
Left Front Side Marker Lamp	BK	At Lamp	N/S
Left Front Wheel Speed Sensor	LRGY	Near Brake Controller	2
Left Headlamp	BL	At Lamp	N/S
Left License Lamp	BK	At Lamp	N/S
Left Rear Door Ajar Switch	BK	Rear Door	31
Left Rear Door Lock Motor/Ajar Switch	BK	Rear Door	31
Left Rear Door Speaker	BK	Rear Door	31
Left Rear Speaker	BK	Left Door	33
Left Rear Window Motor	BK	Left Door	31

Connector Name/Number	Color	Location	Fig.
Left Rear Window Switch	BL	Left Door	31
Left Remote Radio Switch	BK	Steering Column	N/S
Left Speed Control Switch	WT	Steering Column	N/S
Left Tail/Stop/ Turn Signal Lamp	BK	At Lamp	36
License Lamp	BK	At Lamp	N/S
Line Pressure Sensor		Right Side of Transmission	22, 23
Low Note Horn	BK	At Horn	1
Manifold Absolute Pressure Sensor	BK	On Throttle Body	8, 10, 13, 17
Multi-Function Switch	BK	At Steering Column	28
Oil Pressure Sensor	BK	Near Distributor	9, 12, 15
Output Speed Sensor	BK	Under Transmission, Left Side of Transmission	21, 22, 23
Overdrive Switch	BK	At Steering Column	25
Overhead Console	BK	Headliner	32
Oxygen Sensor 1/1 Upstream	BK	At Oxygen Sensor	19, 20, 21, 22, 23
Oxygen Sensor 1/2 Downstream	BK	At Oxygen Sensor	19, 20, 21, 22, 23
Oxygen Sensor 2/1 Upstream	BK	At Oxygen Sensor	19, 20, 21, 22, 23
Oxygen Sensor 2/2 Downstream	BK	At Oxygen Sensor	19, 20, 21, 22, 23
Park Brake Switch		Left Side of Instrument Panel	32, 34
Park/Neutral Position Switch		On Transmission	21
Passenger Airbag	YL	Right Center of Instrument Panel	25, 27
Passenger Airbag On/Off Switch-C1	LTGY	Instrument Panel	25

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Passenger Airbag On/Off Switch-C2	YL	Instrument Panel	25
Passenger Door Ajar Switch	BK	Passenger Door	N/S
Passenger Door Key Cylinder Switch	LTGY	Passenger Door	N/S
Passenger Door Lock Motor/Ajar Switch	BK	Passenger Door	N/S
Passenger Door Lock Switch	NAT	Passenger Door	N/S
Passenger Door Window Motor	BK	Passenger Door	N/S
Passenger Door Window Switch	BL	Passenger Door	N/S
Passenger Power Lock/Window Switch	BK	Passenger Door	N/S
Passenger Power Mirror	BK	Passenger Door	N/S
Power Amplifier-C1	WT	Right Side of Instrument Panel	19
Power Amplifier-C2	WT	Right Side of Instrument Panel	19
Power Mirror Switch	BK	Left Door	N/S
Power Outlet	BK	Upper Center of Instrument Panel	20
Power Seat Motors	BK	Under Seat	N/S
Power Seat Switch		At Switch	N/S
Power Steering Pressure Switch	BK	Near Power Steering Pump	8
Powertrain Control Module-C1	BK	At Powertrain Control Module	7, 15
Powertrain Control Module-C2	WT	At Powertrain Control Module	7, 15
Powertrain Control Module-C3	BK	At Powertrain Control Module	1, 7, 15
PRNDL		At Steering Wheel	N/S

Connector Name/Number	Color	Location	Fig.
Proportional Purge Solenoid	GY	Rear of Engine Compartment	18
Radiator Fan Motor		Below Radiator	1
Radio-C1	GY	Upper Center of Instrument Panel	20
Radio-C2	BK	Upper Center of Instrument Panel	20
Radio-C3	NAT	Upper Center of Instrument Panel	20
Rear Wheel Speed Sensor	BK	At Rear Axle	27
Rear Window Defogger Switch	BK	Upper Center of Instrument Panel	N/S
Right Back-Up Lamp	BK	At Lamp	N/S
Right Door Speaker	BK	Right Door	N/S
Right Door Tweeter	BK	Right Door	N/S
Right Door Woofer	BK	Right Door	N/S
Right Fog Lamp	BK	At Lamp	1
Right Front Park/Turn Signal Lamp No.1	BK	At Lamp	3
Right Front Park/Turn Signal Lamp No. 2	BK	At Lamp	3
Right Front Side Marker Lamp	BK	At Lamp	3
Right Front Wheel Speed Sensor	LTGY	Right Fender Side Shield	1
Right Headlamp	BL	At Lamp	3
Right License Lamp	BK	At Lamp	N/S
Right Rear Door Ajar Switch	BK	Right Rear Door	N/S
Right Rear Door Lock Motor/Ajar Switch	BK	Right Rear Door	N/S
Right Rear Door Speaker	BK	Right Rear Door	N/S
Right Rear Speaker	BK	Right Door	N/S

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Right Rear Window Motor	BK	Right Reear Door	N/S
Right Rear Window Switch	BL	Right Rear Door	N/S
Right Remote Radio Switch	BK	Steering Column	N/S
Right Speed Control Switch	WT	Steering Column	N/S
Right Tail/Stop/ Turn Signal Lamp	BK	At Lamp	N/S
Seatbelt Switch	NAT	At Belt	25
Shift Bezel Lamp	BK	Lower Center of Instrument Panel	25, 34
Throttle Position Sensor	WT	On Throttle Body	8, 10, 13
Throttle Position Sensor	NAT	On Throttle Body	15

Connector Name/Number	Color	Location	Fig.
Trailer Tow Connector	BK	Rear of Frame	N/S
Transmission Control Module	BK	Right Front of Engine Compartment	24
Transmission Solenoid	BK	Left Side opf Transmission	21, 22, 23
Under Hood Lamp & Switch	BK	At Lamp	N/S
Vehicle Speed Control Servo	BK	At Speed Control Servo	7
Washer Fluid Level Sensor	BK	At Washer Fluid Reservoir	7
Windshield Washer Pump	BK	At Washer Fluid Reservoir	7
Wiper Motor	BK	At Motor	4

DESCRIPTION AND OPERATION (Continued)

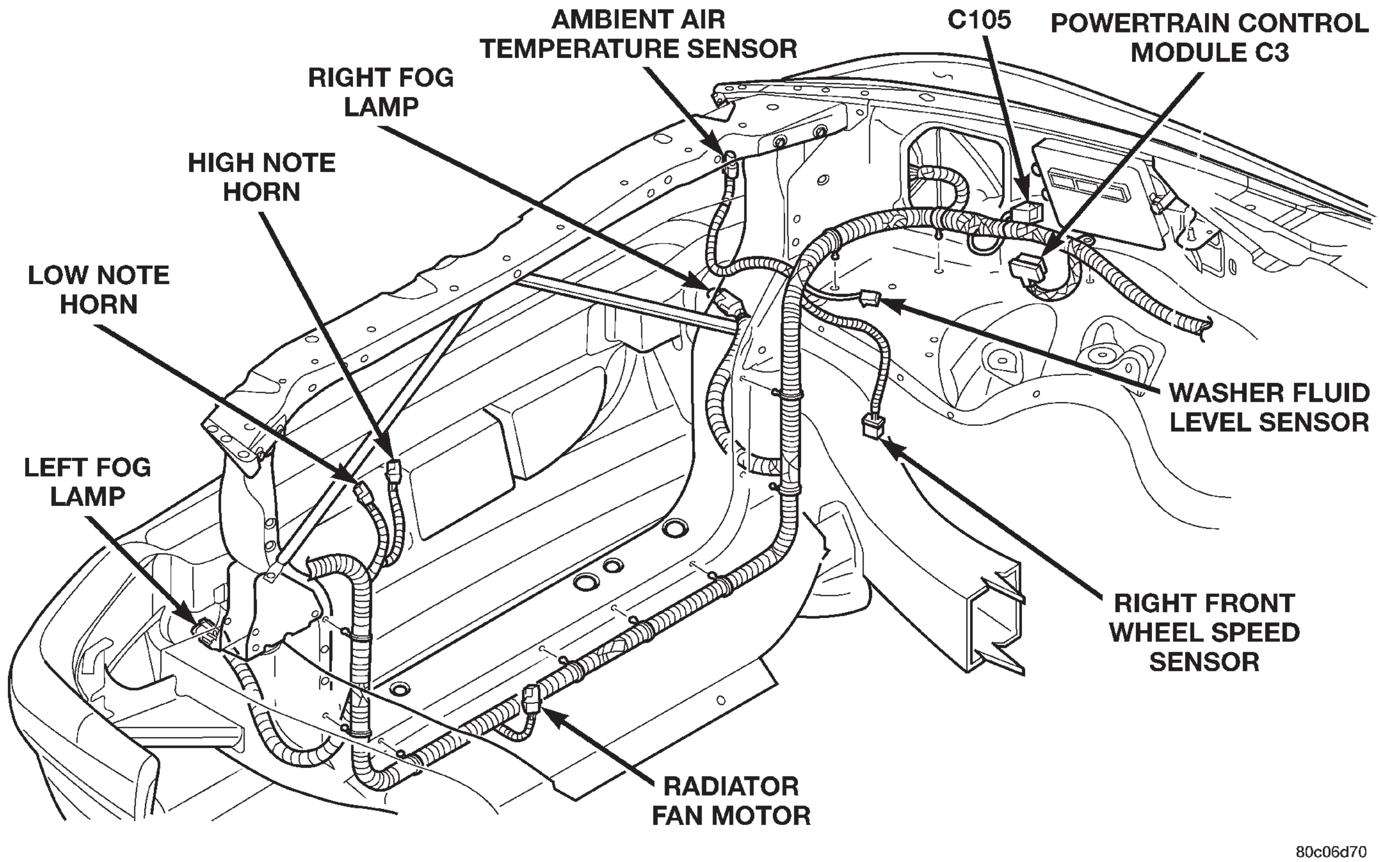


Fig. 1 Right Front Engine Compartment

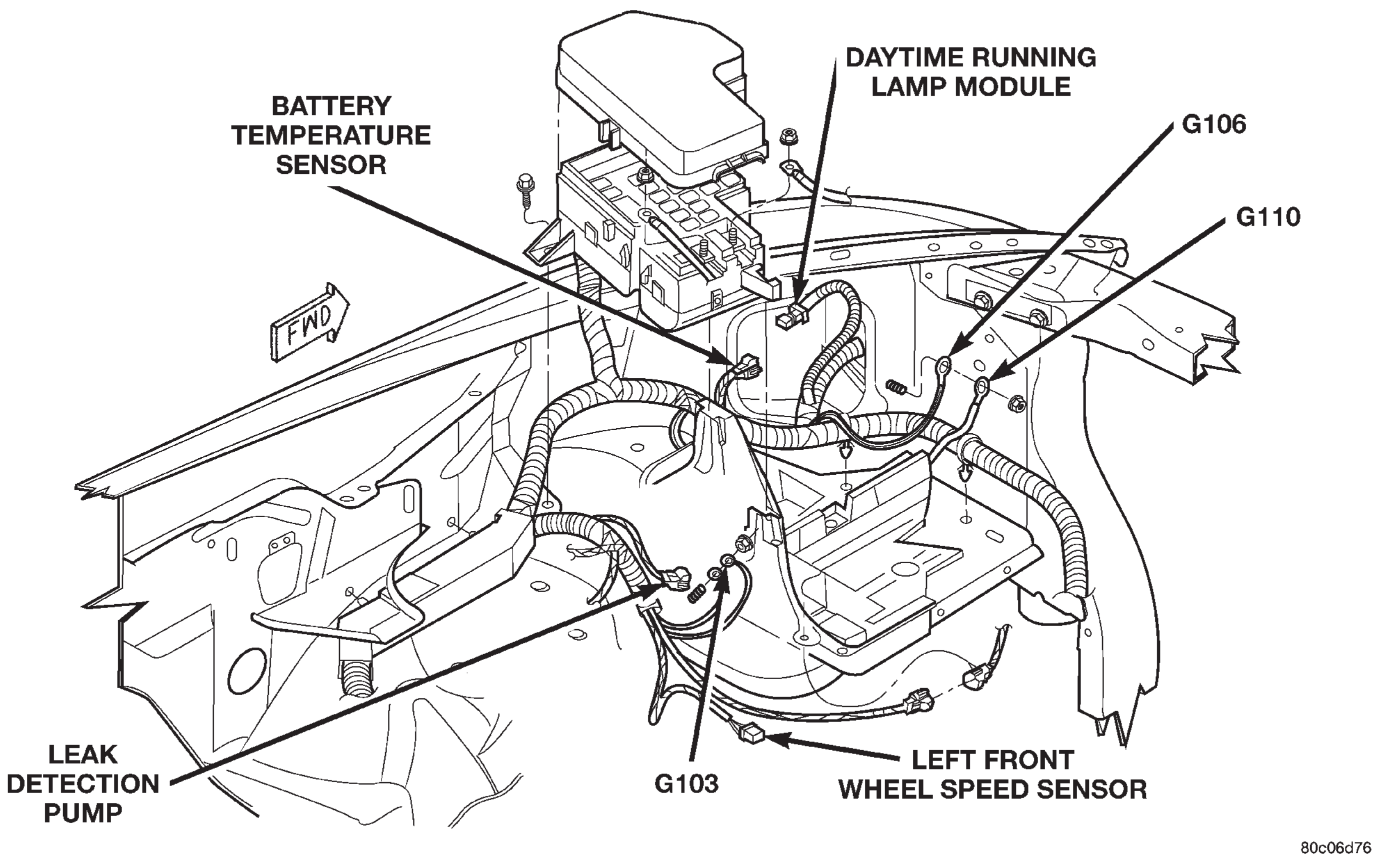


Fig. 2 Left Front Engine Compartment

DESCRIPTION AND OPERATION (Continued)

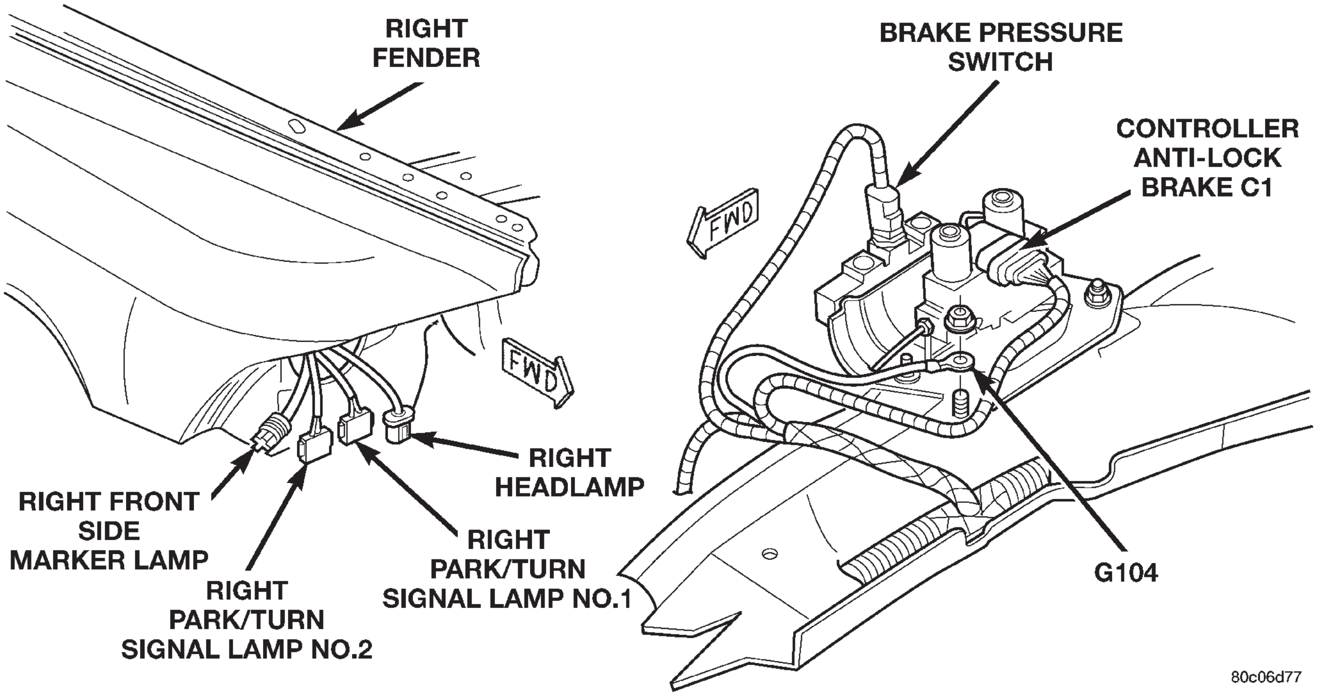


Fig. 3 Right Fender Area

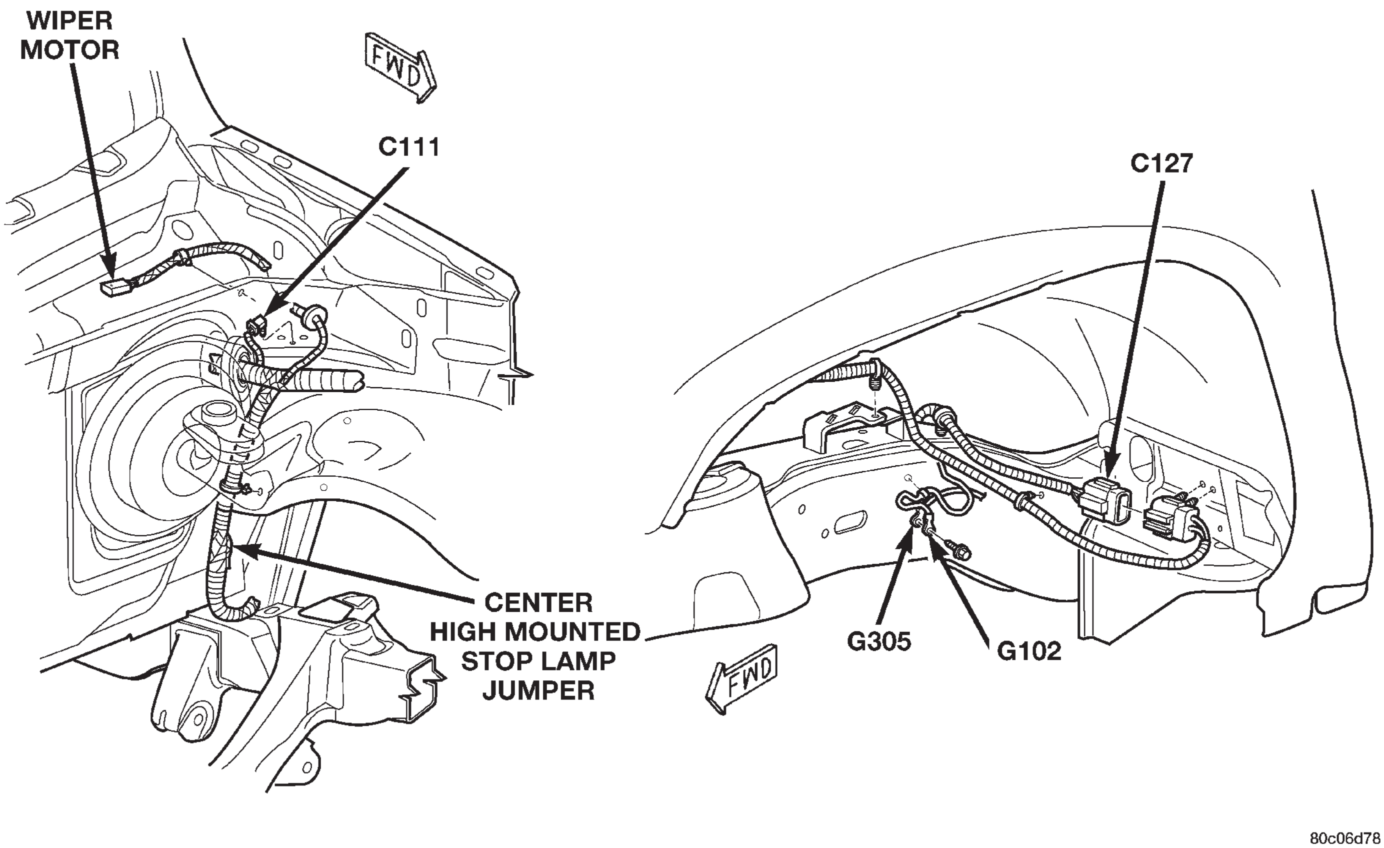


Fig. 4 Left Fender Area

DESCRIPTION AND OPERATION (Continued)

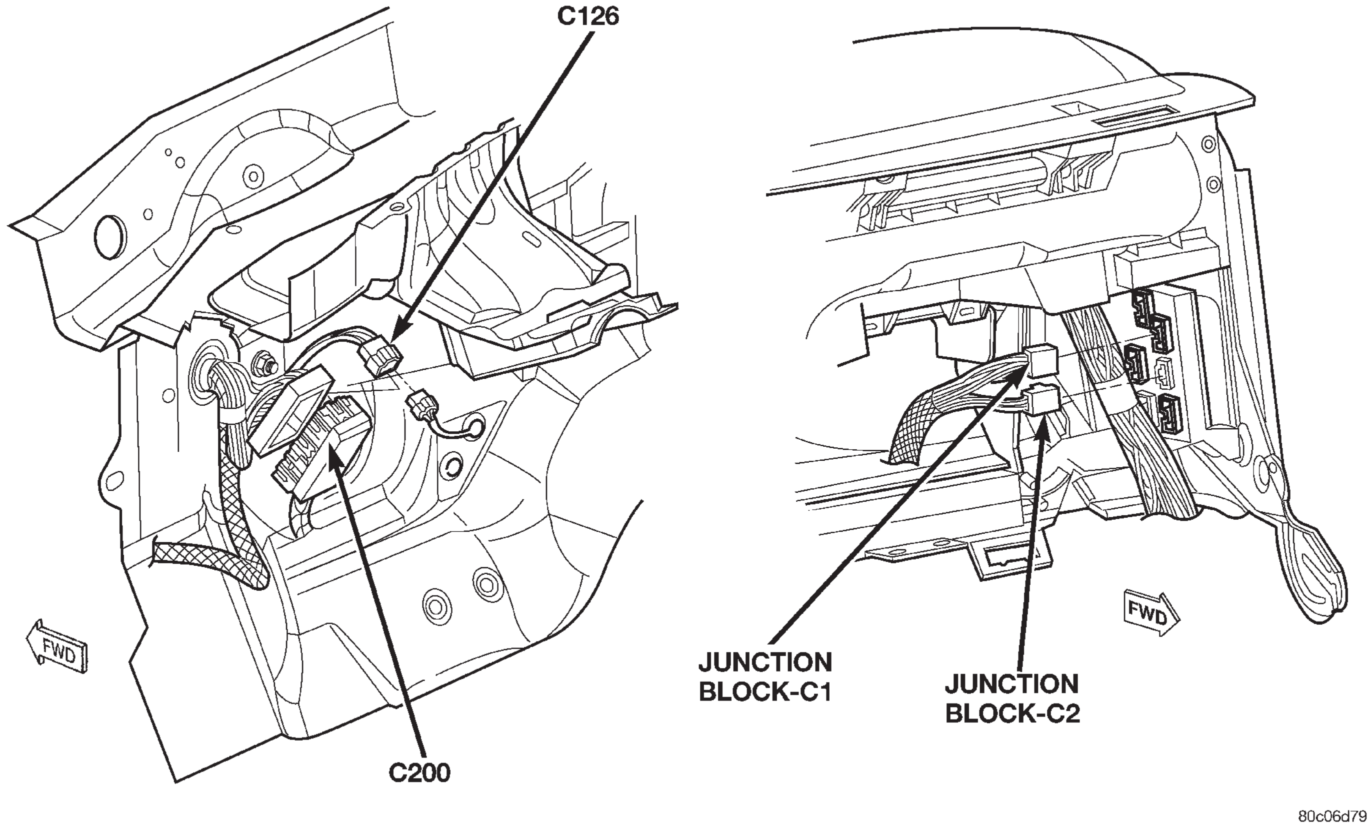


Fig. 5 Kick Panel Areas

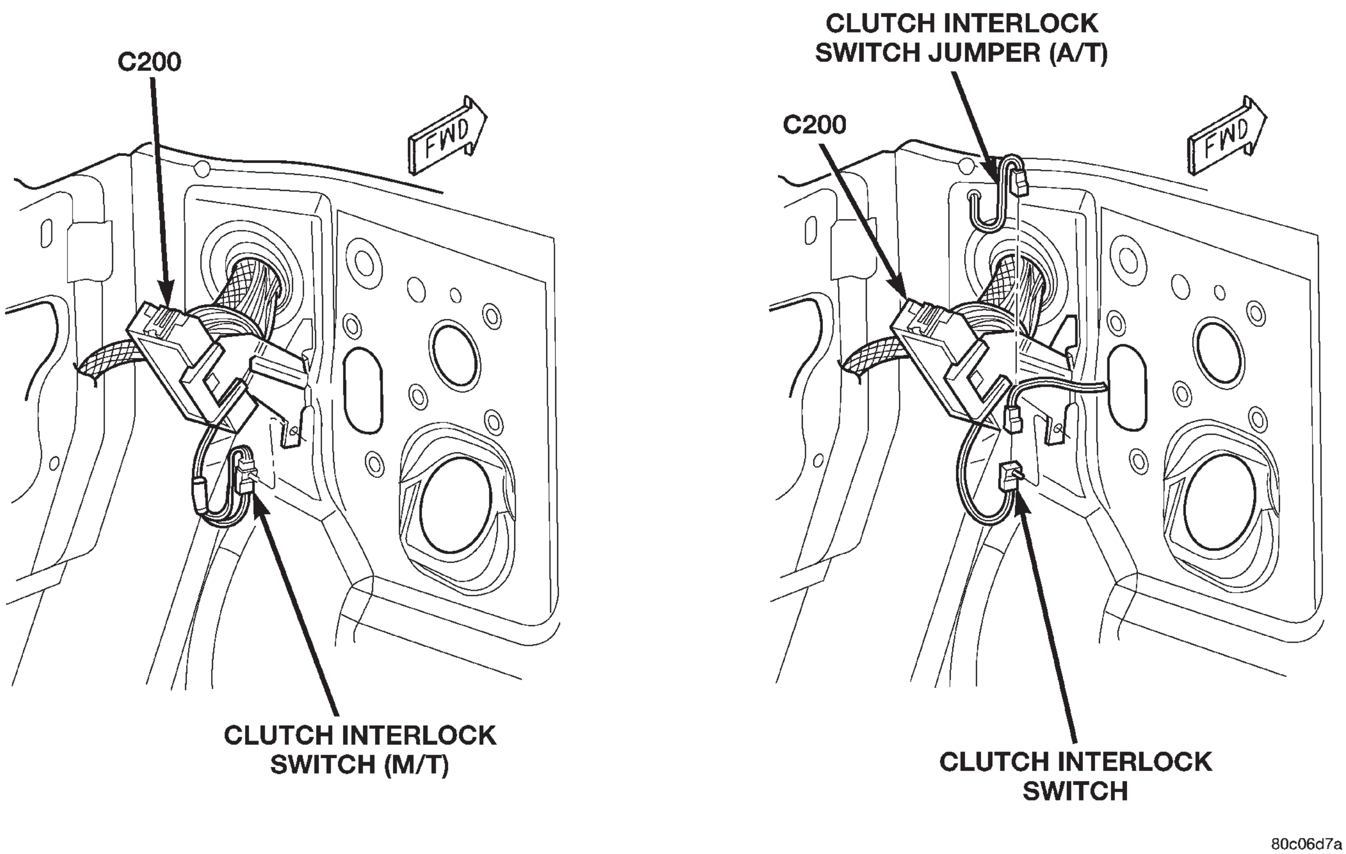


Fig. 6 Engine Compartment to Dash

DESCRIPTION AND OPERATION (Continued)

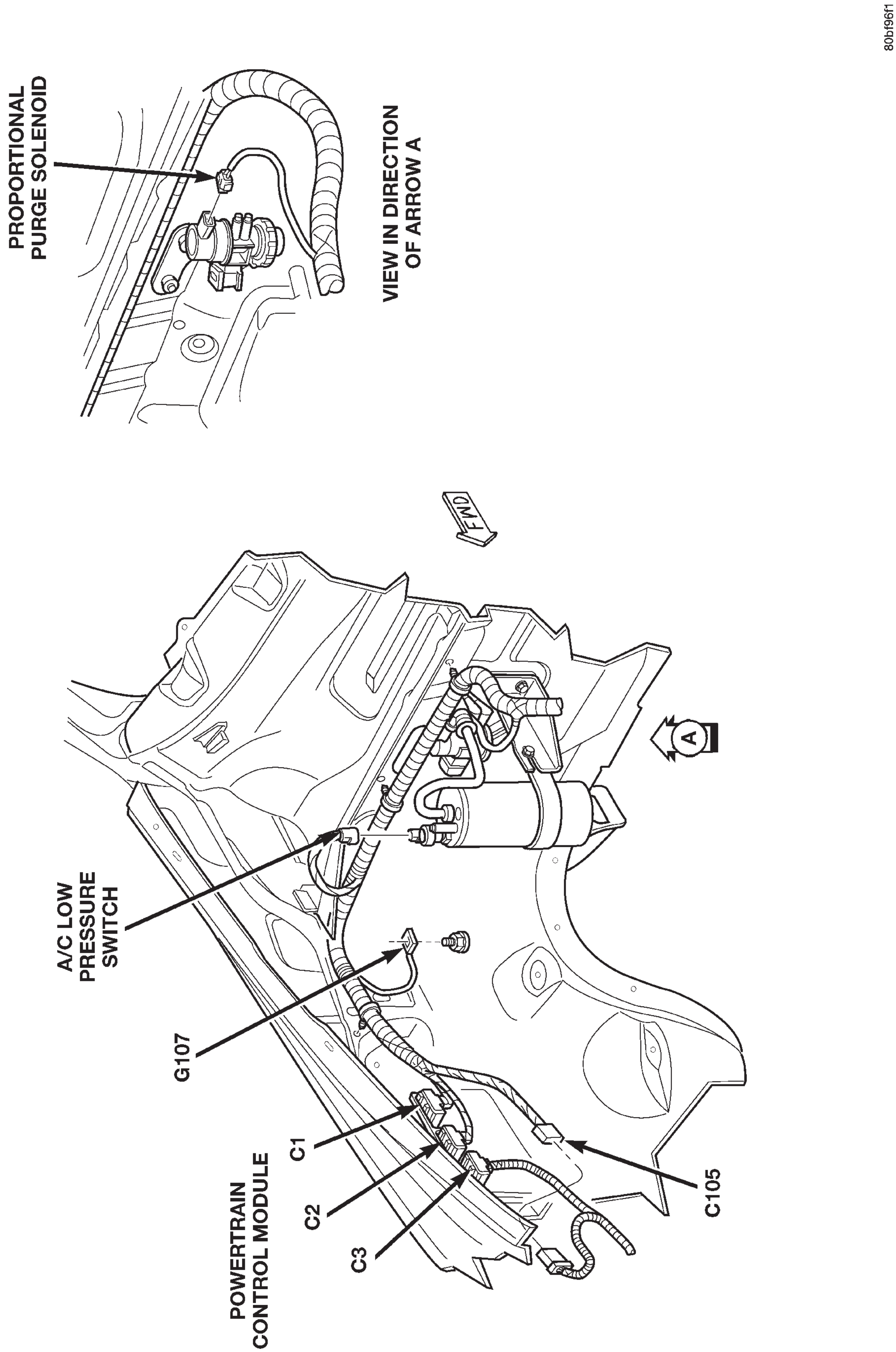


Fig. 7 Right Rear Engine Compartment

DESCRIPTION AND OPERATION (Continued)

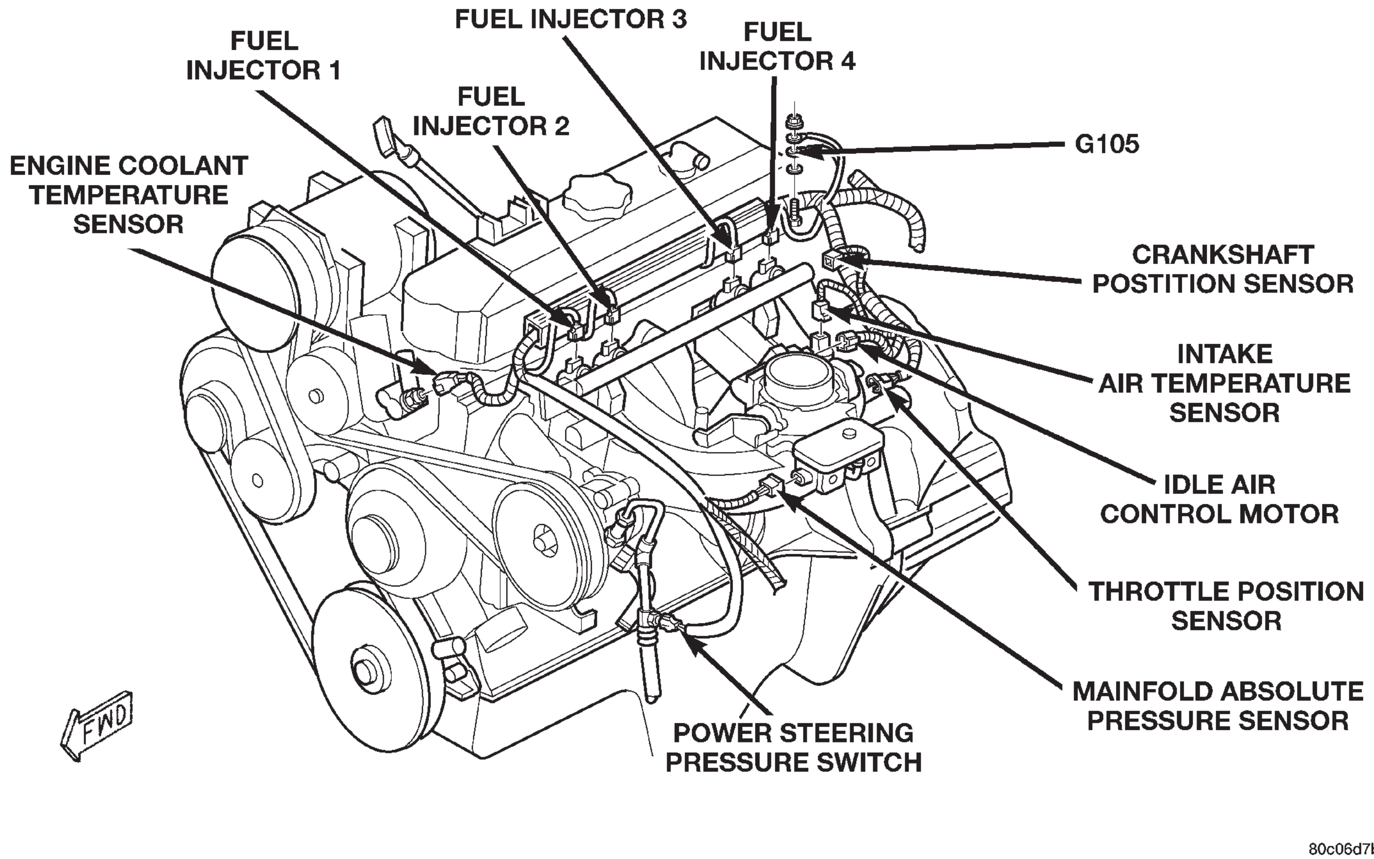


Fig. 8 Engine Left Side 2.5L

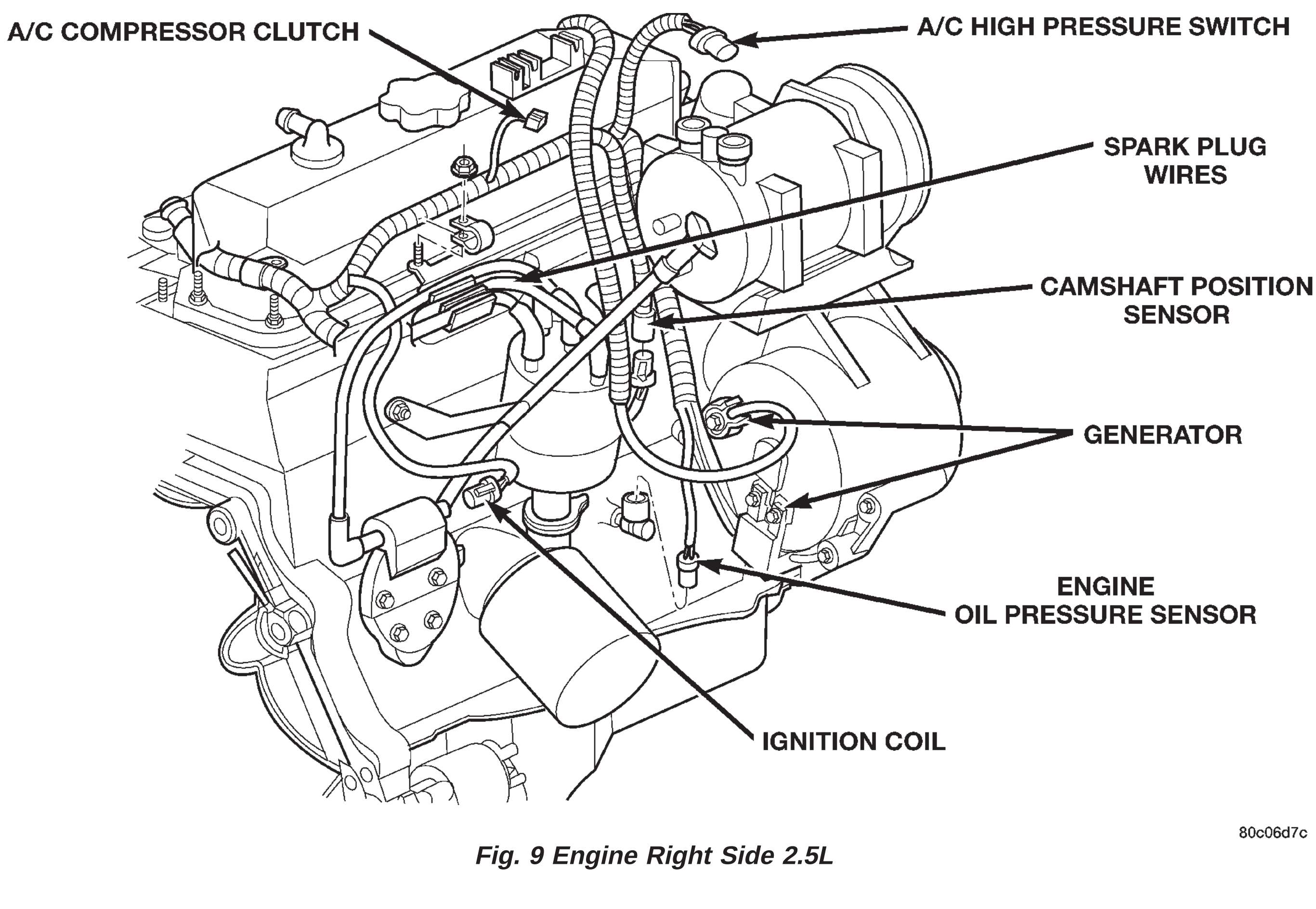


Fig. 9 Engine Right Side 2.5L

DESCRIPTION AND OPERATION (Continued)

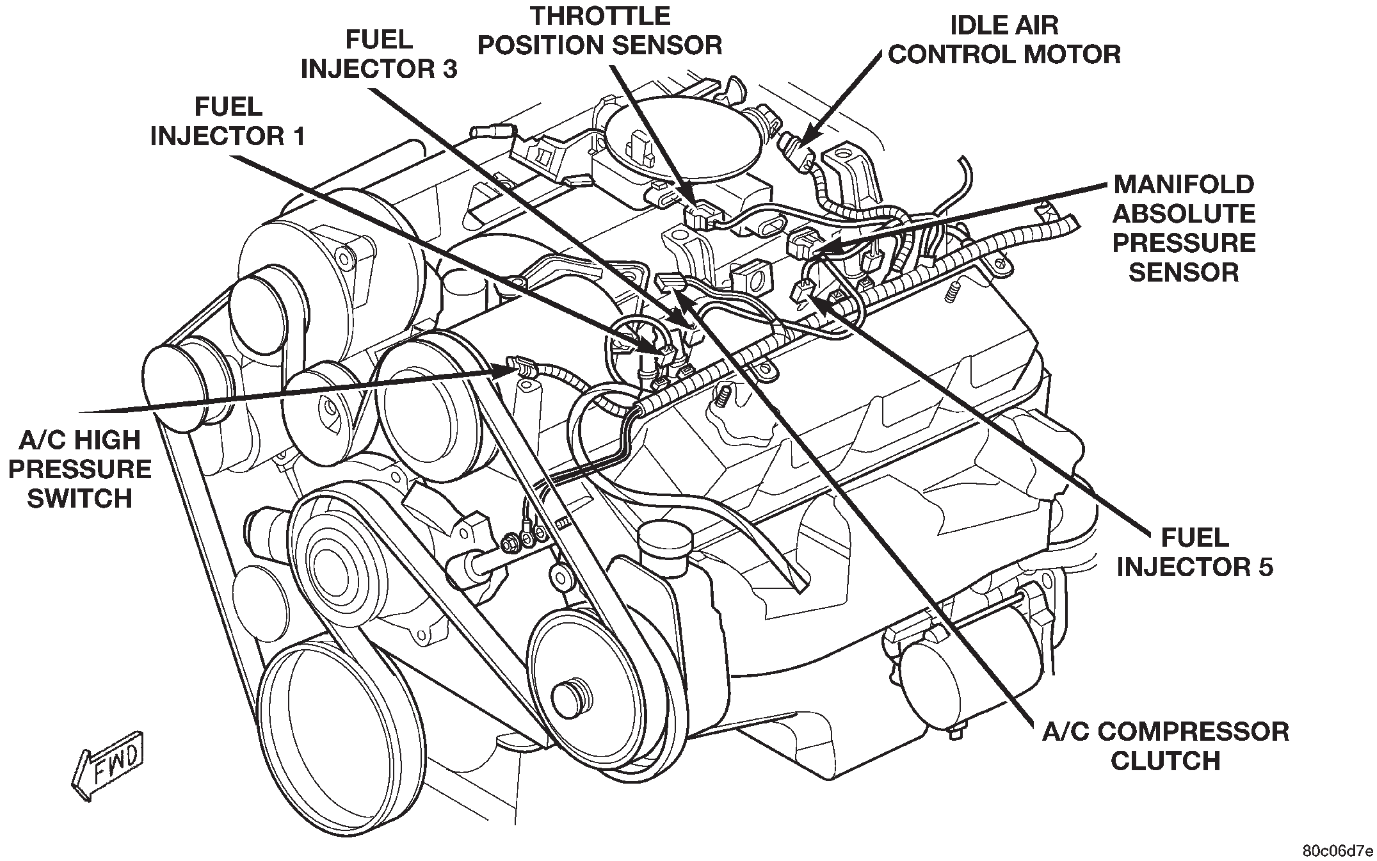


Fig. 10 Engine Left Side 3.9L

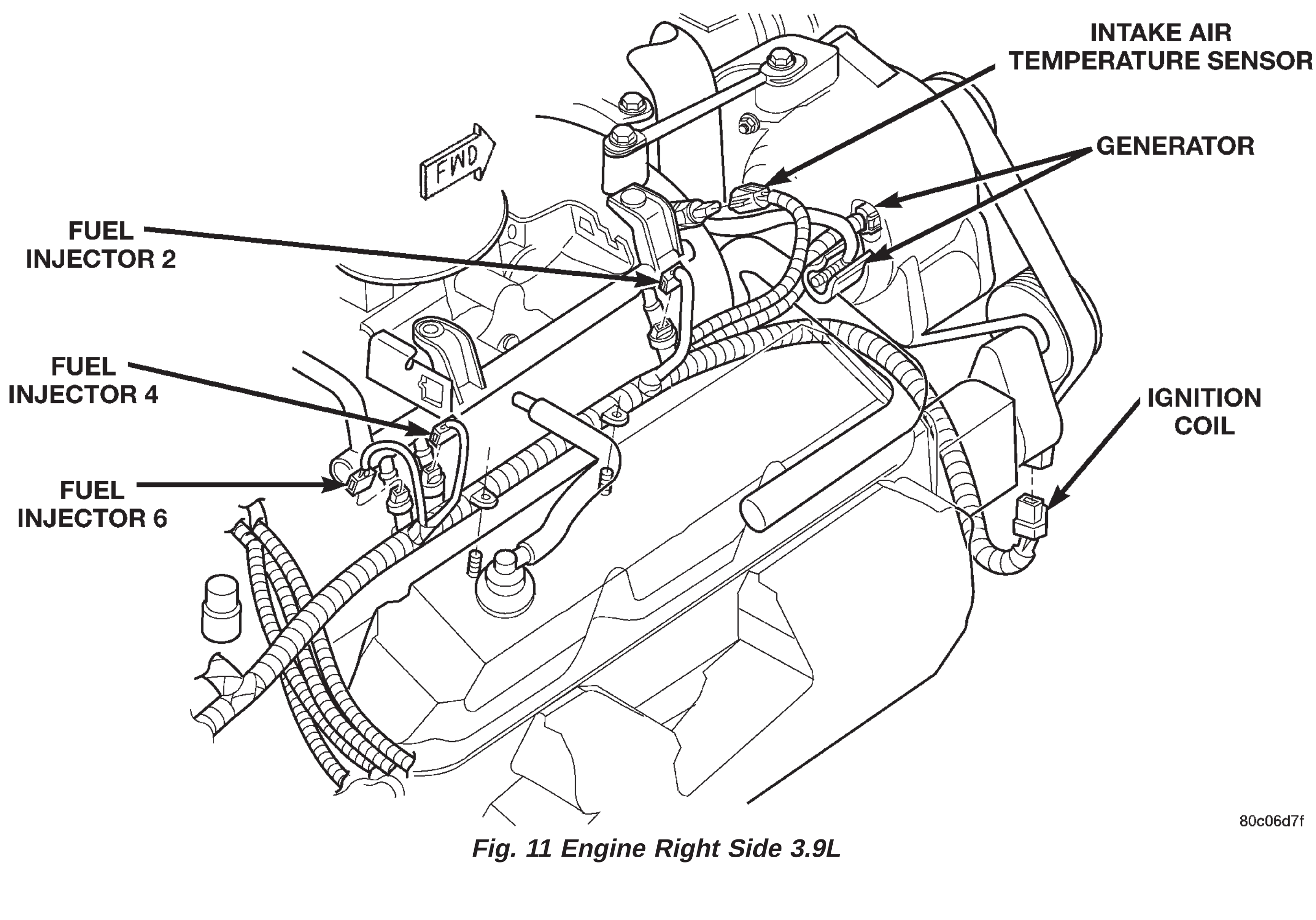


Fig. 11 Engine Right Side 3.9L

DESCRIPTION AND OPERATION (Continued)

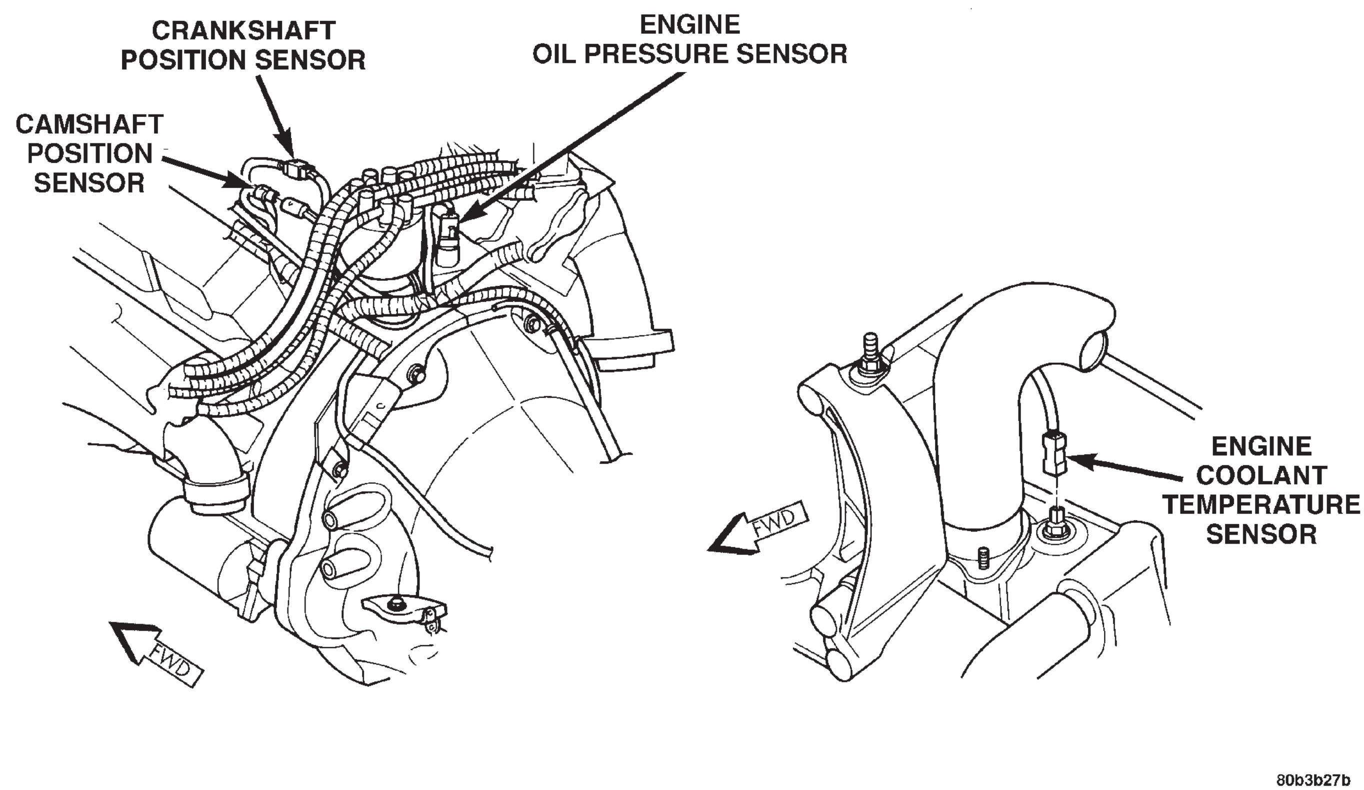


Fig. 12 Engine Rear 3.9L

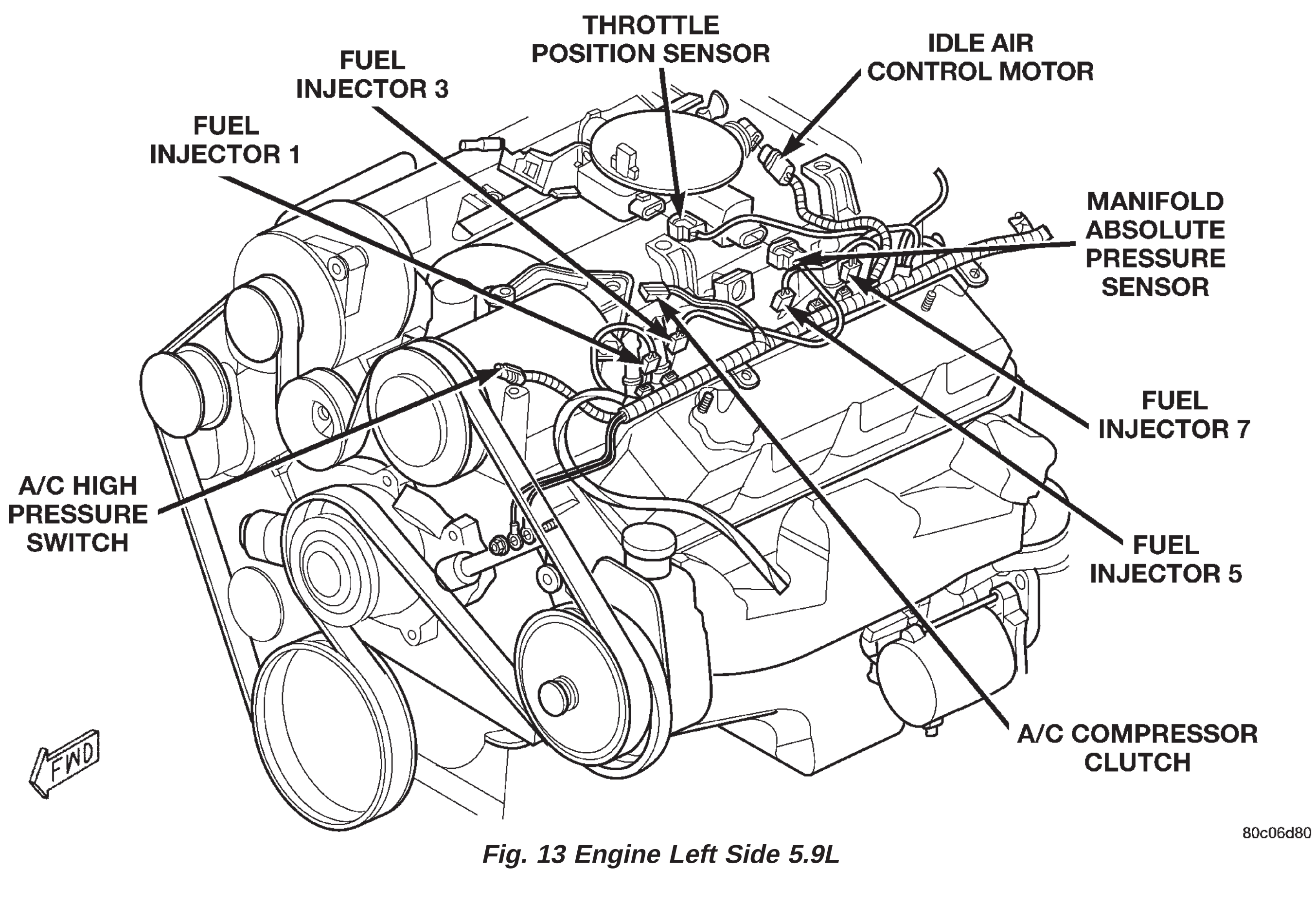


Fig. 13 Engine Left Side 5.9L

DESCRIPTION AND OPERATION (Continued)

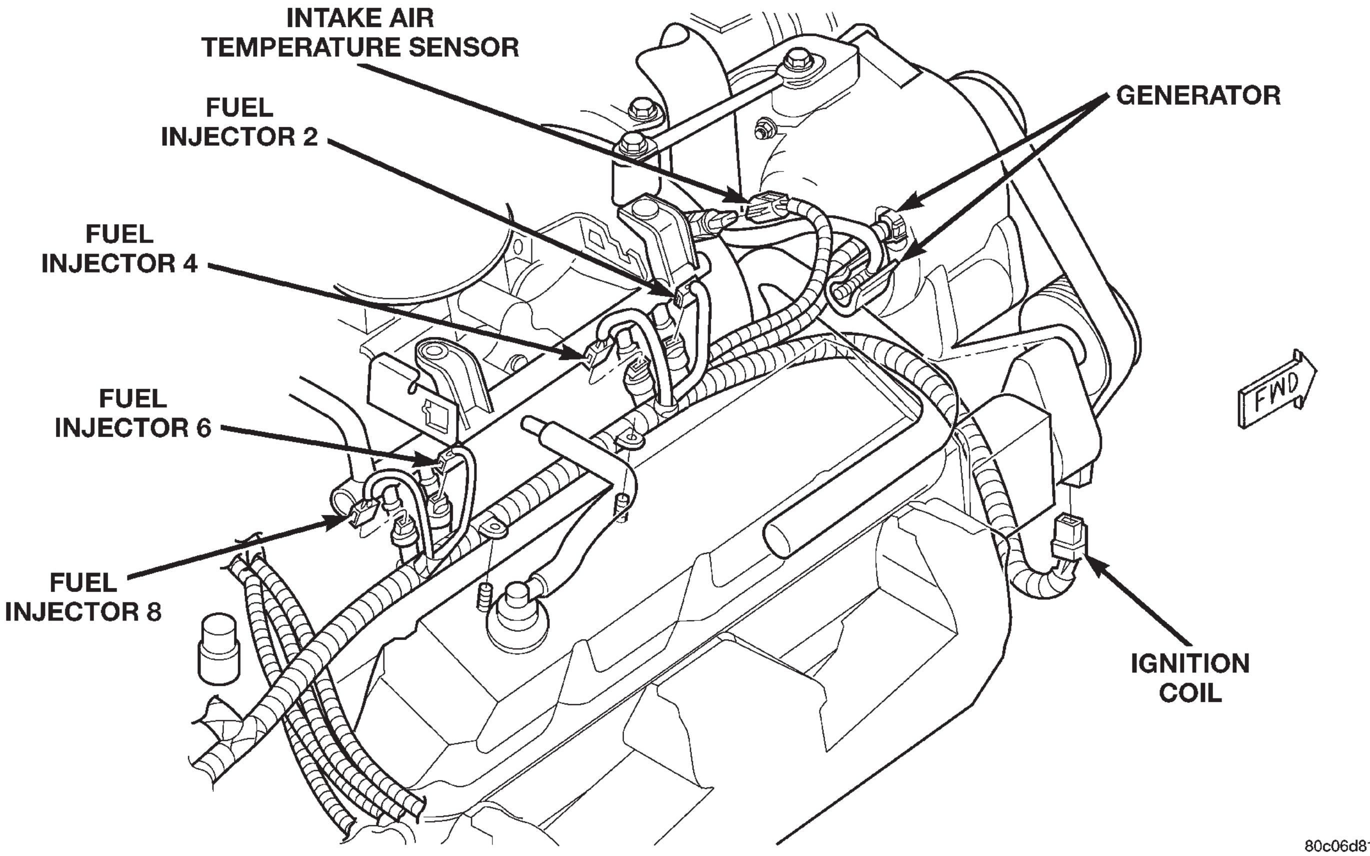


Fig. 14 Engine Right Side 5.9L

DESCRIPTION AND OPERATION (Continued)

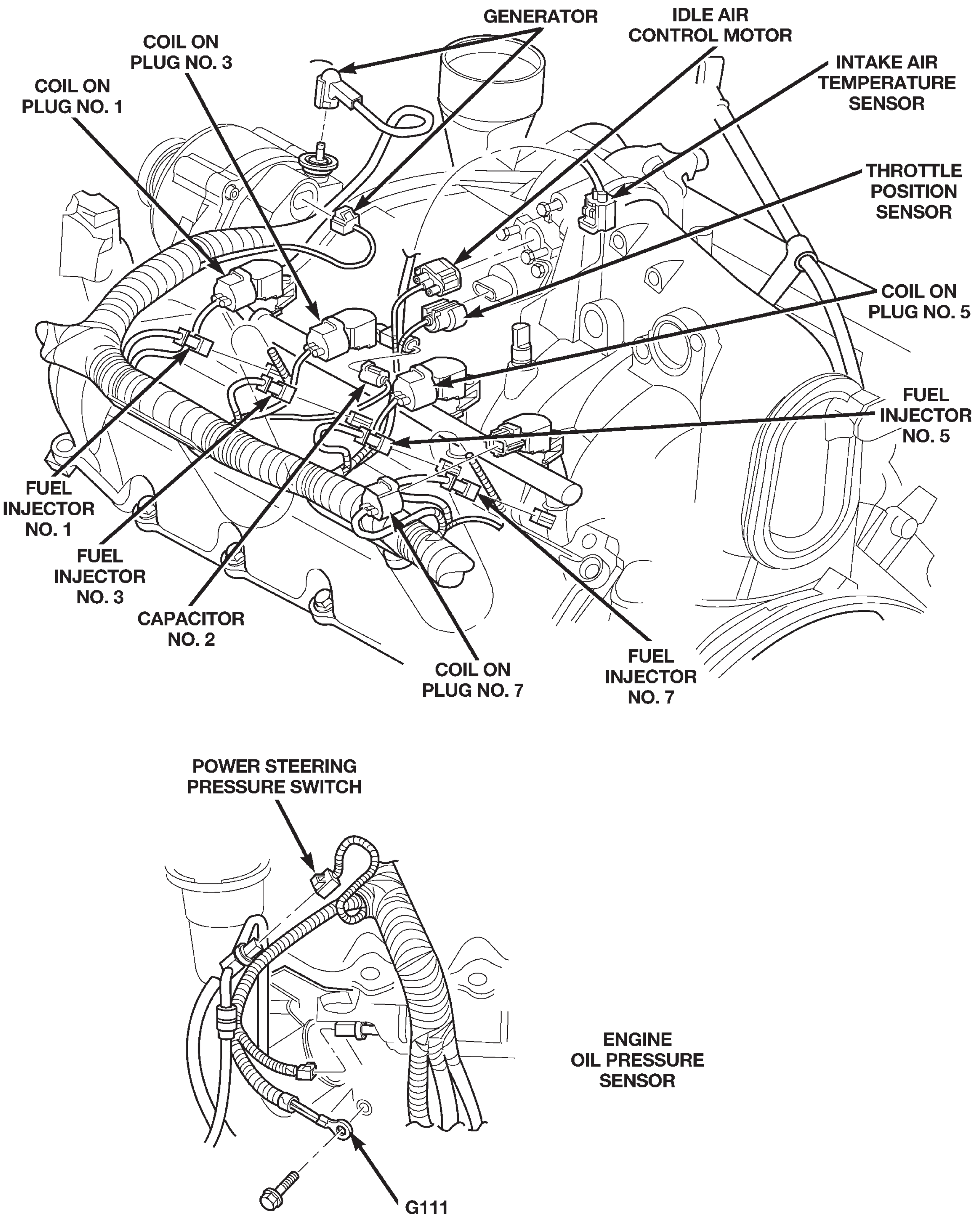


Fig. 15 Engine Left Side 4.7L

DESCRIPTION AND OPERATION (Continued)

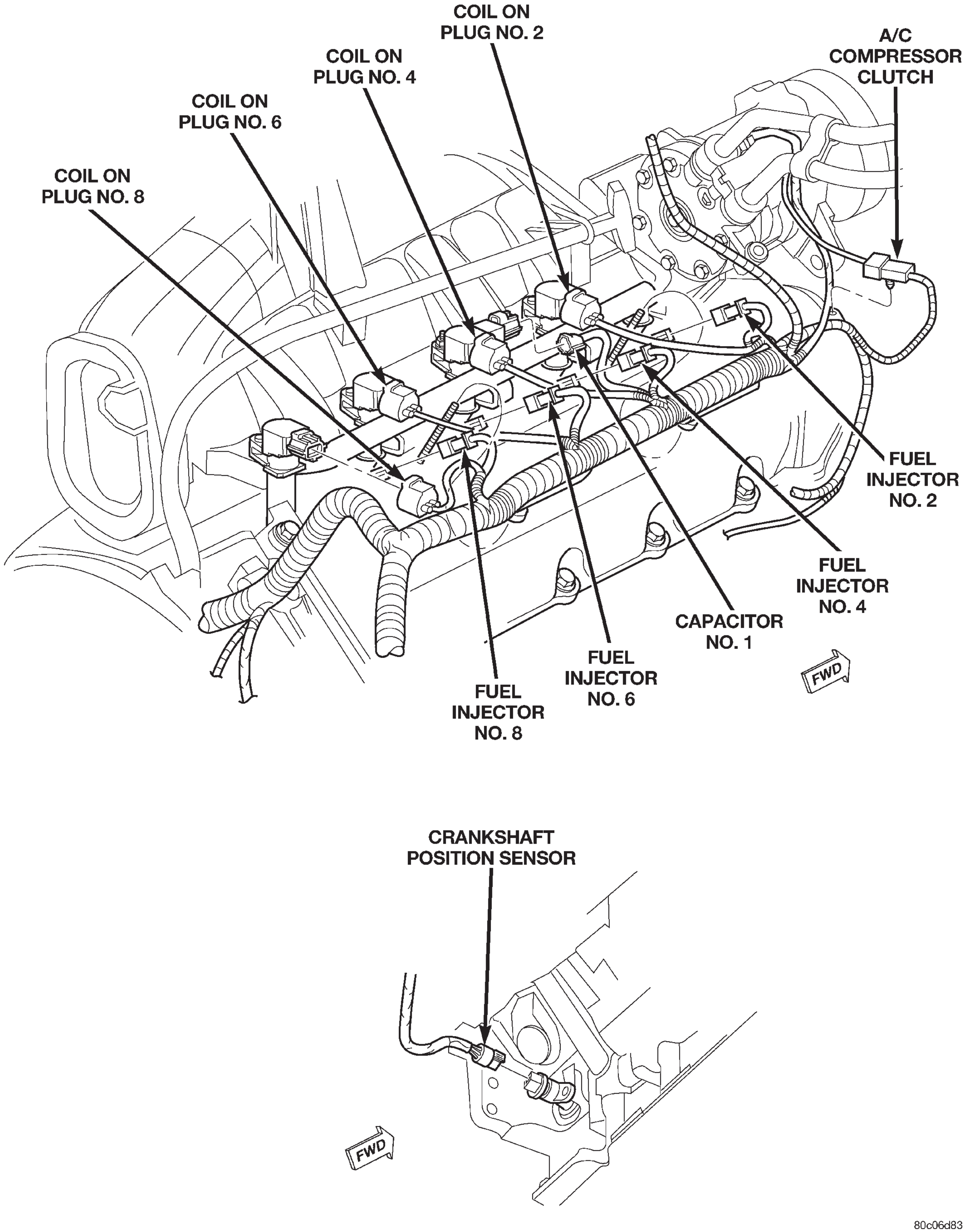


Fig. 16 Engine Right Side 4.7L

DESCRIPTION AND OPERATION (Continued)

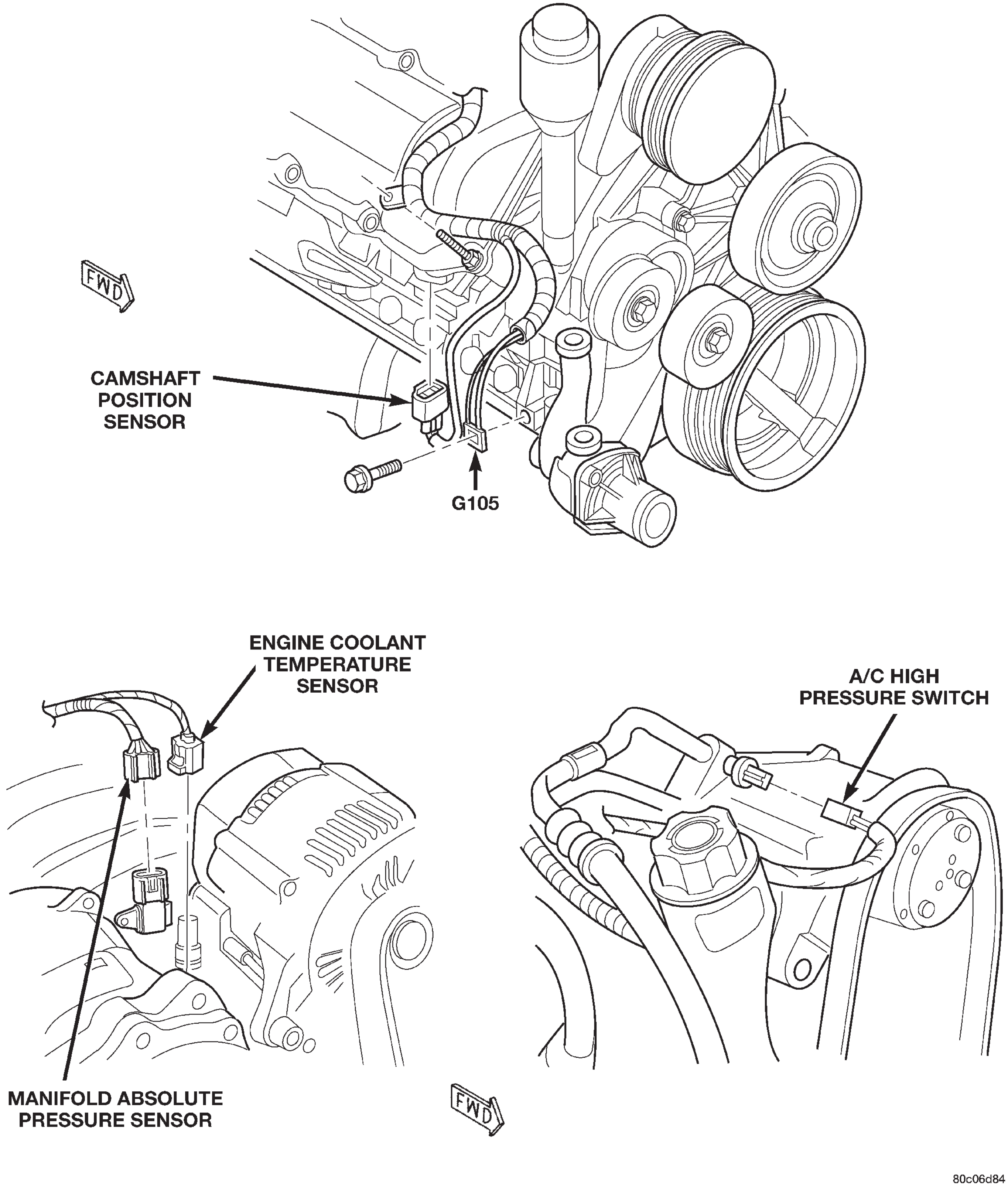


Fig. 17 Engine Front 4.7L

DESCRIPTION AND OPERATION (Continued)

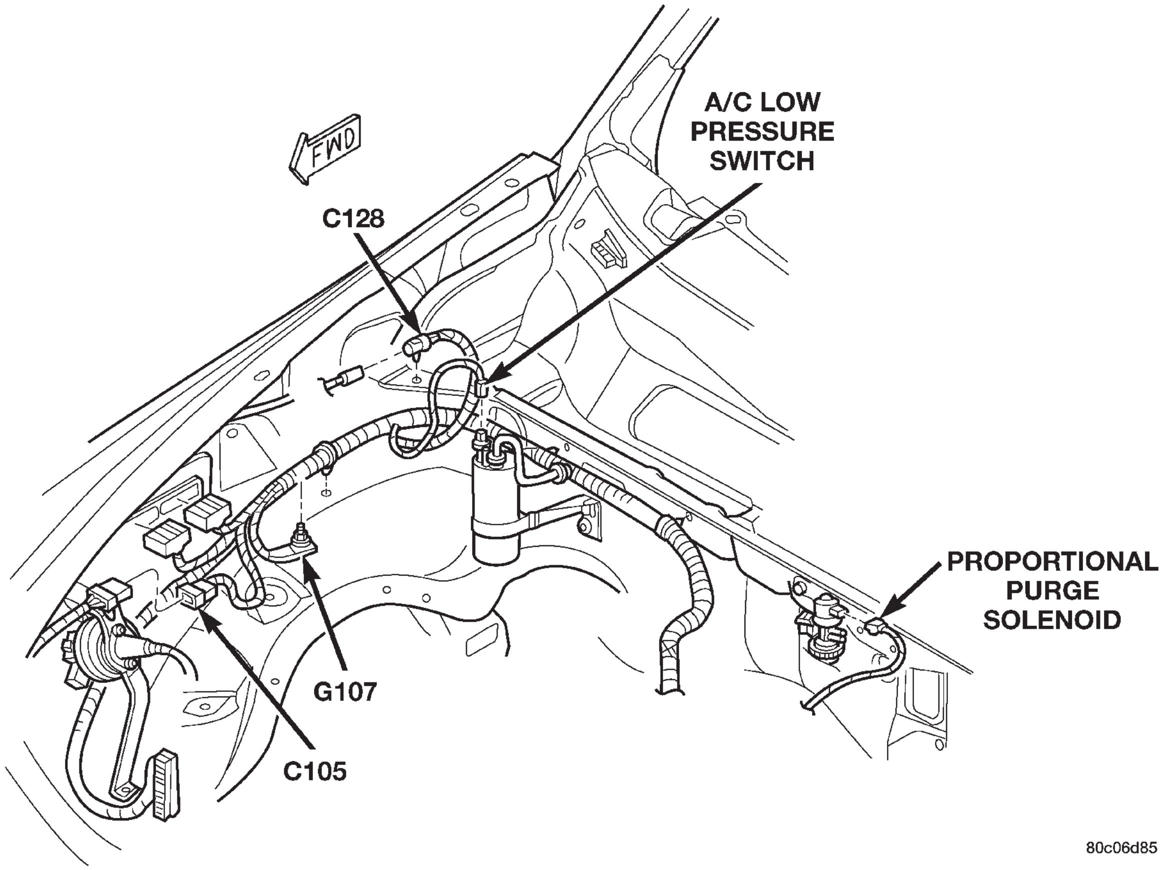


Fig. 18 Right Rear Engine Compartment

DESCRIPTION AND OPERATION (Continued)

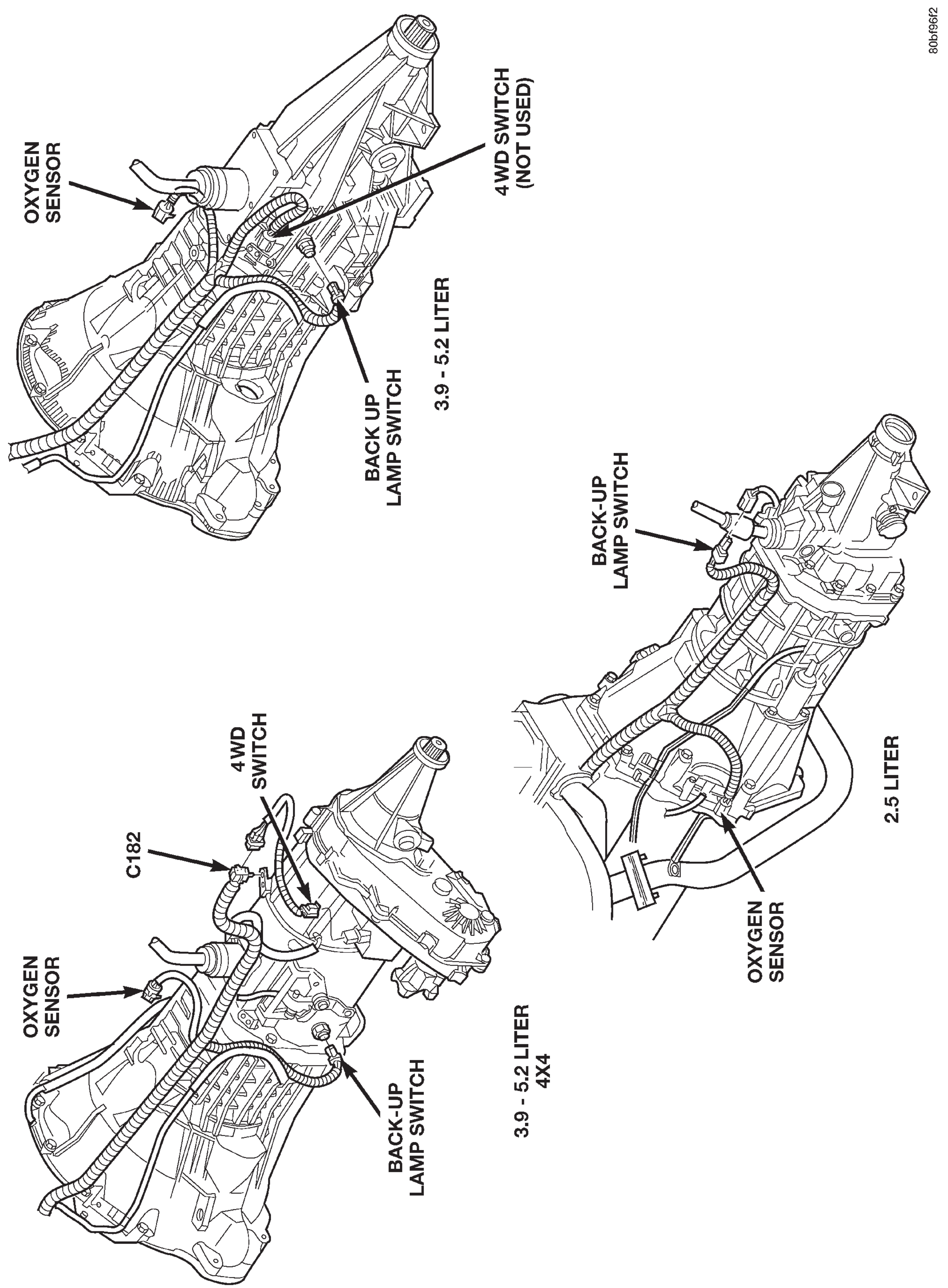


Fig. 19 Manual Transmission Connectors (Except 4.7L)

DESCRIPTION AND OPERATION (Continued)

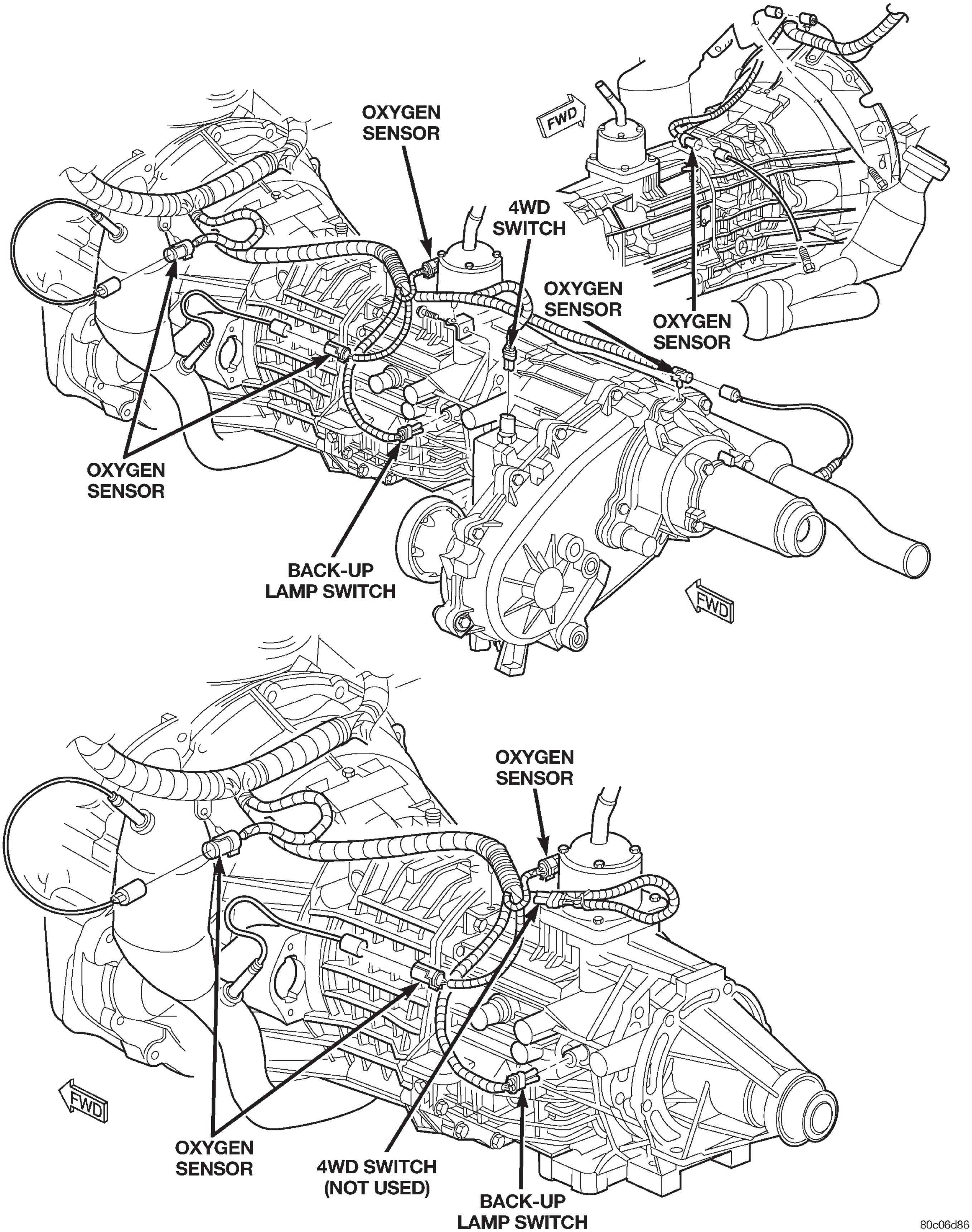


Fig. 20 Manual Transmission Connectors 4.7L

DESCRIPTION AND OPERATION (Continued)

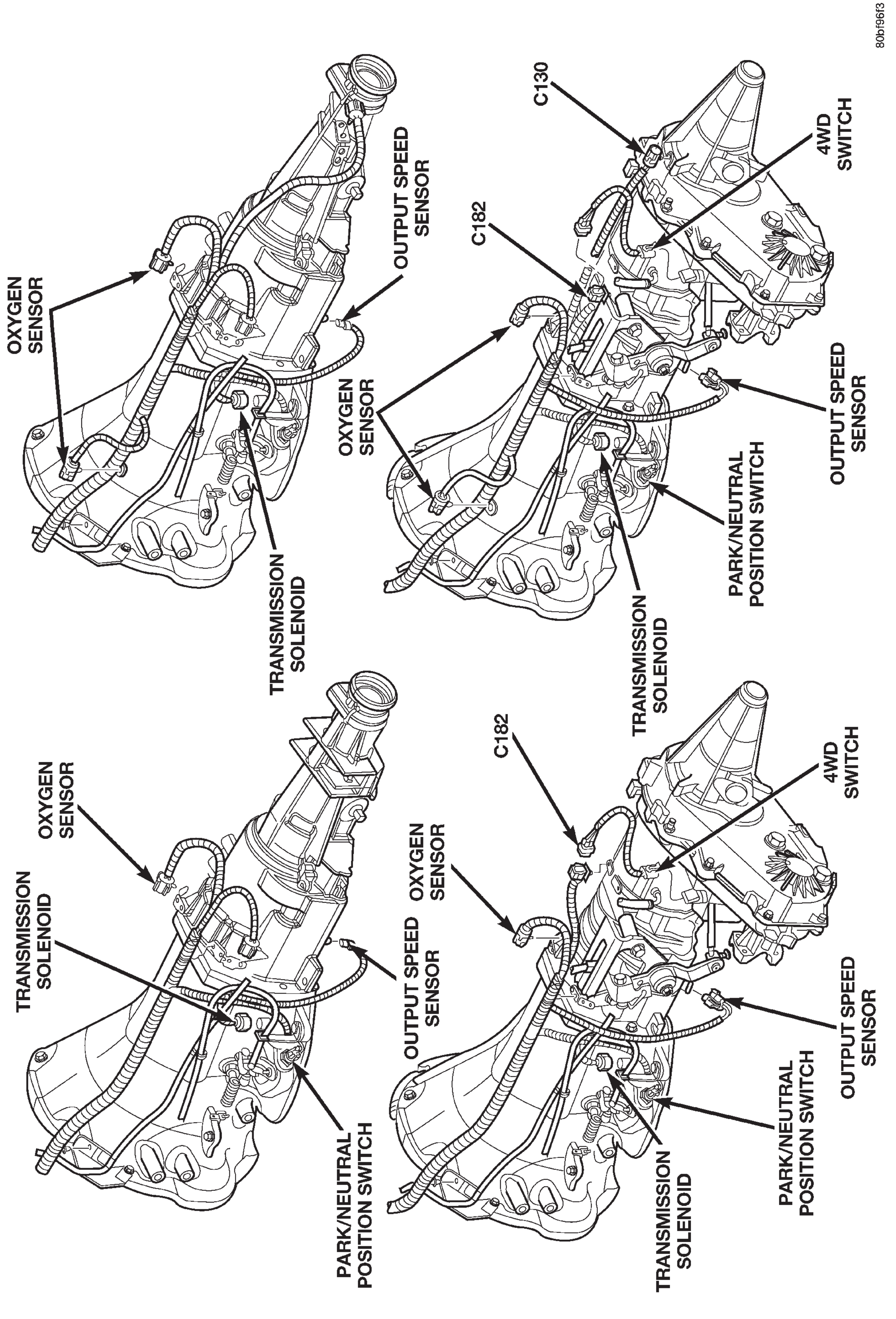


Fig. 21 Automatic Transmission Connectors (Except 4.7L)

DESCRIPTION AND OPERATION (Continued)

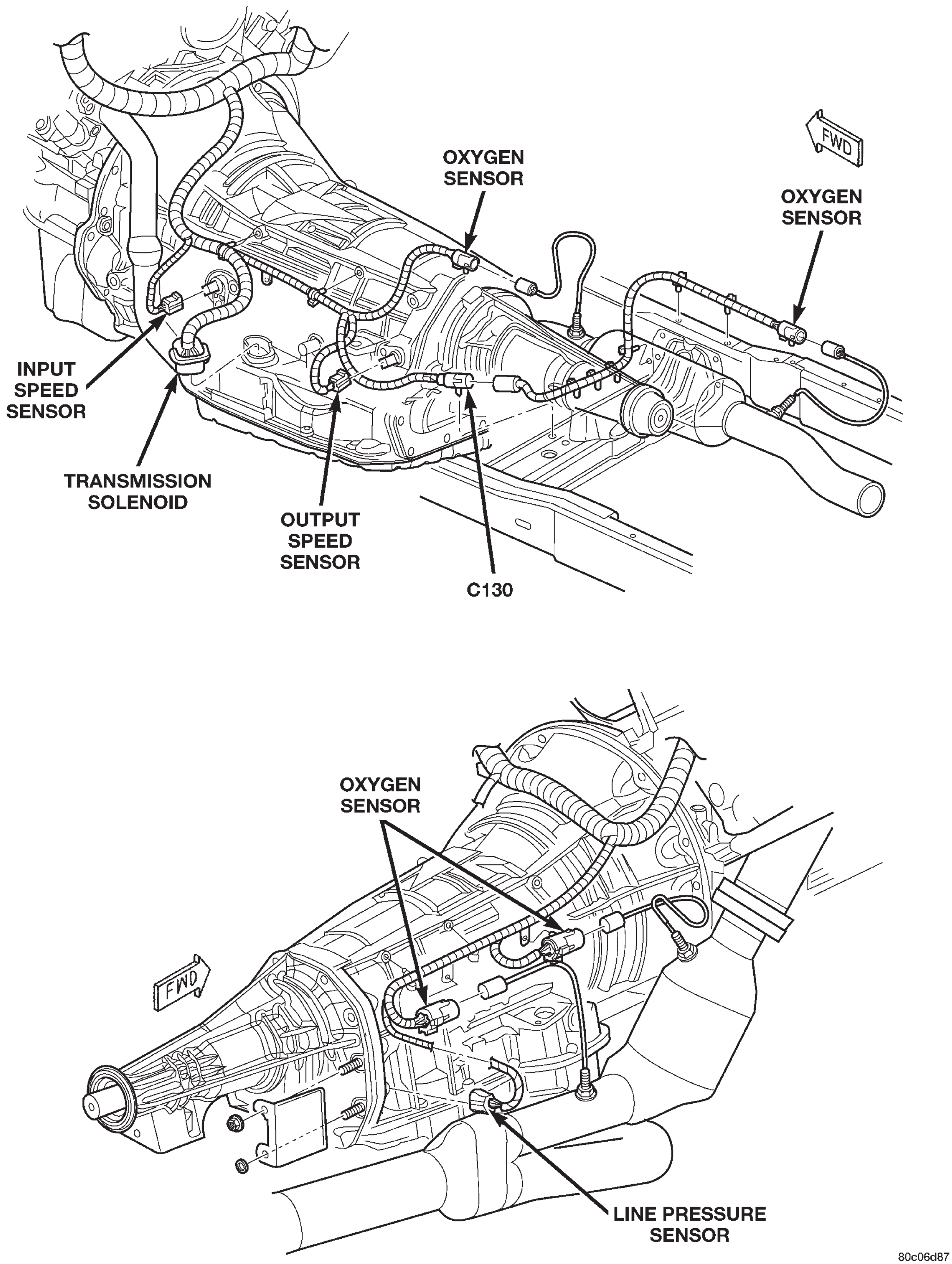


Fig. 22 Automatic Transmission Connectors 4.7L

DESCRIPTION AND OPERATION (Continued)

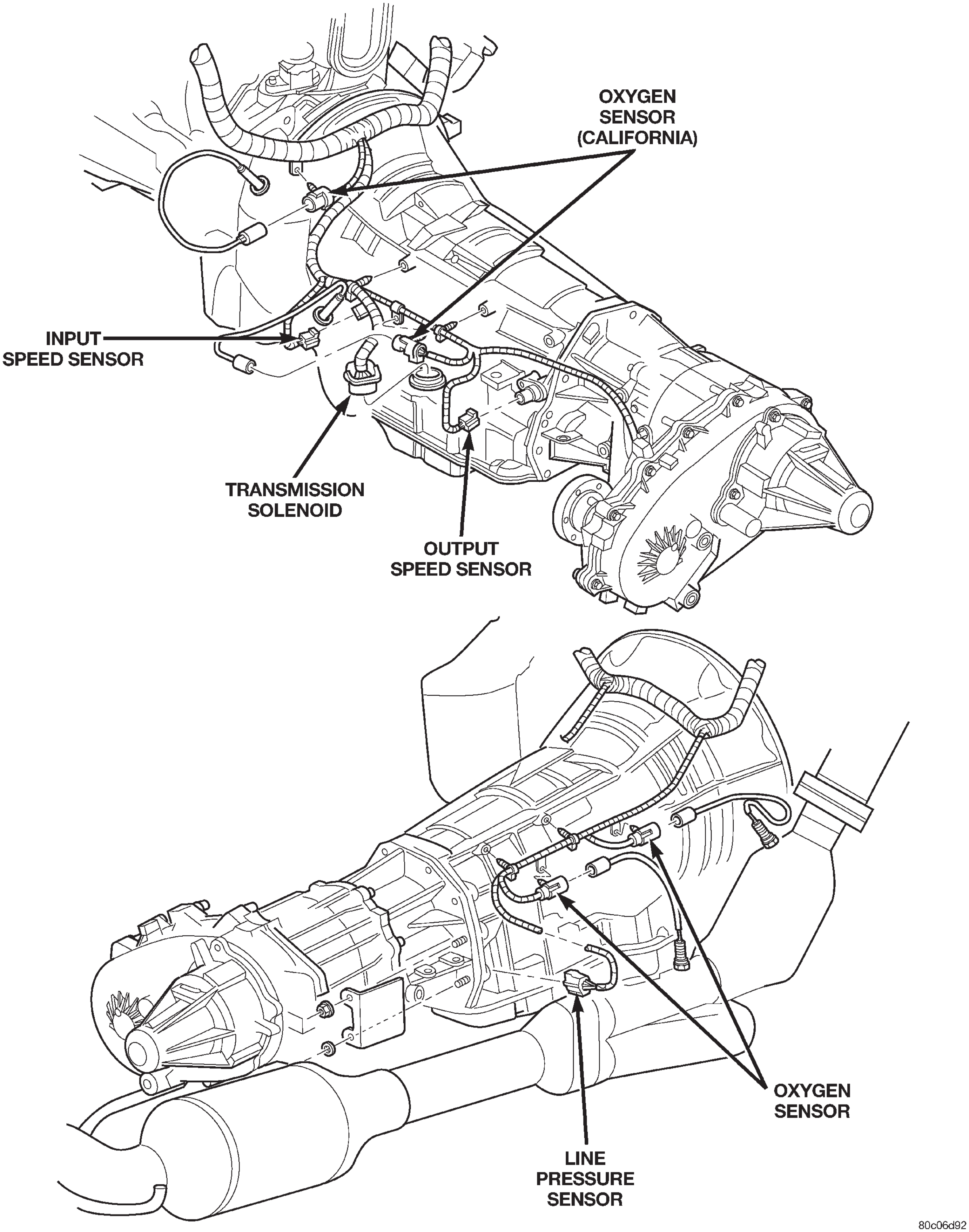


Fig. 23 Automatic Transmission Connectors 4.7L 4WD

DESCRIPTION AND OPERATION (Continued)

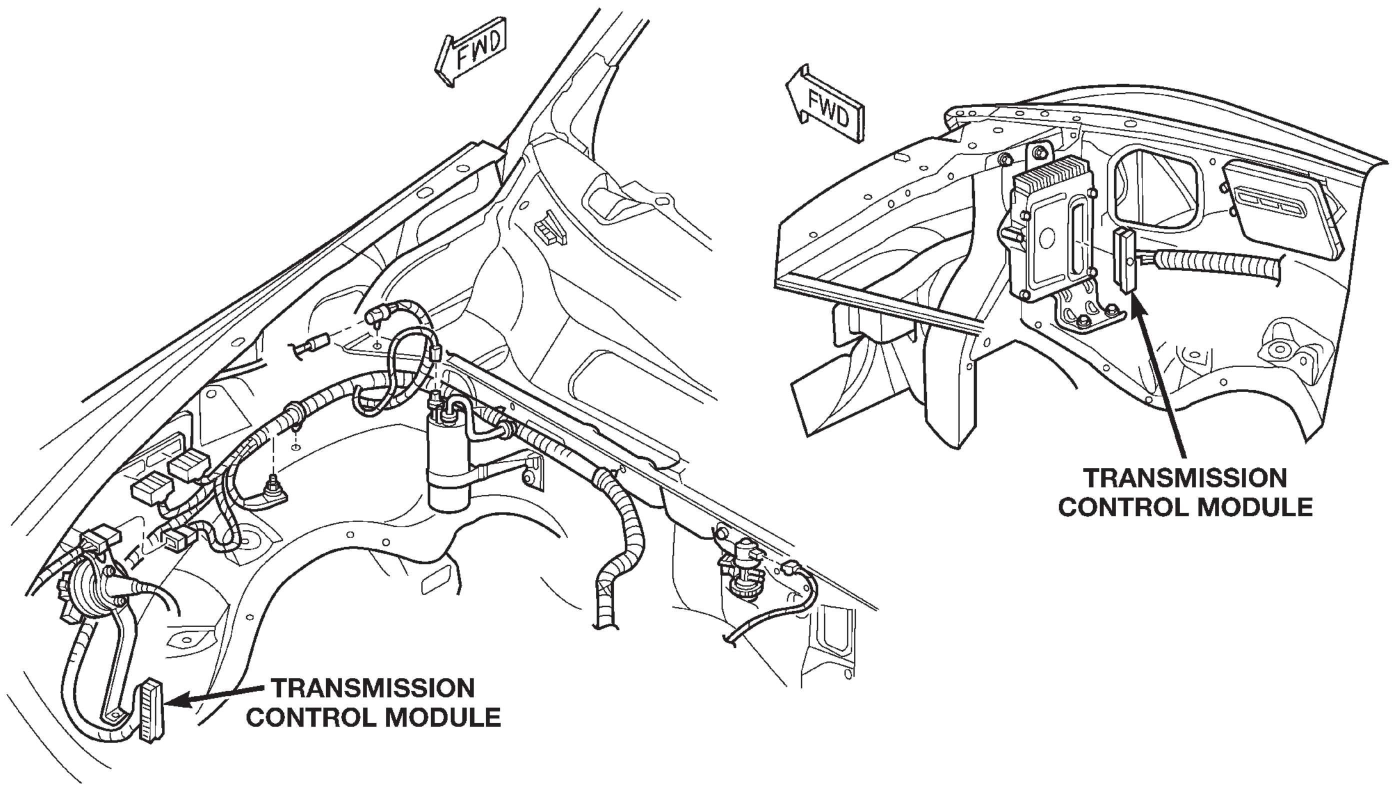


Fig. 24 Transmission Control Module

DESCRIPTION AND OPERATION (Continued)

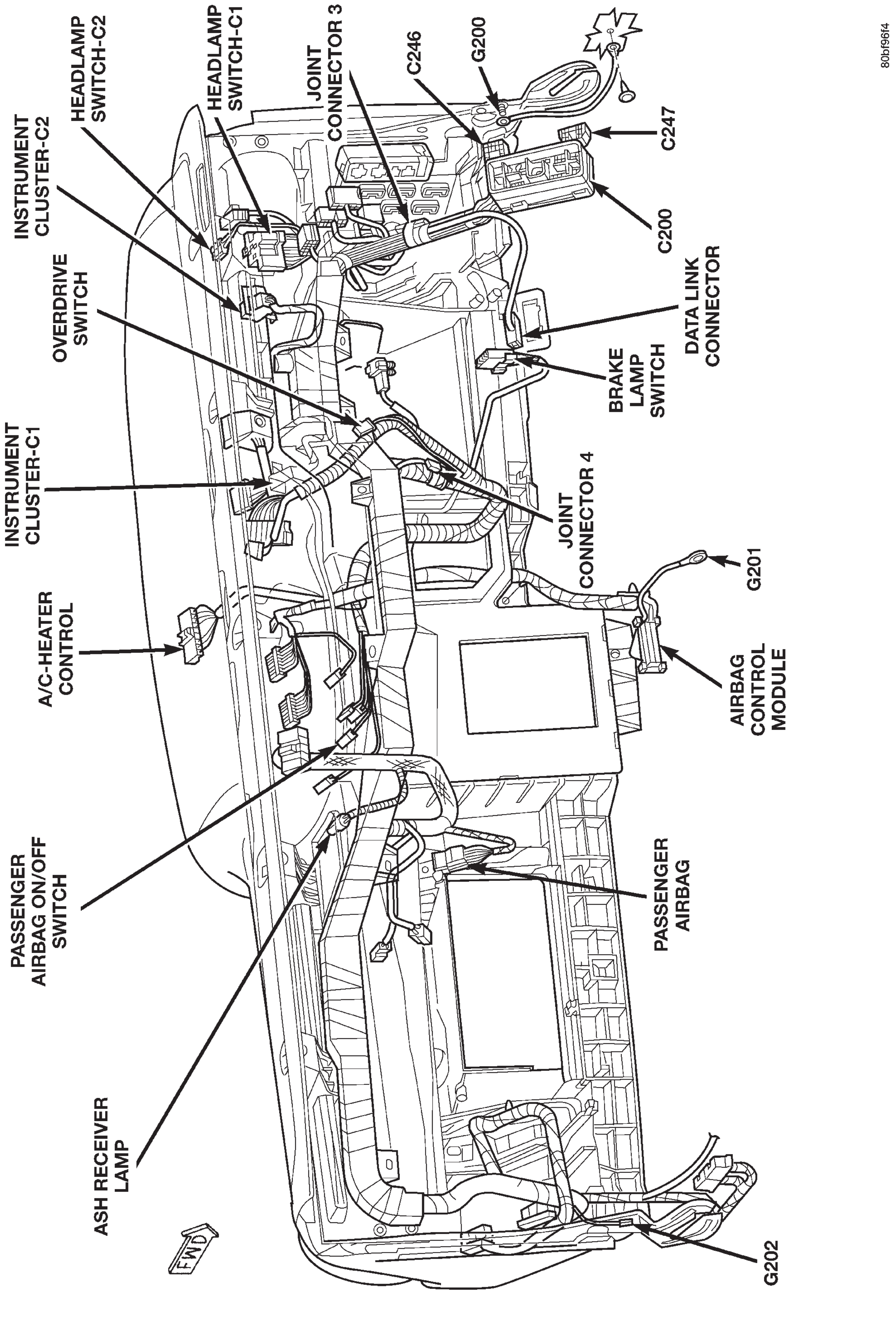


Fig. 25 Instrument Panel

DESCRIPTION AND OPERATION (Continued)

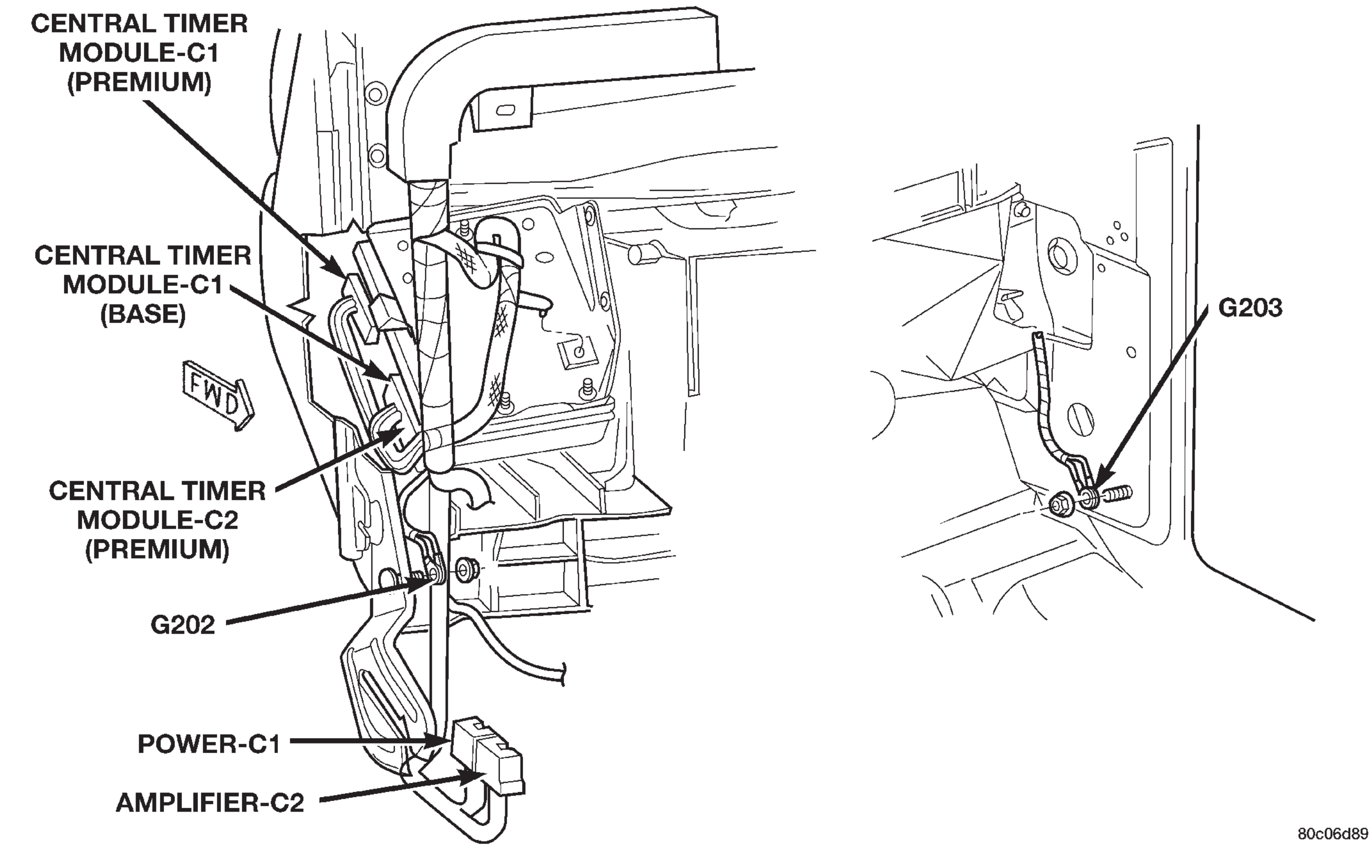


Fig. 26 Right Side Instrument Panel

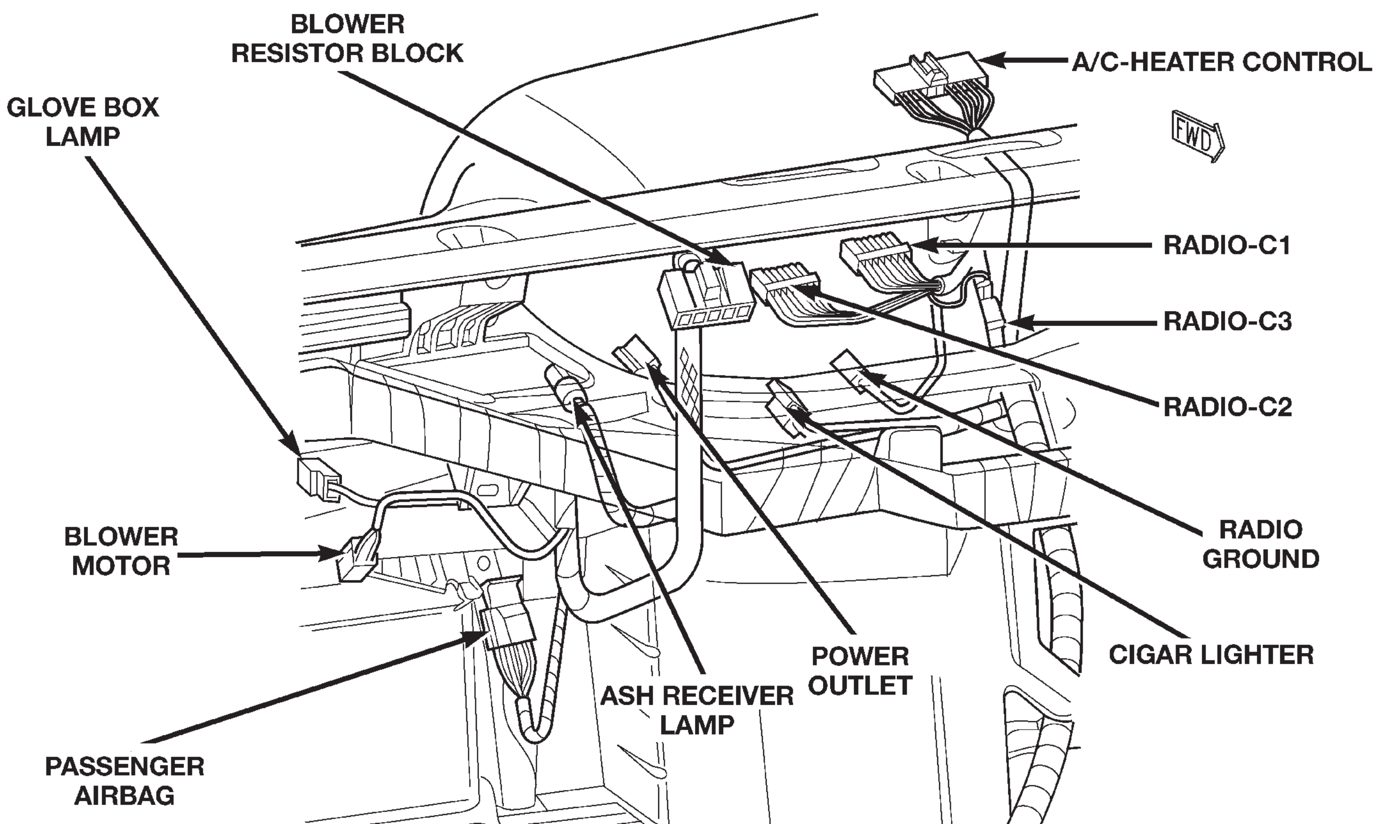


Fig. 27 Instrument Panel Center

DESCRIPTION AND OPERATION (Continued)

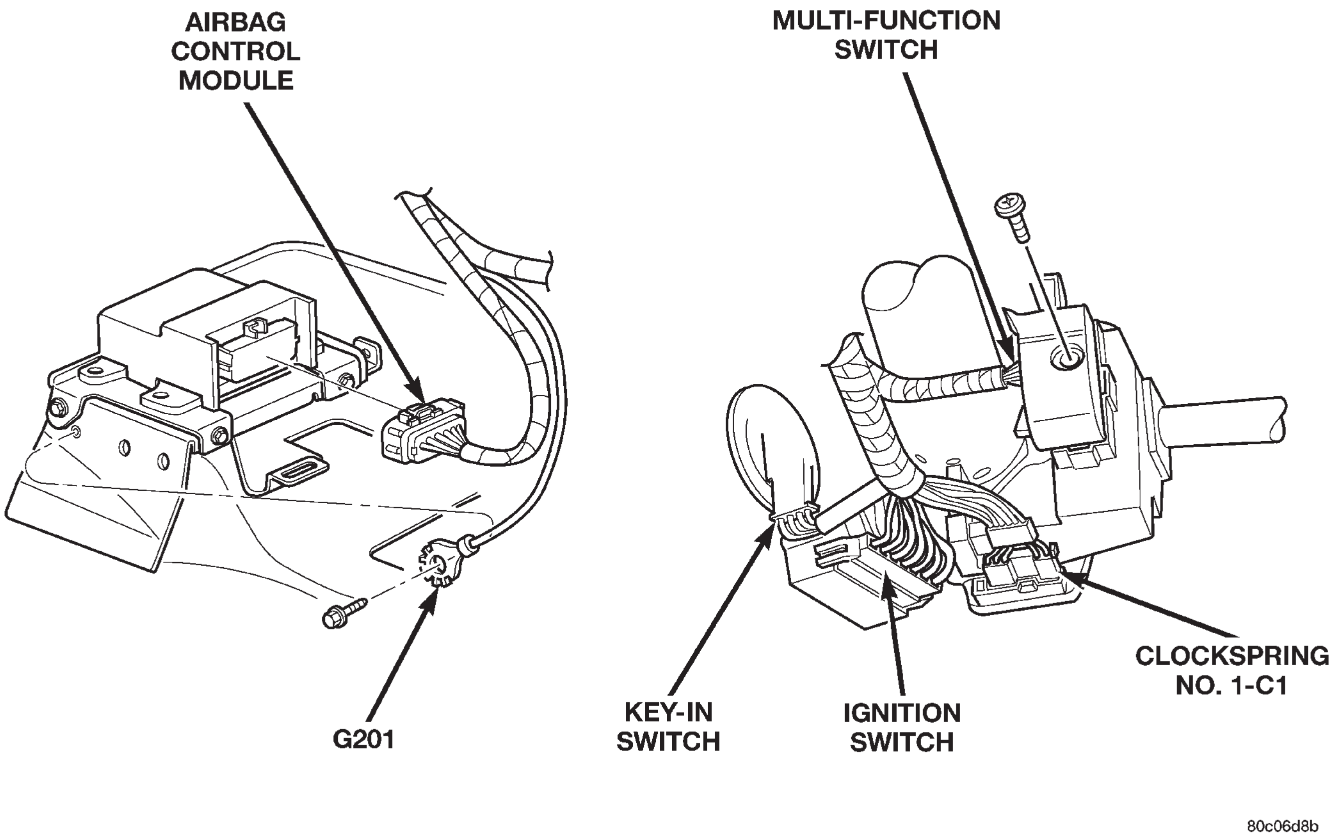


Fig. 28 Multi-Function

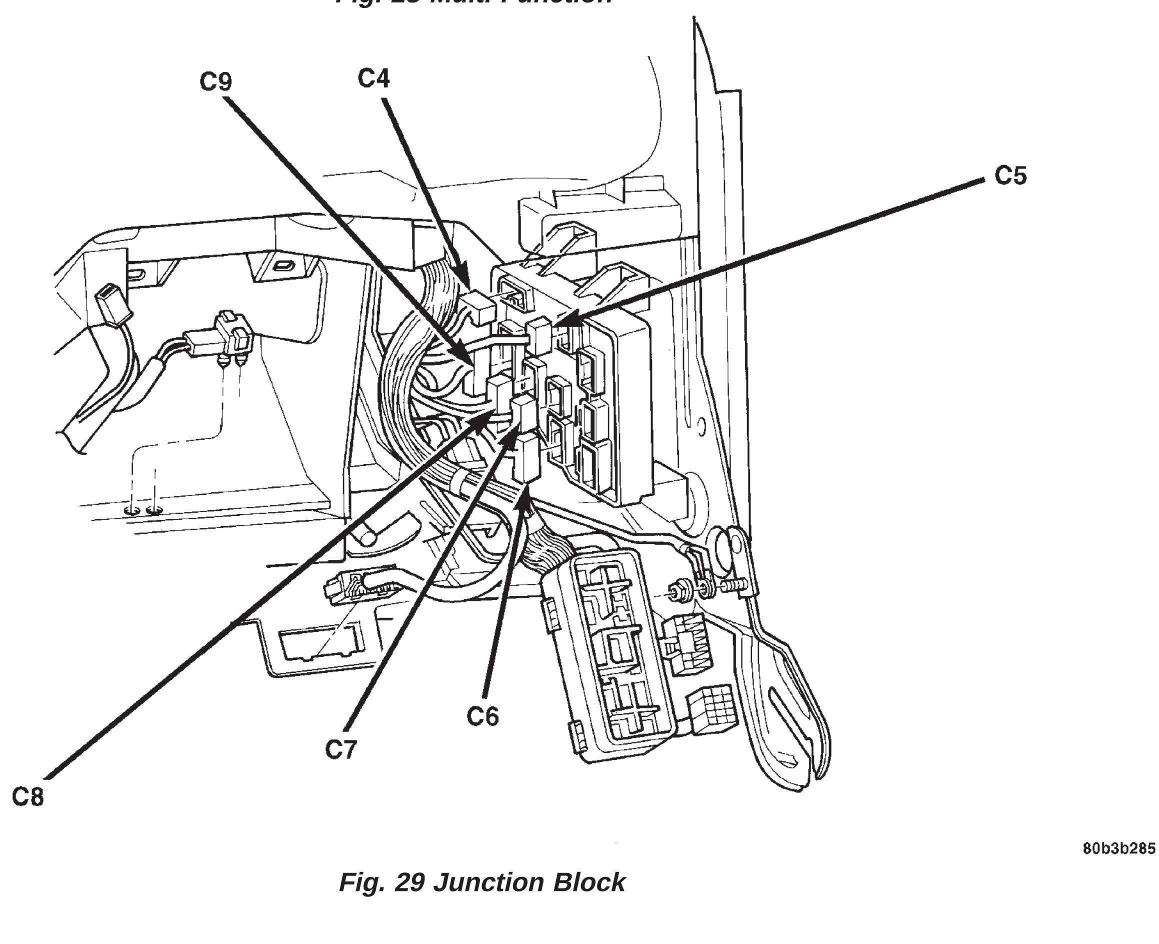


Fig. 29 Junction Block

DESCRIPTION AND OPERATION (Continued)

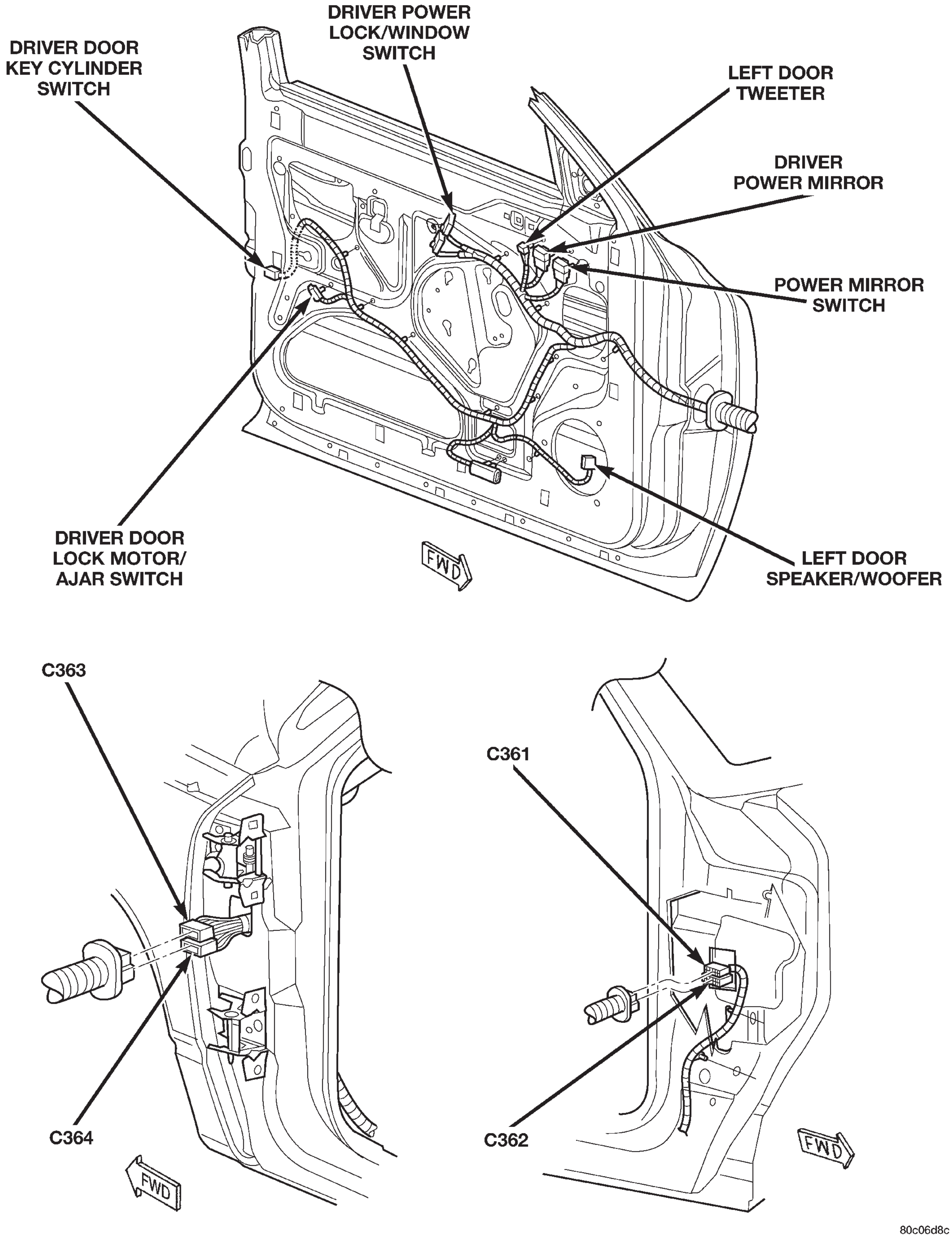


Fig. 30 Front Door Wiring

DESCRIPTION AND OPERATION (Continued)

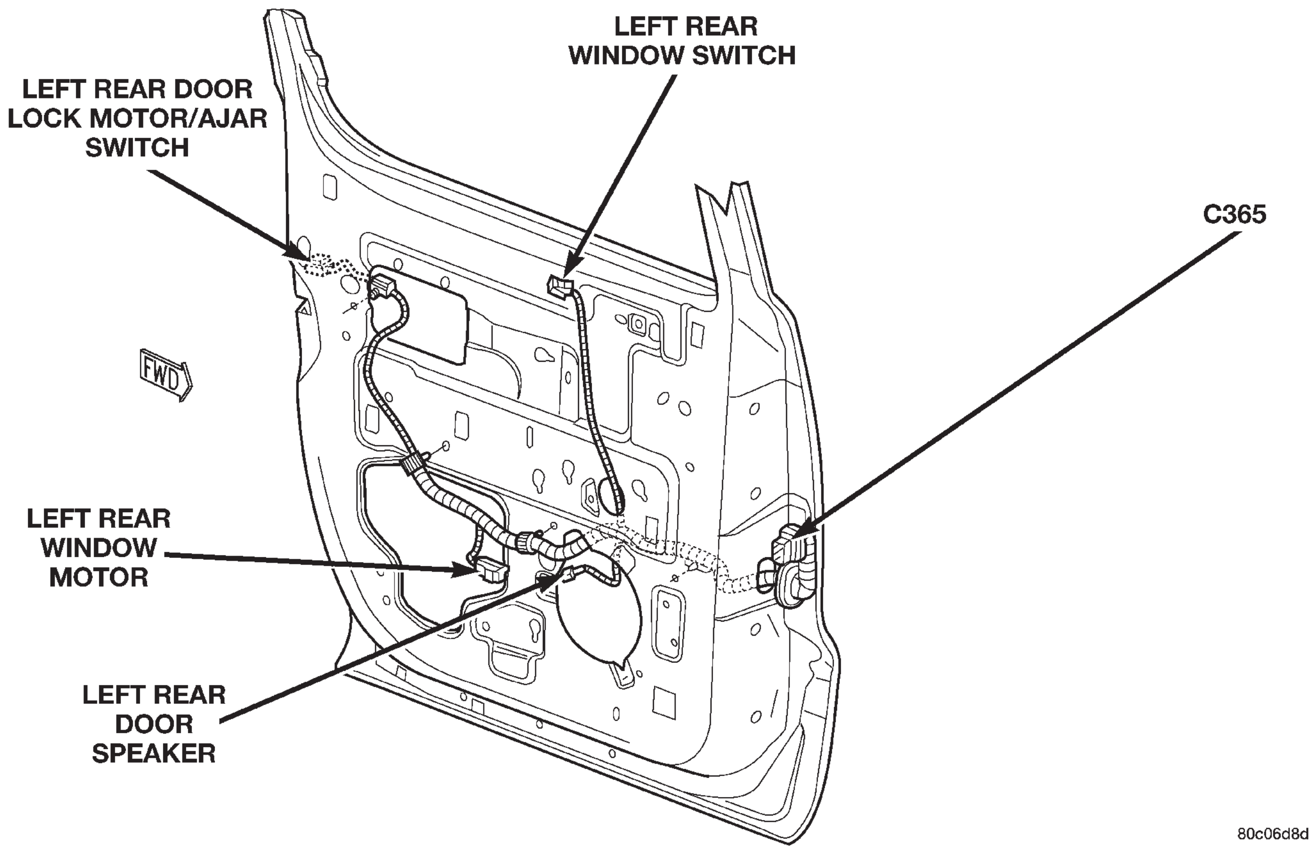


Fig. 31 Rear Door Connectors

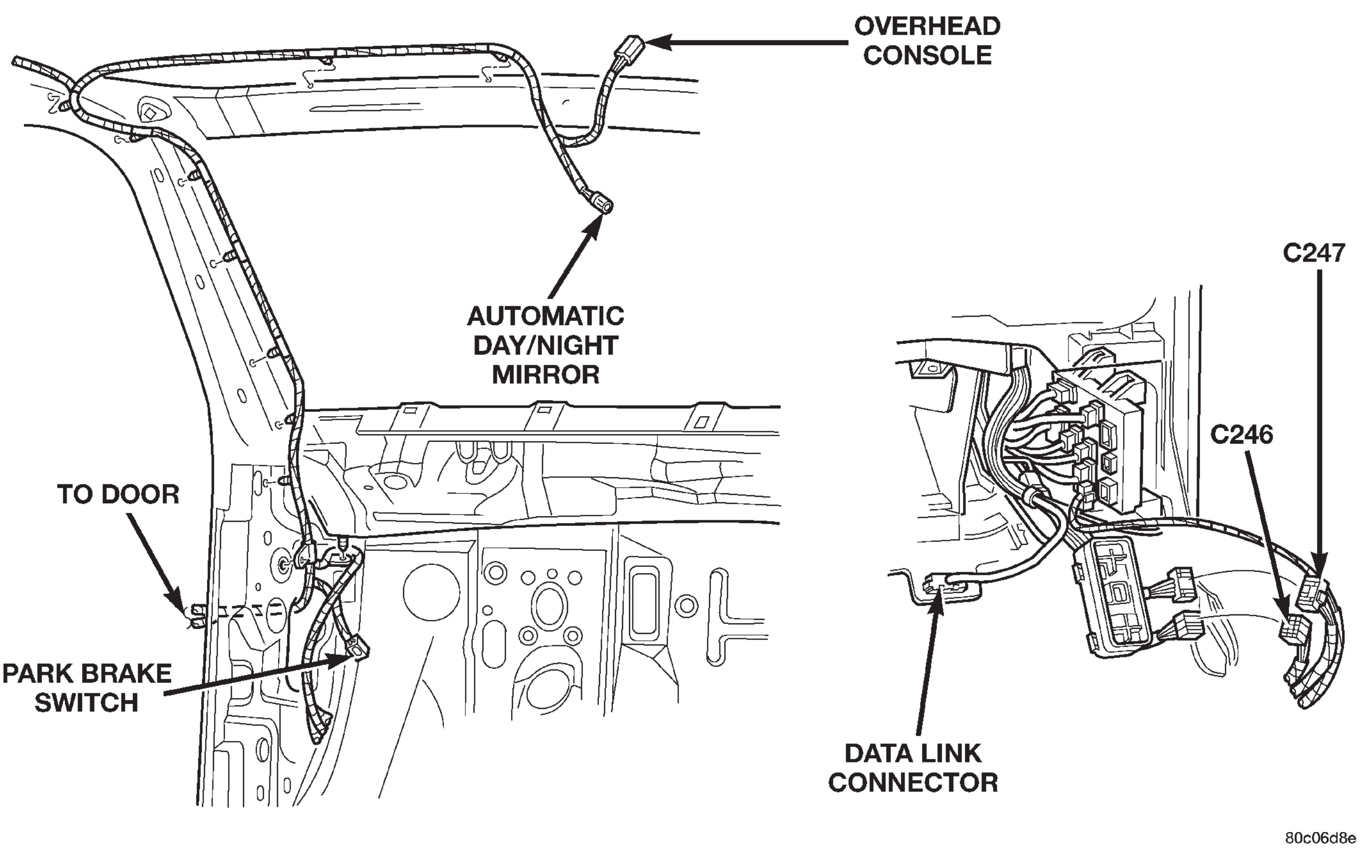


Fig. 32 Body Wiring

DESCRIPTION AND OPERATION (Continued)

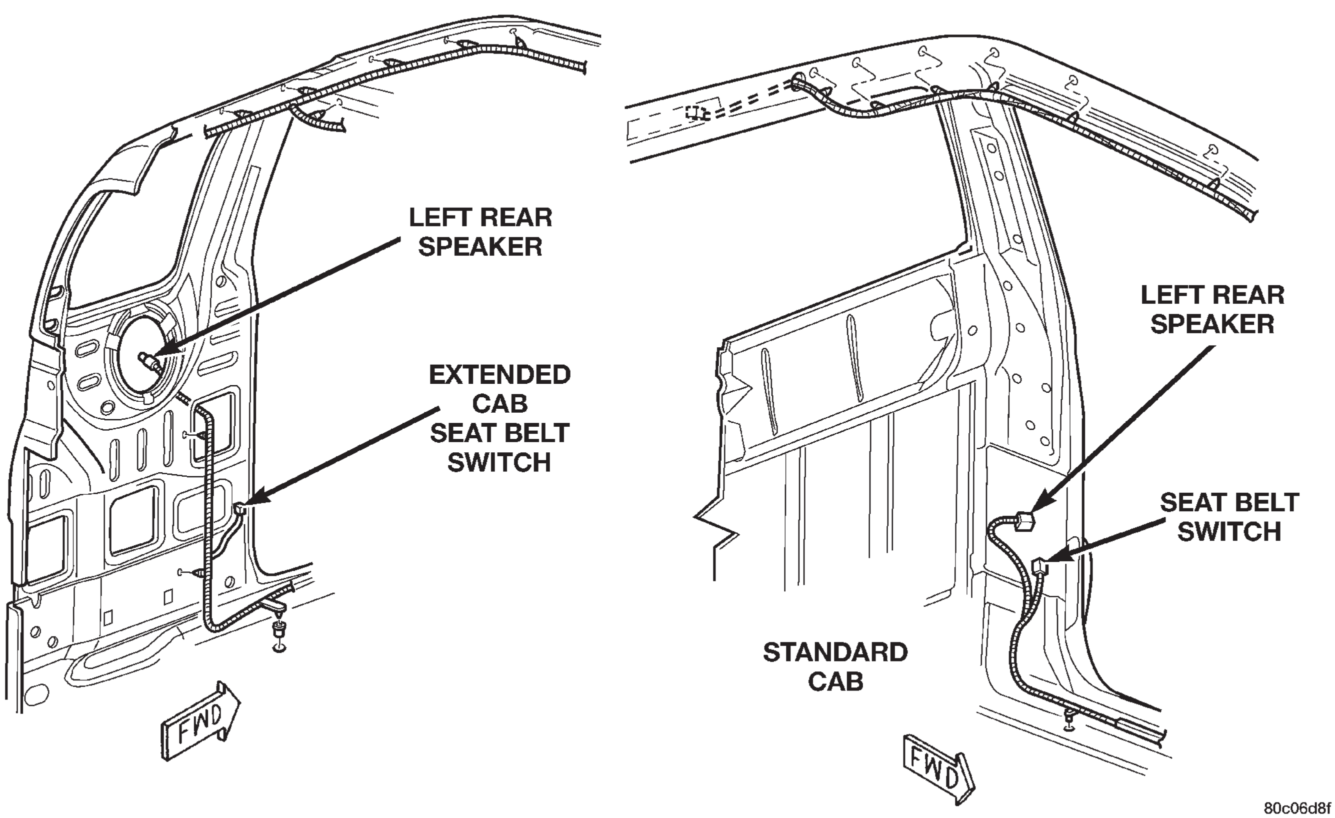


Fig. 33 Cab Wiring

DESCRIPTION AND OPERATION (Continued)

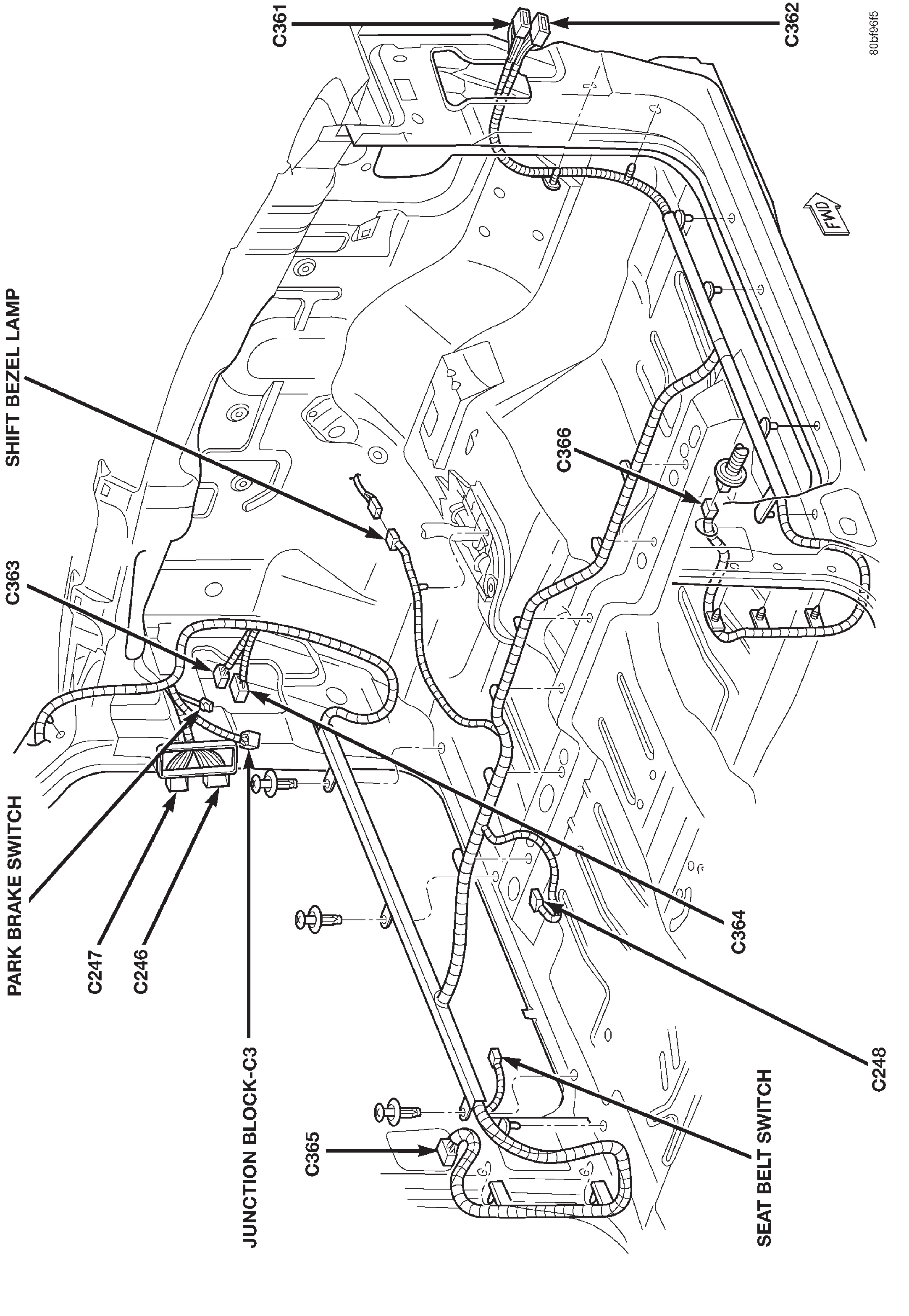


Fig. 34 Body Wiring

DESCRIPTION AND OPERATION (Continued)

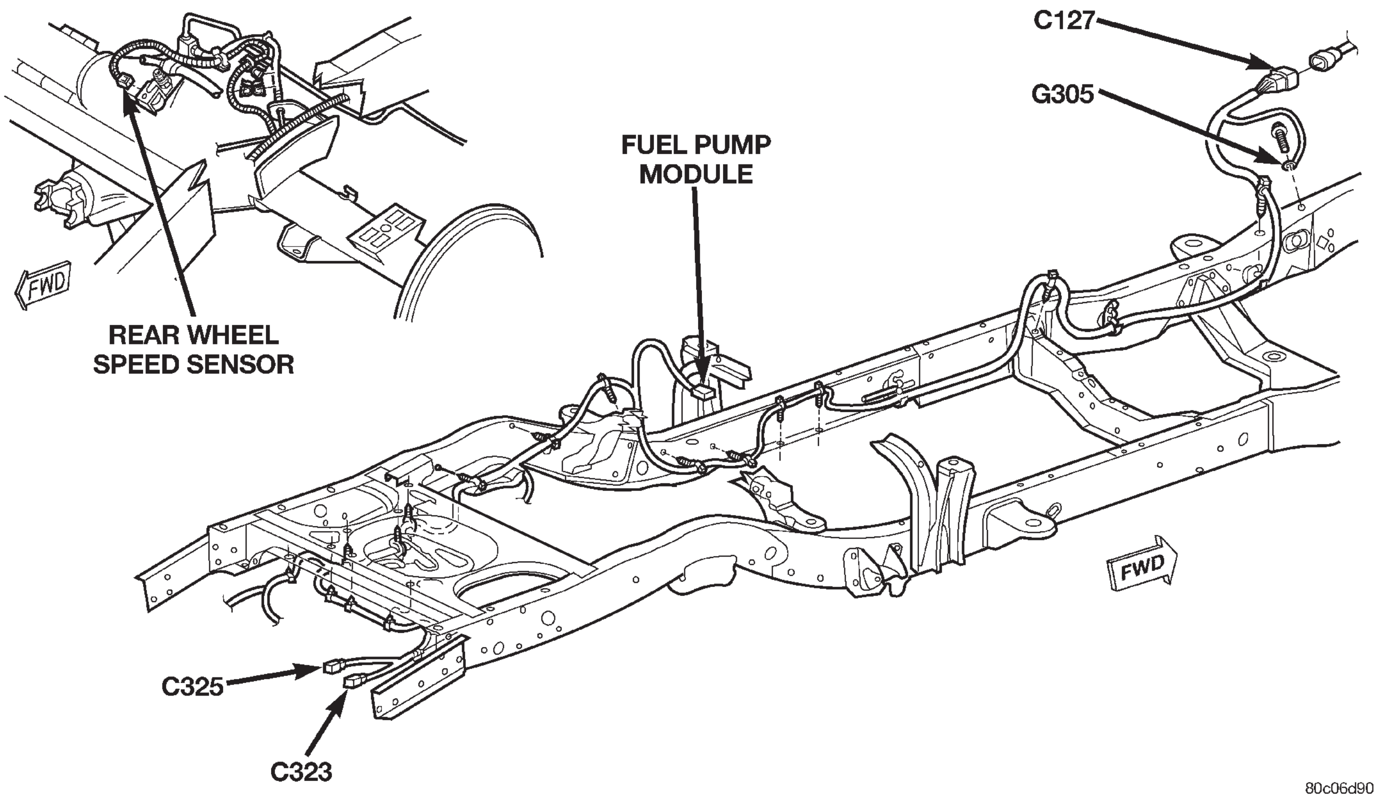


Fig. 35 Chassis Wiring

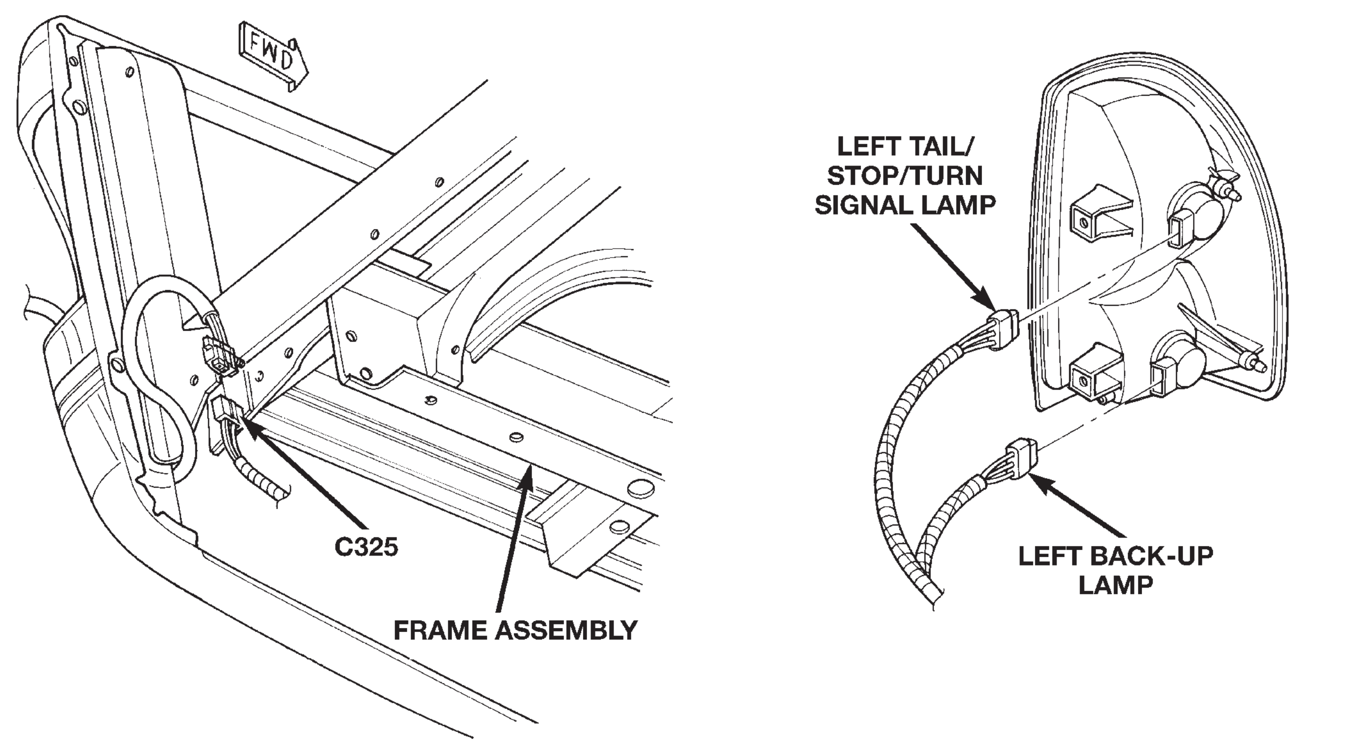


Fig. 36 Tail Lamps

8W-95 SPLICE LOCATIONS

DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of the splices in this vehicle. A splice index is provided. Use the wiring diagrams in each section for splice number identification. Refer to the index for proper splice number.

SPLICE LOCATIONS

For splices not shown in this section a N/S is placed in the Fig. column.

Splice No.	Location	Fig.
S101 (2.5L)	Near T/O for Injector 3	5
S101 (3.9L, 5.9L)	Rear of Engine	N/S
S101 (4.7L)	Near T/O for Injector 7	10
S103 (2.5L)	Rear of Engine	5
S103 (3.9L, 4.7L, 5.9L)	Rear of Engine	N/S
S104	Near A/C Compressor	N/S
S105	Near Powertrain Control Module	3
S106 (2.5L)	Rear of Engine	N/S
S106 (3.9L, 5.9L)	Near Inj #4	8
S107 (2.5L)	Rear of Engine	N/S
S107 (3.9L, 5.2L)	Rear of Engine	N/S
S107 (4.7L	Right Rear of Engine	11
S108 (2.5)	Rear of Engine	N/S
S108 (3.9L, 5.9L)	Rear of Engine	N/S
S109	Near RT Headlamp T/O	2
S110	Near Inj #5 T/O	7, 9
S113	NearT/O for Chassis Harness	N/S
S115	Rear of Engine	N/S
S124	In Wiring Trough	1
S125	Near T/O for Left Fog Lamp	2
S126	In T/O for Controller Anti-Lock Brakes	1
S127	In T/O for Controller Anti-Lock Brakes	1
S128	In T/O for Junction Block C1-C2	N/S
S156	In Wiring Trough	1

Splice No.	Location	Fig.
S159	Near Power Distribution Center	1
S161	Near Power Distribution Center	1
S162	Near Power Distribution Center	1
S163	LT Fender Side Shield	1
S164	LT Fender Side Shield	1
S166	In LT HD/LP T/O	1
S168	Near Left Headlamp T/O	1
S169	Near T/O for Left Fog Lamp	2
S170	Near Right Headlamp T/O	2
S171	Right Rear of Engine	3
S171 (4.7L)	Near Injector 1 T/O	10
S172	Rear of Engine	4
S173	Near Powertrain Control Module	4
S174	Near Powertrain Control Module	4
S175	Near Powertrain Control Module	4
S176	Near Transmission Control Module	4
S177	Right Rear of Engine	4
S178	Near Transmission Control Module	4
S179	Right Rear of Engine	N/S
S180	Rear of Engine	N/S
S181	Near Injector 3 T/O	10
S182	Right Rear of Engine	N/S
S183	Near Injector 6 T/O	11
S184	In Wiring Trough	1
S185	In Wiring Trough	1
S186	Near Power Distribution Center	N/S

DESCRIPTION AND OPERATION (Continued)

Splice No.	Location	Fig.
S187	Near Power Distribution Center	1
S188	Near Power Distribution Center	N/S
S189	Near Right Headlamp T/O	2
S190	Near Right Headlamp T/O	2
S191	Near Right Headlamp T/O	2
S200	Near Instrument Cluster C2 T/O	12
S201	Near Instrument Cluster C2 T/O	12
S202	Center of I. P.	N/S
S204	In Steering Column T/O Near Ignition Switch	N/S
S205	In Steering Column T/O Near Ignition Switch	N/S
S207	In Steering Wheel Jumper	N/S
S208	In Steering Wheel Jumper	N/S
S213	Center of Instrument Panel	12
S214	Near Airbag Control Module Connector	12
S217	Near T/O for Cigar Ltr.	N/S
S218	RT Side of I. P.	12
S221	RT Side of I. P.	12
S222	RT Side of I. P. Near T/O for Right Door	12
S223	RT Side of I. P.	12
S225	Near RT Door T/O	12
S252	Near T/O for Steering Column	12
S253	Left Side of Instrument Panel	12
S254	Left Side of Instrument Panel	12
S255	Left Side of Instrument Panel	12
S256	Left Side of Instrument Panel	12
S257	Near Instrument Cluster C2 T/O	12
S258	Near Instrument Cluster C2 T/O	12
S259	Between Cluster T/O's	12
S260	Between Cluster T/O's	12

Splice No.	Location	Fig.
S261	Between Cluster T/O's	12
S301	Front of Left Door	15
S306	Near Fuel Tank T/O	14
S314	Near T/O for Tail Lamps	14
S316	Left Rear Frame Rail	14
S317	Near T/O for Tail Lamps	14
S318	Left Rear Frame Rail	14
S320	Near T/O for Overhead Console	13
S321	Left A Post	13
S322	Left A Post	13
S324	Left A Post	13
S330	Near T/O for Speaker	15
S331	Near T/O for Speaker	15
S332	Near T/O for Speaker	15
S333	Near T/O for Speaker	15
S336	Near Left Door T/O	13
S337	Front of Left Door Sill	N/S
S338	Front of Left Door Sill	N/S
S339	Left Door Sill	13
S340	Left Door Sill	13
S341	Near Left Door T/O	13
S342	Near Left Door T/O	13
S343	Front of Left Door Sill	N/S
S344	Left Door Sill	13
S345	Left Door Sill	13
S346	Left Door Sill	13
S347	Near T/O for Speaker	15
S348	Front of Left Door	15
S349	Front of Right Door	N/S
S350	Front of Right Door	N/S
S351	Near T/O for Tail Lamps	14
S401	In Tail Lamp Harness	N/S
S404	In Tail Lamp Harness	N/S
S405	Near RT License Lamp	N/S
S406	Near RT License Lamp	N/S

DESCRIPTION AND OPERATION (Continued)

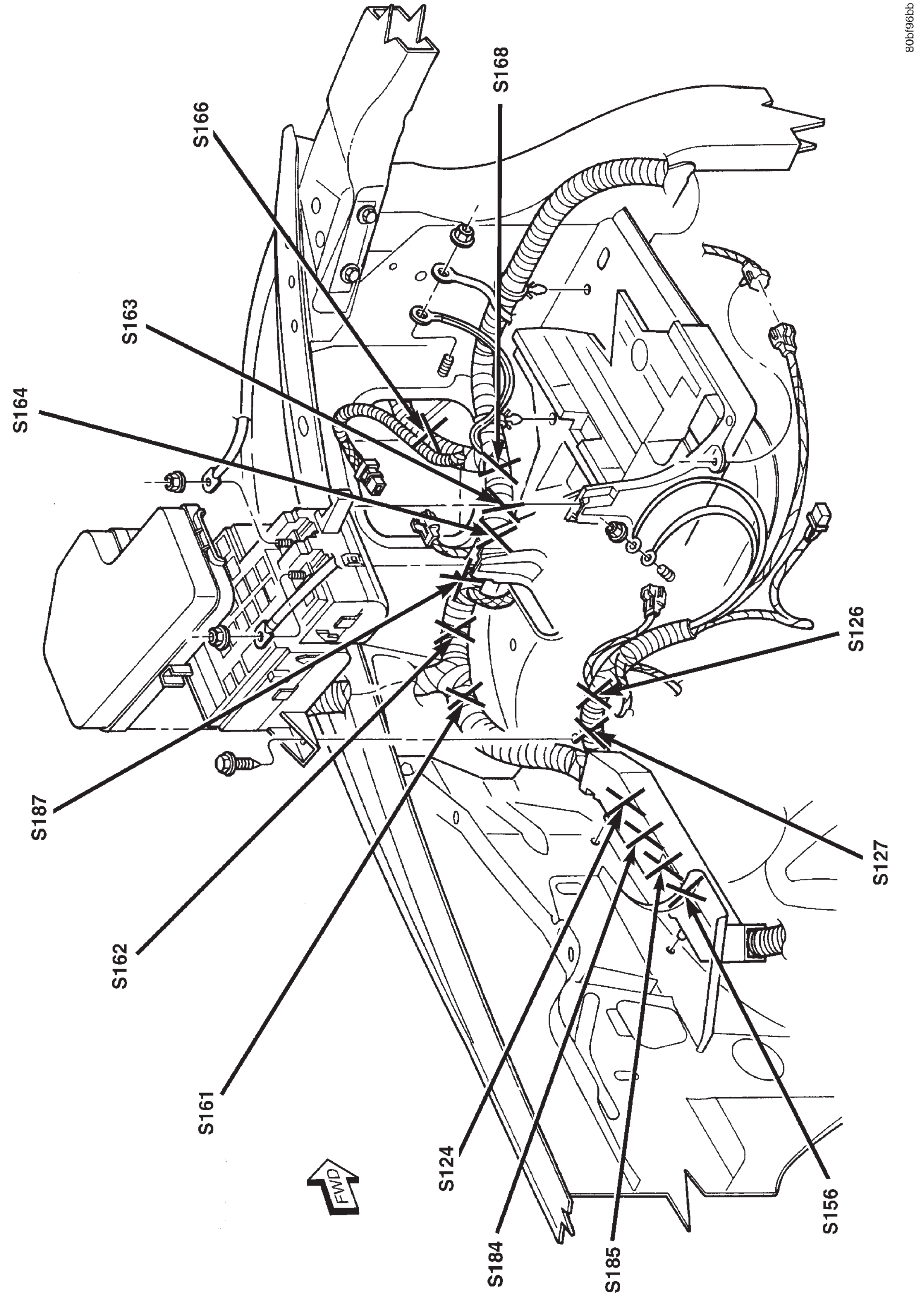


Fig. 1 Engine Compartment Splices (Left Side)

DESCRIPTION AND OPERATION (Continued)

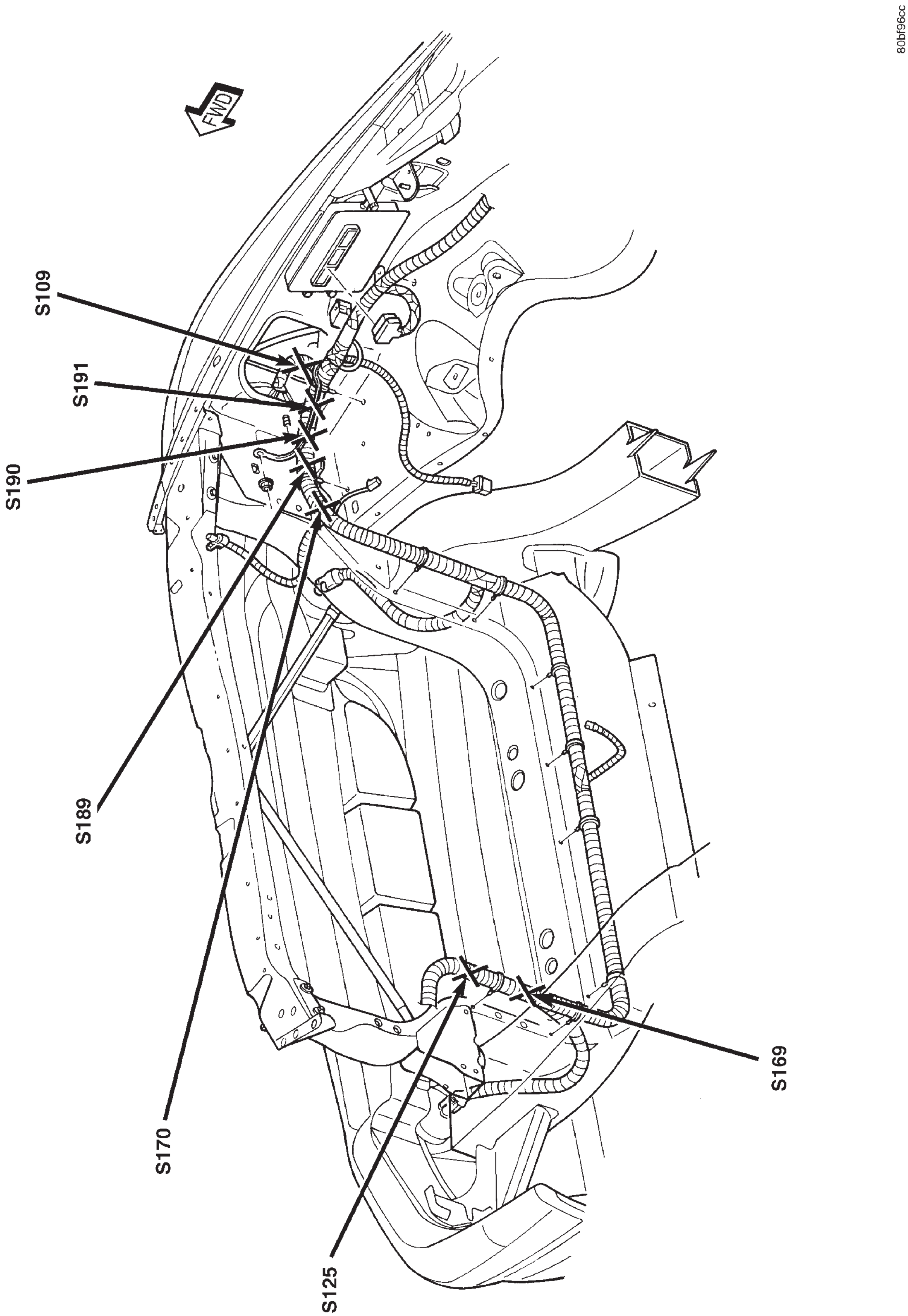


Fig. 2 Engine Compartment Splices (Right Side)

DESCRIPTION AND OPERATION (Continued)

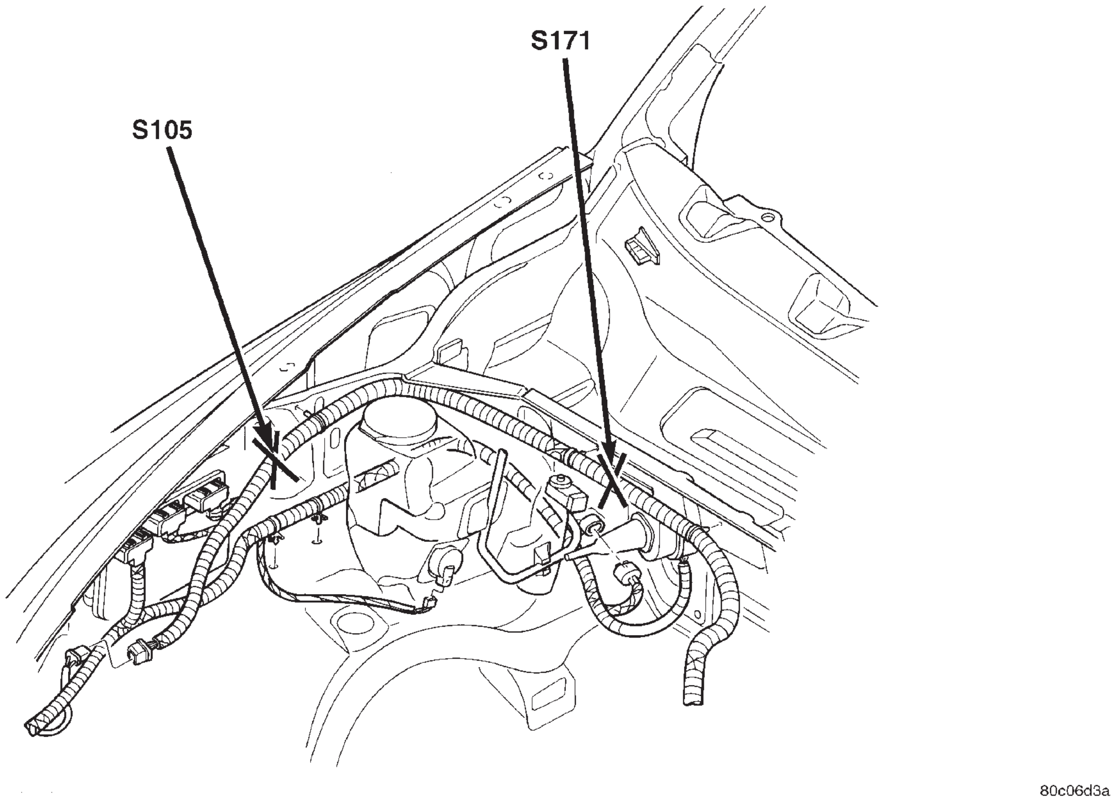


Fig. 3 Engine Harness Splices (Except 4.7L)

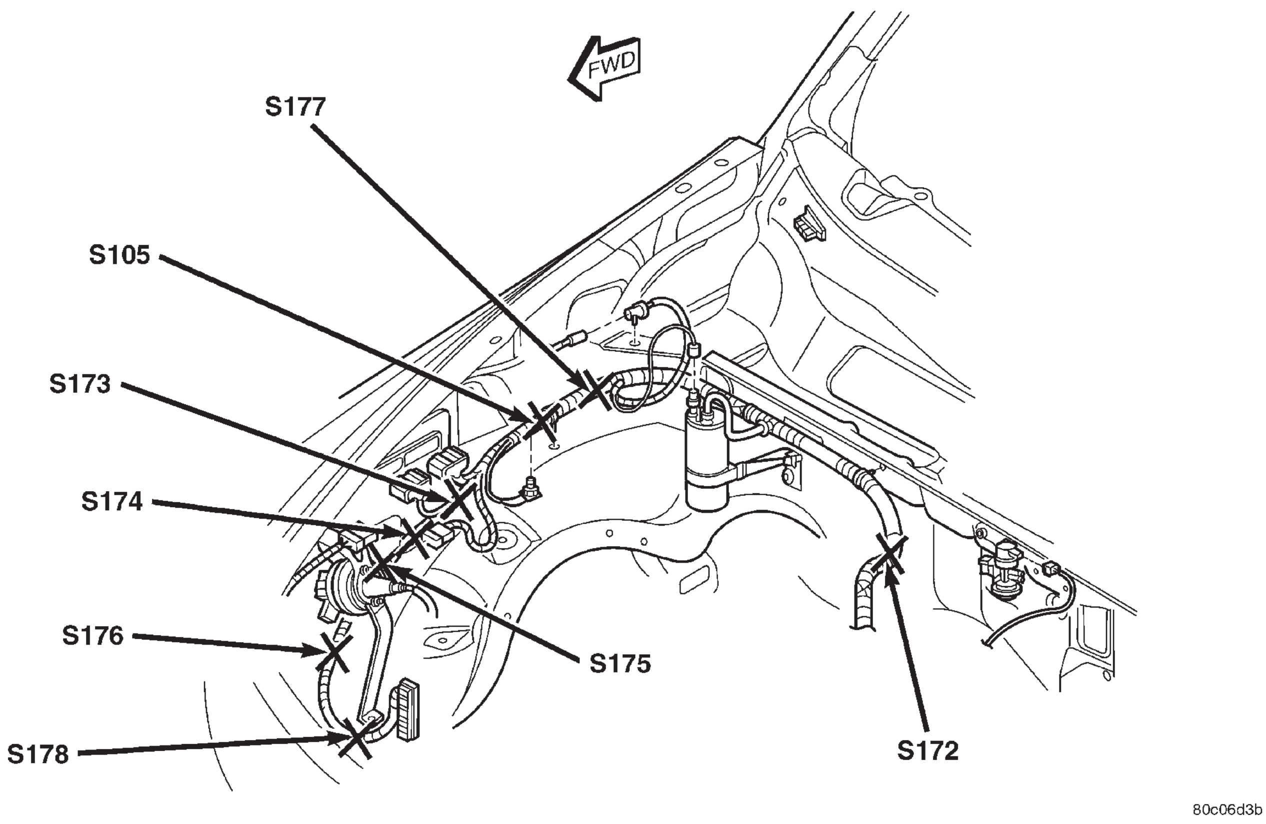


Fig. 4 Engine Harness Splices (4.7L)

DESCRIPTION AND OPERATION (Continued)

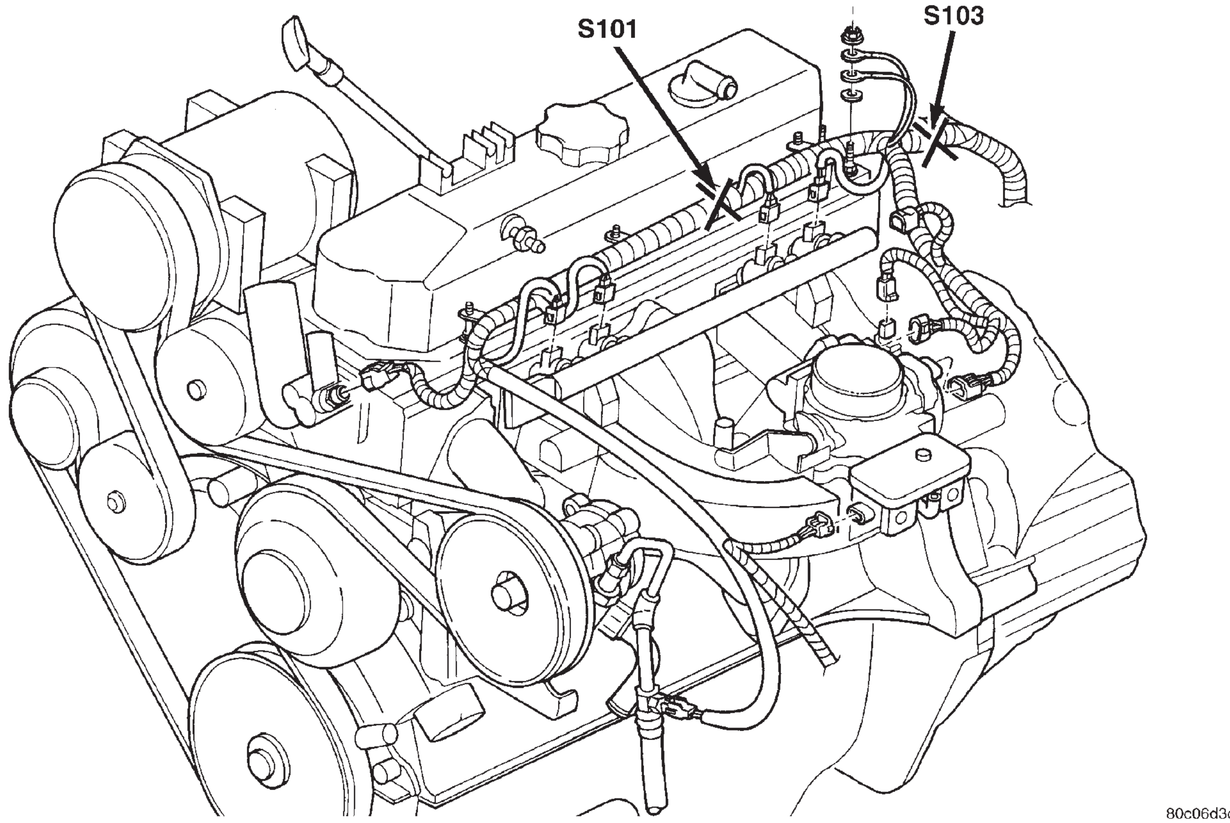


Fig. 5 Left Side Engine Harness Splices 2.5 Liter

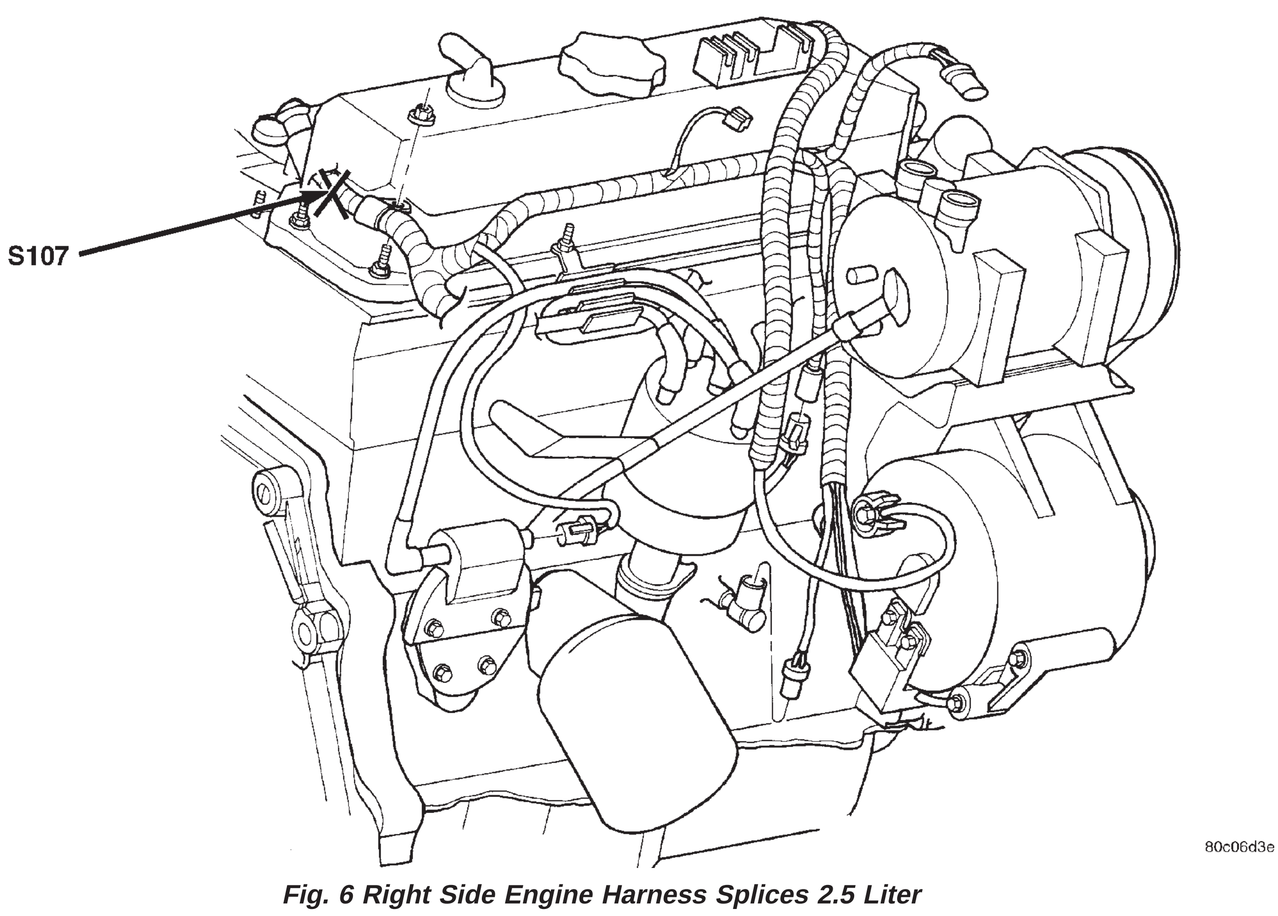


Fig. 6 Right Side Engine Harness Splices 2.5 Liter

DESCRIPTION AND OPERATION (Continued)

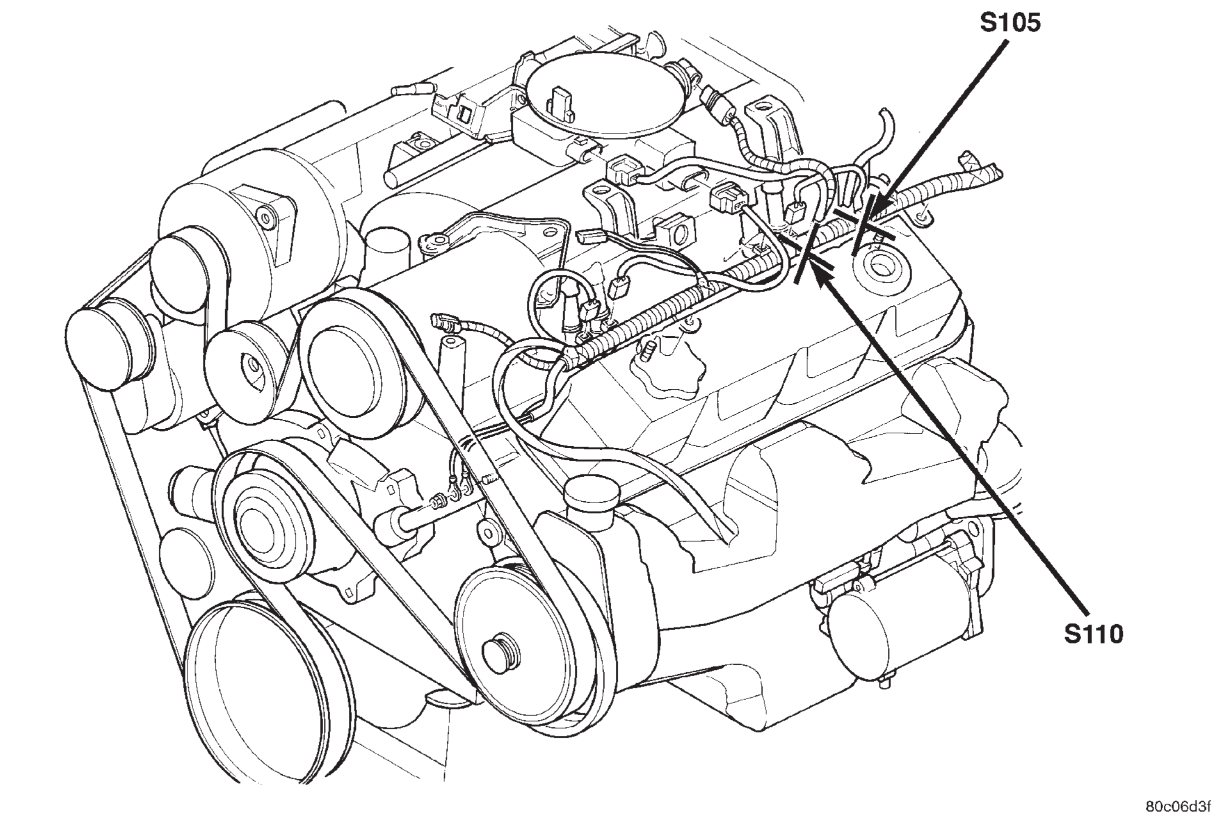


Fig. 7 Left Side Engine Harness Splices 3.9 Liter

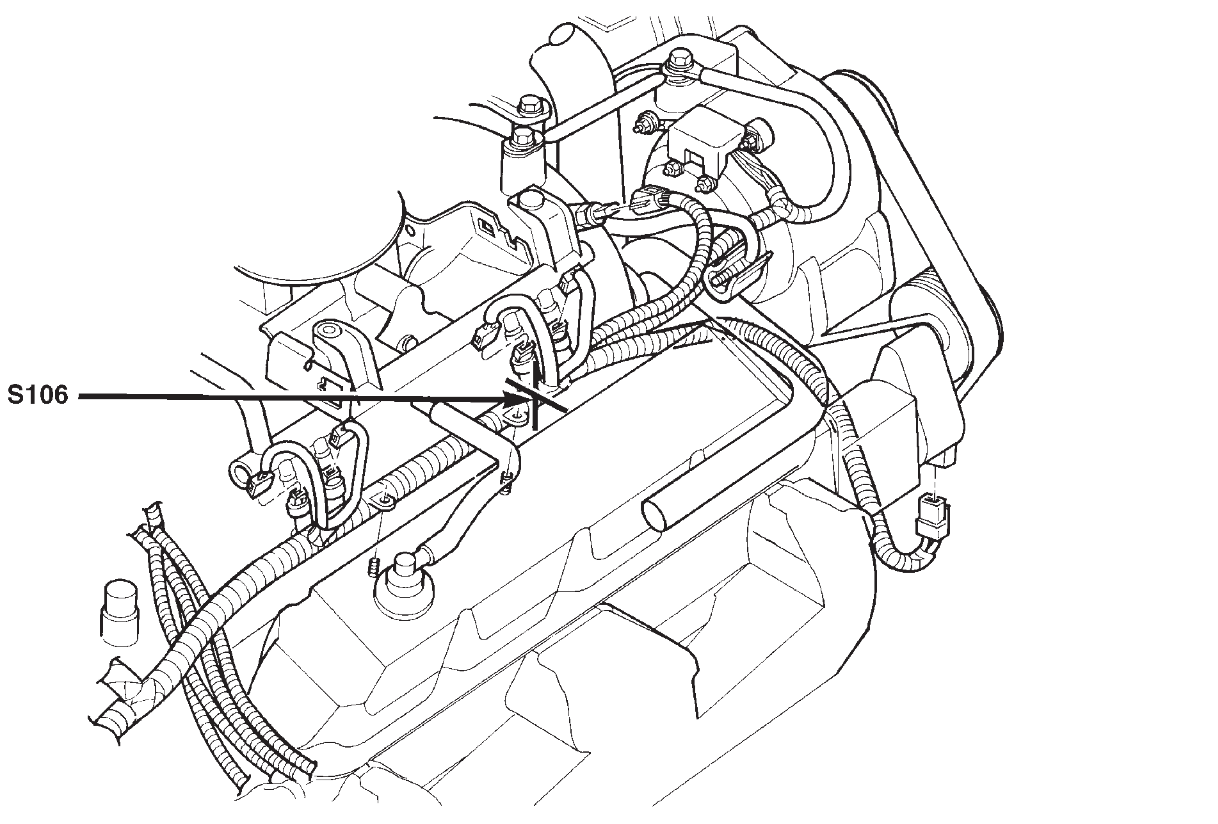


Fig. 8 Right Side Engine Harness Splices 3.9 Liter

DESCRIPTION AND OPERATION (Continued)

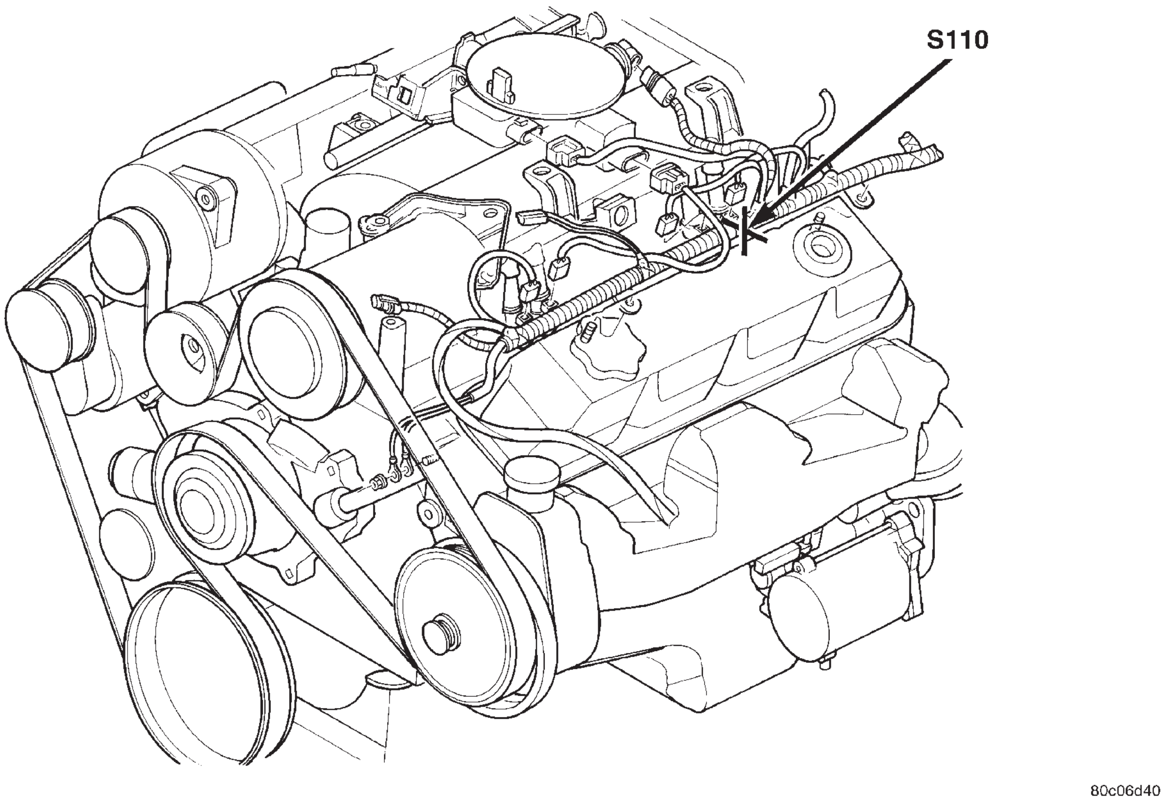


Fig. 9 Left Side Engine Harness Splices 5.9 Liter

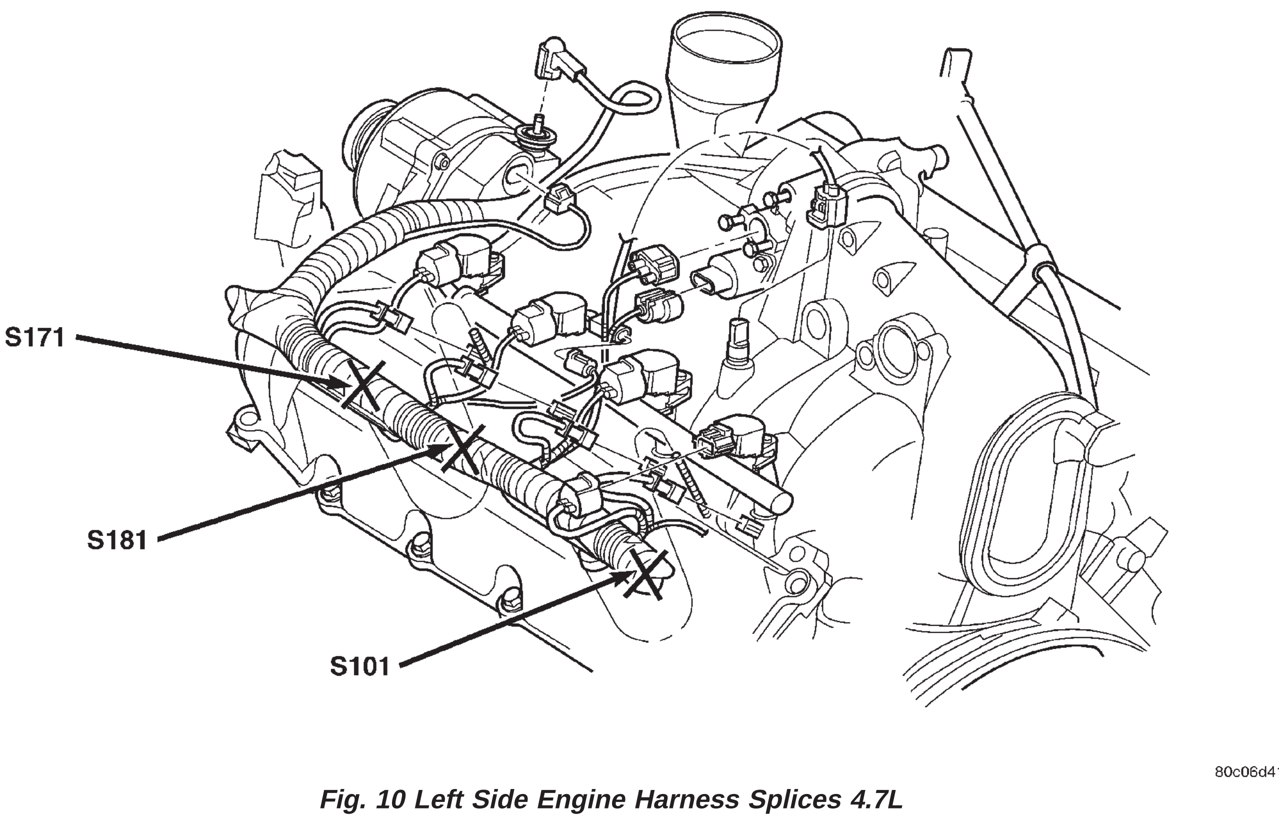


Fig. 10 Left Side Engine Harness Splices 4.7L

DESCRIPTION AND OPERATION (Continued)

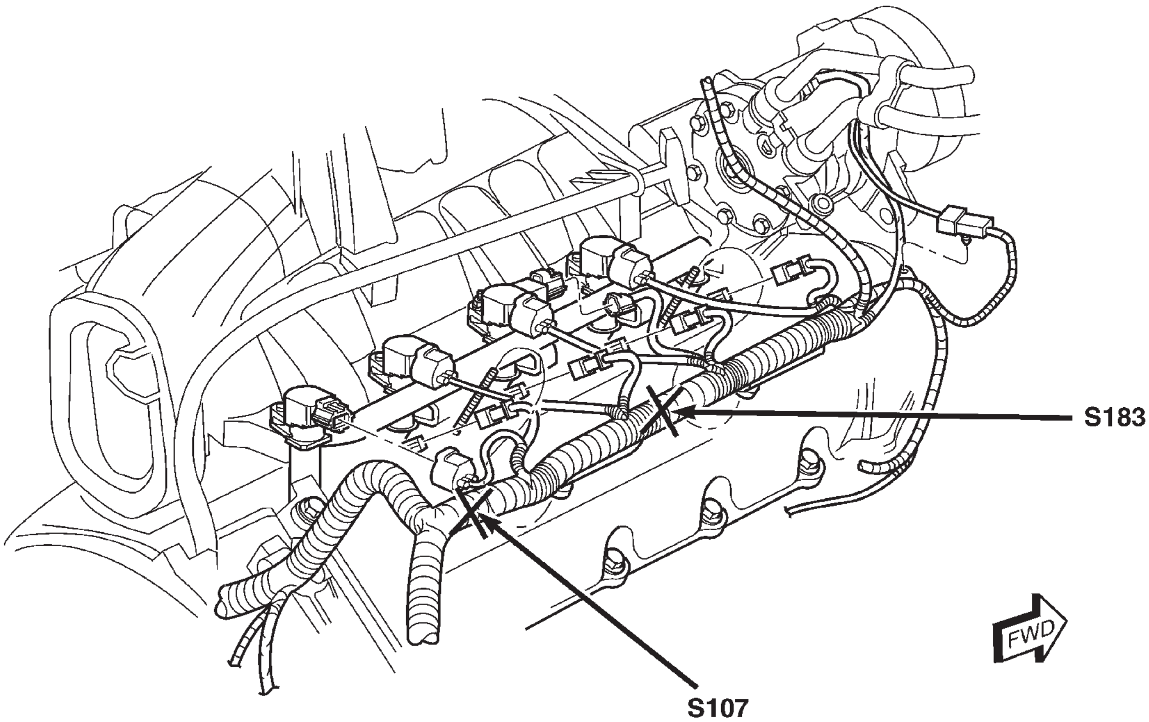


Fig. 11 Right Side Engine Harness Splices 4.7L

DESCRIPTION AND OPERATION (Continued)

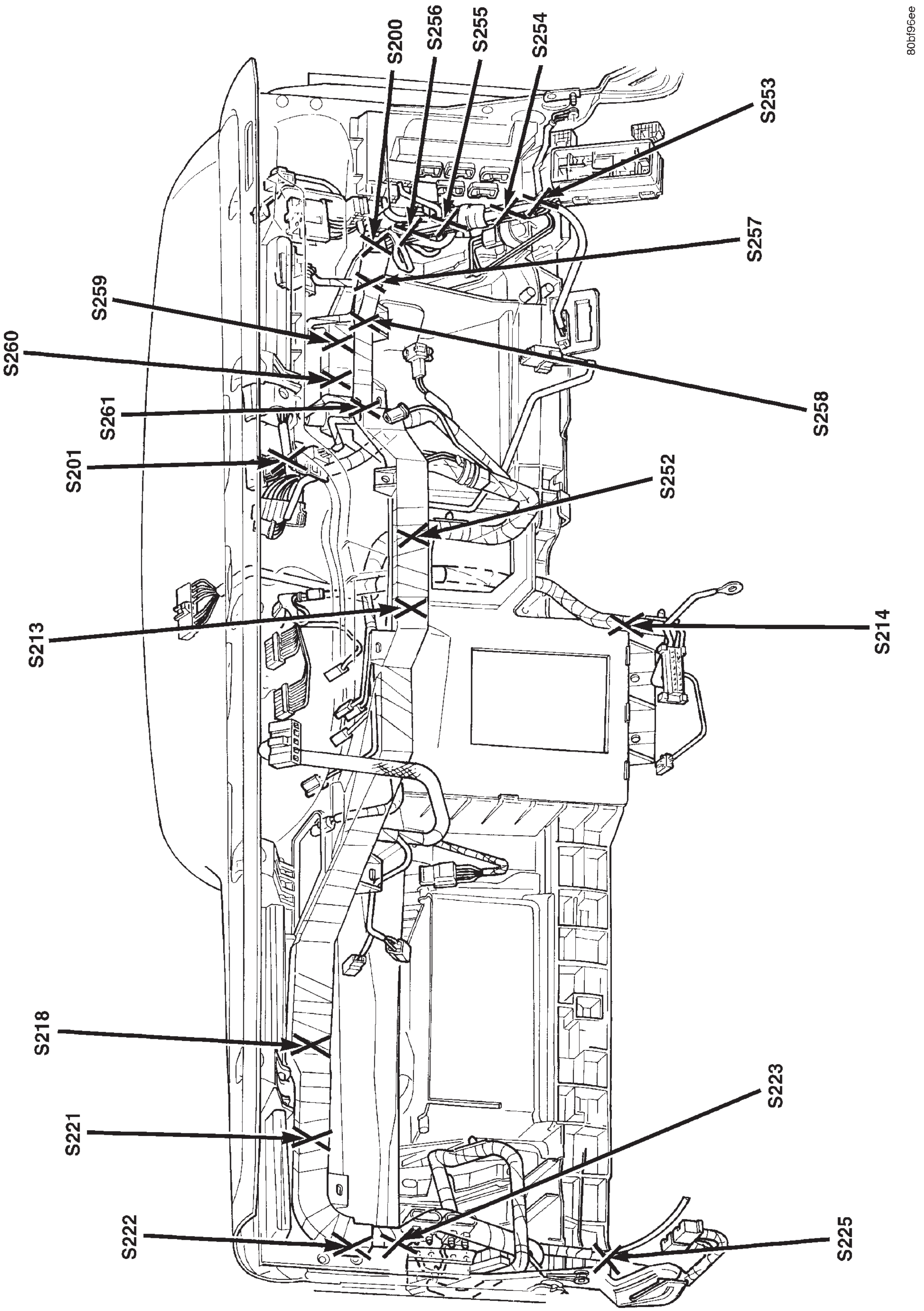


Fig. 12 Instrument Panel Splices

DESCRIPTION AND OPERATION (Continued)

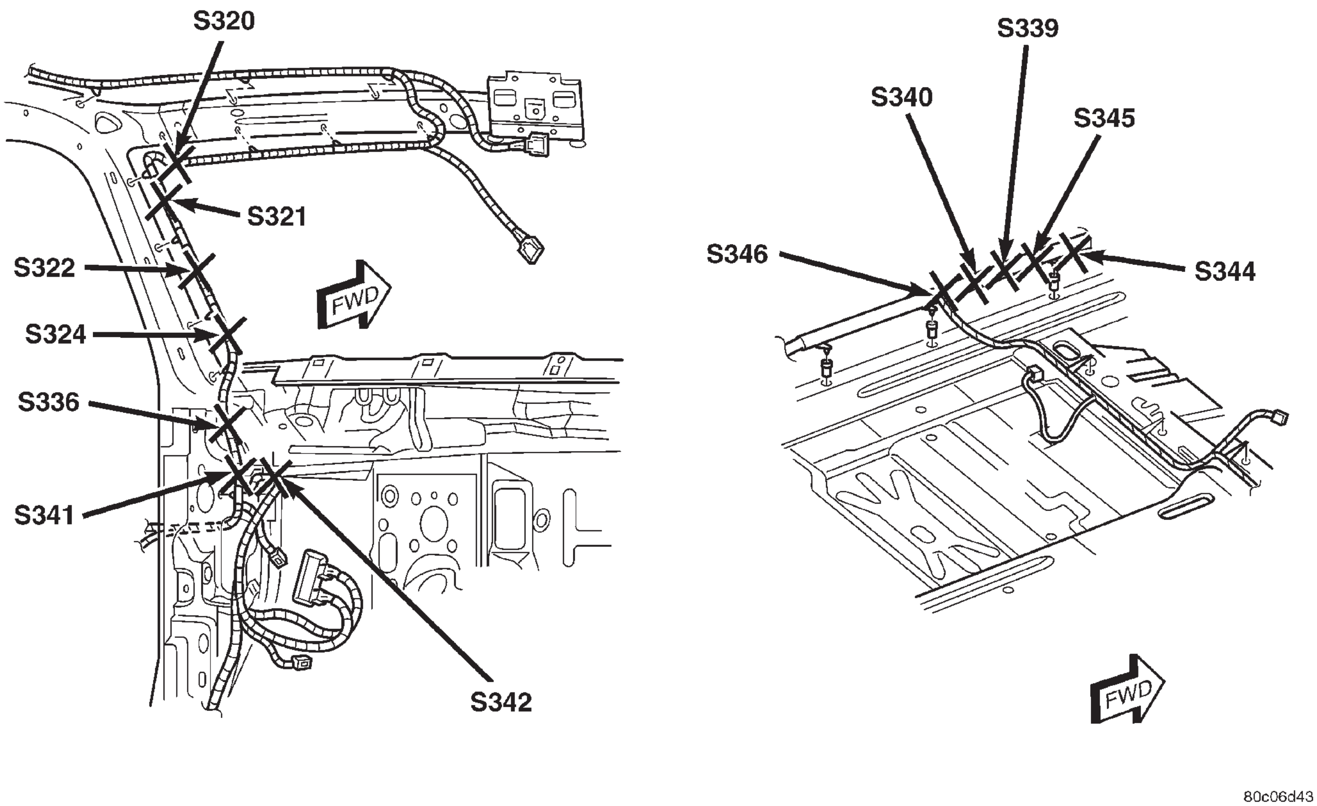


Fig. 13 Cab Splices

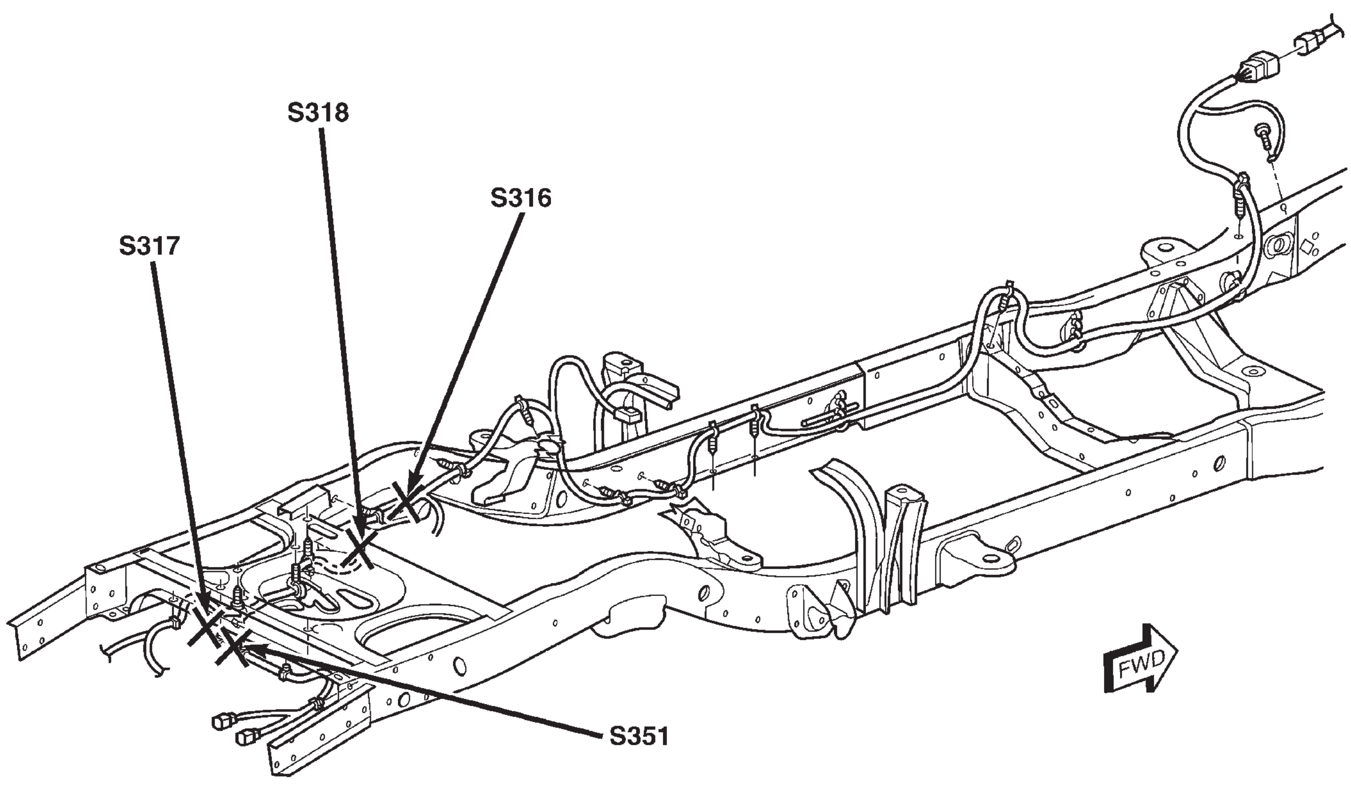


Fig. 14 Chassis Splices

DESCRIPTION AND OPERATION (Continued)

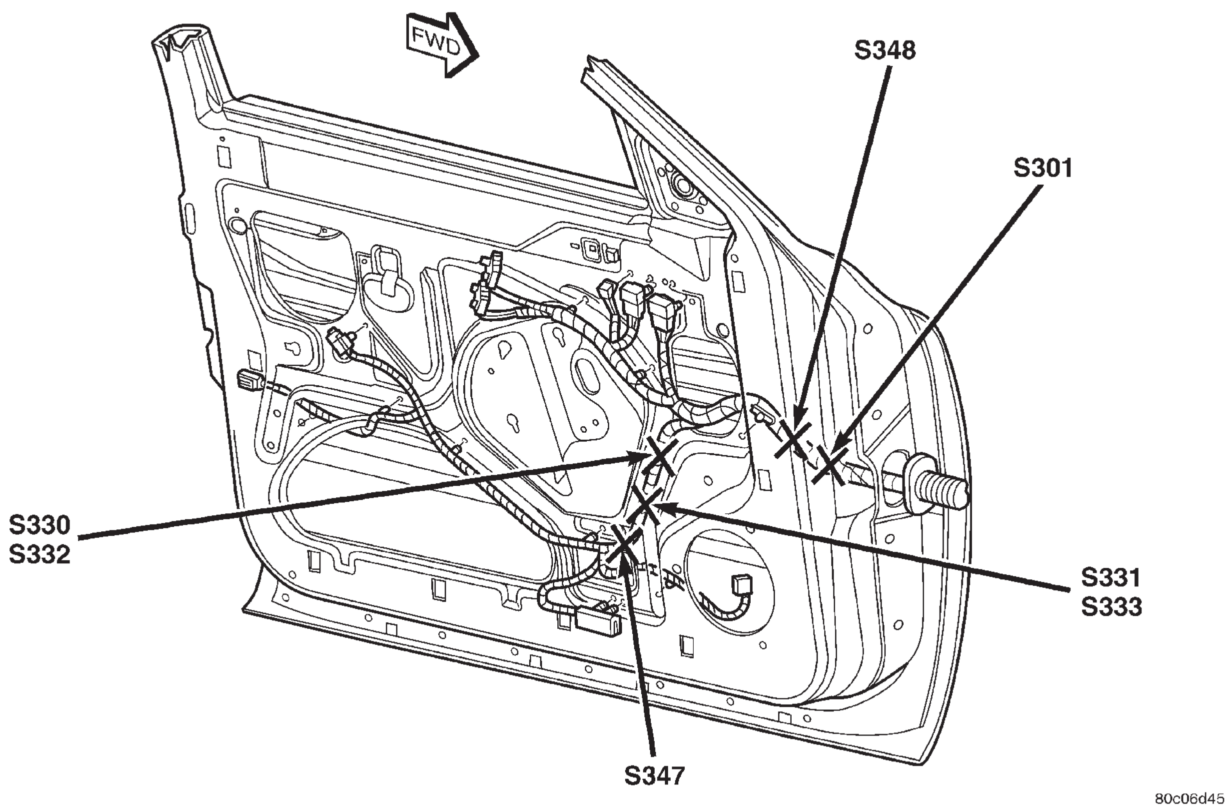


Fig. 15 Front Door Splices

ENGINE

TABLE OF CONTENTS

page

2.5L ENGINE . . . 1
3.9L ENGINE . . . 59
4.7L ENGINE . . . 118
5.9L ENGINE . . . 204

2.5L ENGINE

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
ENGINE . . . 2
LUBRICATION SYSTEM . . . 2
EXHAUST MANIFOLD . . . 3
INTAKE MANIFOLD . . . 3
CYLINDER HEAD . . . 3
CRANKSHAFT . . . 3
CRANKSHAFT MAIN BEARINGS . . . 5
CRANKSHAFT OIL SEALS . . . 5
DIAGNOSIS AND TESTING
ENGINE DIAGNOSIS—INTRODUCTION . . . 6
SERVICE DIAGNOSIS—PERFORMANCE . . . 6
SERVICE DIAGNOSIS—MECHANICAL . . . 8
SERVICE DIAGNOSIS—LUBRICATION . . . 9
INTAKE MANIFOLD LEAKAGE DIAGNOSIS . . . 9
CYLINDER COMPRESSION PRESSURE TEST . . . 9
CYLINDER HEAD GASKET FAILURE DIAGNOSIS . . . 10
CYLINDER COMBUSTION PRESSURE LEAKAGE TEST . . . 10
ENGINE OIL LEAK INSPECTION . . . 11
REAR SEAL AREA LEAKS—INSPECTION . . . 12
HYDRAULIC TAPPETS . . . 12
ENGINE OIL PRESSURE . . . 13
SERVICE PROCEDURES
FORM-IN-PLACE GASKETS . . . 14
ENGINE OIL . . . 14
REPAIR DAMAGED OR WORN THREADS . . . 16
CYLINDER BORE—HONING . . . 16
HYDROSTATIC LOCK . . . 17
VALVE TIMING . . . 17
VALVE, GUIDE AND SEAL . . . 17
PISTON—FITTING . . . 19
PISTON RING—FITTING . . . 20
CONNECTING ROD BEARINGS—FITTING . . . 22
CRANKSHAFT MAIN BEARINGS—FITTING . . . 25
REMOVAL AND INSTALLATION
ENGINE MOUNTS—FRONT . . . 28
ENGINE REAR SUPPORT . . . 29
ENGINE . . . 29
INTAKE MANIFOLD . . . 31
EXHAUST MANIFOLD . . . 33
CYLINDER HEAD COVER . . . 33
ROCKER ARMS AND PUSH RODS . . . 34
VALVE SPRING AND SEAL . . . 35
CYLINDER HEAD . . . 36
HYDRAULIC TAPPETS . . . 38
VIBRATION DAMPER . . . 39
TIMING CASE COVER OIL SEAL . . . 39
TIMING CASE COVER . . . 40
TIMING CHAIN AND SPROCKETS . . . 40
CAMSHAFT . . . 42
CAMSHAFT PIN REPLACEMENT . . . 43
CAMSHAFT BEARINGS . . . 45
CRANKSHAFT MAIN BEARINGS . . . 45
OIL PAN . . . 47
OIL PUMP . . . 48
PISTON AND CONNECTING ROD . . . 49
REAR MAIN OIL SEAL . . . 50
DISASSEMBLY AND ASSEMBLY
CYLINDER HEAD . . . 51
CLEANING AND INSPECTION
ROCKER ARMS AND PUSH RODS . . . 51
HYDRAULIC TAPPETS . . . 51
ENGINE CYLINDER HEAD . . . 52
CYLINDER BLOCK . . . 52
INTAKE MANIFOLD . . . 52
EXHAUST MANIFOLD . . . 53
SPECIFICATIONS
2.5L ENGINE SPECIFICATIONS . . . 53
SPECIFICATIONS—TORQUE . . . 56
SPECIAL TOOLS
2.5L ENGINE . . . 57

DESCRIPTION AND OPERATION

ENGINE

DESCRIPTION

The 2.5 liter (150 CID) four-cylinder engine is an In-line, lightweight, overhead valve engine.

This engine is designed for unleaded fuel. The engine cylinder head has dual quench-type combustion chambers that create turbulence and fast burning of the air/fuel mixture. This results in good fuel economy.

The cylinders are numbered 1 through 4 from front to rear. The firing order is 1-3-4-2 (Fig. 1).

The crankshaft rotation is clockwise, when viewed from the front of the engine. The crankshaft rotates within five main bearings and the camshaft rotates within four bearings.

The engine Build Date Code is located on a machined surface on the right side of the cylinder block between the No.3 and No.4 cylinders (Fig. 2).

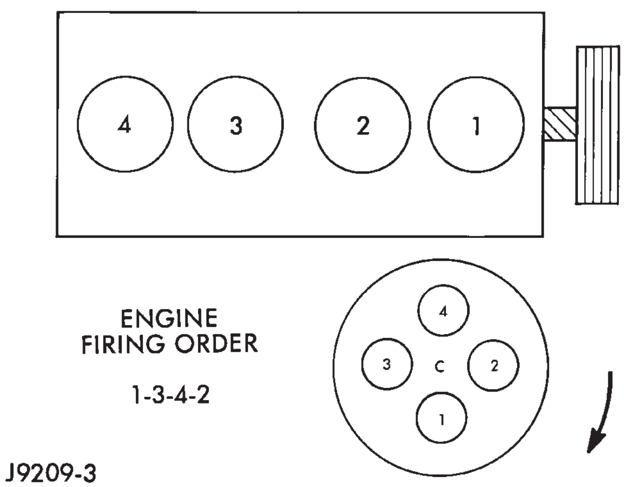


Fig. 1 Engine Firing Order

The digits of the code identify:

- 1st Digit—The year (8 = 1998).
- 2nd & 3rd Digits—The month (01 - 12).
- 4th & 5th Digits—The engine type/fuel system/ compression ratio (HX = A 2.5 liter (150 CID) 9.1:1 compression ratio engine with a multi-point fuel injection system).
- 6th & 7th Digits—The day of engine build (01 - 31).

FOR EXAMPLE: Code * 801HX23 * identifies a 2.5 liter (150 CID) engine with a multi-point fuel injection system, 9.1:1 compression ratio and built on January 23, 1998.

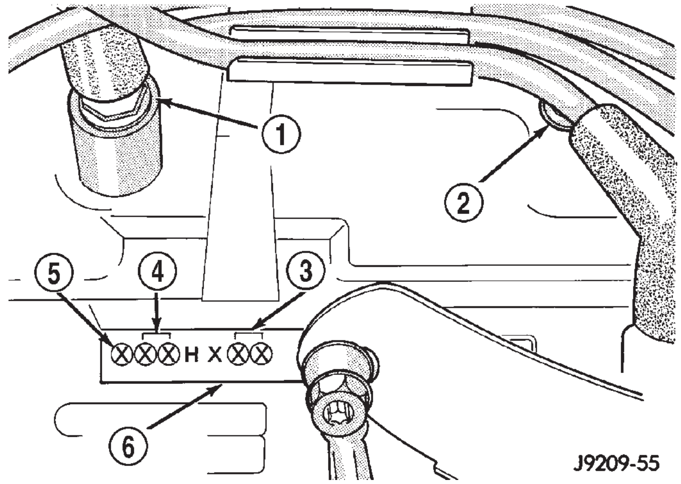


Fig. 2 Build Date Code Location

1 – NO. 4 CYLINDER
2 – NO. 3 CYLINDER
3 – DAY
4 – MONTH
5 – YEAR
6 – MACHINED SURFACE

LUBRICATION SYSTEM

DESCRIPTION

A gear—type positive displacement pump is mounted at the underside of the block opposite the No. 4 main bearing.

OPERATION

The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and pump body, then forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main gallery which extends the entire length of the block.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals (except number 4 main bearing journal) to the connecting rod journals. Each connecting rod bearing cap has a small squirt hole, oil passes through the squirt hole and is thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

DESCRIPTION AND OPERATION (Continued)

The hydraulic valve tappets receive oil directly from the main oil gallery. Oil is provided to the camshaft bearing through galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Oil drains back to the oil pan under the number one main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components, then passes down through the push rod guide holes in the cylinder head past the valve tappet area, and returns to the oil pan.

EXHAUST MANIFOLD

DESCRIPTION

The exhaust manifold is constructed of cast iron and has a ball flange designed exhaust pipe mounting flange.

The exhaust manifold and the intake manifold share a common one piece sealing gasket.

OPERATION

The exhaust manifold collects the engine exhaust exiting the combustion chambers, then channels the exhaust gases to the exhaust pipe attached to the manifold.

INTAKE MANIFOLD

DESCRIPTION

The aluminum intake manifold is a single plane design.

The intake manifold and the exhaust manifold share a common one piece sealing gasket.

CYLINDER HEAD

DESCRIPTION

The cast iron cylinder head is mounted to the cylinder block using ten bolts. The spark plugs are located in the peak of the wedge between the valves.

OPERATION

The cylinder head closes the combustion chamber allowing the pistons to compress the air fuel mixture to the correct ratio for ignition. The valves located in the cylinder head open and close to either allow clean air into the combustion chamber or to allow the exhaust gases out, depending on the stroke of the engine.

CRANKSHAFT

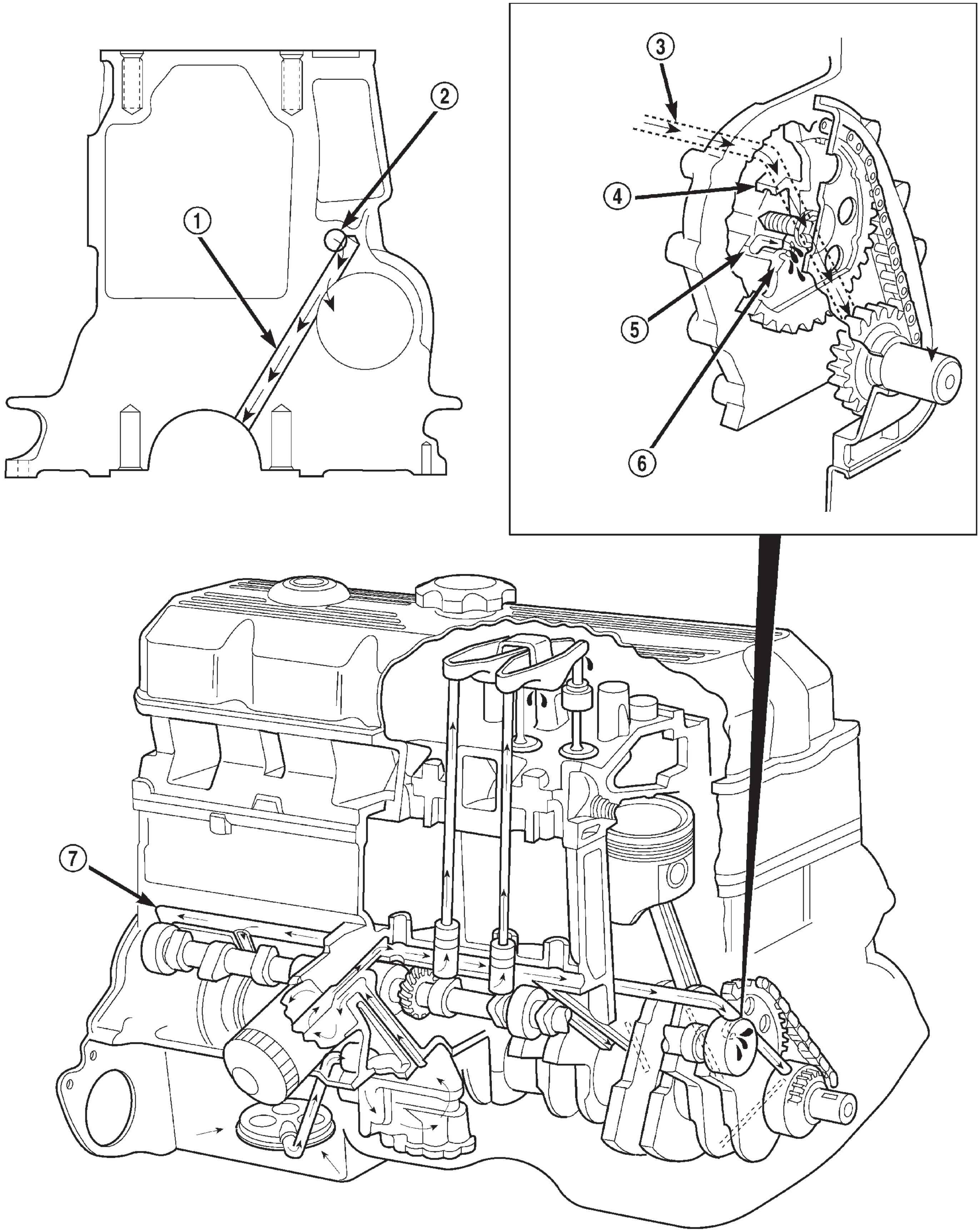
DESCRIPTION

The crankshaft is of a forged steel design, with five main bearing journals and eight counter balance weights.The crankshaft is located at the bottom of the engine block and is held in place with five main bearing caps.

OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flywheel or flexplate.

DESCRIPTION AND OPERATION (Continued)



Oil Lubrication System—2.5L Engine

DESCRIPTION AND OPERATION (Continued)

1 – CAM/CRANK MAIN GALLERY (5)
2 – TAPPET GALLERY
3 – TAPPET GALLERY
4 – CAMSHAFT BEARING
5 – NUMBER 1 CAMSHAFT BEARING JOURNAL
6 – CAMSHAFT SPROCKET
7 – TAPPET GALLERY

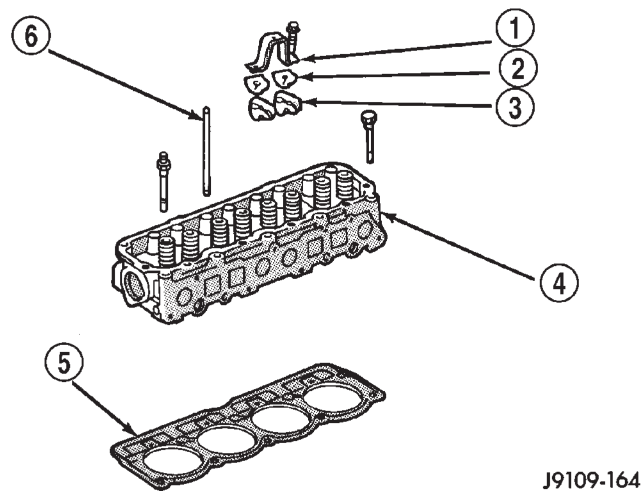


Fig. 3 Cylinder Head—2.5L Engine

1 – BRIDGE
2 – PIVOT ASM.
3 – ROCKER ARM
4 – CYLINDER HEAD
5 – HEAD GASKET
6 – PUSH ROD

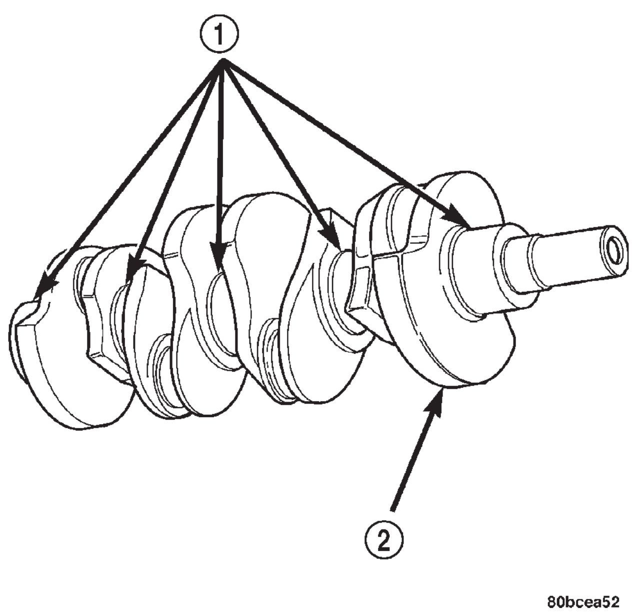


Fig. 4 Crankshaft 3.9L Engine

1 – MAIN BEARING JOURNALS
2 – COUNTER BALANCE WEIGHTS

CRANKSHAFT MAIN BEARINGS

DESCRIPTION

Main bearings are located in the cylinder block. One half of the main bearing is located in the crankshaft main bore the other half of the matching bearing is located in the main bearing cap. there are five main bearings. Number two main bearing is flanged, this flange controls crankshaft thrust.

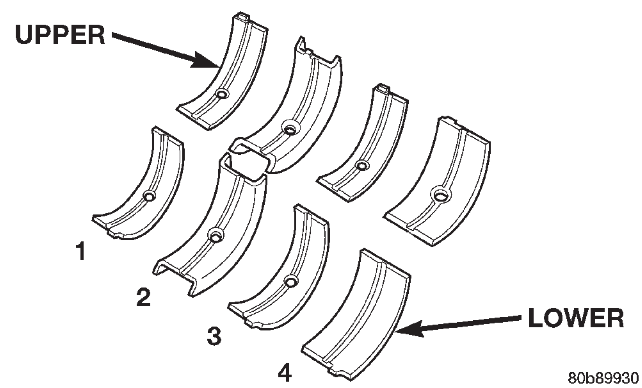


Fig. 5 Main Bearing Orientation

OPERATION

The main bearings encircle the crankshaft main bearing journals, this aligns the crankshaft to the centerline of the engine and allows the crankshaft to turn without wobbling or shaking therefore eliminating vibration. The main bearings are available in standard and undersizes.

CRANKSHAFT OIL SEALS

DESCRIPTION

Both the crankshaft front seal and rear main seal are a one piece viton seal with a steel housing. The front seal is located in the engine front cover. The rear seal is located in a bore at the rear of the engine block, the crankshaft protrudes through the rear main seal.

OPERATION

The crankshaft seals prevent oil from leaking from around the crankshaft, either from the rear of the engine or from the engine front cover.

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS—INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

Refer to the Service Diagnosis—Performance chart and the Service Diagnosis—Mechanical chart for possible causes and corrections of malfunctions. Refer to Group 14, Fuel System for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test.
- Cylinder Combustion Pressure Leakage Test.
- Engine Cylinder Head Gasket Failure Diagnosis.
- Intake Manifold Leakage Diagnosis.

SERVICE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. Refer to Group 8A, Battery/ Starter/ Charging System Diagnostics.
	4. Moisture on ignition wires and distributor cap.	4. Wipe wires and cap clean and dry.
	5. Faulty ignition cables.	5. Replace as necessary.
	6. Faulty coil or control unit.	6. Refer to Group 8D, Ignition System.
	7. Incorrect spark plug gap.	7. Refer to Group 8D, Ignition System.
	8. Incorrect ignition timing.	8. Refer to Group 8D, Ignition System.
	9. Dirt or water in fuel system.	9. Clean system and replace fuel filter.
	10. Faulty fuel pump, relay or wiring.	10. Refer to Group 14, Fuel System.
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set to low.	1. Refer to Group 14, Fuel System.
	2. Idle mixture to lean or to rich.	2. Refer to Group 14, Fuel System.
	3. Vacuum leak.	3. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	4. Worn or burned distributor rotor.	4. Replace distributor rotor.
	5. Incorrect ignition wiring.	5. Install correct wiring.
	6. Faulty coil.	6. Refer to Group 8D, Ignition System.
	7. EGR valve leaking.	7. Refer to Group 25, Emissions Control System.
	8. Incorrect cam timing.	8. Refer to Valve Timing in this section.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE LOSS OF POWER	1. Incorrect ignition timing.	1. Refer to Group 8D, Ignition System.
	2. Worn or burned distributor rotor.	2. Replace distributor rotor.
	3. Worn distributor shaft.	3. Refer to Group 8D, Ignition System.
	4. Dirty or incorrectly gapped spark plugs.	4. Refer to Group 8D, Ignition System.
	5. Dirt or water in fuel system.	5. Clean system and replace fuel filter.
	6. Faulty fuel pump.	6. Refer to Group 14, Fuel System.
	7. Blown cylinder head gasket.	7. Replace cylinder head gasket.
	8. Low compression.	8. Test compression, repair as necessary.
	9. Burned, warped or pitted valves.	9. Replace as necessary.
	10. Plugged or restricted exhaust system.	10. Inspect and replace as necessary.
	11. Faulty ignition cables.	11. Replace as necessary.
	12. Faulty coil.	12. Refer to Group 8D, Ignition System.
	13. Incorrect cam timing.	13. Refer to Valve Timing in this section.
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. Refer to Group 8D, Ignition System.
	2. Incorrect ignition timing.	2. Refer to Group 8D, Ignition System.
	3. Dirt in fuel system.	3. Clean fuel system.
	4. Burned, warped or pitted valves.	4. Replcae as necessary.
	5. Faulty coil.	5. Refer to Group 8D, Ignition System.
	6. Incorrect cam timing.	6. Refer to Valve Timing in this section.
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. Refer to Group 8D, Ignition System.
	2. Worn Distributor Shaft.	2. Refer to Group 8D, Ignition System.
	3. Worn or burned distributor rotor.	3. Replace distributor rotor.
	4. Faulty coil.	4. Refer to Group 8D, Ignition System.
	5. Incorrect ignition timing.	5. Refer to Group 8D, Ignition System.
	6. Dirt or water in fuel system.	6. Clean system and replace fuel filter.
	7. Incorrect cam timing.	7. Refer to Valve Timing in this section.

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. Refer to Group 0, Lubrication and Maintenance.
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Clean lash adjusters.
	5. Bent push rods.	5. Replace as necessary.
	6. Worn rocker arms.	6. Replace as necessary.
	7. Worn tappets	7. Replace as necessary.
	8. Worn valve guides.	8. Refer to Valve Service in this section.
	9. Excessive runout of valve seats on valve faces.	9. Service valves and valve seats. Refer to Valve Service in this section.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Refer to Group 0, Lubrication and maintenance.
	2. Low oil pressure.	2. Refer to Group 0, Lubrication and maintenance.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Refer to Group 0, Lubrication and maintenance.
	2. Low oil pressure.	2. Refer to Group 0, Lubrication and maintenance.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check No. 3 main bearing for wear on flanges.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings.	1.
	(a) Misaligned or damaged.	(a) Replace as necessary.
	(b) Loose fasteners, broken or porous metal parts.	(b) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear seal	2. Replace as necessary.
	3. Crankshaft seal flange. Scratched, nicked or grooved.	3. Polish or replace crankshaft.
	4. Oil pan flange cracked.	4. Replace oil pan.
	5. Timing chain cover seal, damaged or misaligned.	5. Replace seal.
	6. Scratched or damaged vibration damper hub.	6. Polish or replace damper.
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure sending unit.	2. Replace sending unit.
	3. Low oil pressure.	3. Check pump and bearing clearance.
	4. Clogged oil filter.	4. Replace oil filter.
	5. Worn oil pump.	5. Replace as necessary.
	6. Thin or diluted oil.	6. Change oil and filter.
	7. Excessive bearing clearance.	7. Replace as necessary.
	8. Oil pump relief valve stuck.	8. Clean or replace relief valve.
	9. Oil pump suction tube loose or damaged.	9. Replace as necessary.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings.
	2. Carbon in oil ring slots.	2. Replace rings.
	3. Incorrect ring size installed.	3. Replace rings.
	4. Worn valve guides.	4. Ream guides and replace valves.
	5. Leaking intake gasket.	5. Replace intake gaskets.
	6. Leaking valve guide seals.	6. Replace valve guide seals.

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.

(2) Spray a small stream of water at the suspected leak area.

(3) If a change in RPM is observed the area of the suspected leak has been found.

(4) Repair as required.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition.

DIAGNOSIS AND TESTING (Continued)

Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.

(2) Remove the spark plugs.

(3) Secure the throttle in the wide-open position.

(4) Disable the fuel system. (Refer to Group 14, Fuel System for the correct procedure)

(5) Disconnect the ignition coil.

(6) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.

(7) Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.

Refer to Engine Specifications for the correct engine compression pressures.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

• Possible indications of the cylinder head gasket leaking between adjacent cylinders are:
• Loss of engine power
• Engine misfiring
• Poor fuel economy
• Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:
• Engine overheating
• Loss of coolant
• Excessive steam (white smoke) emitting from exhaust
• Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test in this section. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

• Exhaust and intake valve leaks (improper seating).
• Leaks between adjacent cylinders or into water jacket.
• Any causes for combustion/compression pressure loss.

(1) Check the coolant level and fill as required. DO NOT install the radiator cap.

(2) Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

(3) Remove the spark plugs.

(4) Remove the oil filler cap.

(5) Remove the air cleaner.

(6) Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

(7) Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to the Cylinder Combustion Pressure Leakage Test Diagnosis chart.

DIAGNOSIS AND TESTING (Continued)

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat inspection.

(4) **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

Air Leak Detection Test Method

(1) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(2) Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.

(3) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(4) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

(5) If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(6) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.

DIAGNOSIS AND TESTING (Continued)

(4) If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

REAR SEAL AREA LEAKS—INSPECTION

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Group 9, Engines, for proper repair procedures of these items.

(4) If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general).

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. Refer to the service Diagnosis—Mechanical, under the Oil Leak row, for components inspections on possible causes and corrections.

(7) After the oil leak root cause and appropriate corrective action have been identified, Refer to Group 9, Engines—Crankshaft Rear Oil Seals, for proper replacement procedures.

HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, check the oil pressure. If vehicle has no oil pressure gauge, install a reliable gauge at the pressure sending-unit. The pressure should be between 207-552 kPa (30-80 psi) at 3,000 RPM.

Check the oil level after the engine reaches normal operating temperature. Allow 5 minutes to stabilize oil level, check dipstick. The oil level in the pan should never be above the FULL mark or below the ADD OIL mark on dipstick. Either of these two conditions could be responsible for noisy tappets.

OIL LEVEL

HIGH

If oil level is above the FULL mark, it is possible for the connecting rods to dip into the oil. With the engine running, this condition could create foam in the oil pan. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

LOW

Low oil level may allow oil pump to take in air. When air is fed to the tappets, they lose length, which allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected, operate the engine at fast idle. Run engine for a sufficient time to allow all of the air inside the tappets to be bled out.

DIAGNOSIS AND TESTING (Continued)

TAPPET NOISE DIAGNOSIS

(1) To determine source of tappet noise, operate engine at idle with cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger, or by the plunger partially sticking in the tappet body cylinder. The tappet should be replaced. A heavy click is caused by a tappet check valve not seating, or by foreign particles wedged between the plunger and the tappet body. This will cause the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

(4) The valve train generates a noise very much like a light tappet noise during normal operation. Care must be taken to ensure that tappets are making the noise. If more than one tappet seems to be noisy, it's probably not the tappets.

LEAK-DOWN TEST

After cleaning and inspection, test each tappet for specified leak-down rate tolerance to ensure zero-lash operation (Fig. 6).

Swing the weighted arm of the hydraulic valve tappet tester away from the ram of the Universal Leak-Down Tester.

(1) Place a 7.925-7.950 mm (0.312-0.313 inch) diameter ball bearing on the plunger cap of the tappet.

(2) Lift the ram and position the tappet (with the ball bearing) inside the tester cup.

(3) Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. DO NOT tighten the hex nut on the ram.

(4) Fill the tester cup with hydraulic valve tappet test oil until the tappet is completely submerged.

(5) Swing the weighted arm onto the push rod and pump the tappet plunger up and down to remove air. When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

(6) Adjust the nose of the ram to align the pointer with the SET mark on the scale of the tester and tighten the hex nut.

(7) Slowly swing the weighted arm onto the push rod.

(8) Rotate the cup by turning the handle at the base of the tester clockwise one revolution every 2 seconds.

(9) Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark. A normally functioning tappet will require 20-110 seconds to leak-down. Discard tappets with leak-down time interval not within this specification.

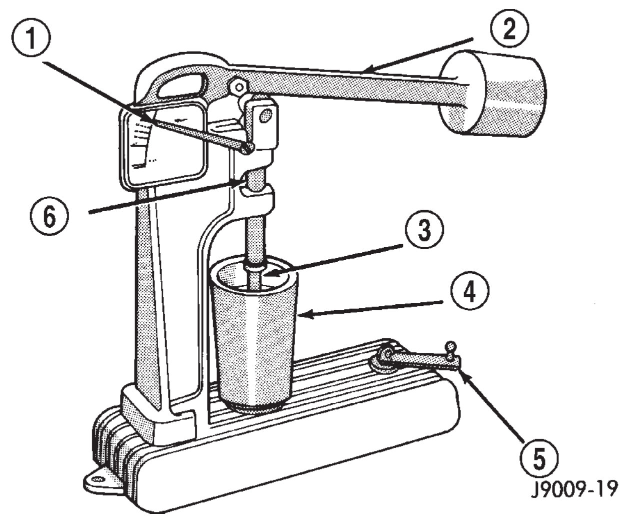


Fig. 6 Leak-Down Tester

1 – POINTER
2 – WEIGHTED ARM
3 – RAM
4 – CUP
5 – HANDLE
6 – PUSH ROD

ENGINE OIL PRESSURE

(1) Disconnect connector and remove oil pressure sending unit.

(2) Install Oil Pressure Line and Gauge Tool C-3292 or equivalent. Start engine and record pressure. Refer to Oil Pressure in Engine Specifications for the correct pressures.

SERVICE PROCEDURES

FORM-IN-PLACE GASKETS

There are several places where form-in-place gaskets are used on the engine. **DO NOT use form-in-place gasket material unless specified.** Care must be taken when applying form-in-place gaskets. Bead size, continuity and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over. A continuous bead of the proper width is essential to obtain a leak-free joint.

Two types of form-in-place gasket materials are used in the engine area (Mopar Silicone Rubber Adhesive Sealant and Mopar Gasket Maker). Each have different properties and cannot be used interchangeably.

MOPAR SILICONE RUBBER ADHESIVE SEALANT

Mopar Silicone Rubber Adhesive Sealant, normally black in color, is available in 3 ounce tubes. Moisture in the air causes the sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of a year and will not properly cure if over aged. Always inspect the package for the expiration date before use.

MOPAR GASKET MAKER

Mopar Gasket Maker, normally red in color, is available in 6 cc tubes. This anaerobic type gasket material cures in the absence of air when squeezed between smooth machined metallic surfaces. It will not cure if left in the uncovered tube. DO NOT use on flexible metal flanges.

SURFACE PREPARATION

Parts assembled with form-in-place gaskets may be disassembled without unusual effort. In some instances, it may be necessary to lightly tap the part with a mallet or other suitable tool to break the seal between the mating surfaces. A flat gasket scraper may also be lightly tapped into the joint but care must be taken not to damage the mating surfaces.

Scrape or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Flatten rails with a hammer on a flat plate, if required. Gasket surfaces must be free of oil and dirt. Make sure the old gasket material is removed from blind attaching holes.

GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care.

Mopar Silicone Rubber Adhesive Sealant should be applied in a continuous bead approximately 3 mm (0.12 inch) in diameter. All mounting holes must be circled. For corner sealing, a 3 or 6 mm (1/8 or 1/4 inch) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

Mopar Gasket Maker should be applied sparingly to one gasket surface. The sealant diameter should be 1.00 mm (0.04 inch) or less. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY.

ENGINE OIL SPECIFICATION

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine failure can result.

API SERVICE GRADE CERTIFIED

In gasoline engines, use an engine oil that is API Service Grade Certified (Fig. 7). Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans. MOPAR only provides engine oil that conforms to this certification.

9400-9

Fig. 7 Engine Oil Container Standard Notations

SERVICE PROCEDURES (Continued)

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 10W-30 specifies a multiple viscosity engine oil. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. When choosing an engine oil, consider the range of temperatures the vehicle will be operated in before the next oil change. Select an engine oil that is best suited to your area's particular ambient temperature range and variation (Fig. 8).

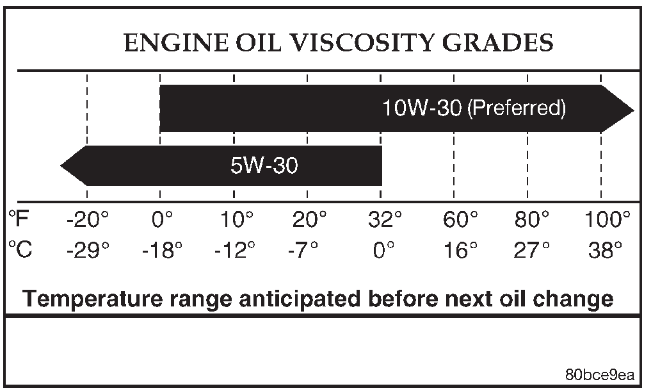


Fig. 8 Temperature/Engine Oil Viscosity Recommendation

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

OIL LEVEL INDICATOR (DIPSTICK)

The engine oil level indicator (Dipstick) is located at the right rear of the 2.5L engine (Fig. 9).

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, oil foaming and oil pressure loss can result.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

(5) Remove dipstick, with handle held above the tip, take oil level reading.

(6) Add oil only if level is below the ADD mark on dipstick.

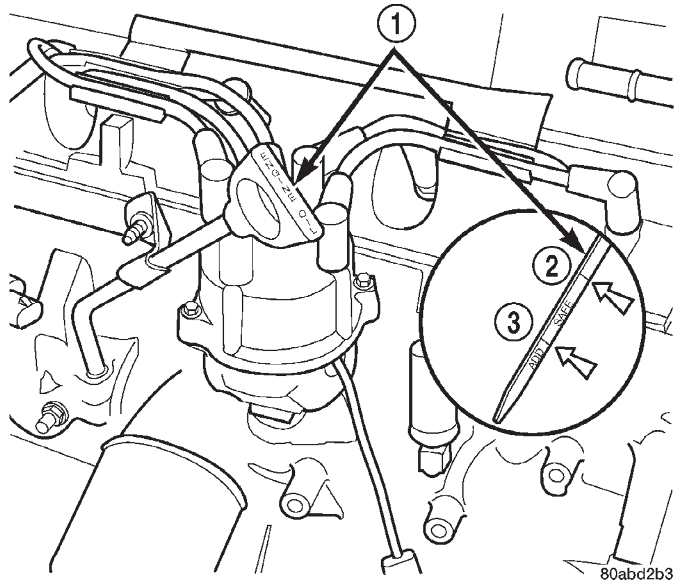


Fig. 9 Engine Oil Dipstick Location—2.5L Engine

1 – DIPSTICK
2 – SAFE
3 – ADD

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule. This information can be found in your owner's manual.

TO CHANGE ENGINE OIL

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

SERVICE PROCEDURES (Continued)

ENGINE OIL FILTER CHANGE

FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar or equivalent oil filter be used.

OIL FILTER REMOVAL

(1) Position a drain pan under the oil filter.
(2) Using a suitable oil filter wrench loosen filter.
(3) Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss (Fig. 10).

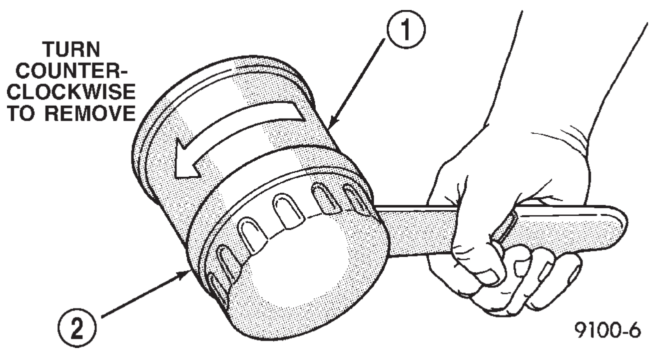


Fig. 10 Oil Filter Removal—Typical

1 – ENGINE OIL FILTER
2 – OIL FILTER WRENCH

(4) When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle.
(5) With a wiping cloth, clean the gasket sealing surface (Fig. 11) of oil and grime.

OIL FILTER INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil or chassis grease.
(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 11) hand tighten filter one full turn, do not over tighten.
(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

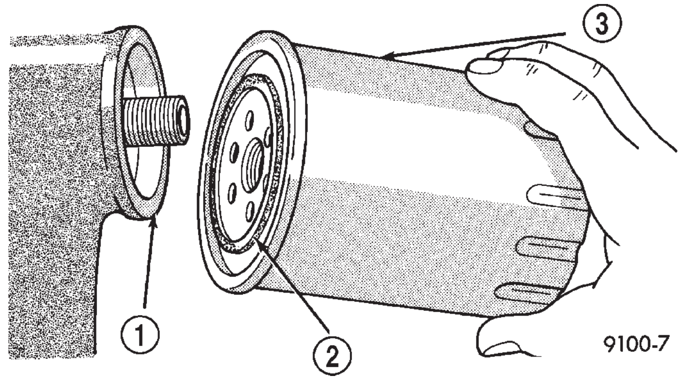


Fig. 11 Oil Filter Sealing Surface—Typical

1 – SEALING SURFACE
2 – RUBBER GASKET
3 – OIL FILTER

CYLINDER BORE—HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

(1) Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

(2) Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings (Fig. 12).
(4) A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.

SERVICE PROCEDURES (Continued)

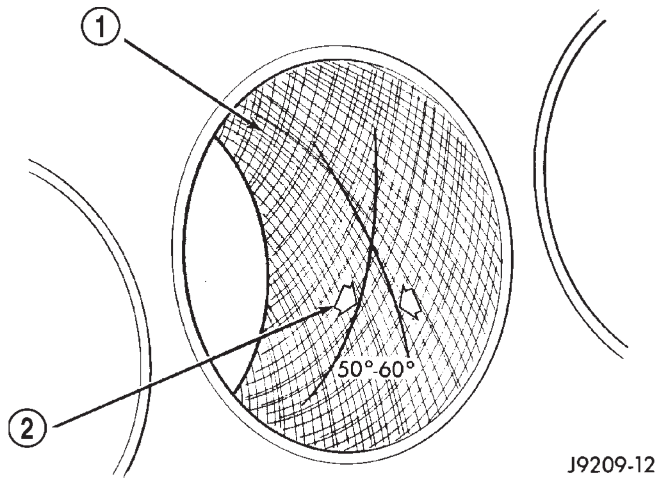


Fig. 12 Cylinder Bore Crosshatch Pattern

1 – CROSSHATCH PATTERN
2 – INTERSECT ANGLE

(5) After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

HYDROSTATIC LOCK

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Perform the Fuel Pressure Release Procedure (refer to Group 14, Fuel System).

(2) Disconnect the battery negative cable.

(3) Inspect air cleaner, induction system and intake manifold to ensure system is dry and clear of foreign material.

(4) Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the plugs from the engine.

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

(5) With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.

(6) Identify the fluid in the cylinders (i.e. coolant, fuel, oil, etc.).

(7) Make sure all fluid has been removed from the cylinders.

(8) Repair engine or components as necessary to prevent this problem from occurring again.

(9) Squirt engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.

(10) Install new spark plugs.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil.

(15) Connect the negative cable to the battery.

(16) Start the engine and check for any leaks.

VALVE TIMING

- Disconnect the spark plug wires and remove the spark plugs.
- Remove the engine cylinder head cover.
- Remove the capscrews, bridge and pivot assembly, and rocker arms from above the No.1 cylinder.
- Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridge.
- Rotate the crankshaft until the No.4 piston is at top dead center (TDC) on the compression stroke.
- Rotate the crankshaft counterclockwise (viewed from the front of the engine) 90°.
- Install a dial indicator on the end of the No.1 cylinder intake valve push rod. Use rubber tubing to secure the indicator stem on the push rod.
- Set the dial indicator pointer at zero.
- Set the dial indicator pointer at zero.
- Rotate the crankshaft clockwise (viewed from the front of the engine) until the dial indicator pointer indicates 0.305 mm (0.012 inch) travel distance (lift).
- The timing notch index on the vibration damper should be aligned with the TDC mark on the timing degree scale.
- If the timing notch is more than 13 mm (1/2 inch) away from the TDC mark in either direction, the valve timing is incorrect.
- If the valve timing is incorrect, the cause may be a broken camshaft pin. It is not necessary to replace the camshaft because of pin failure. A spring pin is available for service replacement.

VALVE, GUIDE AND SEAL

Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

Clean all grime and gasket material from the engine cylinder head machined gasket surface.

Inspect for cracks in the combustion chambers and valve ports.

Inspect for cracks on the exhaust seat.

Inspect for cracks in the gasket surface at each coolant passage.

Inspect valves for burned, cracked or warped heads.

Inspect for scuffed or bent valve stems.

Replace valves displaying any damage.

SERVICE PROCEDURES (Continued)

VALVE REFACING

(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

(2) After refacing, a margin of at least 0.787 mm (0.031 inch) must remain (Fig. 13). If the margin is less than 0.787 mm (0.031 inch), the valve must be replaced.

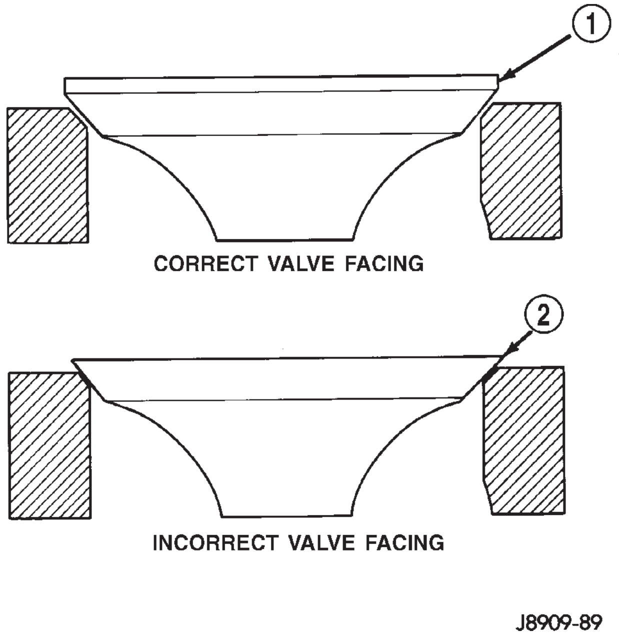


Fig. 13 Valve Facing Margin

1 – 0.787 MM (1/32 INCH) VALVE MARGIN
2 – NO MARGIN

VALVE SEAT REFACING

(1) Install a pilot of the correct size in the valve guide bore. Reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.

(2) Use tapered stones to obtain the specified seat width when required.

(3) Control valve seat runout to a maximum of 0.0635 mm (0.0025 in.)— (Fig. 14).

VALVE STEM OIL SEAL REPLACEMENT

Valve stem oil seals are installed on each valve stem to prevent rocker arm lubricating oil from entering the combustion chamber through the valve guide bores. One seal is marked INT (intake valve) and the other is marked EXH (exhaust valve).

Replace the oil seals whenever valve service is performed or if the seals have deteriorated.

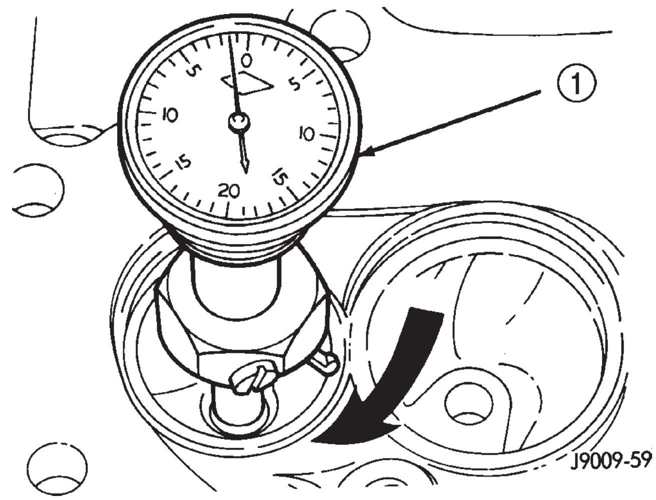


Fig. 14 Measurement of Valve Seat Runout

1 – DIAL INDICATOR

VALVE GUIDES

The valve guides are an integral part of the engine cylinder head and are not replaceable.

When the valve stem guide clearance is excessive, the valve guide bores must be reamed oversize. Service valves with oversize stems are available in 0.076 mm (0.003 inch) and 0.381 mm (0.015 inch) increments.

Corresponding oversize valve stem seals are also available and must be used with valves having 0.381 mm (0.015 inch) oversize stems, 0.076mm (.003in.) oversize stems do not require oversize seals.

NOTE: If the valve guides are reamed oversize, the valve seats must be ground to ensure that the valve seat is concentric to the valve guide.

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

Valve stem-to-guide clearance may be measured by either of the following two methods.

PREFERRED METHOD:

(1) Remove the valve from the head.

(2) Clean the valve stem guide bore with solvent and a bristle brush.

(3) Insert a telescoping gauge into the valve stem guide bore approximately 9.525 mm (.375 inch) from the valve spring side of the head (Fig. 15).

(4) Remove and measure telescoping gauge with a micrometer.

(5) Repeat the measurement with contacts lengthwise to engine cylinder head.

SERVICE PROCEDURES (Continued)

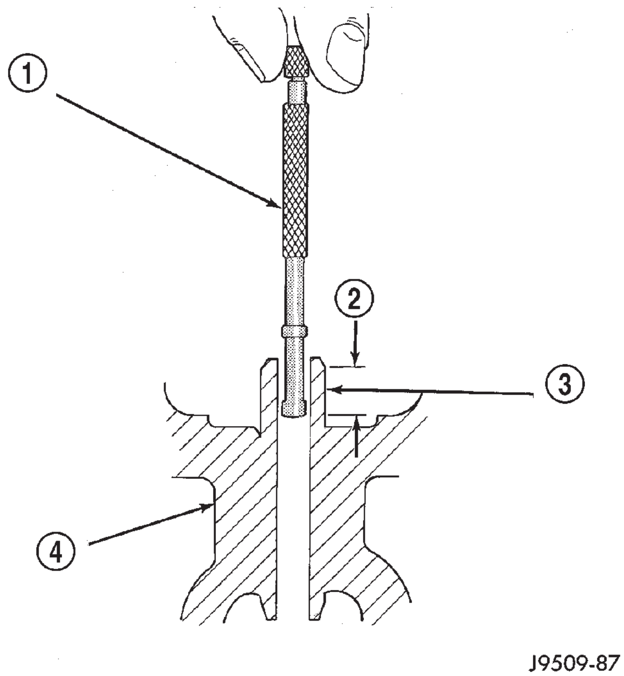


Fig. 15 Measurement of Valve Guide Bore Diameter

1 – GAUGE
2 – 9.525 MM (3/8 INCH)
3 – VALVE STEM GUIDE
4 – CYLINDER HEAD

(6) Compare the crosswise to lengthwise measurements to determine out-of-roundness. If the measurements differ by more than 0.0635 mm (0.0025 in.), ream the guide bore to accommodate an oversize valve stem.

(7) Compare the measured valve guide bore diameter with specifications (7.95-7.97 mm or 0.313-0.314 inch). If the measurement differs from specification by more than 0.076 mm (0.003 inch), ream the guide bore to accommodate an oversize valve stem.

ALTERNATIVE METHOD:

(1) Use a dial indicator to measure the lateral movement of the valve stem (stem-to-guide clearance). This must be done with the valve installed in its guide and just off the valve seat (Fig. 16).

(2) Correct clearance is 0.025-0.0762 mm (0.001-0.003 inch). If indicated movement exceeds the specification ream the valve guide to accommodate an oversize valve stem.

NOTE: Valve seats must be ground after reaming the valve guides to ensure that the valve seat is concentric to the valve guide.

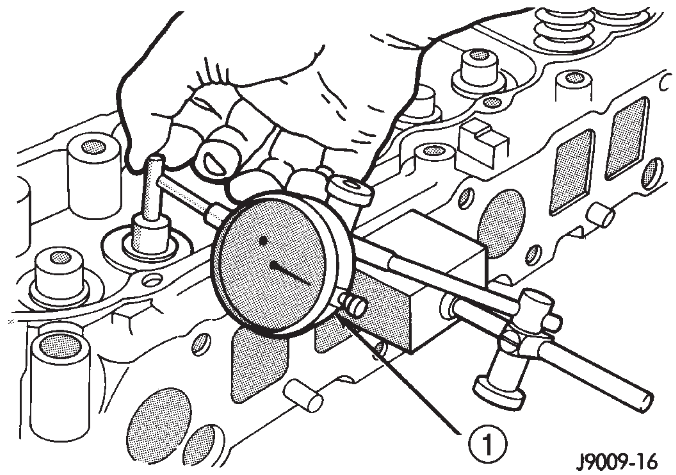


Fig. 16 Measurement of Lateral Movement Of Valve Stem

1 – DIAL INDICATOR

VALVE SPRING TENSION TEST

Use a Universal Valve Spring Tester and a torque wrench to test each valve spring for the specified tension value (Fig. 17).

Replace valve springs that are not within specifications.

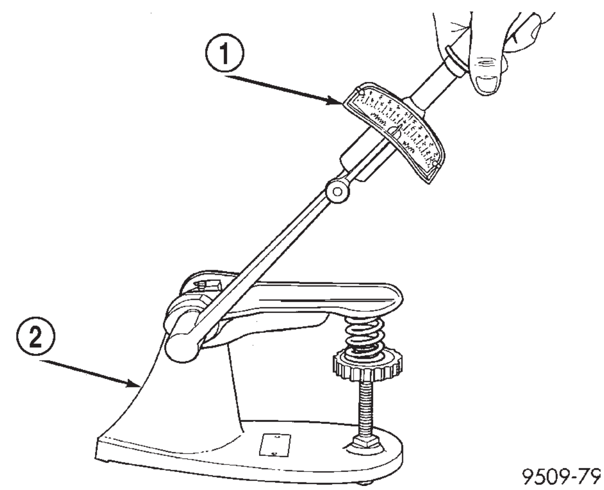


Fig. 17 Valve Spring Tester

1 – TORQUE WRENCH
2 – VALVE SPRING TESTER

PISTON—FITTING

BORE GAUGE METHOD

(1) To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

SERVICE PROCEDURES (Continued)

(2) Measure the inside diameter of the cylinder bore at a point 49.5 mm (1-15/16 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B (Fig. 19).

(3) The coated pistons will be serviced with the piston pin and connecting rod pre-assembled. **The coated piston connecting rod assembly can be used to service previous built engines and MUST be replaced as complete sets.** Tin coated pistons should not be used as replacements for coated pistons.

(4) The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results (Fig. 18). Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.

(5) Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

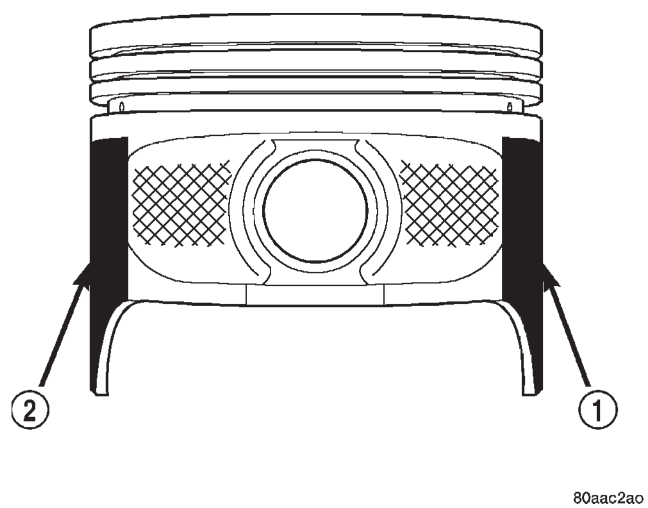


Fig. 18 Moly Coated Piston

1 – MOLY COATED
2 – MOLY COATED

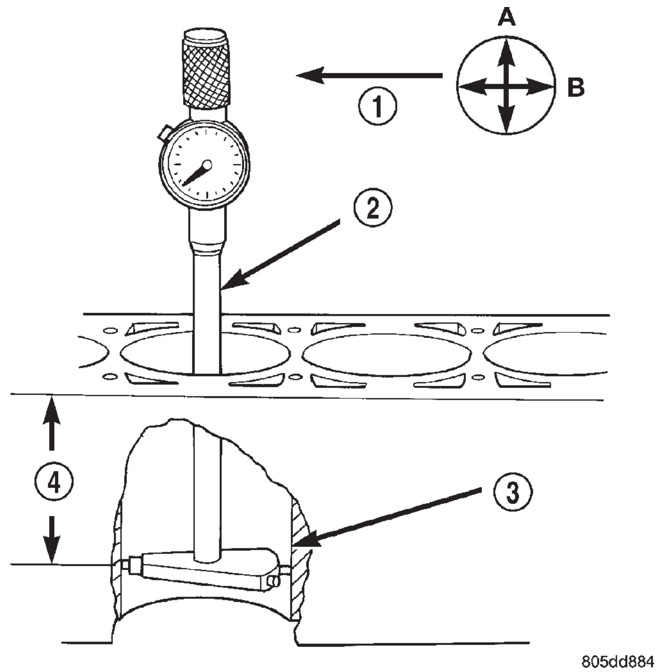


Fig. 19 Bore Gauge

1 – FRONT
2 – BORE GAUGE
3 – CYLINDER BORE
4 – 49.5 MM (1–15/16 in)

PISTON SIZE CHART

CYLINDER BORE SIZE	PISTON LETTER SIZE
98.438 - 98.448 mm (3.8755 - 3.8759 in.)	A
98.448 - 98.458 mm (3.8759 - 3.8763 in.)	B
98.458 - 98.468 mm (3.8763 - 3.8767 in.)	C
98.468 - 98.478 mm (3.8767 - 3.8771 in.)	D
98.478 - 98.488 mm (3.8771 - 3.8775 in.)	E
98.488 - 98.498 mm (3.8775 - 3.8779 in.)	F

PISTON RING—FITTING

(1) Carefully clean the carbon from all ring grooves. Oil drain openings in the oil ring groove and pin boss must be clear. DO NOT remove metal from the grooves or lands. This will change ring-to-groove clearances and will damage the ring-to-land seating.

(2) Be sure the piston ring grooves are free of nicks and burrs.

SERVICE PROCEDURES (Continued)

(3) Measure the ring side clearance with a feeler gauge fitted snugly between the ring land and ring (Fig. 20) (Fig. 21). Rotate the ring in the groove. It must move freely around circumference of the groove.

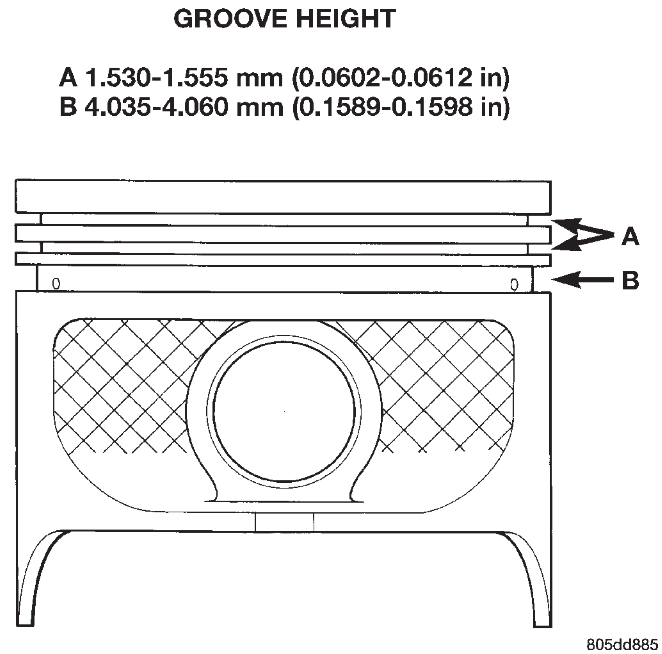


Fig. 20 Piston Dimensions

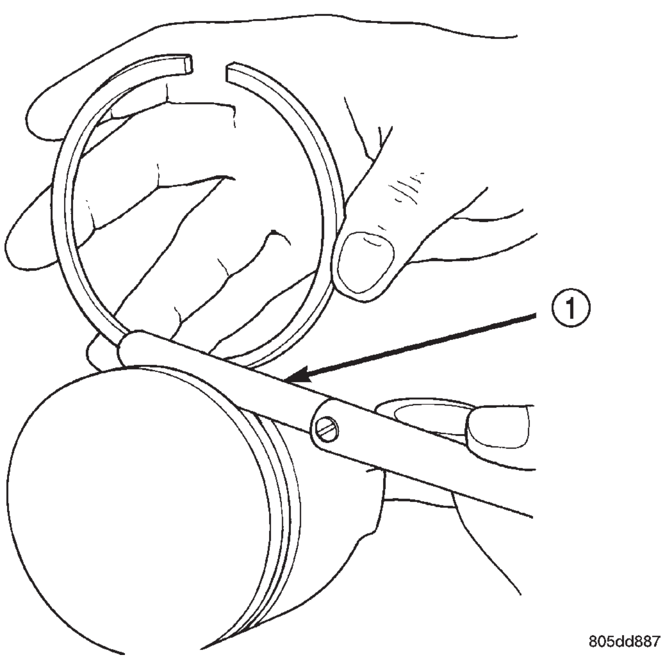


Fig. 21 Ring Side Clearance Measurement

1 – FEELER GAUGE

RING SIDE CLEARANCE CHART

ITEM	SPECIFICATION
Top Compression Ring	0.042 - 0.084 mm (0.0017 - 0.0033 in.)
Second Compression Ring	0.042 - 0.084 mm (0.0017 - 0.0033 in.)
Oil Control Ring	0.06 - 0.21 mm (0.0024 - 0.0083 in.)

(4) Place ring in the cylinder bore and push down with inverted piston to position near lower end of the ring travel. Measure ring gap with a feeler gauge fitting snugly between ring ends (Fig. 22).

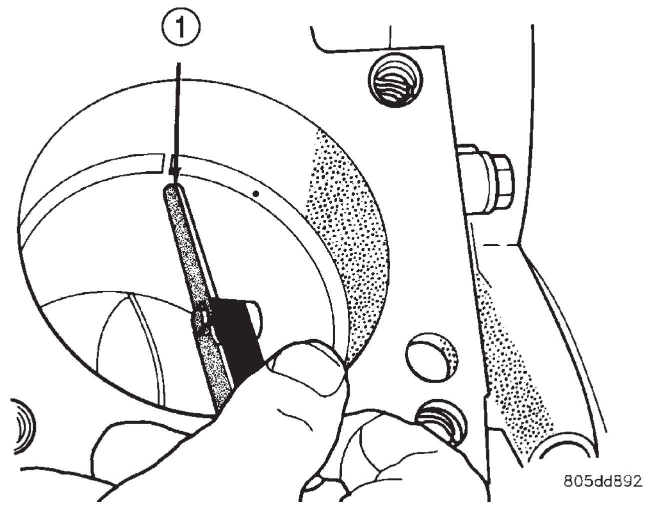


Fig. 22 Gap Measurement

1 – FEELER GAUGE

RING GAP MEASUREMENT CHART

ITEM	SPECIFICATION
Top Compression Ring	0.229 - 0.610 mm (0.0090 - 0.0240 in.)
Second Compression Ring	0.483 - 0.965 mm (0.0190 - 0.080 in.)
Oil Control Ring	0.254 - 1.500 mm (0.010 - 0.060 in.)

(5) The oil control rings are symmetrical, and can be installed with either side up. It is not necessary to use a tool to install the upper and lower rails. Insert oil rail spacer first, then side rails.

SERVICE PROCEDURES (Continued)

(6) The two compression rings are different and cannot be interchanged. The top compression ring can be identified by the shiny coating on the outer sealing surface and can be installed with either side up (Fig. 23).

(7) The second compression ring has a slight chamfer on the bottom of the inside edge and a dot on the top for correct installation (Fig. 24).

(8) Using a ring installer, install the second compression ring with the dot facing up (Fig. 24) (Fig. 26).

(9) Using a ring installer, install the top compression ring (either side up).

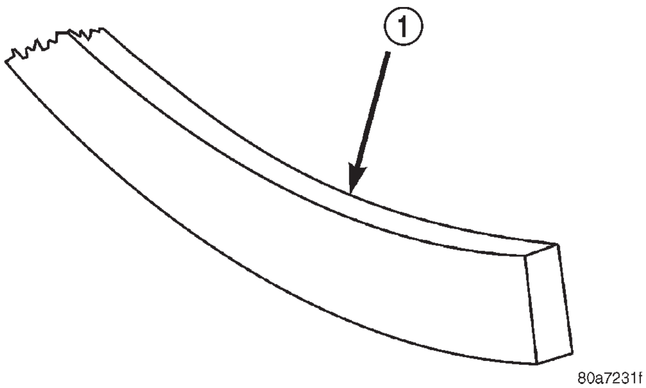


Fig. 23 Top Compression ring identification

1 – TOP COMPRESSION RING

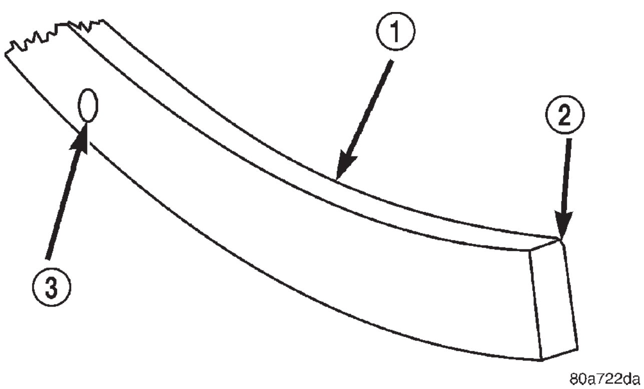


Fig. 24 Second Compression Ring Identification

1 – SECOND COMPRESSION RING
2 – CHAMFER
3 – ONE DOT

Ring Gap Orientation

• Position the gaps on the piston as shown (Fig. 27).

• Oil spacer - Gap on center line of piston skirt.

• Oil rails - gap 180° apart on centerline of piston pin bore.

• No. 2 Compression ring - Gap 180° from top oil rail gap.

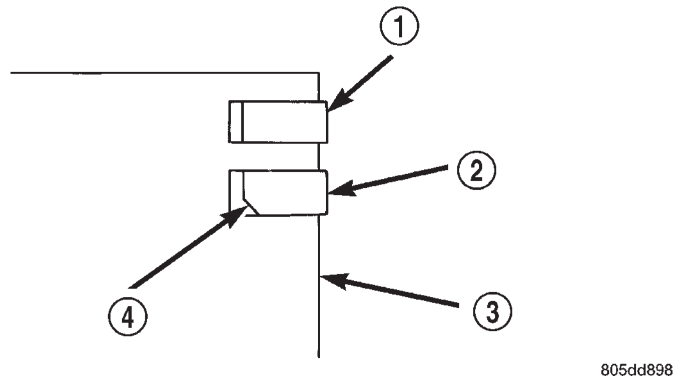


Fig. 25 Compression Ring Chamfer Location

1 – TOP COMPRESSION RING
2 – SECOND COMPRESSION RING
3 – PISTON
4 – CHAMFER

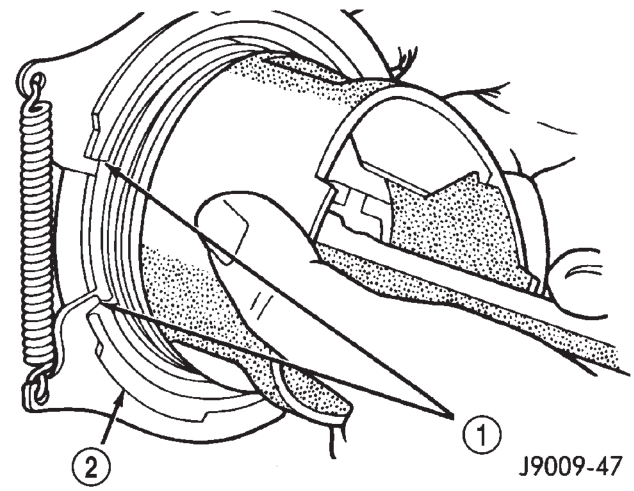


Fig. 26 Compression Ring Installation

1 – COMPRESSION RING
2 – RING EXPANDER RECOMMENDED

• No. 1 Compression ring - Gap 180° from No. 2 compression ring gap.

CONNECTING ROD BEARINGS—FITTING

Inspect the connecting rod bearings for scoring and bent alignment tabs (Fig. 28) (Fig. 29). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 30). Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod

SERVICE PROCEDURES (Continued)

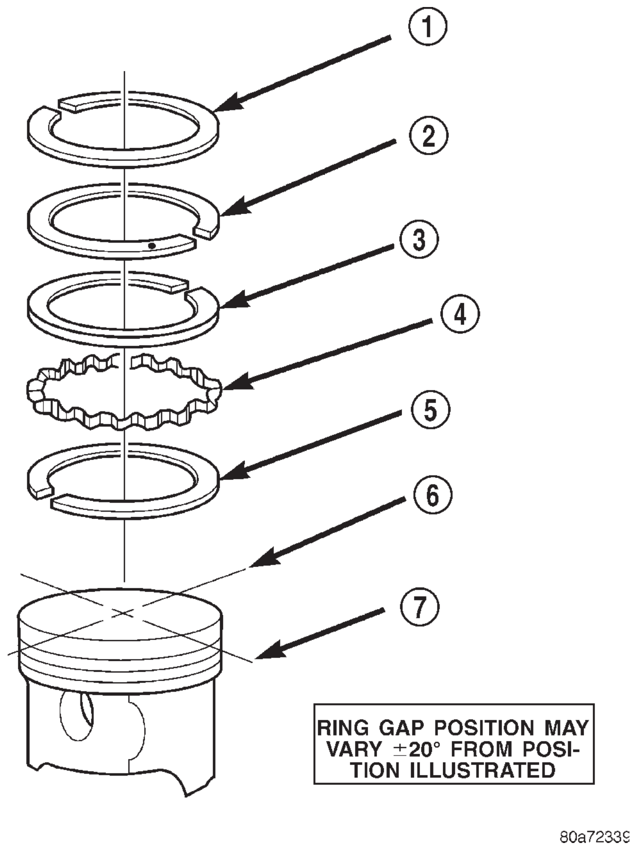


Fig. 27 Ring Gap Orientation

1 – TOP COMPRESSION RING
2 – BOTTOM COMPRESSION RING
3 – TOP OIL CONTROL RAIL
4 – OIL RAIL SPACER
5 – BOTTOM OIL CONTROL RAIL
6 – IMAGINARY LINE PARALLEL TO PISTON PIN
7 – IMAGINARY LINE THROUGH CENTER OF PISTON SKIRT

alignment. Replace misaligned, bent or twisted connecting rods.

(1) Wipe the oil from the connecting rod journal.

(2) Use short rubber hose sections over rod bolts during installation.

(3) Lubricate the upper bearing insert and install in connecting rod.

(4) Use piston ring compressor to install the rod and piston assemblies. The oil squirt holes in the rods must face the camshaft. The arrow on the piston crown should point to the front of the engine (Fig. 31). Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

(5) Install the lower bearing insert in the bearing cap. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.

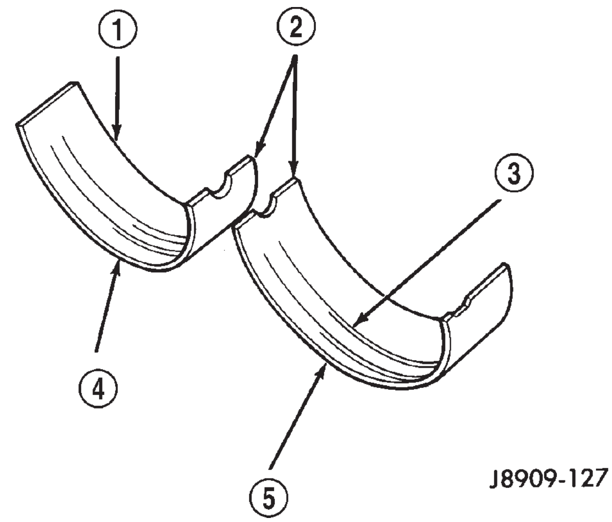


Fig. 28 Connecting Rod Bearing Inspection

1 – UPPER BEARING HALF
2 – MATING EDGES
3 – GROOVES CAUSED BY ROD BOLTS SCRATCHING JOURNAL DURING INSTALLATION
4 – WEAR PATTERN — ALWAYS GREATER ON UPPER BEARING
5 – LOWER BEARING HALF

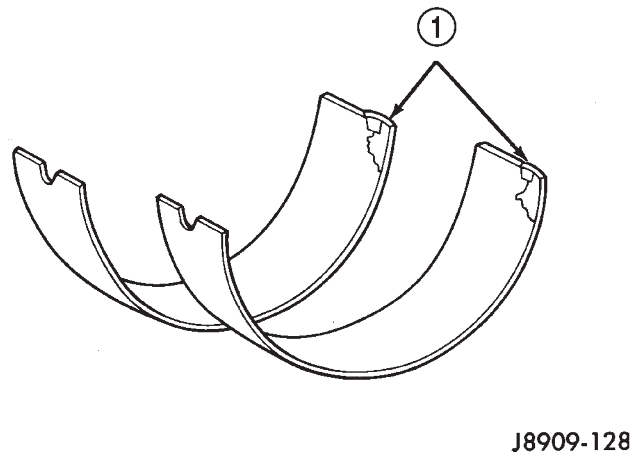


Fig. 29 Locking Tab Inspection

1 – ABNORMAL CONTACT AREA CAUSED BY LOCKING TABS NOT FULLY SEATED OR BEING BENT

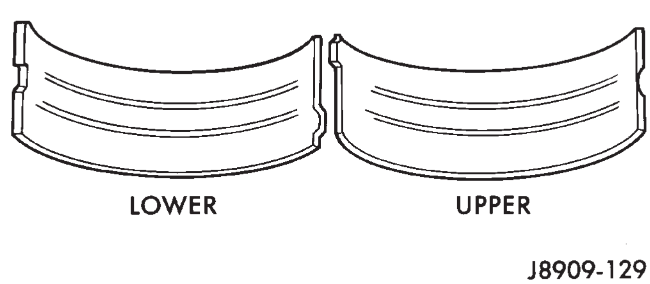


Fig. 30 Scoring Caused by Insufficient Lubrication or by Damaged Crankshaft Pin Journal

SERVICE PROCEDURES (Continued)

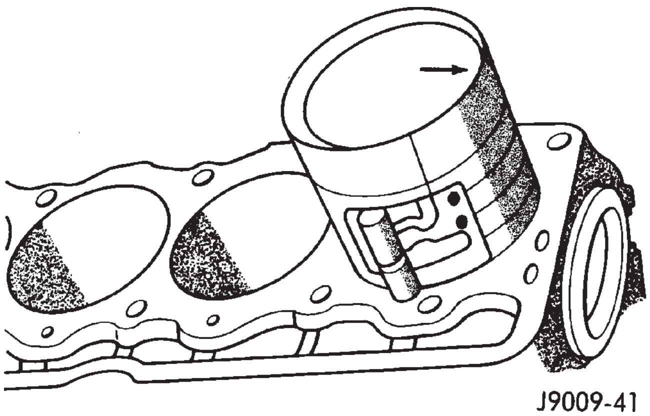


Fig. 31 Rod and Piston Assembly Installation

(6) Install bearing cap and connecting rod on the journal and tighten nuts to 45 N·m (33 ft. lbs.) torque. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

(7) Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (Fig. 32). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**

(8) If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

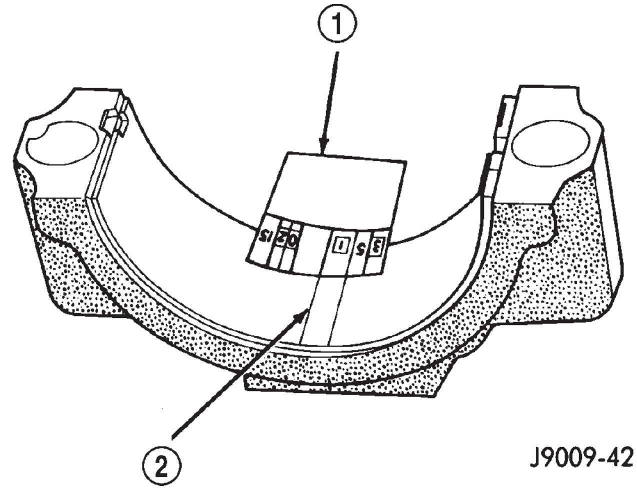


Fig. 32 Measuring Bearing Clearance with Plastigage

1 – PLASTIGAGE SCALE
2 – COMPRESSED PLASTIGAGE

(9) If bearing-to-journal clearance exceeds the specification, install a pair of 0.0254 mm (0.001 inch) undersize bearing inserts. All the odd size inserts must be on the bottom. The sizes of the service replacement bearing inserts are stamped on the backs of the inserts. Measure the clearance as described in the previous steps.

(10) The clearance is measured with a pair of 0.0254 mm (0.001 inch) undersize bearing inserts installed. This will determine if two 0.0254 mm (0.001 inch) undersize inserts or another combination is needed to provide the correct clearance (refer to Connecting Rod Bearing Fitting Chart).

CONNECTING ROD BEARING FITTING CHART

CRANKSHAFT JOURNAL		CORRESPONDING CONNECTING ROD BEARING INSERT	
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	53.2257-53.2079 mm (2.0955-2.0948 in.)	Yellow - Standard	Yellow - Standard
Orange	53.2079 - 53.1901 mm (2.0948 - 2.0941 in.) 0.0178 mm (0.0007 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
Blue	53.1901 - 53.1724 mm (2.0941 - 2.0934 in.) 0.0356 mm (0.0014 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)

SERVICE PROCEDURES (Continued)

CRANKSHAFT JOURNAL		CORRESPONDING CONNECTING ROD BEARING INSERT	
Red	52.9717 - 52.9539 mm (2.0855 - 2.0848 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

(11) **FOR EXAMPLE:** If the initial clearance was 0.0762 mm (0.003 inch), 0.025 mm (0.001 inch) undersize inserts would reduce the clearance by 0.025 mm (0.001 inch). The clearance would be 0.002 inch and within specification. A 0.051 mm (0.002 inch) undersize insert would reduce the initial clearance an additional 0.013 mm (0.0005 inch). The clearance would then be 0.038 mm (0.0015 inch).

(12) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(13) Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 45 N·m (33 ft. lbs.) torque.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange (Fig. 33). Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

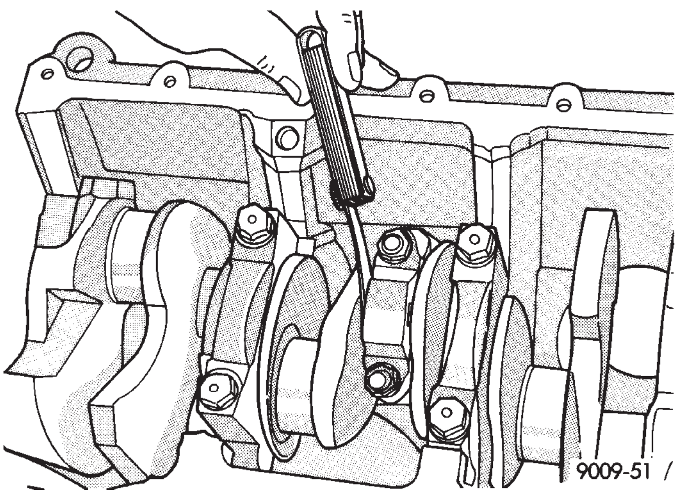


Fig. 33 Checking Connecting Rod Side Clearace—Typical

CRANKSHAFT MAIN BEARINGS—FITTING

INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated (Fig. 34).

NOTE: If any of the crankshaft journals are scored, remove the engine for crankshaft repair.

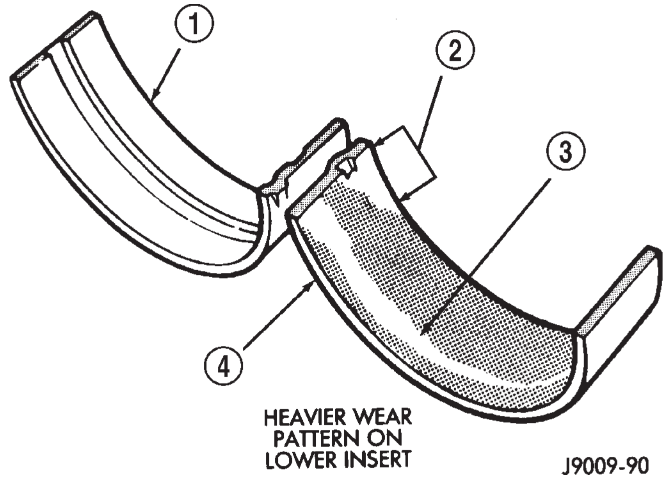


Fig. 34 Main Bearing Wear Patterns

1 – UPPER INSERT
2 – NO WEAR IN THIS AREA
3 – LOW AREA IN BEARING LINING
4 – LOWER INSERT

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

FITTING BEARINGS (CRANKSHAFT INSTALLED)

The main bearing caps, numbered (front to rear) from 1 through 5 have an arrow to indicate the forward position. The upper main bearing inserts are grooved to provide oil channels while the lower inserts are smooth.

Each bearing insert pair is selectively fitted to its respective journal to obtain the specified operating clearance. In production, the select fit is obtained by using various-sized color-coded bearing insert pairs as listed in the Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert. **The size is not stamped on bearing inserts used for engine production.**

The main bearing journal size (diameter) is identified by a color-coded paint mark on the adjacent cheek or counterweight towards the rear of the crankshaft (flange end). The rear main journal, is identified by a color-coded paint mark on the crankshaft rear flange.

SERVICE PROCEDURES (Continued)

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce the clearance by 0.013 mm (0.0005 inch). **Never use a pair of bearing inserts with greater than a 0.025 mm (0.001 inch) difference in size.**

BEARING INSERT PAIR CHART

INSERT	CORRECT	INCORRECT
UPPER	STANDARD	STANDARD
LOWER	0.025 mm U/S (0.001 in.)	0.051 mm U/S (0.002 in.)

NOTE: When replacing inserts, the odd size inserts must be either all on the top (in cylinder block) or all on the bottom (in main bearing cap).

Once the bearings have been properly fitted, proceed to Crankshaft Main Bearing—Installation.

BEARING-TO-JOURNAL CLEARANCE (CRANKSHAFT INSTALLED)

When using Plastigage, check only one bearing clearance at a time.

Install the grooved main bearings into the cylinder block and the non-grooved bearings into the bearing caps.

Install the crankshaft into the upper bearings dry.

Place a strip of Plastigage across full width of the crankshaft journal to be checked.

Install the bearing cap and tighten the bolts to 108 N·m (80 ft. lbs.) torque.

NOTE: DO NOT rotate the crankshaft. This will cause the Plastigage to shift, resulting in an inaccurate reading. Plastigage must not be permitted to crumble. If brittle, obtain fresh stock.

Remove the bearing cap. Determine the amount of clearance by measuring the width of the compressed Plastigage with the scale on the Plastigage envelope (Fig. 35). Refer to Engine Specifications for the proper clearance.

Plastigage should indicate the same clearance across the entire width of the insert. If clearance varies, it may indicate a tapered journal or foreign material trapped behind the insert.

If the specified clearance is indicated and there are no abnormal wear patterns, replacement of the bearing inserts is not necessary. Remove the Plastigage from the crankshaft journal and bearing insert. Proceed to Crankshaft Main Bearing—Installation.

If the clearance exceeds specification, install a pair of 0.025 mm (0.001 inch) undersize bearing inserts

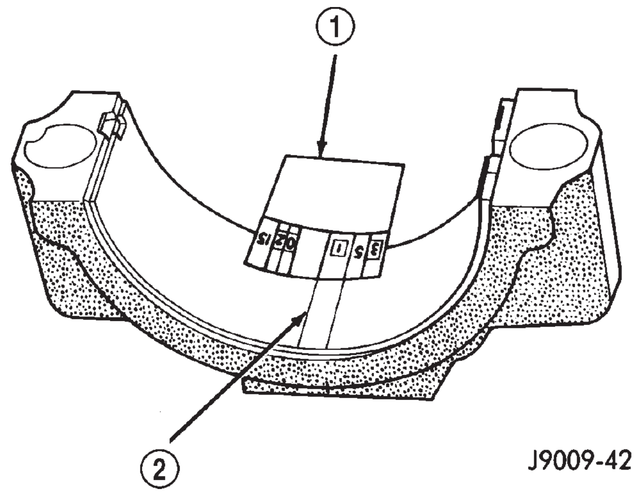


Fig. 35 Measuring Bearing Clearance with Plastigage

1 – PLASTIGAGE SCALE
2 – COMPRESSED PLASTIGAGE

and measure the clearance as described in the previous steps.

The clearance indicated with the 0.025 mm (0.001 inch) undersize insert pair installed will determine if this insert size or some other combination will provide the specified clearance. **FOR EXAMPLE:** If the clearance was 0.0762 mm (0.003 inch) originally, a pair of 0.0254 mm (0.001 inch) undersize inserts would reduce the clearance by 0.0254 mm (0.001 inch). The clearance would then be 0.0508 mm (0.002 inch) and within the specification. A 0.051 mm (0.002 inch) undersize bearing insert and a 0.0254 mm (0.001 inch) undersize insert would reduce the original clearance an additional 0.0127 mm (0.0005 inch). The clearance would then be 0.0381 mm (0.0015 inch).

CAUTION: Never use a pair of inserts that differ more than one bearing size as a pair.

FOR EXAMPLE: DO NOT use a standard size upper insert and a 0.051 mm (0.002 inch) undersize lower insert.

If the clearance exceeds specification using a pair of 0.051 mm (0.002 inch) undersize bearing inserts, measure crankshaft journal diameter with a micrometer. If the journal diameter is correct, the crankshaft bore in the cylinder block may be misaligned, which requires cylinder block replacement or machining to true bore.

If journals 1 through 5 diameters are less than 63.4517 mm (2.4981 inches), replace crankshaft or grind crankshaft down to accept the appropriate undersize bearing inserts.

SERVICE PROCEDURES (Continued)

Once the proper clearances have been obtained, proceed to Crankshaft Main Bearing—Installation.

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block (refer to Cylinder Block - Disassemble).

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper and out of round is 0.013 mm (0.0005 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

Once the proper clearances have been obtained, proceed to Crankshaft Main Bearing—Installation.

MAIN BEARING FITTING CHART

Color Code	Diameter	Upper Insert Size	Lower Insert Size
Crankshaft Journals #1 - #4			
Yellow	63.5025 - 63.4898 mm (2.5001 - 2.4996 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4898 - 63.4771 mm (2.4996 - 2.4991 in.) 0.0127 mm (0.0005 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Yellow - Standard
Blue	63.4771 - 63.4644 mm (2.4991 - 2.4986 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4644 - 63.4517 mm (2.4986 - 2.4981 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2485 - 63.2358 mm (2.4901 - 2.4896 in.) 0.254 mm (0.010 in.) Undersize	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)
Crankshaft Journal #5 Only			
Color Code	**Diameter**	**Upper Insert Size**	**Lower Insert Size**
Yellow	63.4873 - 63.4746 mm (2.4995 - 2.4990 in.)	Yellow - Standard	Yellow - Standard
Orange	63.4746 - 63.4619 mm (2.4990 - 2.4985 in.)	Blue - Undersize 0.025 mm (0.001 in.)	Yellow - Standard

SERVICE PROCEDURES (Continued)

Crankshaft Journals #1 - #4			
	0.0127 mm (0.0005 in.) Undersize		
Blue	63.4619 - 63.4492 mm (2.4985 - 2.4980 in.) 0.0254 mm (0.001 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Blue - Undersize 0.025 mm (0.001 in.)
Green	63.4492 - 63.4365 mm (2.4980 - 2.4975 in.) 0.0381 mm (0.0015 in.) Undersize	Blue - Undersize 0.025 mm (0.001 in.)	Green - Undersize 0.051 mm (0.002 in.)
Red	63.2333 - 63.2206 mm (2.4895 - 2.4890 in.) 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)	Red - Undersize 0.254 mm (0.010 in.)

REMOVAL AND INSTALLATION

ENGINE MOUNTS—FRONT

The front mounts support the engine at each side. These supports are made of resilient rubber.

REMOVAL

(1) Disconnect negative cable from battery.
(2) Raise the vehicle.
(3) Support the engine.
(4) Remove through bolt and nut.
(5) Raise engine to allow clearance when removing insulator.
(6) Remove the retaining bolts attaching insulator assembly to engine block.
(7) Remove the insulator assembly (Fig. 36) (Fig. 37).

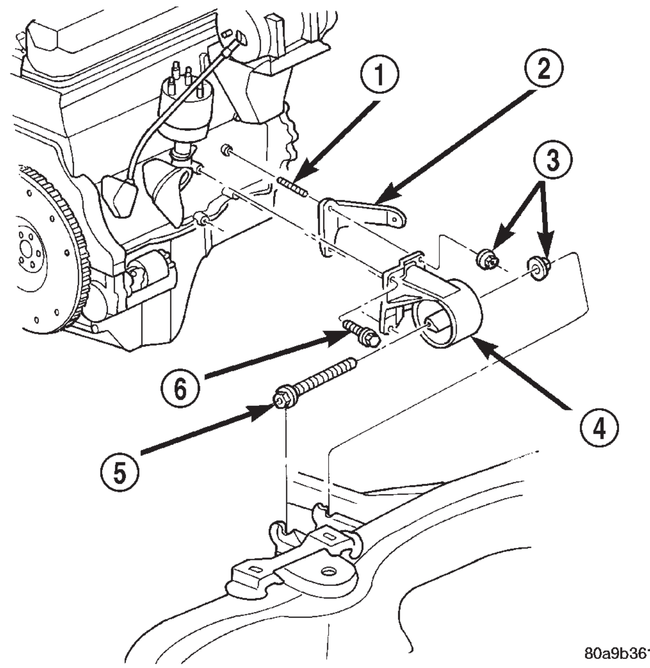


Fig. 36 Right Front Engine Mount Assembly

1 – STUD
2 – GENERATOR BRACKET
3 – NUT
4 – INSULATOR
5 – THROUGH BOLT
6 – BOLT

INSTALLATION

(1) Position insulator assembly on cylinder block and install the nuts and bolts. Tighten the bolts to 81 N·m (60 ft. lbs.) torque. Tighten the nuts to 47 N·m (35 ft. lbs.).
(2) Install the through bolt and retaining nut but DO NOT TIGHTEN.

REMOVAL AND INSTALLATION (Continued)

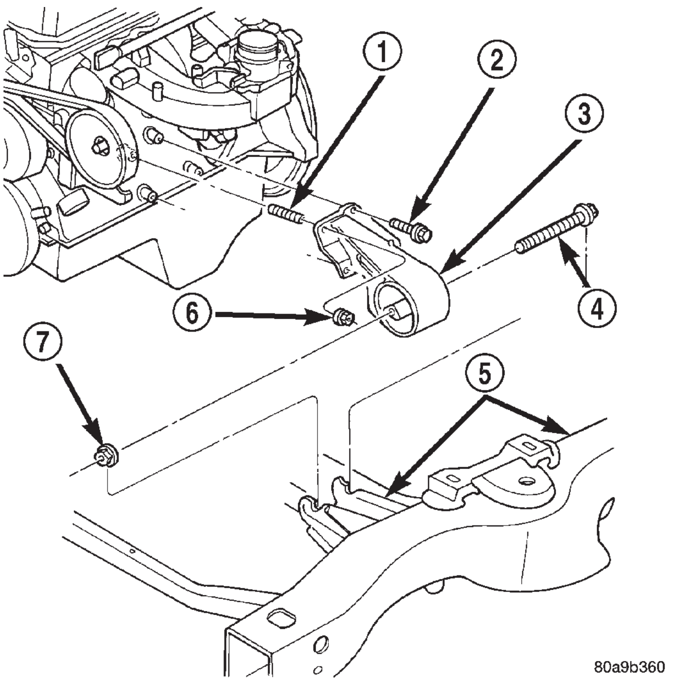


Fig. 37 Left Front Engine Mount Assembly

1 – STUD
2 – BOLT
3 – INSULATOR
4 – THROUGH BOLT
5 – FRAME
6 – NUT
7 – NUT

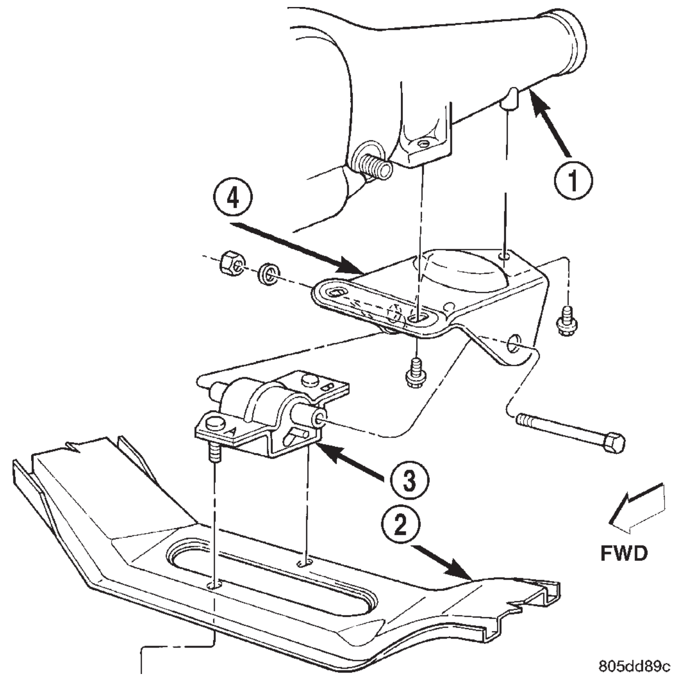


Fig. 38 Rear Engine Support

1 – TRANSMISSION
2 – CROSSMEMBER
3 – INSULATOR
4 – SUPPORT BRACKET

(3) Lower engine until through bolt and nut are resting in frame bracket and weight of engine is off of supporting device.

(4) Tighten the through bolt nut to 68 N·m (60 ft. lbs.) torque.

(5) Remove the engine support.

(6) Lower the vehicle.

(7) Connect negative cable to battery.

ENGINE REAR SUPPORT

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise vehicle on hoist.

(3) Remove the through bolt and nut.

(4) Support the transmission with a jack. Raise transmission slightly.

(5) Remove nuts securing insulator to crossmember (Fig. 38).

(6) Remove insulator.

INSTALLATION

(1) If the rear engine support bracket was removed, position the bracket to the transmission. Tighten the stud nuts to 41 N·m (30 ft. lbs.) torque.

(2) Install the insulator onto the transmission mounting crossmember. Tighten the stud nuts to 41 N·m (30 ft. lbs.) torque.

(3) Lower the transmission and engine while aligning the rear engine support bracket to the insulator.

(a) Install through-bolt in bracket and insulator. Tighten through-bolt nut to 68 Nm (50 ft. lbs.) torque.

(4) Remove transmission jack.

(5) Lower the vehicle.

(6) Connect the negative cable to the battery.

ENGINE

REMOVAL

(1) Disconnect the battery cables. Remove the battery.

(2) Mark the hinge locations on the hood panel for alignment reference during installation. Remove the engine compartment lamp. Remove the hood.

WARNING: THE COOLANT IN A RECENTLY OPERATED ENGINE IS HOT AND PRESSURIZED. USE CARE TO PREVENT SCALDING BY HOT COOLANT. CAREFULLY RELEASE THE PRESSURE BEFORE REMOVING THE RADIATOR DRAIN COCK AND CAP.

REMOVAL AND INSTALLATION (Continued)

(3) Loosen the radiator drain cock and radiator cap to drain the coolant. DO NOT waste usable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(4) Remove the air cleaner assembly, air in-let hose and resonator assembly (Fig. 39).

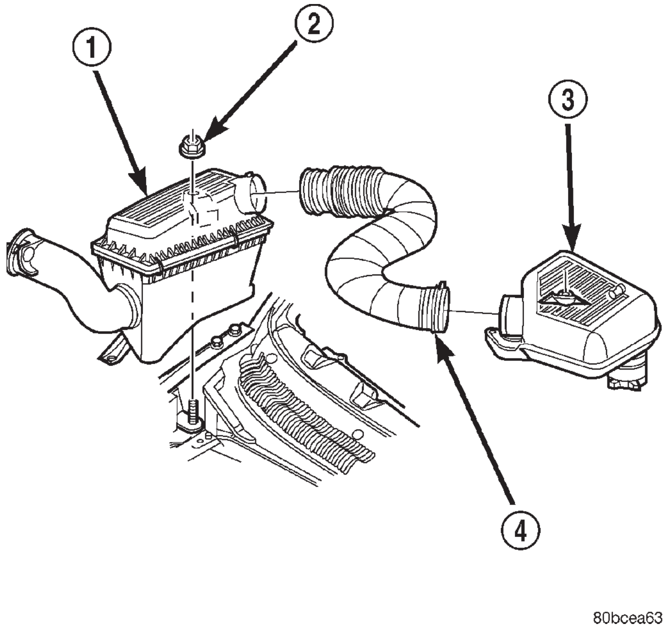


Fig. 39 Air Cleaner and Resonator Removal and Installation

1 – AIR CLEANER ASSEMBLY
2 – NUT AND WASHER
3 – RESONATOR ASSEMBLY
4 – AIR INLET HOSE

(5) Recover refrigerant (if equipped with A/C). Refer to HEATING and AIR CONDITIONING.

(6) Remove the lower radiator hose.

(7) Remove the upper radiator hose and coolant recovery hose (Fig. 40).

(8) Remove the fan shroud (Fig. 40).

(9) Remove the radiator/condenser (if equipped with air conditioning).

(10) Remove fan assembly and install a 5/16 x 1/2-inch SAE capscrew through fan pulley into water pump flange. This will maintain the pulley and water pump in alignment when crankshaft is rotated.

(11) Disconnect the heater hoses.

(12) Disconnect the throttle cable, speed control cable (if equipped) and transmission cable (if equipped).

(13) Disconnect the body ground at the firewall.

(14) Disconnect the wires from the starter motor solenoid.

(15) Disconnect all fuel injection harness connections.

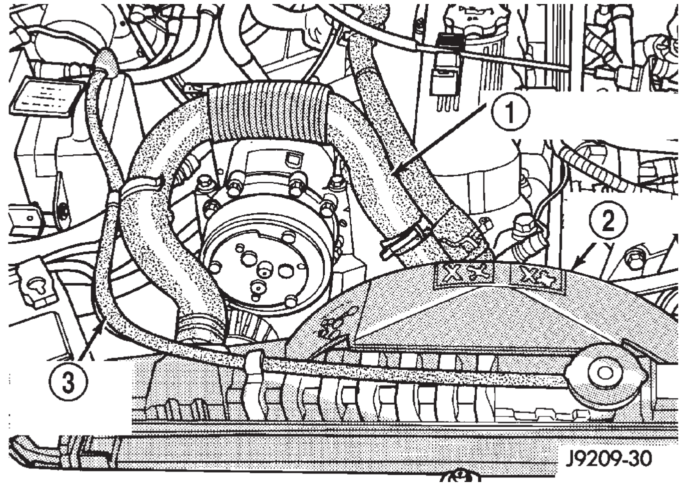


Fig. 40 Upper Radiator Hose, Coolant Recovery Hose & Fan Shroud

1 – UPPER RADIATOR HOSE
2 – FAN SHROUD
3 – COOLANT RECOVERY HOSE

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE TURNED OFF). BEFORE DISCONNECTING FUEL LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED.

(16) Perform fuel pressure release procedure. Refer to FUEL SYSTEM.

(17) Remove latch clip and disconnect the quick-connect fuel line at the fuel rail

(18) Disconnect suction/discharge hose from A/C compressor and cap off ports to prevent intrusion of foreign material or refrigerant oil loss.

(19) Remove the power brake vacuum check valve from the booster, if equipped.

(20) If equipped with power steering:

(a) Disconnect the power steering hoses from the fittings at the steering gear.

(b) Drain the pump reservoir.

(c) Cap the fittings on the hoses and steering gear to prevent foreign material from entering the system.

(21) Identify, tag and disconnect all necessary wire connectors and vacuum hoses.

(22) Raise the vehicle.

(23) Remove the oil filter.

(24) Remove the starter motor.

(25) Disconnect the exhaust pipe from the exhaust manifold.

(26) Remove the flywheel housing access cover.

(27) Remove the upper flywheel and converter housing bolts and loosen the bottom bolts.

(28) Remove the engine support cushion-to-engine compartment bracket bolts.

REMOVAL AND INSTALLATION (Continued)

(29) Remove the engine shock damper bracket from the sill.

(30) Lower the vehicle.

(31) Attach a lifting device to the engine.

(32) Raise the engine slightly off the front supports.

(33) Place a support stand under the converter or flywheel housing.

(34) Lift the engine out of the engine compartment and install on an engine stand.

(35) Install the oil filter to keep foreign material out of the engine.

INSTALLATION

(1) Remove the oil filter.

(2) Lift the engine off the stand and lower it into the engine compartment. For easier installation, it may be useful to remove the engine support cushions from the engine support brackets as an aide for alignment of the engine-to-transmission.

(3) Insert the transmission shaft into the clutch spline. (M/T models)

(4) Align the flywheel housing with the engine.

(5) Install and tighten the flywheel housing lower bolts.

(6) Install the engine support cushions (if removed).

(7) Lower the engine and engine support cushions onto the engine compartment brackets.

(8) Remove the engine lifting device.

(9) Raise the vehicle.

(10) Install the converter-housing access cover.

(11) Install the exhaust pipe support.

(12) Install the starter motor and connect the cable. Tighten the bolts to 45 N·m (33 ft. lbs.) torque.

(13) Tighten the engine support cushion through-bolt nuts.

(14) Connect the exhaust pipe to the manifold.

(15) Install the oil filter.

(16) Lower the vehicle.

(17) Connect the coolant hoses and tighten the clamps.

(18) If equipped with power steering:

(a) Remove the protective caps

(b) Connect the hoses to the fittings at the steering gear. Tighten the nut to 52 N·m (38 ft. lbs.) torque.

(c) Fill the pump reservoir with fluid.

(19) Remove the pulley-to-water pump flange alignment capscrew and install the fan assembly.

(20) Install the fan shroud and radiator and condenser (if equipped with air conditioning).

(21) Connect the radiator hoses.

(22) Connect the oxygen sensor wire connector.

(23) Connect the throttle cable and install the rod. Connect the transmission and speed control cables (if equipped)

(24) Connect the fuel supply line to the injector rail. push until a “click” is heard. Re-install latch clip.

(25) Connect all the vacuum hoses and wire connectors.

(26) Connect suction/discharge hose to compressor (if equipped).

(27) Fill the power steering reservoir.

(28) Connect the battery cables.

(29) Install the resonator assembly, air in-let hose and air cleaner (Fig. 39).

(30) Install the hood.

(31) Add engine oil and coolant.

(32) Start the engine and inspect for leaks.

(33) Stop the engine and check the fluid levels. Add fluid, as required.

(34) Recharge air conditioning.

INTAKE MANIFOLD

REMOVAL

(1) Disconnect the battery negative cable.

(2) Remove the air inlet hose and resonator from the throttle body and air cleaner (Fig. 41).

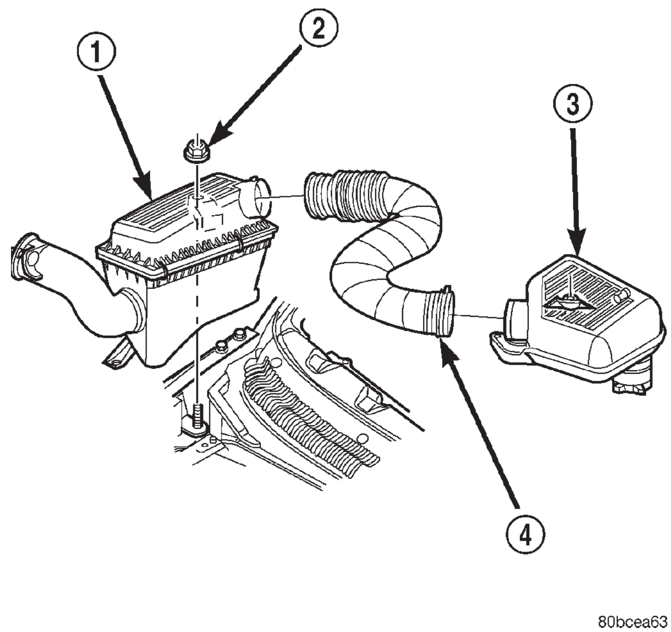


Fig. 41 Air Cleaner, Resonator and Air Inlet Hose Removal and Installation

1 – AIR CLEANER ASSEMBLY
2 – NUT AND WASHER
3 – RESONATOR ASSEMBLY
4 – AIR INLET HOSE

(3) Loosen the accessory drive belt tension and remove the belt from the power steering pump (refer to Group 07, Cooling Systems for proper procedures).

(4) Remove the power steering pump and brackets from the water pump and intake manifold. Secure power steering pump and bracket out of the way.

(5) Perform fuel system pressure release procedure (refer to Group 14, Fuel System for correct procedure).

(6) Disconnect fuel supply tube from the fuel rail. Some fuel lines require a special tool for removal/installation (refer to Group 14, Fuel System - Quick Connect Fittings).

(7) Disconnect the accelerator cable, the cruise control cable (if equipped), and the transmission line pressure cable (if equipped) from the throttle body and remove them from the cable bracket.

CAUTION: When disconnecting the cruise control connector at the throttle body, DO NOT pry the connector off with pliers or screwdriver. Use finger pressure only. Prying the connector off could break it.

(8) Disconnect the electrical connectors. Pull the harnesses away from the manifold and secure them so they do not interfere with the manifold removal and installation process.

- The throttle position sensor.
- The idle air control motor.
- The coolant temperature sensor at the thermostat.
- The manifold air temperature sensor at the intake manifold.
- The fuel injectors.
- The oxygen sensor.

(9) Disconnect the crankcase ventilation (CCV) vacuum hose and manifold absolute pressure (MAP) sensor vacuum hose connector at the intake manifold.

(10) Disconnect vacuum hose from vacuum port on the intake manifold.

(11) Disconnect CCV hose at the cylinder head cover (Fig. 42).

(12) Remove the molded vacuum harness.

(13) Disconnect the vacuum brake booster hose at the intake manifold.

(14) Remove bolts 2 through 5 securing the intake manifold to the cylinder head (Fig. 43). Slightly loosen bolt No.1 and nuts 6 and 7.

(15) Remove the intake manifold and gaskets. Drain the coolant from the manifold.

INSTALLATION

(1) Clean the intake manifold and cylinder head mating surfaces. **DO NOT allow foreign material to enter either the intake manifold or the ports in the cylinder head.**

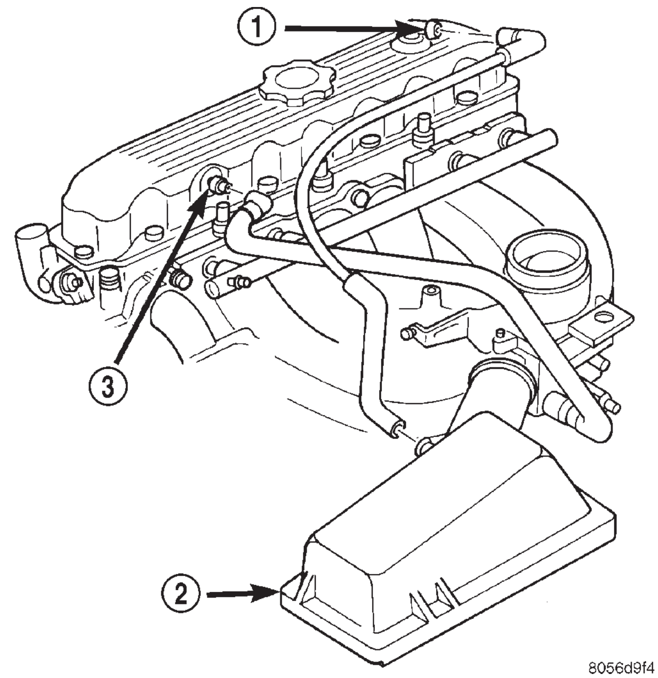


Fig. 42 Crankcase Ventilation (CCV) Hose—2.5L Engine

1 – AIR INLET FITTING
2 – AIR FILTER COVER
3 – FIXED ORIFICE FITTING

(2) Install the new intake manifold gasket over the locating dowels.

(3) Position the manifold in place and finger tighten the mounting bolts.

(4) Tighten the fasteners in sequence and to the specified torque (Fig. 43).

- Fastener No.1—Tighten to 41 N·m (30 ft. lbs.) torque.
- Fasteners Nos.2 through 5—Tighten to 31 N·m (23 ft. lbs.) torque.
- Fasteners Nos.6 and 7—Tighten to 23 N·m (17 ft. lbs.) torque.

(5) Connect fuel supply tube to the fuel rail inlet. Push tube until a “click” is heard. **Before connecting the fuel line to the fuel rail replace the O-rings at the quick-connect fuel line coupling.**

(6) Pull out on the fuel supply tube to ensure that it is locked in place.

(7) Connect the molded vacuum hoses to the vacuum port on the intake manifold and the cylinder head cover.

(8) Connect the electrical connectors.

- The throttle position sensor.
- The idle air control motor.
- The coolant temperature sensor at the thermostat housing.

REMOVAL AND INSTALLATION (Continued)

- The fuel injectors.
- The air manifold temperature sensor.
- The oxygen sensor.

(9) Connect the CCV vacuum hose and MAP sensor vacuum hose connectors to the throttle body.

(10) Install the power steering pump and bracket assembly to the water pump and intake manifold. Hand start the three (3) tensioner bracket to p/s pump to intake manifold bolts and the two (2) tensioner bracket to water pump bolts.

(11) Tighten the power steering pump bolts to 28 N·m (21 ft. lbs.) Tighten the tensioner bracket to water pump bolts to 28 N·m (21 ft. lbs.).

(12) Connect the accelerator cable, cruise control cable (if equipped), and the transmission line pressure cable (if equipped) to the hold-down bracket and the throttle lever.

(13) Install and tension the accessory drive belt. Refer to Group 7, Cooling System for the proper procedure.

CAUTION: Ensure that the accessory drive belt is routed correctly. Failure to do so can cause the water pump to turn in the opposite direction resulting in engine overheating. Refer to Group 7, Cooling System for the proper procedure.

(14) Connect the air inlet hose and resonator to the throttle body and the air cleaner. Tighten clamps to 4 N·m (35 in. lbs.).

(15) Connect the battery negative cable.

(16) Start the engine and check for leaks.

EXHAUST MANIFOLD

REMOVAL

(1) Disconnect the battery negative cable.

(2) Raise the vehicle.

(3) Disconnect the exhaust pipe from the engine exhaust manifold.

(4) Lower the vehicle.

(5) Remove intake manifold (refer to procedure in this section).

(6) Remove fasteners 2 through 5 and remove the intake manifold (Fig. 43).

(7) Remove fasteners 1, 6 and 7 and remove the engine exhaust manifold (Fig. 43).

INSTALLATION

(1) Clean the intake and engine exhaust manifolds and cylinder head mating surfaces. **DO NOT allow foreign material to enter either the intake manifold or the ports in the cylinder head.**

(2) Install a new intake manifold gasket over the alignment dowels on the cylinder head.

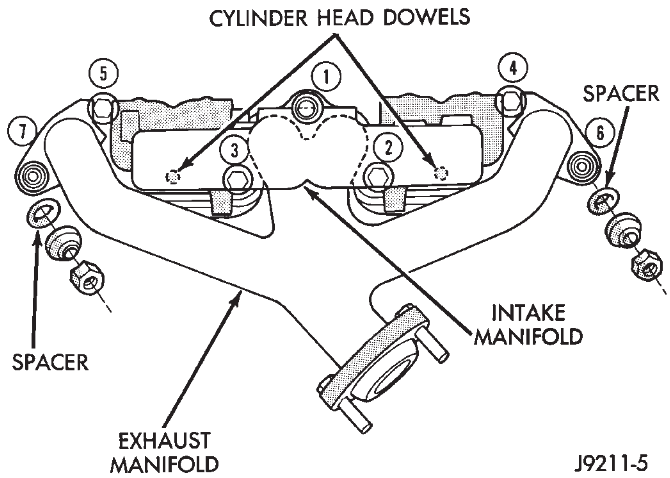


Fig. 43 Intake/Exhaust Manifold Removal/ Installation—2.5L Engine

(3) Install the engine exhaust manifold assembly. **Exhaust manifold must be centrally located over the end studs and spacer (Fig. 43).**

(4) Tighten bolt No.1 to 41 N·m (30 ft. lbs.) torque (Fig. 43).

(5) Install the intake manifold on the cylinder head dowels (Fig. 43).

(6) Install bolts 2 through 5 (Fig. 43). Tighten these bolts to 31 N·m (23 ft. lbs.) torque.

(7) Install new engine exhaust manifold spacers over the engine exhaust manifold mounting studs in the cylinder head (Fig. 43).

(8) Tighten nuts 6 and 7 to 23 N·m (17 ft. lbs.) torque (Fig. 43).

(9) Install all components to the intake manifold.

(10) Raise the vehicle.

(11) Connect the exhaust pipe to the engine exhaust manifold. Tighten the bolts to 31 N·m (23 ft. lbs.) torque.

(12) Lower the vehicle.

(13) Connect the battery negative cable.

(14) Start the engine and check for leaks.

CYLINDER HEAD COVER

A cured gasket is part of the engine cylinder head cover.

REMOVAL

(1) Disconnect negative cable from battery.

(2) Disconnect the Crankcase Ventilation (CCV) vacuum hose from engine cylinder head cover (Fig. 44).

(3) Remove the air inlet hose and resonator from the air cleaner and throttle body.

(4) Remove the engine cylinder head cover mounting bolts.

(5) Remove the engine cylinder head cover (Fig. 44).

REMOVAL AND INSTALLATION (Continued)

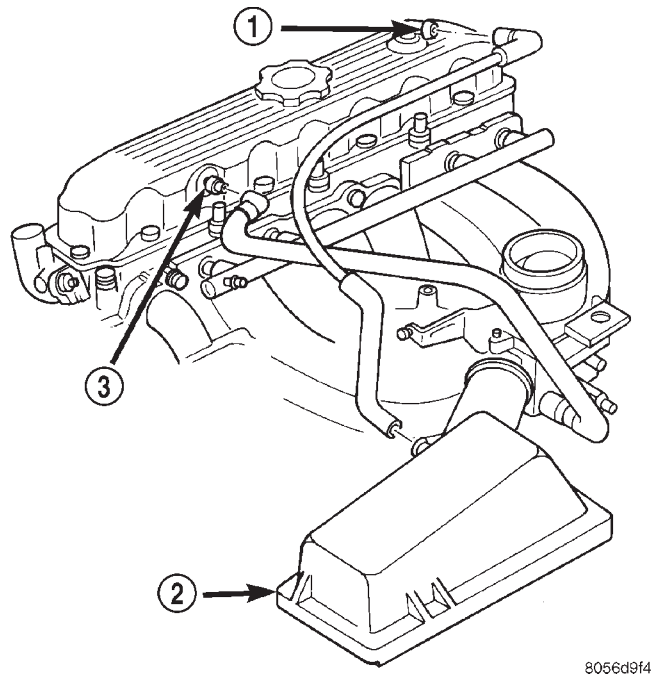


Fig. 44 Engine Cylinder Head Cover

1 – AIR INLET FITTING
2 – AIR FILTER COVER
3 – FIXED ORIFICE FITTING

(6) Remove any original sealer from the cover sealing surface of the engine cylinder head and clean the surface using a fabric cleaner.

(7) Remove all residue from the sealing surface using a clean, dry cloth.

INSTALLATION

(1) Inspect the engine cylinder head cover for cracks. Replace the cover, if cracked.

NOTE: The original dark grey gasket material should NOT be removed. If sections of the gasket material are missing or are compressed, replace the engine cylinder head cover. However, sections with minor damage such as small cracks, cuts or chips may be repaired with a hand held applicator. The new material must be smoothed over to maintain gasket height. Allow the gasket material to cure prior to engine cylinder head cover installation.

(2) If a replacement cover is installed, transfer the CCV valve grommet the oil filler cap from the original cover to the replacement cover.

(3) Install engine cylinder head cover. Tighten the mounting bolts to 13 N·m (115 in. lbs.) torque.

(4) Connect the CCV hoses (Fig. 44).

(5) Connect negative cable to battery.

(6) Install the air inlet hose and resonator.

ROCKER ARMS AND PUSH RODS

This procedure can be done with the engine in or out of the vehicle.

REMOVAL

(1) Remove the engine cylinder head cover. (Refer to procedure in this section)

(2) Check for rocker arm bridges which are causing misalignment of the rocker arm to valve tip area.

(3) Remove the capscrews at each bridge and pivot assembly (Fig. 45). Alternately loosen the capscrews one turn at a time to avoid damaging the bridges.

(4) Remove the bridges, pivots and corresponding pairs of rocker arms (Fig. 45). Place them on a bench in the same order as removed.

(5) Remove the push rods and place them on a bench in the same order as removed.

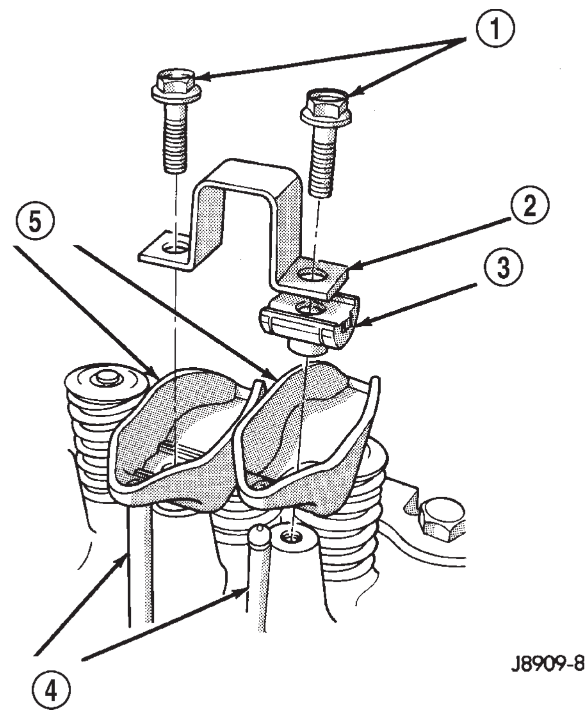


Fig. 45 Rocker Arm Assembly

1 – CAPSCREWS
2 – BRIDGE
3 – PIVOT ASSEMBLY
4 – PUSH RODS
5 – ROCKER ARMS

(6) Clean all the components with cleaning solvent.

(7) Use compressed air to blow out the oil passages in the rocker arms and push rods.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Lubricate the ball ends of the push rods with Mopar Engine Oil Supplement, or equivalent and install push rods in their original locations. Ensure that the bottom end of each push rod is centered in the tappet plunger cap seat.

(2) Using Mopar Engine Oil Supplement, or equivalent, lubricate the area of the rocker arm that the pivot contacts. Install rocker arms, pivots and bridge above each cylinder in their original position.

(3) Loosely install the capscrews through each bridge.

(4) At each bridge, tighten the capscrews alternately, one turn at a time, to avoid damaging the bridge. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(5) Install the engine cylinder head cover.

VALVE SPRING AND SEAL

This procedure can be done with the engine cylinder head installed on the block.

REMOVAL

Each valve spring is held in place by a retainer and a set of conical valve locks. The locks can be removed only by compressing the valve spring.

(1) Remove the engine cylinder head cover. Refer to procedure in this section.

(2) Remove cap screws, bridge and pivot assemblies and rocker arms for access to each valve spring to be removed.

(3) Remove push rods. **Retain the push rods, bridges, pivots and rocker arms in the same order and position as removed.**

(4) Inspect the springs and retainer for cracks and possible signs of weakening.

(5) Remove the spark plug(s) adjacent to the cylinder(s) below the valve springs to be removed.

(6) Install a 14 mm (1/2 inch) (thread size) air hose adaptor in the spark plug hole.

(7) Connect an air hose to the adapter and apply air pressure slowly. Maintain at least 621 kPa (90 psi) of air pressure in the cylinder to hold the valves against their seats. For vehicles equipped with an air conditioner, use a flexible air adaptor when servicing the No.1 cylinder.

(8) Tap the retainer or tip with a rawhide hammer to loosen the lock from the retainer. Use Valve Spring Compressor Tool MD-998772A to compress the spring and remove the locks (Fig. 46).

(9) Remove valve spring and retainer (Fig. 46).

(10) Remove valve stem oil seals (Fig. 46). Note the valve seals are different for intake and exhaust valves. The top of each seal is marked either INT (intake/black in color) or EXH (exhaust/brown in color). DO NOT mix the seals.

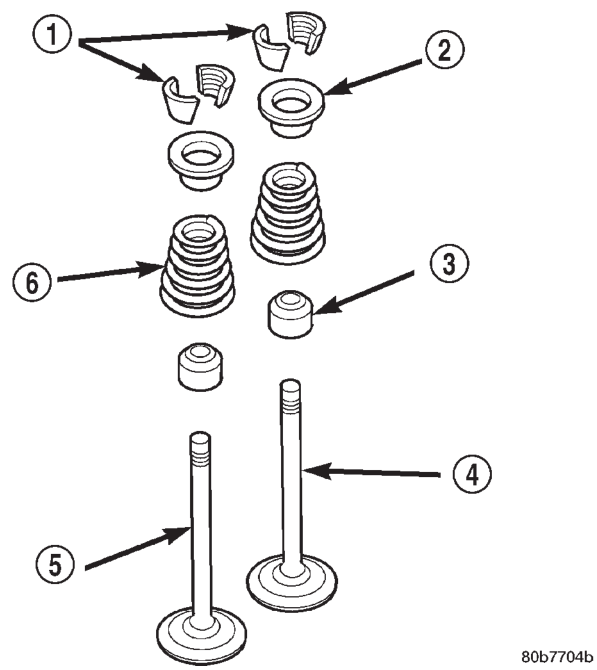


Fig. 46 Valve and Valve Components

1 – VALVE LOCKS (3–BEAD)
2 – RETAINER
3 – VALVE STEM OIL SEAL
4 – INTAKE VALVE
5 – EXHAUST VALVE
6 – VALVE SPRING

INSTALLATION

Inspect the valve stems, especially the grooves. An Arkansas smooth stone should be used to remove nicks and high spots.

CAUTION: Install oil seals carefully to prevent damage from the sharp edges of the valve spring lock grove.

(1) Lightly push the valve seal over the valve stem and valve guide boss. Be sure the seal is completely seated on the valve guide boss.

(2) Install valve spring and retainer.

(3) Compress the valve spring with Valve Spring Compressor Tool MD-998772A and insert the valve locks. Release the spring tension and remove the tool. Tap the spring from side-to-side to ensure that the spring is seated properly on the engine cylinder head.

(4) Release air pressure and disconnect the air hose. Remove the adaptor from the spark plug hole and install the spark plug.

(5) Repeat the procedures for each remaining valve spring to be removed.

(6) Install the push rods. Ensure the bottom end of each rod is centered in the plunger cap seat of the hydraulic valve tappet.

REMOVAL AND INSTALLATION (Continued)

(7) Install the rocker arms, pivots and bridge at their original location.

(8) Tighten the bridge cap screws alternately, one at a time, to avoid damaging the bridge. Tighten the cap screws to 28 N·m (21 ft. lbs.) torque.

(9) Install the engine cylinder head cover.

CYLINDER HEAD

This procedure can be done with the engine in or out of the vehicle.

REMOVAL

(1) Disconnect negative cable from battery.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN THE RADIATOR DRAIN COCK WITH THE SYSTEM HOT AND PRESSURIZED BECAUSE SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

(2) Drain the coolant and disconnect the hoses at the engine thermostat housing. DO NOT waste reusable coolant. If the solution is clean and is being drained only to service the engine or cooling system, drain the coolant into a clean container for reuse.

(3) Remove the air in-let hose and resonator assembly.

(4) Remove the engine cylinder head cover. Refer to procedure in this section.

(5) Remove the capscrews, bridge and pivot assemblies and rocker arms (Fig. 47).

(6) Remove the push rods (Fig. 47). **Retain the push rods, bridges, pivots and rocker arms in the same order as removed.**

(7) Loosen the accessory drive belt at the power steering pump bracket, if equipped or at the idler pulley bracket. Refer to COOLING SYSTEM.

(8) If equipped with air conditioning, perform the following:

(a) Remove the bolts from the A/C compressor mounting bracket and set the compressor aside.

(b) Remove the air conditioner compressor bracket bolts from the engine cylinder head.

(c) Loosen the through bolt at the bottom of the bracket.

(9) If equipped, disconnect the power steering pump bracket. Set the pump and bracket aside. DO NOT disconnect the hoses.

(10) Perform fuel pressure release procedure. Refer to FUEL SYSTEM.

(11) Remove the latch clip and disconnect the fuel supply hose.

(12) Remove the intake and engine exhaust manifolds from the engine cylinder head.

(13) Number and disconnect the ignition wires and remove the spark plugs.

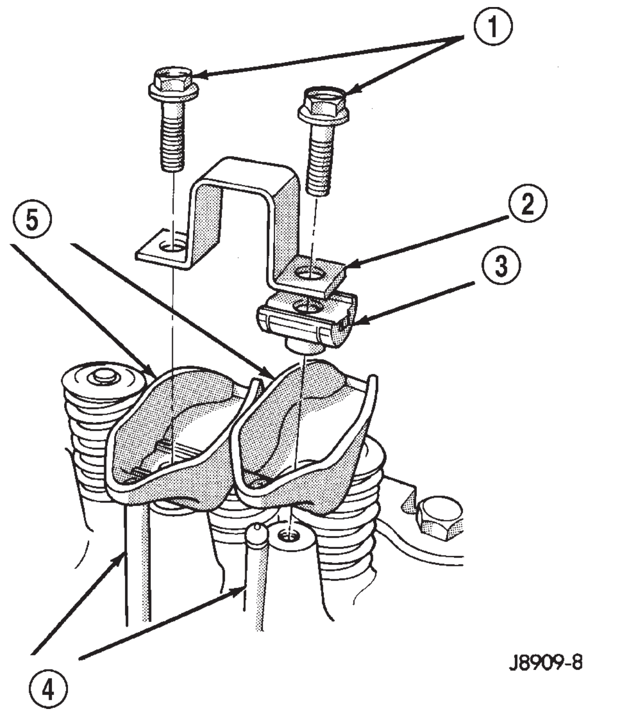


Fig. 47 Rocker Arm Assembly

1 – CAPSCREWS
2 – BRIDGE
3 – PIVOT ASSEMBLY
4 – PUSH RODS
5 – ROCKER ARMS

(14) Disconnect the coolant temperature sending unit connector.

(15) Remove the engine cylinder head bolts.

(16) Remove the engine cylinder head and gasket (Fig. 48).

(17) If this was the first time the bolts were removed, put a paint dab on the top of the bolt. If the bolts have a paint dab on the top of the bolt or it isn't known if they were used before, discard the bolts.

(18) Stuff clean lint free shop towels into the cylinder bores.

NOTE: If valves, springs, or seals are to be inspected/replaced at this time, refer to Valves and Valve Springs later in this section for proper inspection procedures.

INSTALLATION

The engine cylinder head gasket is a composition gasket. The gasket is to be installed DRY. **DO NOT use a gasket sealing compound on the gasket.**

REMOVAL AND INSTALLATION (Continued)

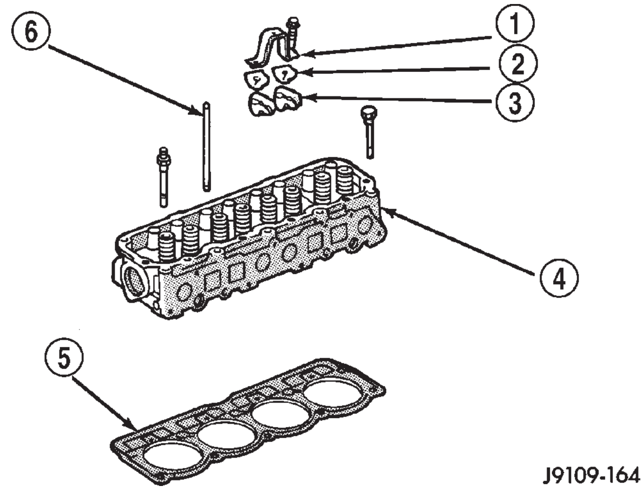


Fig. 48 Engine Cylinder Head Assembly

1 – BRIDGE
2 – PIVOT ASM.
3 – ROCKER ARM
4 – CYLINDER HEAD
5 – HEAD GASKET
6 – PUSH ROD

If the engine cylinder head is to be replaced and the original valves used, measure the valve stem diameter. Only standard size valves can be used with a service replacement engine cylinder head unless the replacement head valve stem guide bores are reamed to accommodate oversize valve stems. Remove all carbon buildup and reface the valves.

(1) Fabricate two engine cylinder head alignment dowels from used head bolts (Fig. 49). Use the longest head bolt. Cut the head of the bolt off below the hex head. Then cut a slot in the top of the dowel to allow easier removal with a screwdriver.

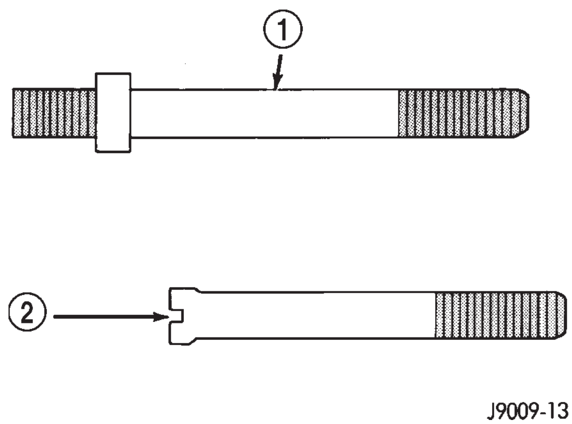


Fig. 49 Fabricate Alignment Dowels

1 – USED CYLINDER HEAD BOLT
2 – SLOT

(2) Install one dowel in bolt hole No.10 and the other dowel in bolt hole No. 8 (Fig. 50).

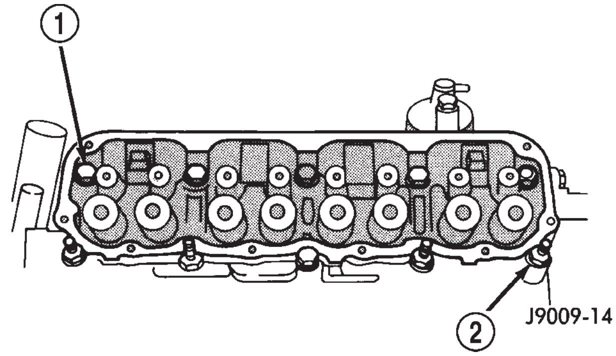


Fig. 50 Alignment Dowel Locations

1 – ALIGNMENT DOWEL
2 – ALIGNMENT DOWEL

(3) Remove the shop towels from the cylinder bores. Coat the bores with clean engine oil.

(4) Place the engine cylinder head gasket (with the numbers facing up) over the dowels.

(5) Place the engine cylinder head over the dowels.

CAUTION: Engine cylinder head bolts should be reused only once. Replace the head bolts if they were used before or if they have a paint dab on the top of the bolt.

(6) Coat the threads of bolt No.7 only, with Loctite PST sealant or equivalent.

(7) Install all head bolts, except No.8 and No.10.

(8) Remove the dowels.

(9) Install No.8 and No.10 head bolts.

CAUTION: During the final tightening sequence, bolt No.7 will be tightened to a lower torque than the rest of the bolts. DO NOT overtighten bolt No.7.

(10) Tighten the engine cylinder head bolts in sequence according to the following procedure (Fig. 51):

(a) Tighten all bolts in sequence (1 through 10) to 30 N·m (22 ft. lbs.) torque.

(b) Tighten all bolts in sequence (1 through 10) to 61 N·m (45 ft. lbs.) torque.

(c) Check all bolts to verify they are set to 61 N·m (45 ft. lbs.) torque.

(d) Tighten bolts (in sequence):

- Bolts 1 through 6 to 149 N·m (110 ft. lbs.) torque.
- Bolt 7 to 136 N·m (100 ft. lbs.) torque.
- Bolts 8 through 10 to 149 N·m (110 ft. lbs.) torque.

(e) Check all bolts in sequence to verify the correct torque.

REMOVAL AND INSTALLATION (Continued)

(f) If not already done, clean and mark each bolt with a dab of paint after tightening. Should you encounter bolts which were painted in an earlier service operation, replace them.

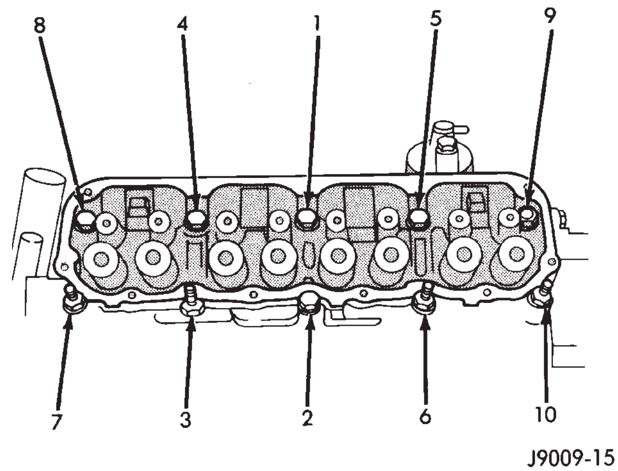


Fig. 51 Engine cylinder head Bolt Tightening Sequence

(11) Connect the coolant temperature sending unit connector.

(12) Install the spark plugs and tighten to 37 N·m (27 ft. lbs.) torque. Connect the ignition wires.

(13) Install the intake and exhaust manifolds.

(14) Install the fuel supply line. Push until a “click” is heard. Reinstall latch clip.

(15) If equipped, attach the power steering pump and bracket.

(16) Install the push rods, rocker arms, pivots and bridges in the order they were removed.

(17) Install the engine cylinder head cover.

(18) Attach the air conditioning compressor mounting bracket to the engine cylinder head and block. Tighten the bolts to 40 N·m (30 ft. lbs.) torque.

(19) Attach the air conditioning compressor to the bracket. Tighten the bolts to 27 N·m (20 ft. lbs.) torque.

CAUTION: The accessory drive belt must be routed correctly. Incorrect routing can cause the water pump to turn in the opposite direction causing the engine to overheat.

(20) Install the accessory drive belt and correctly tension the belt.

(21) Install the resonator assembly and air in-let hose. Tighten clamps to 4 N·m (35 in. lbs.).

(22) Connect the hoses to the thermostat housing.

(23) Install the coolant temperature sending unit connector.

(24) Connect negative cable to battery.

(25) Connect the upper radiator hose and heater hose at the thermostat housing.

(26) Fill the cooling system. Check for leaks.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH THE FAN. DO NOT PUT HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(27) Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the thermostat opens. Add coolant, if required.

HYDRAULIC TAPPETS

REMOVAL

Retain all the components in the same order as removed.

(1) Remove the engine cylinder head cover (refer to procedure earlier in this section).

(2) Remove the bridge and pivot assemblies and rocker arms by removing the capscrews at each bridge. Alternately loosen each capscrew, one turn at a time, to avoid damaging the bridges.

(3) Remove the push rods.

(4) Remove the tappets through the push rod openings in the cylinder head with a Hydraulic Valve Tappet Removal/Installation Tool (Fig. 52).

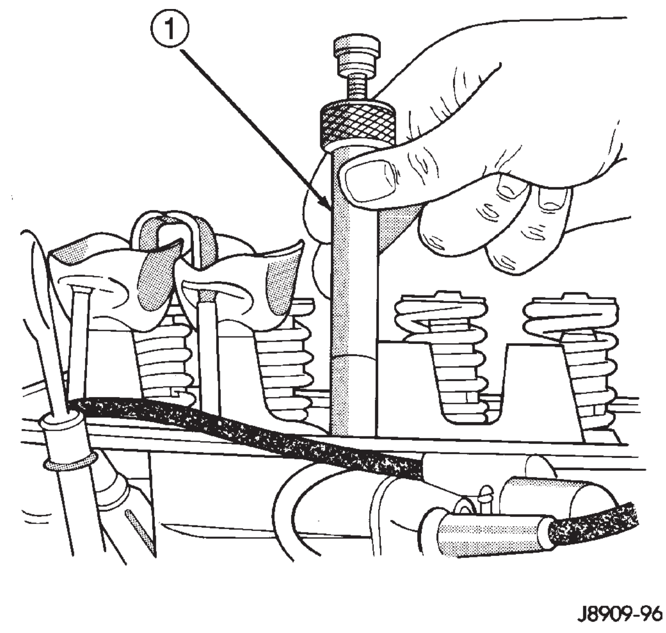


Fig. 52 Hydraulic Valve Tappet Removal/Installation Tool

1 – HYDRAULIC VALVE TAPPET REMOVAL/INSTALLATION TOOL

INSTALLATION

It is not necessary to charge the tappets with engine oil. They will charge themselves within a very short period of engine operation.

(1) Dip each tappet in Mopar Engine Oil Supplement, or equivalent.

REMOVAL AND INSTALLATION (Continued)

(2) Use Hydraulic Valve Tappet Removal/Installation Tool to install each tappet in the same bore from where it was originally removed.

(3) Install the push rods in their original locations.

(4) Install the rocker arms and bridge and pivot assemblies at their original locations. Loosely install the capscrews at each bridge.

(5) Tighten the capscrews alternately, one turn at a time, to avoid damaging the bridges. Tighten the capscrews to 28 N·m (21 ft. lbs.) torque.

(6) Install the engine cylinder head cover.

VIBRATION DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt and fan shroud.

(3) Remove the vibration damper retaining bolt and washer.

(4) Use Vibration Damper Removal Tool 7697 to remove the damper from the crankshaft (Fig. 53).

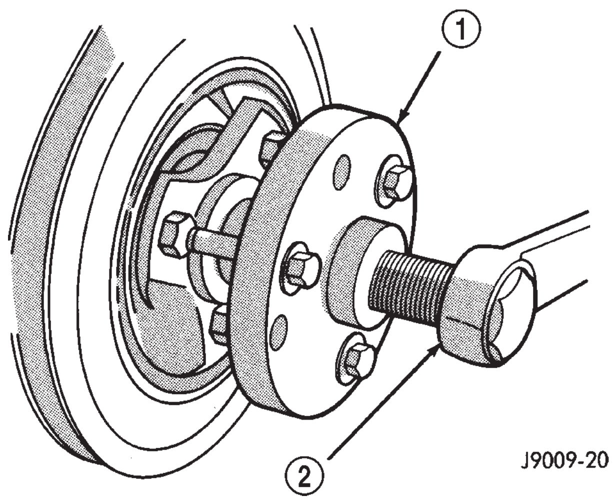


Fig. 53 Vibration Damper Removal Tool 7697

1 – VIBRATION DAMPER REMOVAL TOOL
2 – WRENCH

INSTALLATION

(1) Apply Mopar Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in position, align the keyway on the vibration damper hub with the crankshaft key and tap the damper onto the crankshaft.

(2) Install the vibration damper retaining bolt and washer.

(3) Tighten the damper retaining bolt to 108 N·m (80 ft. lbs.) torque.

(4) Install the serpentine drive belt and tighten to the specified tension (refer to Group 7, Cooling Systems for the proper specifications and procedures).

(5) Connect negative cable to battery.

TIMING CASE COVER OIL SEAL

REMOVAL

This procedure is done with the timing case cover installed.

(1) Disconnect negative cable from battery.

(2) Remove the serpentine drive belt.

(3) Remove the vibration damper.

(4) Remove the radiator shroud.

(5) Carefully remove the oil seal. Make sure seal bore is clean.

INSTALLATION

(1) Position the replacement oil seal on Timing Case Cover Alignment and Seal Installation Tool 6139 with seal open end facing inward. Apply a light film of Perfect Seal, or equivalent, on the outside diameter of the seal. Lightly coat the crankshaft with engine oil.

(2) Position the tool and seal over the end of the crankshaft and insert a draw screw tool into Seal Installation Tool 6139 (Fig. 54). Tighten the nut against the tool until it contacts the cover.

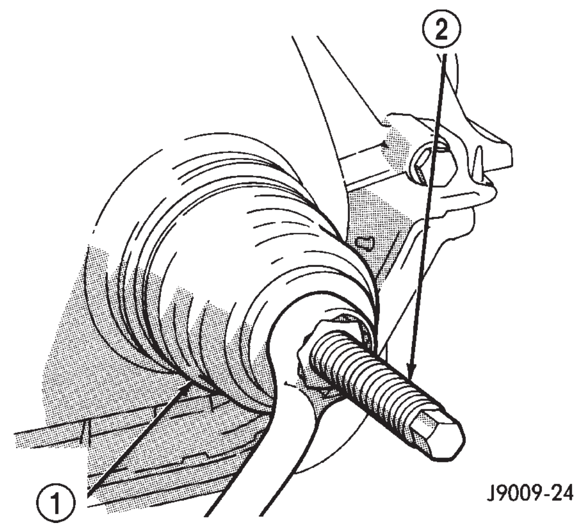


Fig. 54 Timing Case Cover Oil Seal Installation

1 – SEAL INSTALLATION TOOL
2 – DRAW SCREW TOOL

(3) Remove the tools. Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(4) Apply Mopar Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the crankshaft, install the vibration damper, washer and bolt. Lubricate and tighten the bolt to 108 N·m (80 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

(5) Install the serpentine belt and tighten to the specified tension (refer to Group 7, Cooling Systems for the proper specifications and procedures).

(6) Install the radiator shroud.

(7) Connect negative cable to battery.

TIMING CASE COVER

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove accessory drive belt (Refer to Group 07, Cooling System for proper procedure)

(3) Remove the accessory drive brackets that are attached to the timing case cover.

(4) Remove the fan and hub assembly and remove the fan shroud.

(5) Remove the A/C compressor (if equipped) and generator bracket assembly from the engine cylinder head and move to one side.

(6) Remove the vibration damper (Fig. 55).

(7) Remove the oil pan-to-timing case cover bolts and timing case cover-to-cylinder block bolts.

(8) Remove the timing case cover and gasket from the engine.

(9) Pry the crankshaft oil seal from the front of the timing case cover (Fig. 55).

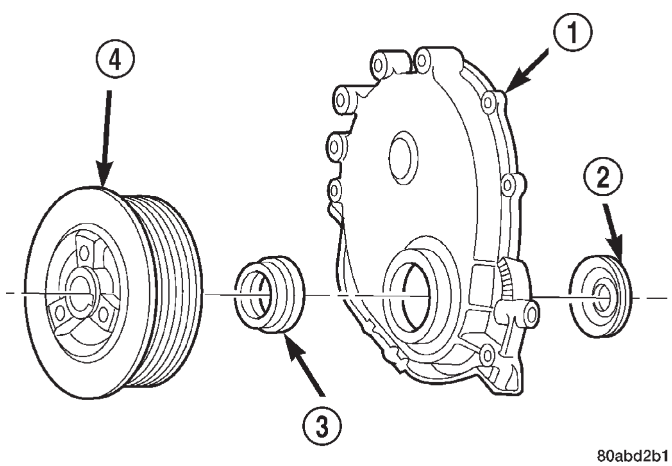


Fig. 55 Timing Case Cover Components

1 – TIMING CASE COVER
2 – OIL SLINGER
3 – CRANKSHAFT OIL SEAL
4 – VIBRATION DAMPER PULLEY

INSTALLATION

(1) Clean the timing case cover, oil pan and cylinder block gasket surfaces.

(2) Install a new crankshaft oil seal in the timing case cover. The open end of the seal should be toward the inside of the cover. Support the cover at the seal area while installing the seal. Force it into position with Seal Installation Tool 6139.

(3) Position the gasket on the cylinder block.

(4) Position the timing case cover on the oil pan gasket and the cylinder block.

(5) Insert Timing Case Cover Alignment and Seal Installation Tool 6139 in the crankshaft opening in the cover (Fig. 56).

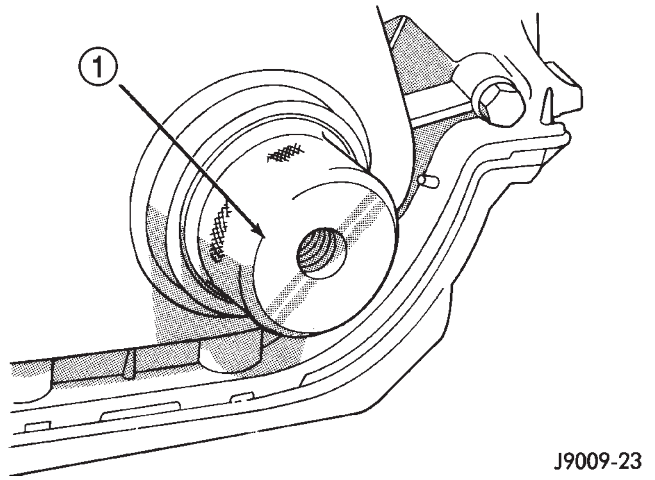


Fig. 56 Timing Case Cover Alignment and Seal Installation Tool 6139

1 – TIMING CASE COVER ALIGNMENT AND SEAL INSTALLATION TOOL

(6) Install the timing case cover-to-cylinder block and the oil pan-to-timing case cover bolts.

(7) Tighten the 1/4 inch cover-to-block bolts to 7 N·m (60 in. lbs.) torque. Tighten the 5/16 inch front cover-to-block bolts to 22 N·m (192 in. lbs.) torque. Tighten the oil pan-to-cover bolts to 9.5 N·m (84 in. lbs.) torque.

(8) Remove the cover alignment tool.

(9) Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(10) Apply Mopar Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key inserted in the keyway in the crankshaft, install the vibration damper, washer and bolt. Lubricate and tighten the bolt to 108 N·m (80 ft. lbs.) torque.

(11) Install the A/C compressor (if equipped) and generator bracket assembly.

(12) Install the engine fan and hub assembly and shroud.

(13) Install the accessory drive belt and tighten to obtain the specified tension.

(14) Connect negative cable to battery.

TIMING CHAIN AND SPROCKETS

The chain drive system ie equipped with a timing chain tensioner which reduces noise and prolongs timing chain life. In addition, it compensates for wear and temperature changes on the valve train for proper engine operation.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect negative cable from battery.
(2) Remove the fan and shroud.
(3) Remove the serpentine drive belt.
(4) Remove the crankshaft vibration damper.
(5) Remove the timing case cover.
(6) Rotate crankshaft until the “0” timing mark is closest to and on the center line with camshaft sprocket timing mark (Fig. 57).

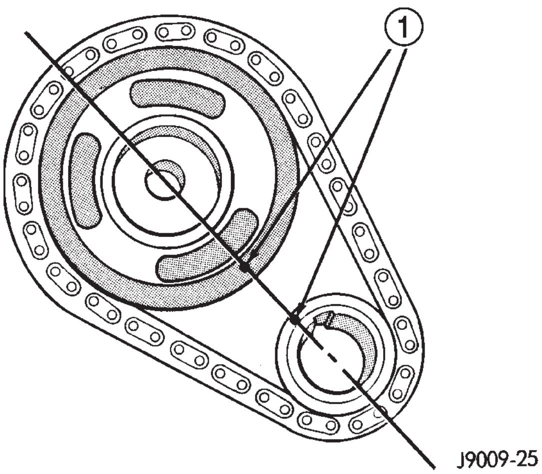


Fig. 57 Crankshaft—Camshaft Alignment

1 – TIMING MARKS

(7) Remove the oil slinger from the crankshaft.
(8) Remove the camshaft retaining bolt and remove the sprockets and chain as an assembly (Fig. 58).
(9) To replace the timing chain tensioner, the oil pan must be removed.

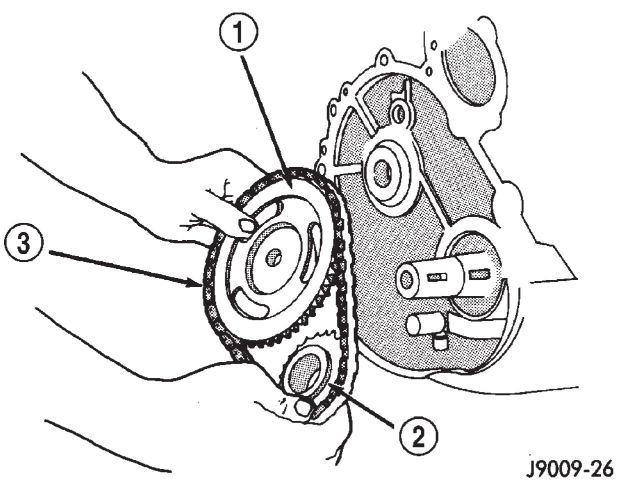


Fig. 58 Camshaft and Crankshaft Sprockets and Chain

1 – CAMSHAFT SPROCKET
2 – CRANKSHAFT SPROCKET
3 – CHAIN

INSTALLATION

(1) Turn the tensioner lever to the unlocked (down) position (Fig. 59).
(2) Pull the tensioner block toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the lock position (Fig. 59).

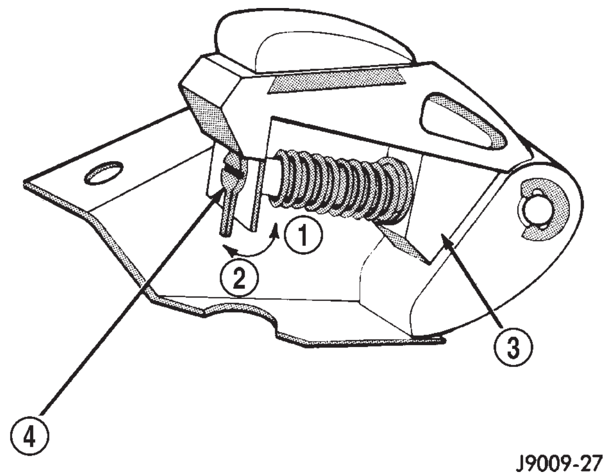


Fig. 59 Loading Timing Chain Tensioner

1 – LOCK
2 – UNLOCK
3 – TENSIONER BLOCK
4 – TENSIONER LEVER

(3) Apply Mopar Silicone Rubber Adhesive Sealant to the keyway in the crankshaft and insert the key. With the key in the crankshaft keyway, install the crankshaft, camshaft sprockets and timing chain. Ensure the timing marks on the sprockets are properly aligned (Fig. 57).
(4) Install the camshaft sprocket retaining bolt and washer. Tighten the bolt to 108 N·m (80 ft. lbs.) torque.
(5) To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark as shown in (Fig. 60). Count the number of chain pins between the timing marks of both sprockets. There must be 20 pins.
(6) Turn the chain tensioner lever to the unlocked (down) position (Fig. 59).
(7) Install the oil slinger.
(8) Replace the oil seal in the timing case cover.
(9) Install the timing case cover and gasket.
(10) With the key inserted in the keyway in the crankshaft, install the vibration damper, washer and bolt. Lubricate and tighten the bolt to 108 N·m (80 ft. lbs.) torque.
(11) Install the fan and shroud.
(12) Connect negative cable to battery.

REMOVAL AND INSTALLATION (Continued)

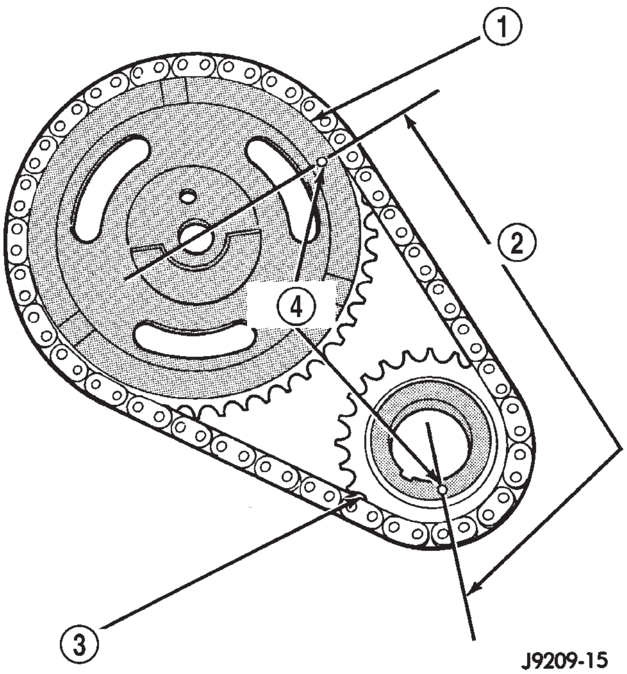


Fig. 60 Verify Sprocket—Chain Installation

1 – CAMSHAFT SPROCKET
2 – 20 PINS
3 – CRANKSHAFT SPROCKET
4 – TIMING MARKS

CAMSHAFT

REMOVAL

WARNING: THE COOLANT IN A RECENTLY OPERATED ENGINE IS HOT AND PRESSURIZED. RELEASE THE PRESSURE BEFORE REMOVING THE DRAIN COCK, CAP AND DRAIN PLUGS.

(1) Disconnect negative cable from battery.

(2) Drain the cooling system. DO NOT waste reusable coolant. If the solution is clean, drain it into a clean container for reuse.

(3) Remove the radiator or radiator and condenser, if equipped with A/C.

(4) Scribe a mark on the distributor housing in line with the lip of the rotor.

(5) Scribe a mark on the distributor housing near the clamp and continue the scribe mark on the cylinder block in line with the distributor mark.

(6) For ease of installation, note the position of the rotor and distributor housing in relation to adjacent engine components.

(7) Remove the distributor and ignition wires.

(8) Remove the air in-let hose and resonator assembly.

(9) Remove the engine cylinder head cover.

(10) Remove the rocker arms, bridges and pivots.

(11) Remove the push rods.

(12) Remove the hydraulic valve tappets from the engine cylinder head.

(13) Remove the vibration damper.

(14) Remove the timing case cover.

(15) Remove the timing chain and sprockets.

(16) Remove the camshaft (Fig. 61).

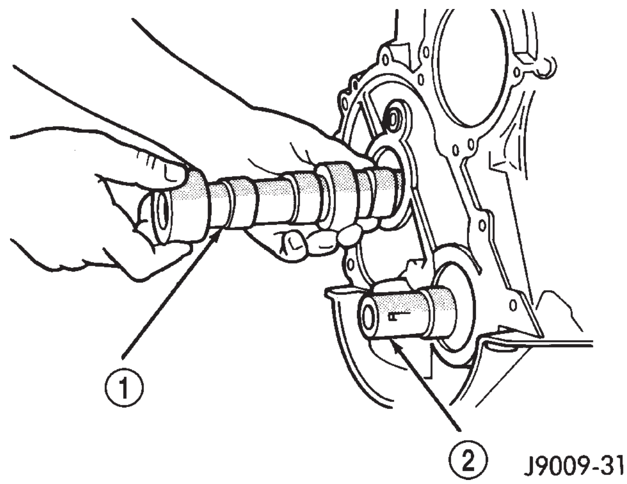


Fig. 61 Camshaft

1 – CAMSHAFT
2 – CRANKSHAFT

INSTALLATION

(1) Inspect the cam lobes for wear.

(2) Inspect the bearing journals for uneven wear pattern or finish.

(3) Inspect the bearings for wear.

(4) Inspect the distributor drive gear for wear.

(5) If the camshaft appears to have been rubbing against the timing case cover, examine the oil pressure relief holes in the rear cam journal. The oil pressure relief holes must be free of debris.

(6) Lubricate the camshaft with Mopar Engine Oil Supplement, or equivalent.

(7) Carefully install the camshaft to prevent damage to the camshaft bearings (Fig. 61).

(8) Turn the tensioner lever to the unlocked (down) position (Fig. 62).

(9) Pull the tensioner block toward the tensioner lever to compress the spring. Hold the block and turn the tensioner lever to the lock position (Fig. 62).

(10) Install the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks aligned.

(11) Install the camshaft sprocket retaining bolt and washer. Tighten the bolt to 108 N·m (80 ft. lbs.) torque.

(12) Release the timing chain tensioner by moving the lever to the unlock position (Fig. 62).

(13) Install the timing case cover with a replacement oil seal (Fig. 63). Refer to Timing Case Cover Installation.

REMOVAL AND INSTALLATION (Continued)

(14) Install the vibration damper.

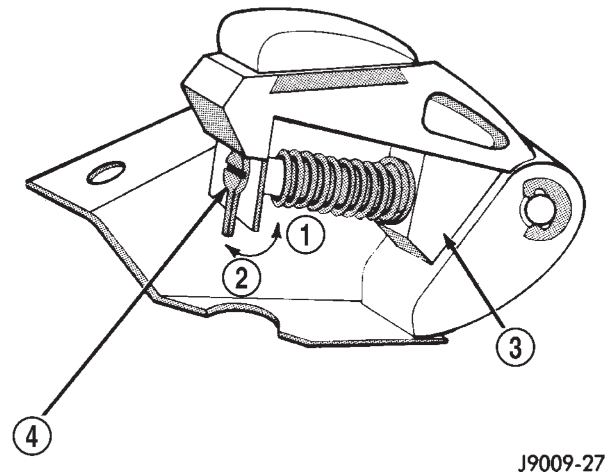


Fig. 62 Loading Timing Chain Tensioner

1 – LOCK
2 – UNLOCK
3 – TENSIONER BLOCK
4 – TENSIONER LEVER

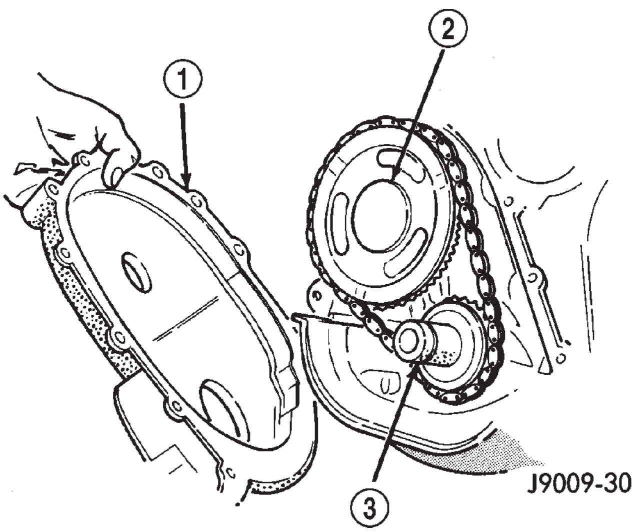


Fig. 63 Timing Case Cover

1 – TIMING CASE COVER
2 – CAMSHAFT
3 – CRANKSHAFT

(15) Install the hydraulic valve tappets.
(16) Install the push rods.
(17) Install the rocker arms, bridges and pivots.
(18) Install the engine cylinder head cover.
(19) Position the oil pump gear. Refer to IGNITION SYSTEM.
(20) Install the distributor and ignition wires. Refer to IGNITION SYSTEM.
(21) Install the resonator assembly and air in-let hose. Tighten clamps to 4 N·m (35 in. lbs.).
(22) Install the radiator or radiator and condenser, if equipped with A/C.
(23) Fill the cooling system.
(24) Connect negative cable to battery.

CAMSHAFT PIN REPLACEMENT

REMOVAL

WARNING: DO NOT LOOSEN THE RADIATOR DRAIN COCK WITH THE SYSTEM HOT AND PRESSURIZED BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) Disconnect negative cable from battery.
(2) Drain the radiator. DO NOT waste reusable coolant. Drain the coolant into a clean container.
(3) Remove the fan and shroud.
(4) Disconnect the radiator overflow tube, radiator hoses, automatic transmission fluid cooler pipes (if equipped).
(5) Remove the radiator.
(6) If equipped with air conditioning:

CAUTION: DO NOT loosen or disconnect any air conditioner system fittings. Move the condenser and receiver/drier aside as a complete assembly.

(a) Remove the A/C compressor serpentine drive belt idler pulley.
(b) Disconnect and remove the generator.
(c) Remove the A/C condenser attaching bolts and move the condenser and receiver/drier assembly up and out of the way.

(7) Remove the serpentine drive belt.
(8) Remove the crankshaft vibration damper.
(9) Remove the timing case cover. Clean the gasket material from the cover.
(10) Rotate crankshaft until the crankshaft sprocket timing mark is closest to and on the center line with the camshaft sprocket timing mark (Fig. 64).
(11) Remove camshaft sprocket retaining bolt.
(12) Remove the crankshaft oil slinger.
(13) Remove the sprockets and chain as an assembly (Fig. 65).

CAUTION: The following procedural step must be accomplished to prevent the camshaft from damaging the rear camshaft plug during pin installation.

(14) Inspect the damaged camshaft pin.
(15) If the pin is a spring-type pin, remove the broken pin by inserting a self-tapping screw into the pin and carefully pulling the pin from the camshaft.

REMOVAL AND INSTALLATION (Continued)

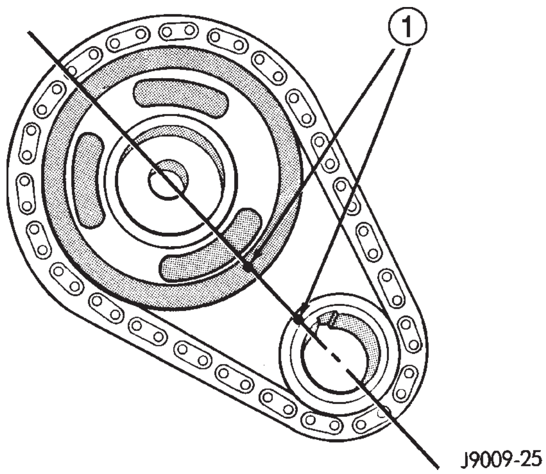


Fig. 64 Timing Chain Alignment

1 – TIMING MARKS

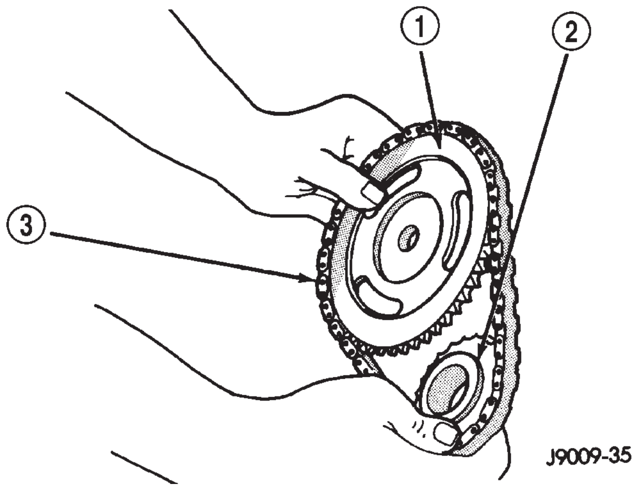


Fig. 65 Camshaft and Crankshaft Sprocket and Chain

1 – CAMSHAFT SPROCKET
2 – CRANKSHAFT SPROCKET
3 – CHAIN

(16) If the pin is a dowel-type pin, center-punch it. Ensure the exact center is located when center-punching the pin.

CAUTION: Cover the opened oil pan area to prevent metal chips from entering the pan.

(17) Drill into the pin center with a 4 mm (5/32 inch) drill bit.

(18) Insert a self-tapping screw into the drilled pin and carefully pull the pin from the camshaft.

INSTALLATION

(1) Clean the camshaft pin hole.

(2) Compress the center of the replacement spring pin with vise grips.

(3) Carefully drive the pin into the camshaft pin hole until it is seated.

(4) Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks aligned (Fig. 64).

(5) To verify correct installation of the timing chain, turn the crankshaft to position the camshaft sprocket timing mark as shown in (Fig. 66). Count the number of chain pins between the timing marks of both sprockets. There must be 20 pins.

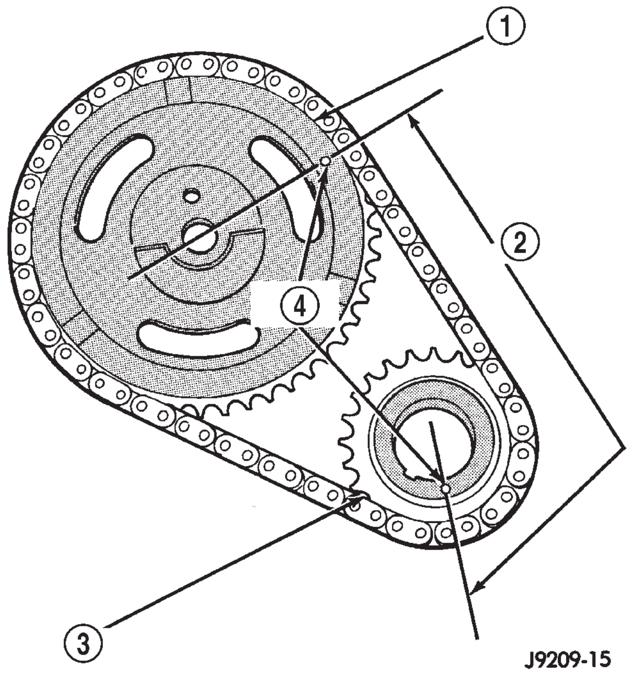


Fig. 66 Verify Crankshaft—Camshaft Installation

1 – CAMSHAFT SPROCKET
2 – 20 PINS
3 – CRANKSHAFT SPROCKET
4 – TIMING MARKS

(6) Install the crankshaft oil slinger.

(7) Tighten the camshaft sprocket bolt to 108 N·m (80 ft. lbs.) torque.

(8) Check the valve timing.

(9) Coat both sides of the replacement timing case cover gasket with gasket sealer. Apply a 3 mm (1/8 inch) bead of Mopar Silicone Rubber Adhesive Sealant, or equivalent to the joint formed at the timing case cover and cylinder block.

(10) Position the timing case cover on the oil pan gasket and the cylinder block.

(11) Place Timing Case Cover Alignment and Seal Installation Tool 6139 in the crankshaft opening of the cover (Fig. 67).

REMOVAL AND INSTALLATION (Continued)

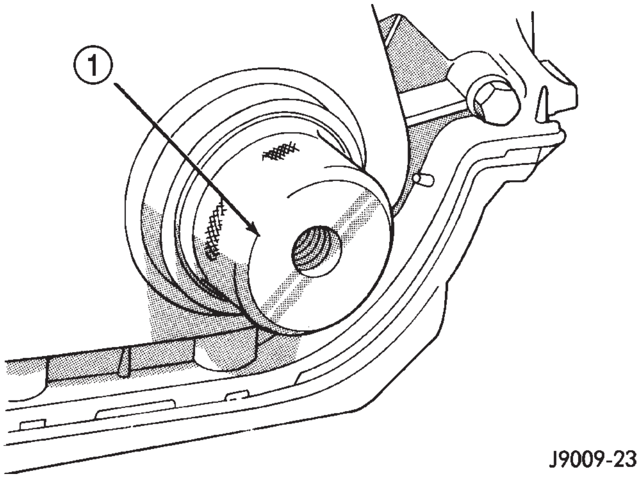


Fig. 67 Timing Case Cover Alignment and Seal Installation Tool 6139

1 – TIMING CASE COVER ALIGNMENT AND SEAL INSTALLATION TOOL

(12) Install the timing case cover-to-cylinder block bolts. Install the oil pan-to-timing case cover bolts.

(13) Tighten the 1/4 inch cover-to-block bolts to 7 N·m (60 in. lbs.) torque. Tighten the 5/16 inch front cover-to-block bolts to 22 N·m (192 in. lbs.) torque. Tighten the oil pan-to-cover 1/4 inch bolts to 14 N·m (120 in. lbs.) torque. Tighten the oil pan-to-cover 5/16 inch bolts to 18 N·m (156 in. lbs.) torque.

(14) Remove the cover alignment tool and install a replacement oil seal into the cover.

(15) Install the vibration damper on the crankshaft.

(16) Lubricate and tighten the damper bolt to 108 N·m (80 ft. lbs.) torque.

(17) If equipped with air conditioning:

(a) Install the A/C compressor serpentine drive belt idler pulley.

(b) Install the generator.

(c) Install the A/C condenser and receiver/drier assembly.

(18) Install the serpentine drive belt on the pulleys and tighten (refer to Group 7, Cooling System for the specifications and procedures).

(19) Install the radiator. Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped. Fill the cooling system.

(20) Install the fan and shroud.

(21) Connect negative cable to battery.

CAMSHAFT BEARINGS

The camshaft rotates within four steel-shelled, babbitt-lined bearings that are pressed into the cylinder block and then line reamed. The camshaft bearing bores and bearing diameters are not the same size. They are stepped down in 0.254 mm (0.010 inch) increments from the front bearing (largest) to the rear bearing (smallest). This permits easier removal and installation of the camshaft. The camshaft bearings are pressure lubricated.

NOTE: It is not advisable to attempt to replace camshaft bearings unless special removal and installation tools are available, such as recommended tool 8544 Camshaft Bushing Remover Installer.

Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear. The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face.

CRANKSHAFT MAIN BEARINGS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the spark plugs.

(3) Raise the vehicle.

(4) Remove the oil pan and oil pump.

(5) Remove only one main bearing cap and lower insert at a time (Fig. 68).

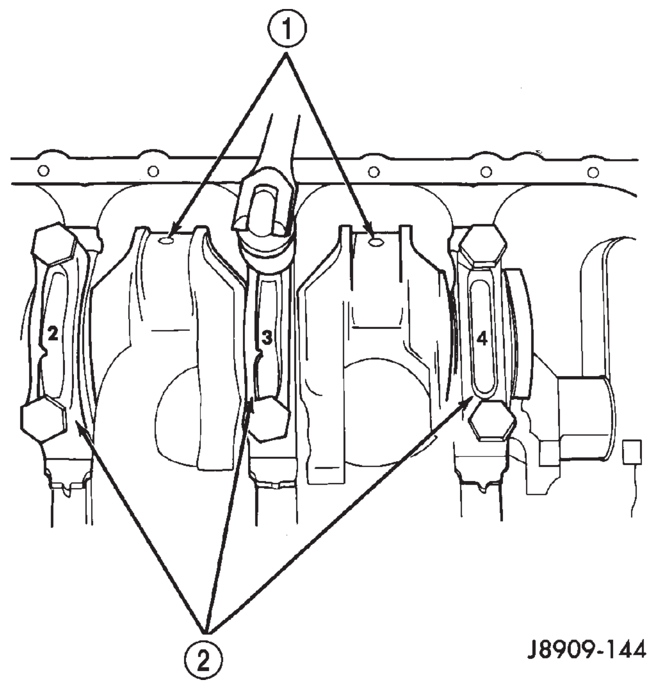


Fig. 68 Removing Main Bearing Caps and Lower Inserts

1 – CONNECTING ROD JOURNAL

2 – MAIN BEARING CAPS

REMOVAL AND INSTALLATION (Continued)

(6) Remove the lower insert from the bearing cap.

(7) Remove the upper insert by LOOSENING (DO NOT REMOVE) all of the other bearing caps. Now insert a small cotter pin tool in the crankshaft journal oil hole. Bend the cotter pin as illustrated to fabricate the tool (Fig. 69). With the cotter pin tool in place, rotate the crankshaft so that the upper bearing insert will rotate in the direction of its locking tab. Because there is no hole in the No.3 main journal, use a tongue depressor or similar soft-faced tool to remove the bearing insert (Fig. 69). After moving the insert approximately 25 mm (1 inch), it can be removed by applying pressure under the tab.

(8) Using the same procedure described above, remove the remaining bearing inserts one at a time for inspection.

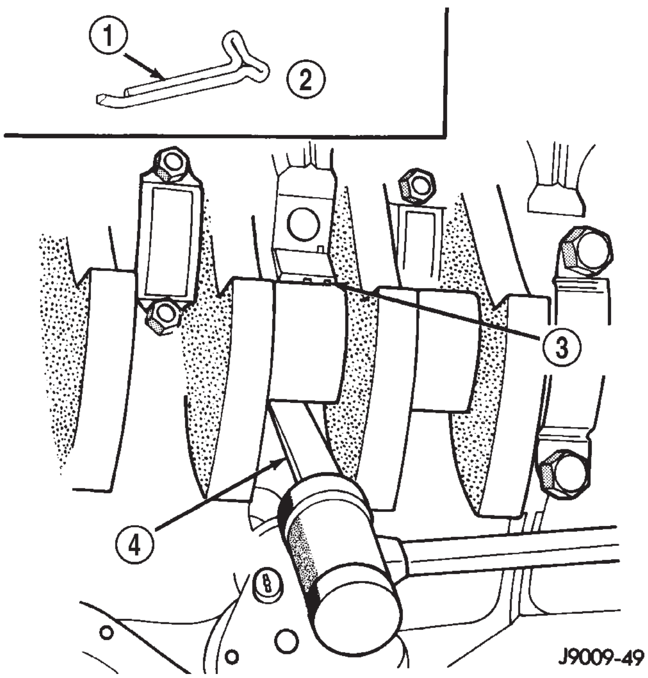


Fig. 69 Removing Upper Inserts

1 – COTTER PIN
2 – FABRICATED TOOL
3 – BEARING INSERT
4 – TONGUE DEPRESSOR

INSTALLATION

(1) Lubricate the bearing surface of each insert with engine oil.

(2) Loosen all the main bearing caps. Install the main bearing upper inserts.

(3) Install the lower bearing inserts into the main bearing caps.

(4) Install the main bearing cap(s) and lower insert(s).

(5) Clean the rear main bearing cap (No.5) mating surfaces.

(6) Apply Mopar® Gasket Maker, or equivalent on the rear bearing cap (Fig. 70). The bead should be 3 mm (0.125 in) thick. DO NOT apply Mopar® Gasket Maker, or equivalent to the lip of the seal.

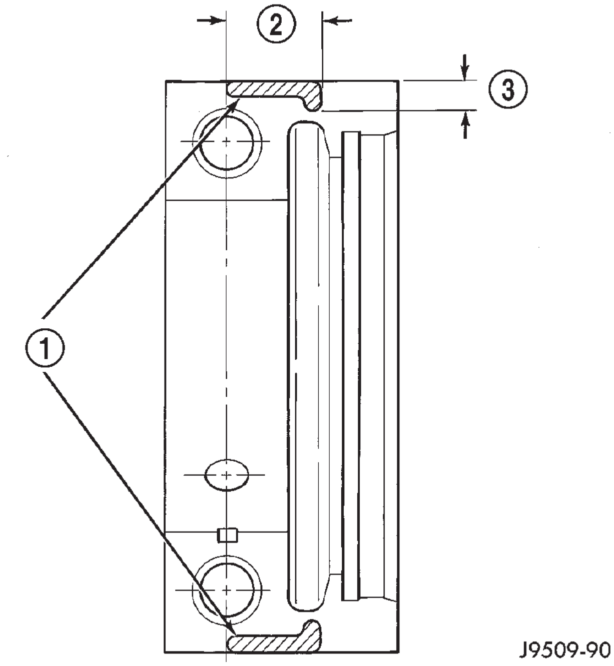


Fig. 70 Location of Mopar® Gasket Maker

1 – MOPAR® GASKET MAKER (OR EQUIVALENT)
2 – 19 mm (.75 IN)
3 – 6 mm (0.025 IN)

(7) Install the rear main bearing cap. DO NOT strike the cap more than twice for proper engagement.

(8) Tighten the bolts of caps 1, 3, 4 and 5 to 54 N·m (40 ft. lbs.) torque. Now tighten these bolts to 95 N·m (70 ft. lbs.) torque. Finally, tighten these bolts to 108 N·m (80 ft. lbs.) torque.

(9) Push the crankshaft forward and backward. Load the crankshaft front or rear and tighten cap bolt No.2 to 54 N·m (40 ft. lbs.) torque. Then tighten to 95 N·m (70 ft. lbs.) torque and finally tighten to 108 N·m (80 ft. lbs.) torque.

(10) Rotate the crankshaft after tightening each main bearing cap to ensure the crankshaft rotates freely.

(11) Check crankshaft end play. Crankshaft end play is controlled by the thrust bearing which is flange and installed at the No.2 main bearing position.

(a) Attach a magnetic base dial indicator to the cylinder block at either the front or rear of the engine.

(b) Position the dial indicator rod so that it is parallel to the center line of the crankshaft.

REMOVAL AND INSTALLATION (Continued)

(c) Pry the crankshaft forward, position the dial indicator to zero.

(d) Pry the crankshaft forward and backward. Note the dial indicator readings. End play is the difference between the high and low measurements (Fig. 71). Correct end play is 0.038-0.165 mm (0.0015-0.0065 inch). The desired specifications are 0.051-0.064 mm (0.002-0.0025 inch).

(e) If end play is not within specification, inspect crankshaft thrust faces for wear. If no wear is apparent, replace the thrust bearing and measure end play. If end play is still not within specification, replace the crankshaft.

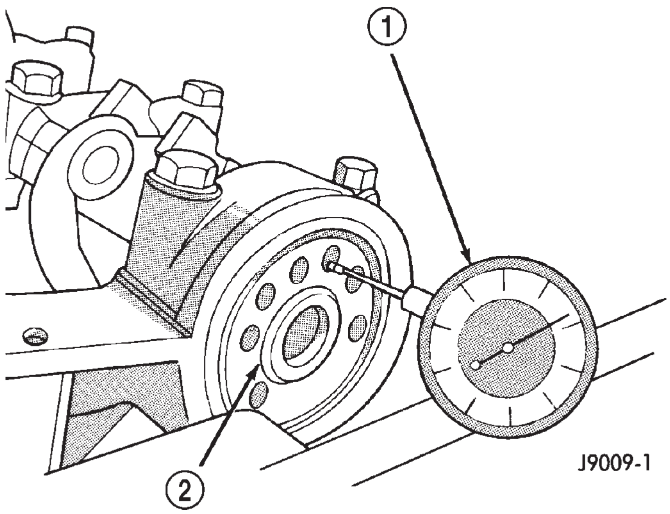


Fig. 71 Crankshaft End Play Measurement

1 – DIAL INDICATOR
2 – CRANKSHAFT

(12) If the crankshaft was removed, install the crankshaft into the cylinder block (refer to Cylinder Block - Assemble).

(13) Install the oil pan.

(14) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(15) Install new rear main seal. Refer to Rear Main Seal in this section.

(16) Lower the vehicle.

(17) Install the spark plugs. Tighten the plugs to 37 N·m (27 ft. lbs.) torque.

(18) Fill the oil pan with engine oil to the safe mark on the dipstick level.

(19) Connect negative cable to battery.

OIL PAN

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise the vehicle.

(3) Remove the oil pan drain plug and drain the engine oil.

(4) Disconnect the exhaust pipe at the engine exhaust manifold.

(5) Disconnect the exhaust hanger at the catalytic converter and lower the pipe.

(6) Remove the engine starter motor.

(7) Remove the flywheel/torque converter housing access cover.

(8) Position a jack stand directly under the engine vibration damper.

(9) Place a piece of wood (2 x 2) between the jack stand and the engine vibration damper.

(10) Remove the engine mount through bolts.

(11) Using the jack stand, raise the engine until adequate clearance is obtained to remove the oil pan.

(12) If equipped, disconnect the transmission cooler lines and oxygen sensor harness from oil pan mounting studs.

(13) Remove the oil pan bolts and studs. Carefully remove the oil pan and gasket.

INSTALLATION

(1) Clean the block and pan gasket surfaces.

(2) Fabricate 4 alignment dowels from 1/4 x 1 1/2 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 72).

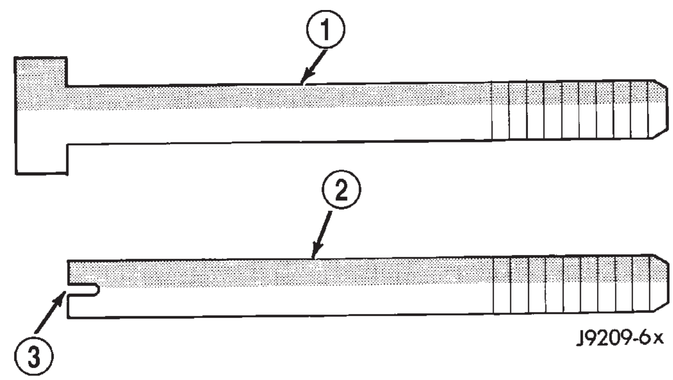


Fig. 72 Fabrication of Alignment Dowels

1 – 1/4′′ × 1 1/2′′ BOLT
2 – DOWEL
3 – SLOT

(3) Install two dowels in the timing case cover. Install the other two dowels in the cylinder block (Fig. 73).

(4) Apply Mopar® Silicone Adhesive Sealant onto the cylinder block in four location as shown (Fig. 74)

(5) Slide the one-piece gasket over the dowels and onto the block and timing case cover.

(6) Position the oil pan over the dowels and onto the gasket.

REMOVAL AND INSTALLATION (Continued)

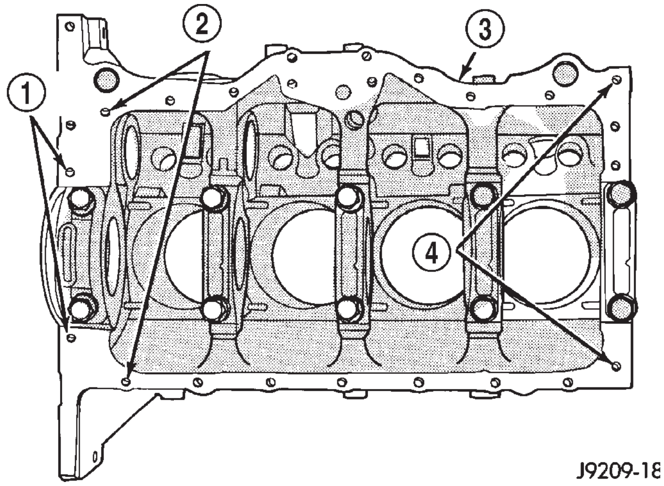


Fig. 73 Position of Dowels in Cylinder Block

1 – 5/16′′ HOLES
2 – DOWEL HOLES
3 – CYLINDER BLOCK
4 – 5/16′′ HOLES

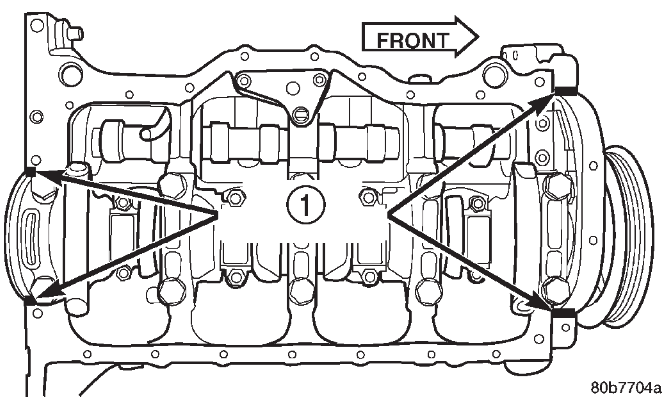


Fig. 74 Location of Mopar® Silicone Adhesive Sealant on Cylinder Block

1 – SEALER LOCATIONS

(7) Install the 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque. Install the 5/16 inch oil pan bolts (Fig. 75). Tighten these bolts to 15 N·m (132 in. lbs.) torque.

(8) Remove the dowels. Install the remaining 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque.

(9) Lower the engine until it is properly located on the engine mounts.

(10) Install the through bolts and tighten the nuts.

(11) Lower the jack stand and remove the piece of wood.

(12) Install the flywheel and torque converter housing access cover.

(13) Install the engine starter motor.

(14) Connect the exhaust pipe to the hanger and to the engine exhaust manifold.

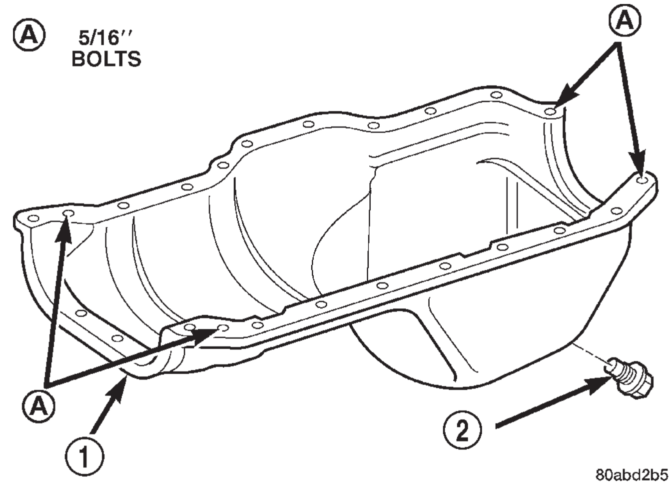


Fig. 75 Position of 5/16 inch Oil Pan Bolts

1 – OIL PAN
2 – OIL PAN DRAIN PLUG

(15) Install the oil pan drain plug (Fig. 75). Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(16) Lower the vehicle.

(17) Connect negative cable to battery.

(18) Fill the oil pan with engine oil to the specified level.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(19) Start the engine and inspect for leaks.

OIL PUMP

The positive-displacement gear-type oil pump is driven by the distributor shaft, which is driven by a gear on the camshaft. Oil is siphoned into the pump through an inlet tube and strainer assembly that is pressed into the pump body.

The pump incorporates a nonadjustable pressure relief valve to limit maximum pressure to 517 kPa (75 psi). In the relief position, the valve permits oil to bypass through a passage in the pump body to the inlet side of the pump.

Oil pump removal or replacement will not affect the distributor timing because the distributor drive gear remains in mesh with the camshaft gear.

REMOVAL

(1) Drain the engine oil.

(2) Remove the oil pan.

(3) Remove the pump-to-cylinder block attaching bolts. Remove the pump assembly with gasket (Fig. 76).

REMOVAL AND INSTALLATION (Continued)

CAUTION: If the oil pump is not to be serviced, DO NOT disturb position of oil inlet tube and strainer assembly in pump body. If the tube is moved within the pump body, a replacement tube and strainer assembly must be installed to assure an airtight seal.

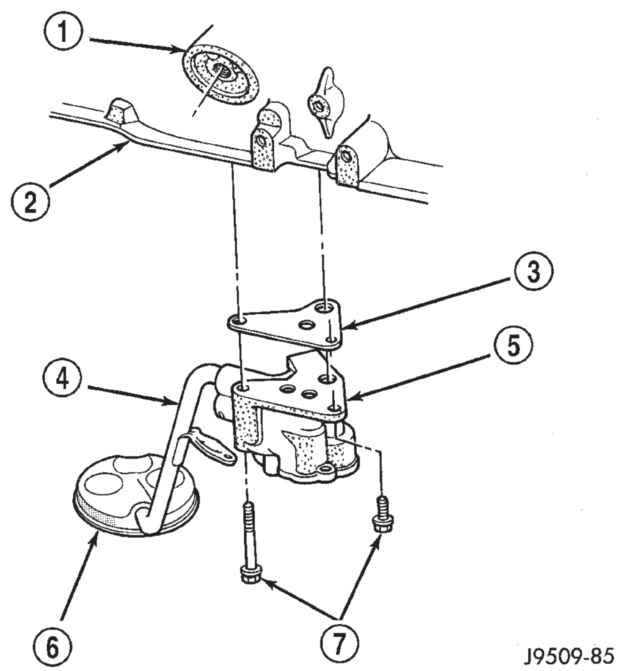


Fig. 76 Oil Pump Assembly

1 – OIL FILTER ADAPTOR
2 – BLOCK
3 – GASKET
4 – OIL INLET TUBE
5 – OIL PUMP
6 – STRAINER ASSEMBLY
7 – ATTACHING BOLTS

INSTALLATION

(1) Install the oil pump on the cylinder block using a replacement gasket. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(2) Install the oil pan and gasket.

(3) Fill the oil pan with oil to the specified level.

PISTON AND CONNECTING ROD

REMOVAL

(1) Remove the engine cylinder head cover.

(2) Remove the rocker arms, bridges and pivots.

(3) Remove the push rods.

(4) Remove the engine cylinder head.

(5) Position the pistons one at a time near the bottom of the stroke. Use a ridge reamer to remove the ridge from the top end of the cylinder walls. Use a protective cloth to collect the cuttings.

(6) Raise the vehicle.

(7) Drain the engine oil.

(8) Remove the oil pan and gasket.

(9) Remove the connecting rod bearing caps and inserts. Mark the caps and rods with the cylinder bore location. The connecting rods and caps are stamped with a two letter combination (Fig. 77).

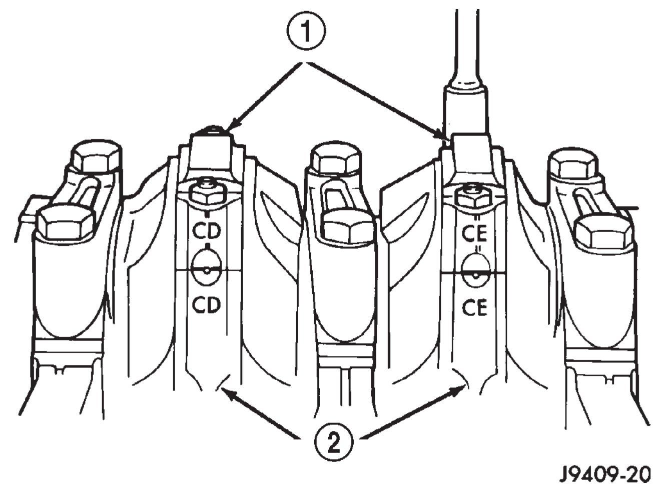


Fig. 77 Stamped Connecting Rods and Caps

1 – CONNECTING ROD CAP
2 – CONNECTING ROD

(10) Lower the vehicle until it is about 2 feet from the floor.

CAUTION: Ensure that the connecting rod bolts DO NOT scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose, slipped over the rod bolts will provide protection during removal.

(11) Have an assistant push the piston and connecting rod assemblies up and through the top of the cylinder bores (Fig. 78).

INSTALLATION

(1) Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean lint-free cloth.

(2) Install the piston rings on the pistons if removed.

(3) Lubricate the piston and rings with clean engine oil.

CAUTION: Ensure that connecting rod bolts do not scratch the crankshaft journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod bolts will provide protection during installation.

(5) Use a piston ring compressor to install the connecting rod and piston assemblies through the top of the cylinder bores (Fig. 79).

REMOVAL AND INSTALLATION (Continued)

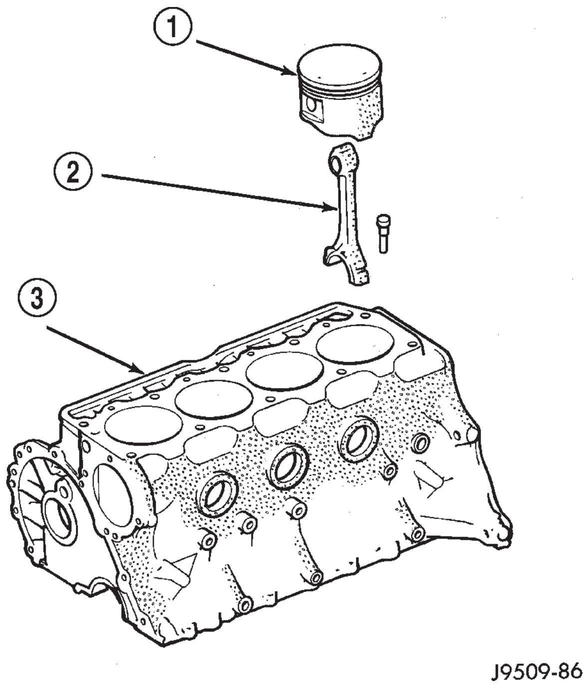


Fig. 78 Removal of Connecting Rod and Piston Assembly

1 – PISTON
2 – CONNECTING ROD
3 – CYLINDER BLOCK

(6) Ensure the arrow on the piston top points to the front of the engine (Fig. 79).

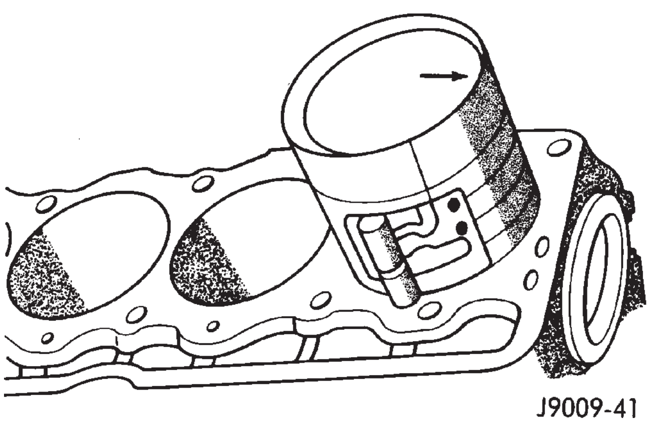


Fig. 79 Rod and Piston Assembly Installation

(7) Raise the vehicle.

(8) Each bearing insert is fitted to its respective journal to obtain the specified clearance between the bearing and the journal. In production, the select fit is obtained by using various-sized, color-coded bearing inserts as listed in the Connecting Rod Bearing Fitting Chart. The color code appears on the edge of the bearing insert. The size is not stamped on inserts used for production of engines.

(9) The rod journal is identified during the engine production by a color-coded paint mark on the adjacent cheek or counterweight toward the flange (rear) end of the crankshaft. The color codes used to indicate journal sizes are listed in the Connecting Rod Bearing Fitting Chart.

(10) When required, upper and lower bearing inserts of different sizes may be used as a pair (refer to Connecting Rod Bearing Fitting Chart). A standard size insert is sometimes used in combination with a 0.025 mm (0.001 inch) undersize insert to reduce clearance 0.013 mm (0.0005 inch).

CAUTION: DO NOT intermix bearing caps. Each connecting rod and bearing cap are stamped with the cylinder number. The stamp is located on a machined surface adjacent to the oil squirt hole that faces the camshaft side of the cylinder block.

(11) Install the connecting rod bearing caps and inserts in the same positions as removed.

CAUTION: Verify that the oil squirt holes in the rods face the camshaft and that the arrows on the pistons face the front of the engine.

(13) Install the oil pan and gaskets as outlined in the installation procedure.

(14) Lower the vehicle.

(15) Install the engine cylinder head, push rods, rocker arms, bridges, pivots and engine cylinder head cover.

(16) Fill the crankcase with engine oil.

REAR MAIN OIL SEAL

REMOVAL

(1) Remove the flywheel or converter drive plate. Discard the old bolts.

(2) Pry out the seal from around the crankshaft flange, making sure not to scratch or nick the crankshaft (Fig. 80).

INSTALLATION

(1) Wipe the seal surface area of the crankshaft until it is clean.

(2) Coat the outer lip of the replacement rear main bearing seal with engine oil.

(3) Carefully position the seal into place. Use rear main Seal Installer Tool 6271A to install the seal flush with the cylinder block.

CAUTION: The felt lip must be located inside the flywheel mounting surface. If the lip is not positioned correctly the flywheel could tear the seal.

REMOVAL AND INSTALLATION (Continued)

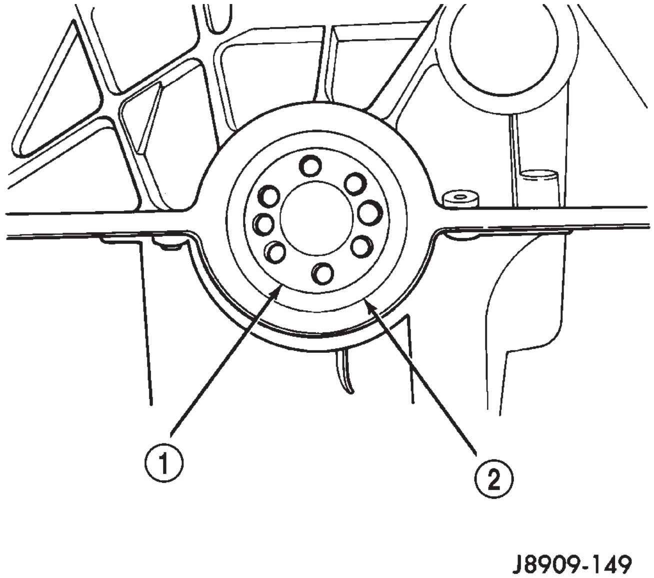


Fig. 80 Replacement of Rear Crankshaft Oil Seal

1 – CRANKSHAFT
2 – CRANKSHAFT OIL SEAL

(4) Install the flywheel or converter drive plate. New bolts MUST be used when installing the flywheel or converter plate. Tighten the new bolts to 68 N·m (50 ft. lbs.) torque. Turn the bolts an additional 60°.

DISASSEMBLY AND ASSEMBLY

CYLINDER HEAD

DISASSEMBLY

(1) Use Valve Spring Compressor Tool MD-998772A and compress each valve spring.

(2) Remove the valve locks, retainers, springs and valve stem oil seals. Discard the oil seals.

(3) Use an Arkansas smooth stone or a jewelers file to remove any burrs on the top of the valve stem, especially around the groove for the locks.

(4) Remove the valves, and place them in a rack in the same order as removed.

ASSEMBLY

(1) Thoroughly clean the valve stems and the valve guide bores.

(2) Lightly lubricate the stem.

(3) Install the valve in the original valve guide bore.

(4) Install the replacement valve stem oil seals on the valve stems. If the 0.381 mm (0.015 inch) oversize valve stems are used, oversize oil seals are required.

(5) Position the valve spring and retainer on the engine cylinder head and compress the valve spring with Valve Spring Compressor Tool MD-998772A.

(6) Install the valve locks and release the tool.

(7) Tap the valve spring from side to side with a hammer to ensure that the spring is properly seated at the engine cylinder head. Also tap the top of the retainer to seat the valve locks.

CLEANING AND INSPECTION

ROCKER ARMS AND PUSH RODS

CLEANING

Clean all the components with cleaning solvent.

Use compressed air to blow out the oil passages in the rocker arms and push rods.

INSPECTION

Inspect the pivot surface area of each rocker arm. Replace any that are scuffed, pitted, cracked or excessively worn.

Inspect the valve stem tip contact surface of each rocker arm and replace any rocker arm that is deeply pitted.

Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn because of lack of oil, replace it and inspect the corresponding hydraulic tappet for excessive wear.

Inspect the push rods for straightness by rolling them on a flat surface or by shining a light between the push rod and the flat surface.

A wear pattern along the length of the push rod is not normal. Inspect the engine cylinder head for obstruction if this condition exists.

HYDRAULIC TAPPETS

CLEANING

Clean each tappet assembly in cleaning solvent to remove all varnish, gum and sludge deposits.

INSPECTION

Inspect for indications of scuffing on the side and base of each tappet body.

Inspect each tappet base for concave wear with a straightedge positioned across the base. If the base is concave, the corresponding lobe on the camshaft is also worn. Replace the camshaft and defective tappets.

CLEANING AND INSPECTION (Continued)

ENGINE CYLINDER HEAD

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and exhaust manifold and engine cylinder head mating surfaces. Remove all gasket material and carbon.

Check to ensure that no coolant or foreign material has fallen into the tappet bore area.

Remove the carbon deposits from the combustion chambers and top of the pistons.

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces.

CYLINDER BLOCK

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:

- The galley at the oil filter adaptor hole, the filter bypass hole (Fig. 81).

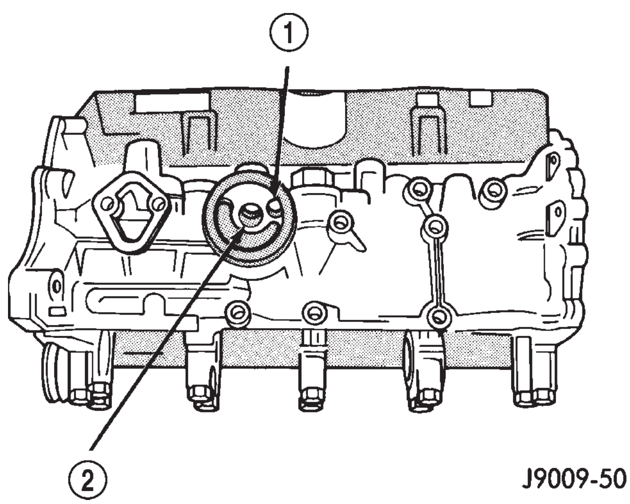


Fig. 81 Oil Filter Adaptor Hole

1 – FILTER BYPASS HOLE
2 – OIL FILTER ADAPTOR HOLE

- The front and rear oil galley holes (Fig. 82) (Fig. 83).
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Mopar® Thread Sealant with Teflon to the threads of the front and rear oil galley plugs. Tighten the plugs to 41 N·m (30 ft. lbs.) torque.

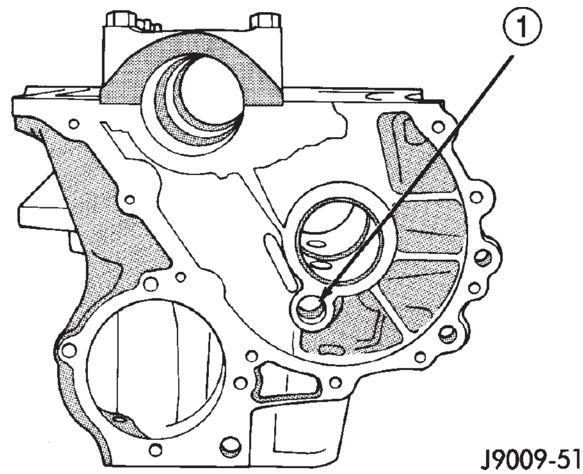


Fig. 82 Front Oil Galley Hole

1 – FRONT OIL GALLEY HOLE

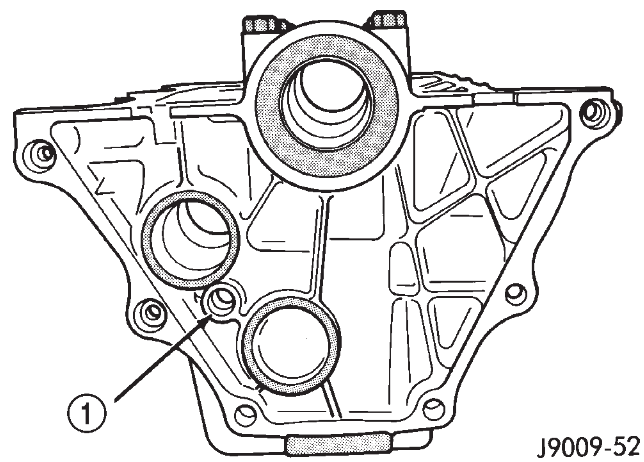


Fig. 83 Rear Oil Galley Hole

1 – REAR OIL GALLEY HOLE

INSPECTION

Inspect the cylinder bores for signs of scorring, pitting or cracks. If the cylinder bores are scorred or pitted the cylinder bores will require boreing or honing to clean them up. Refer to Honing Cylinder Bores in this Section. If the cylinder bore(s) are cracked the cylinder block must be replaced.

Inspect the cylinder block to cylinder head mating surface for flatness and/or pitting.

INTAKE MANIFOLD

CLEANING

CAUTION: DO NOT allow foreign material to enter either the intake manifold ports, or the cylinder head ports.

CLEANING AND INSPECTION (Continued)

Clean the intake manifold to cylinder head mating surfaces.

INSPECTION

Inspect manifold to cylinder head mating surfaces for cracks and/or pitting. Inspect manifold for warp or twist.

EXHAUST MANIFOLD

CLEANING

Clean mating surfaces on cylinder head and manifold, wash with solvent and blow dry with compressed air.

INSPECTION

Inspect manifold for cracks, Inspect mating surfaces of manifold for flatness with a straight edge. Seal surfaces must be flat within 0.1 mm (0.004 inch) overall.

SPECIFICATIONS

2.5L ENGINE SPECIFICATIONS

ENGINE DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	In-line 4 Cylinder
Bore and Stroke	98.4 x 81.0 mm (3.88 x 3.19 in.)
Displacement	2.5L (150 cu. in.)
Compression Ratio	9.1:1
Compression Pressure Range	827 to 1,034 kPa (120 to 150 psi)
Max. Variation Between Cylinders	206 kPa (30 psi)
Firing Order	1–3–4–2
Lubrication	Pressure Feed–Full Flow Filtration
Cooling System	Liquid Cooled–Forced Circulation
Cylinder Block	Cast Iron
Crankshaft	Cast Nodular Iron
Cylinder Head	Cast Iron

DESCRIPTION	SPECIFICATION
Camshaft	Cast Iron
Pistons	Aluminum Alloy
Cylinder Combustion Cavity	Double Quench
Connecting Rods	Cast Iron
CAMSHAFT	
Hydraulic Tappet Clearance	Zero Lash
Bearing Clearance	0.025 - 0.076 mm (0.001 - 0.003 in.)
Bearing Journal Diameter	
No. 1	51.54 - 51.56 mm (2.029 - 2.030 in.)
No. 2	51.28 - 51.31 mm (2.019 - 2.020 in.)
No. 3	51.03 - 51.05 mm (2.009 - 2.010 in.)
No. 4	50.78 - 50.80 mm (1.999 - 2.000 in.)
Base Circle Runout (Max)	0.03 mm (0.001 in.)
Camshaft Lobe Lift	
Exhaust	6.579 mm (0.259 in.)
Intake	6.477 mm (0.255 in.)
Camshaft Duration	
Intake	253.3°
Exhaust	259°
VALVES	
Valve Lift	
Exhaust	10.528 mm (0.4145 in.)
Intake	10.350 mm (0.4075 in.)
Intake Valve Timing	
Opens	15.4° (BTDC)
Closes	58° (ABDC)
Duration	253.3°
Exhaust Valve Timing	
Opens	52.8° (BBDC)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Closes Duration	26.2° (ATDC) 259°
Valve Overlap	41.6°
Valve Lenght (Overall) Intake Exhaust	 124.435 - 125.070 mm (4.899 - 4.924 in.) 125.120 - 125.755 mm (4.927 - 4.952 in.)
Valve Stem Diameter	7.899 - 7.925 mm (0.311 - 0.312 in.)
Stem to Guide Clearance	0.025 - 0.076 mm (0.001 - 0.003 in.)
ValveFace Angle Intake Exhaust	 46.5° 46.5°
Valve Head Diameter Intake Exhaust	 48.387 - 48.641 mm (1.905 - 1.915 in.) 37.973 - 38.227 mm (1.495 - 1.505 in.)
Tip Refinishing (Max Alowable)	0.25 mm (0.010 in.)
VALVE SPRINGS	
Free Length (Approx.)	47.65 mm (1.876 in.)
Spring Load Valve Closed Valve Open	 316 to 351 N @ 41.656 mm (71 to 79 Lbs. @ 1.64 in.) 898.6 to 969.7 N @ 30.89 mm (202 to 218 Lbs. @ 1.216 in.)
Inside Diameter (Top)	21.0 mm to 21.51 mm (0.827 to 0.847 in.)
Installed Height	41.656 mm (1.640 in.)

DESCRIPTION	SPECIFICATION
CRANKSHAFT	
End Play	0.038 to 0.165 mm (0.0015 to 0.0065 in.)
Main Bearing Journal Diameter	63.489 to 63.502 mm (2.4996 to 2.5001 in.)
Main Bearing Journal Width No. 1 No. 2 No. 3-4-5	 27.58 to 27.89 mm (1.086 to 1.098 in.) 32.28 to 32.33 mm (1.271 to 1.273 in.) 30.02 to 30.18 mm (1.182 to 1.188 in.)
Main Bearing Clearance	0.03 to 0.06 mm (0.001 to 0.0025 in.)
Main Bearing Clearance (Preferred)	0.051 mm (0.002 in.)
Connecting Rod Journal Diameter	53.17 to 53.23 mm (2.0934 to 2.0955 in.)
Connecting Rod Journal Width	27.18 to 27.33 mm (1.070 to 1.076 in.)
Out of Round - Max	0.013 mm (0.0005 in.)
Taper - Max	0.013 mm (0.0005 in.)
CYLINDER BLOCK	
Deck Height	236.73 mm (9.320 in.)
Deck Clearance	0.000 mm (0.000 in.)
Cylinder Bore Diameter—Standard	98.45 to 98.48 mm (3.8759 to 3.8775 in.)
Cylinder Bore Diameter— Taper (Max) Out of Round (Max)	 0.025 mm (0.001 in.) 0.025 mm (0.001 in.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Tappet Bore Diameter	23.000 to 23.025 mm (0.9055 to 0.9065 in.)
Flatness	0.03 mm per 25 mm (0.001 in. per 1 in.) 0.05 mm per 152 mm (0.002 in. per 6 in.)
Flatness Max	0.20 mm for total length (0.008 in. for total length)
Main Bearing Bore Diameter	68.3514 to 68.3768 mm (2.691 to 2.692 in.)
CONNECTING RODS	
Total Weight (Less Bearing)	663 to 671 grams (23.39 to 23.67 oz.)
Length (Center to Center)	155.52 to 155.62 mm (6.123 to 6.127 in.)
Piston Pin Bore Diameter	23.59 to 23.62 mm (0.9288 to 0.9298 in.)
Bore (Less Bearings)	56.08 to 56.09 mm (2.2080 to 2.2085 in.)
Bearing Clearance	0.025 to 0.076 mm (0.001 to 0.003 in.)
Bearing Clearance (Preferred)	0.044 to 0.050 mm (0.0015 to 0.0020 in.)
Side Clearance	0.25 to 0.48 mm (0.010 to 0.019 in.)
Twist (Max)	0.002 mm per mm (0.002 in. per in.)
Bend (Max)	0.006 mm per mm (0.006 in. per inch.)
CYLINDER HEAD	
Combustion Chamber	49.9 to 52.9 cc (3.04 to 3.23 cu. in.)
Valve Guide I.D. (Integral)	7.95 to 7.97 mm

DESCRIPTION	SPECIFICATION
	(0.313 to 0.314 in.)
Valve Seat Angle	
Intake	44.5°
Exhaust	44.5°
Valve Seat Width	1.01 to 1.52 mm (0.040 to 0.060 in.)
Valve Seat Runout	0.064 mm (0.0025 in.)
Flatness	0.03 mm per 25 mm (0.001 in. per 1 in.) 0.05 mm per 152 mm (0.002 in. per 6 in.)
Flatness (Max)	0.20 mm for total length (0.008 in. for total length)
ROCKER ARMS, PUSH RODS & TAPPETS	
Rocker Arm Ratio	1.6:1
Push Rod Length (Blue)	241.300 to 241.808 mm (9.500 to 9.520 in.)
Push Rod Diameter	7.92 to 8.00 mm (0.312 to 0.315 in.)
Hydraulic Tappet Diameter	22.962 to 22.974 mm (0.904 to 0.9045 in.)
Tappet to Bore Clearance	0.025 to 0.063 mm (0.001 to 0.0025 in.)
PISTON	
Weight (Less Pin)	417 to 429 grams (14.7 to 15.1 oz.)
Compression Height	40.61 to 40.72 mm (1.599 to 1.603 in.)
Piston to Bore Clearance	0.018 to 0.038 mm (0.0008 to 0.0015 in.)
Piston Ring Groove Height	
Compression Rings	1.530 to 1.555 mm (0.0602 to 0.0612 in.)
Oil Control Ring	4.035 to 4.060 mm

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
	(0.1589 to 0.1598 in.)
Piston Ring Groove Diameter	
Compression Ring #1	88.39 to 88.65 mm (3.48 to 3.49 in.)
Compression Ring #2	87.63 to 87.88 mm (89.66 to 89.92 in.)
Oil Control Ring	89.66 to 89.92 mm (3.53 to 3.54 in.)
Piston Pin Bore Diameter	23.650 to 23.658 mm (0.9312 to 0.9315 in.)
Piston Pin Diameter	23.637 to 23.640 mm (0.9306 to 0.9307 in.)
Piston to Pin Clearance	0.0102 to 0.0208 mm (0.0005 to 0.0009 in.)
PISTON RINGS	
Ring Gap Clearance	
Top Compression Ring	0.229 to 0.610 mm (0.0090 to 0.0240 in.)
2nd Compression Ring	0.483 to 0.965 mm (0.0190 to 0.0380 in.)
Oil Control Steel Rails	0.254 to 1.500 mm (0.010 to 0.060 in.)
Ring Side Clearance	
Compression Rings	0.042 to 0.084 mm (0.0017 to 0.0033 in.)
Oil Control Rings	0.06 to 0.21 mm (0.0024 to 0.0083 in.)
OIL PUMP AND OIL PRESSURE	
Gear to Body Clearance	
(Radial)	0.051 to 0.102 mm (0.002 to 0.004 in.)
(Radial Preferred)	0.051 mm (0.002 in.)
Gear End Clearance—	
Plastigage	0.051 to 0.152 mm (0.002 to 0.006 in.)
Plastigage Preferred	0.051 mm (0.002 in.)
Feeler Gauge	0.1016 to 0.2032 mm (0.004 to 0.008 in.)
Feeler Gauge Preferred	0.1778 mm (0.007 in.)
Min. Pressure (600 rpm)	89.6 kPa (13 psi)
Min. Pressure at Idle (800 rpm)	172 to 241 kPa (25 to 35 psi)
Min. Pressure at 1600 rpm and Higher	255 to 517 kPa (37 to 75 psi)
Oil Pressure Relief	517 kPa (75 psi)

SPECIFICATIONS—TORQUE

TORQUE CHART 2.5L ENGINE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs
A/C Compressor Bracket to Engine—Bolts	47	35	—
A/C Compressor Mounting Bolts	28	—	250
Block Heater Nut	1.8	—	16
Camshaft Sprocket Bolt	108	80	—
Clutch Cover to Flywheel Bolts	31	23	—
Connecting Rod Cap Nuts	45	33	—
Cylinder Block Drain Plugs	41	30	—
Cylinder Head Bolts #1–10 & #12–14	149	110	—
Cylinder Head Bolt #11	135	100	—
Cylinder Head Cover Bolts	13	—	115
Dipstick Tube Bracket to Cylinder Block—Bolt	19	—	168
Distributor Hold-Down Clamp Bolt	23	—	204
Engine Front Insulator Bracket— Bolts	81	60	—

SPECIFICATIONS (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs
Insulator Bracket—Nuts	47	35	—
Insulator—Through Bolt	81	60	—
Engine Rear Support Cushion /Crossmember—Nuts	22	—	192
Support Cushion/Bracket Nuts	46	34	—
Transmission Support Bracket— Bolts	43	32	—
Transmission Support Bracket /Cushion—Bolt	75	55	—
Transmission Support Adaptor Bracket—Bolts	75	55	—
Exhaust Manifold/Pipe Nuts	27	20	—
Exhaust Manifold			
Bolt #1	41	30	—
Bolts #2-5	31	23	—
Nuts 6 and 7	14	—	126
Flywheel/Converter Housing Bolts	38	28	—
Flywheel to Crankshaft Bolts	143	105	—
Front Cover to Block Bolts 1/4-20	7	—	60
Front Cover to Block 5/16-18	22	—	192
Generator Mounting— Bolts	57	42	—
Generator Mounting Bracket to Engine—Bolts	47	35	—
Main Bearing Cap Bolts	108	80	—
Oil Filter Adaptor Bolt	102	75	—
Oil Filter Connector	68	50	—
Oil Filter	18	13	—
Oil Galley Plug	41	30	—
Oil Pan 1/4-20 Bolts	9.5	—	84
Oil Pan 5/16-18 Bolts	15	—	132
Oil Pan Drain Plug	34	25	—
Oil Pressure Sending Unit	15	—	130
Oil Pump Short Attaching Bolts	23	—	204
Oil Pump Long Attaching Bolts	23	—	204
Oil Pump Cover Bolts	8	—	70
Rocker Arm—Bolts	28	21	—
Spark Plugs	37	27	—
Starter Motor Mounting Bolts	45	33	—
Thermostat Housing Bolts	18	—	156
Throttle Body Bolts	10	—	90
Vibration Damper Bolt	108	80	—
Water Pump to Block Bolts	31	23	—

SPECIAL TOOLS

2.5L ENGINE

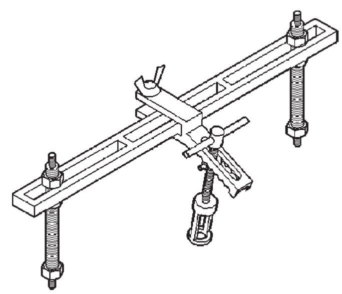


Fig. 84 Valve Spring Compressor Tool MD-998772A

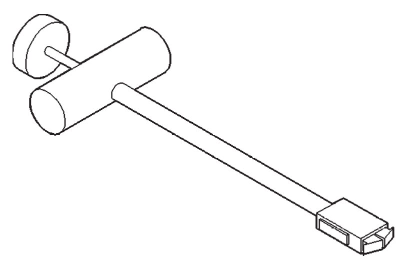


Fig. 85 Hydraulic Valve Tappet Removal Tool C-4129–A

SPECIAL TOOLS (Continued)

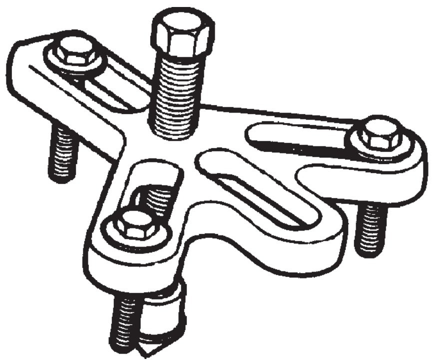


Fig. 86 Vibration Damper Removal Tool 7697

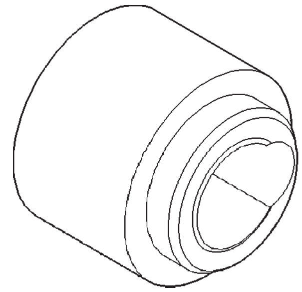
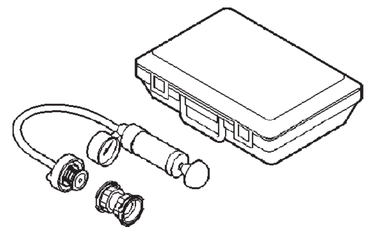
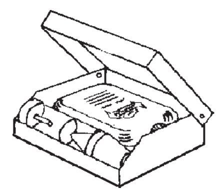


Fig. 87 Timing Case Cover Alignment and Seal Tool 6139



Pressure Tester Kit 7700



Bloc–Chek–Kit C-3685–A

3.9L ENGINE

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
ENGINE 60
ENGINE LUBRICATION SYSTEM 60
CYLINDER HEAD COVER GASKET 63
EXHAUST MANIFOLD 63
INTAKE MANIFOLD 63
CYLINDER HEAD 64
VALVES AND VALVE SPRINGS 64
TIMING CHAIN TENSIONER 64
PISTON AND CONNECTING ROD 64
CRANKSHAFT 64
CRANKSHAFT MAIN BEARINGS 65
CRANKSHAFT OIL SEALS 65
DIAGNOSIS AND TESTING
ENGINE DIAGNOSIS—INTRODUCTION. 65
SERVICE DIAGNOSIS—GASOLINE ENGINES . . . 66
INTAKE MANIFOLD LEAKAGE DIAGNOSIS 70
CYLINDER COMPRESSION PRESSURE TEST . . 70
CYLINDER HEAD GASKET FAILURE DIAGNOSIS 70
CYLINDER COMBUSTION PRESSURE LEAKAGE TEST 70
INSPECTION (ENGINE OIL LEAKS IN GENERAL) 71
REAR SEAL AREA LEAKS—INSPECTION 71
HYDRAULIC TAPPETS. 72
ENGINE OIL PRESSURE 73
SERVICE PROCEDURES
FORM-IN-PLACE GASKETS. 73
ENGINE OIL. 74
REPAIR DAMAGED OR WORN THREADS. 76
CYLINDER BORE—HONING 76
HYDROSTATIC LOCK 76
VALVE TIMING. 77
VALVES, GUIDES AND SPRINGS. 77
TIMING CHAIN STRETCH—MEASURING 79
PISTON—FITTING 79
PISTON RINGS—FITTING 80
CONNECTING ROD BEARINGS—FITTING 81
CRANKSHAFT MAIN BEARINGS—FITTING 82
REMOVAL AND INSTALLATION
ENGINE FRONT MOUNTS 82

page

ENGINE REAR SUPPORT 84
EXHAUST MANIFOLD 87
ENGINE ASSEMBLY. 88
CYLINDER HEAD COVER 89
CYLINDER HEAD COMPONENTS—IN VEHICLE SERVICE. 89
CYLINDER HEADS. 90
VALVES AND VALVE SPRINGS—CYLINDER HEAD REMOVED 91
HYDRAULIC TAPPETS. 92
INTAKE MANIFOLD 92
DISTRIBUTOR DRIVE SHAFT BUSHING 94
VIBRATION DAMPER. 95
TIMING CHAIN COVER 96
TIMING CHAIN AND TENSIONER 97
CAMSHAFT 98
CAMSHAFT BEARINGS 100
CRANKSHAFT MAIN BEARINGS 100
OIL PAN 100
OIL PUMP 102
PISTON AND CONNECTING ROD ASSEMBLY . . 102
CRANKSHAFT 103
CRANKSHAFT FRONT OIL SEAL. 103
CRANKSHAFT REAR OIL SEALS. 104
ENGINE CORE OIL AND CAMSHAFT PLUGS . . 106
DISASSEMBLY AND ASSEMBLY
OIL PUMP 107
CLEANING AND INSPECTION
CYLINDER HEAD COVER 108
CYLINDER HEAD. 108
PISTON AND CONNECTING ROD INSPECTION. 108
OIL PUMP 108
OIL PAN 109
CYLINDER BLOCK 110
INTAKE MANIFOLD 110
EXHAUST MANIFOLD. 111
SPECIFICATIONS
3.9L ENGINE SPECIFICATIONS 111
TORQUE SPECIFICATIONS 115
SPECIAL TOOLS
3.9L ENGINE 116

DESCRIPTION AND OPERATION

ENGINE

DESCRIPTION

The 3.9 Liter (238 CID) six-cylinder engine is a V-Type, lightweight, single cam, overhead valve engine with hydraulic roller tappets. This engine is designed to use unleaded fuel.

The engine lubrication system consists of a rotor type oil pump and a full-flow oil filter.

The cylinders are numbered from front to rear; 1, 3, 5 on the left bank and 2, 4, 6 on the right bank. The firing order is 1-6-5-4-3-2 (Fig. 1).

The engine serial number is stamped into a machined pad located on the left front corner of the cylinder block. When component part replacement is necessary, use the engine type and serial number for reference (Fig. 2).

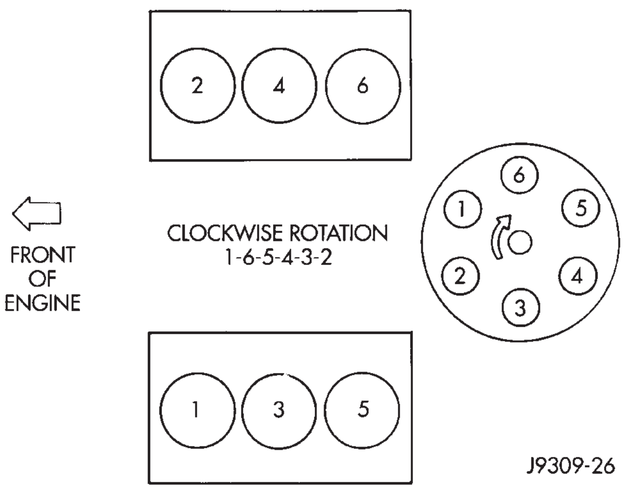


Fig. 1 Firing Order

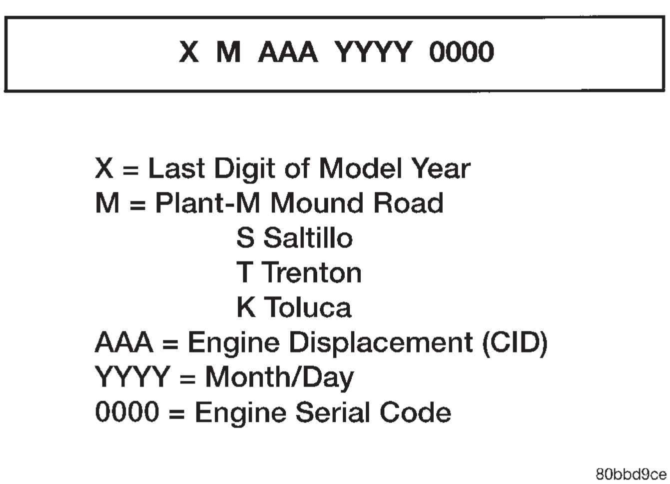


Fig. 2 Engine Identification (Serial) Number

ENGINE LUBRICATION SYSTEM

DESCRIPTION

A gear-type positive displacement pump (Fig. 3) is mounted at the underside of the rear main bearing cap. The pump uses a pick-up tube and screen assembly to gather engine oil from the oil pan.

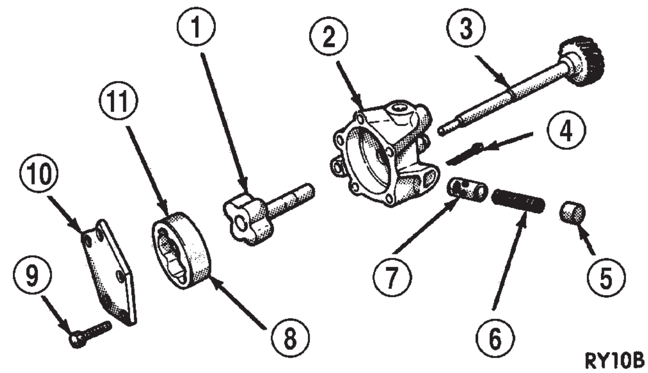


Fig. 3 Positive Displacement Oil Pump—Typical

1 – INNER ROTOR AND SHAFT
2 – BODY
3 – DISTRIBUTOR DRIVESHAFT (REFERENCE)
4 – COTTER PIN
5 – RETAINER CAP
6 – SPRING
7 – RELIEF VALVE
8 – LARGE CHAMFERED EDGE
9 – BOLT
10 – COVER
11 – OUTER ROTOR

OPERATION

The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and pump body, then forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main gallery, which extends the entire length on the right side of the block. The oil then goes down to the No. 1 main bearing, back up to the left side of the block, and into the oil gallery on the left side of the engine.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals to the connecting rod journals. Each connecting rod bearing has half a hole in it, oil passes through the hole when the rods rotate and the hole lines up, oil is then thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

DESCRIPTION AND OPERATION (Continued)

The hydraulic valve tappets receive oil directly from the main oil gallery. The camshaft bearings receive oil from the main bearing galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Oil drains back to the oil pan under the No. 1 main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets, which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components. The oil then passes down through the push rod guide holes and the oil drain-back passages in the cylinder head, past the valve tappet area, and then returns to the oil pan.

DESCRIPTION AND OPERATION (Continued)

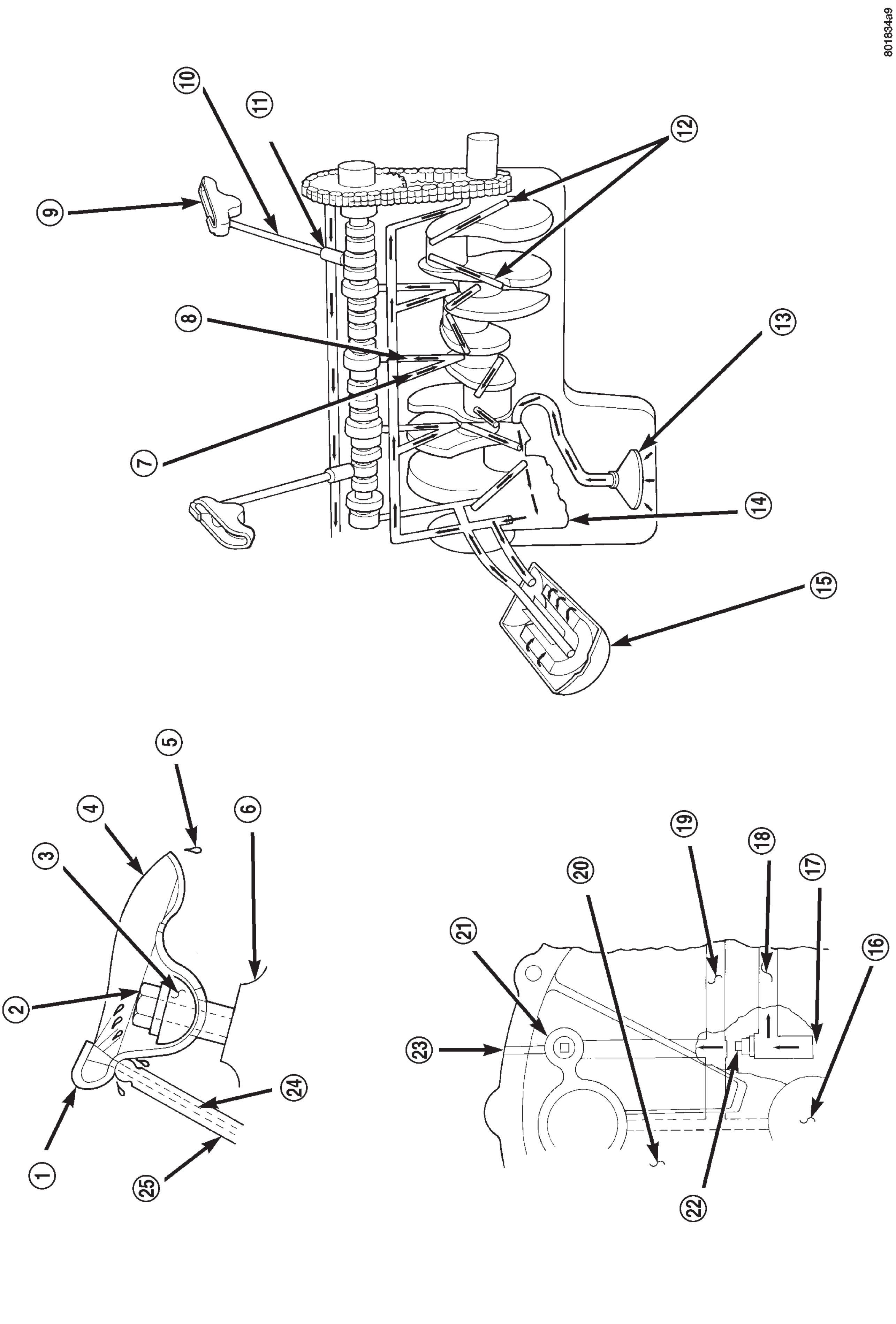


Fig. 4 Oil Lubrication System

DESCRIPTION AND OPERATION (Continued)

1 – OIL DEFLECTOR TAB
2 – BOLT
3 – ROCKER ARM PIVOT
4 – ROCKER ARM
5 – DRIP OILING FOR VALVE TIP
6 – CYLINDER HEAD BOSS
7 – TO MAIN BEARINGS
8 – TO CAMSHAFT BEARINGS
9 – ROCKER ARM
10 – HOLLOW PUSH ROD
11 – TAPPET
12 – TO CONNECTING ROD BEARINGS
13 – OIL INTAKE
14 – OIL PUMP
15 – OIL FILTER
16 – CRANKSHAFT
17 – FROM OIL PUMP
18 – OIL TO FILTER
19 – OIL FROM FILTER TO SYSTEM
20 – PASSAGE TO CAMSHAFT REAR BEARING
21 – RIGHT OIL GALLERY
22 – PLUG
23 – OIL PASSAGE FOR OIL PRESSURE INDICATOR LIGHT
24 – OIL SUPPLY VIA HOLLOW PUSH ROD SUPPLY IS FROM OIL GALLERY METERED THROUGH HYDRAULIC TAPPET
25 – OIL SUPPLY FROM HOLLOW PUSH ROD

CYLINDER HEAD COVER GASKET

DESCRIPTION

The cylinder head cover gasket is a steel-backed silicone gasket, designed for long life usage (Fig. 5).

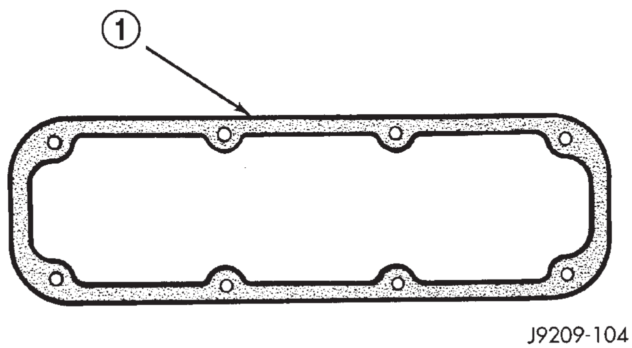


Fig. 5 Cylinder Head Cover Gasket—3.9L Engine

1 – CYLINDER HEAD COVER GASKET

OPERATION

The steel-backed silicone gasket is designed to seal the cylinder head cover for long periods of time through extensive heat and cold, without failure. The gasket is designed to be reusable.

EXHAUST MANIFOLD

DESCRIPTION

The exhaust manifolds (Fig. 6) are constructed of cast iron and are LOG type with balanced flow. One exhaust manifold is attached to each cylinder head.

OPERATION

The exhaust manifolds collect the engine exhaust exiting the combustion chambers, then channels the exhaust gases to the exhaust pipes attached to the manifolds.

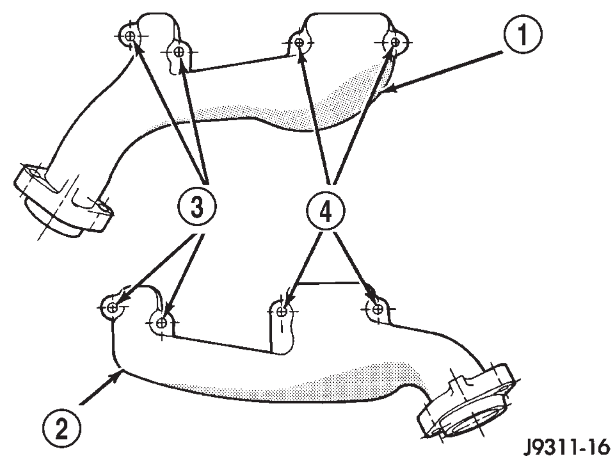


Fig. 6 Exhaust Manifolds—3.9L Engine

1 – EXHAUST MANIFOLD (RIGHT)
2 – EXHAUST MANIFOLD (LEFT)
3 – BOLTS & WASHERS
4 – NUTS & WASHERS

INTAKE MANIFOLD

DESCRIPTION

The aluminum intake manifold is a single plane design with equal length runners (Fig. 7). This manifold uses a separate plenum pan and gasket, therefore the plenum gasket is servicable. It also uses separate flange gaskets and front and rear cross-over gaskets. Extreme care must be used when sealing the gaskets to ensure that excess sealant does not enter the intake runners causing a restriction.

OPERATION

The intake manifold, meters and delivers air to the combustion chambers allowing the fuel delivered by the fuel injectors to ignite, thus producing power.

DESCRIPTION AND OPERATION (Continued)

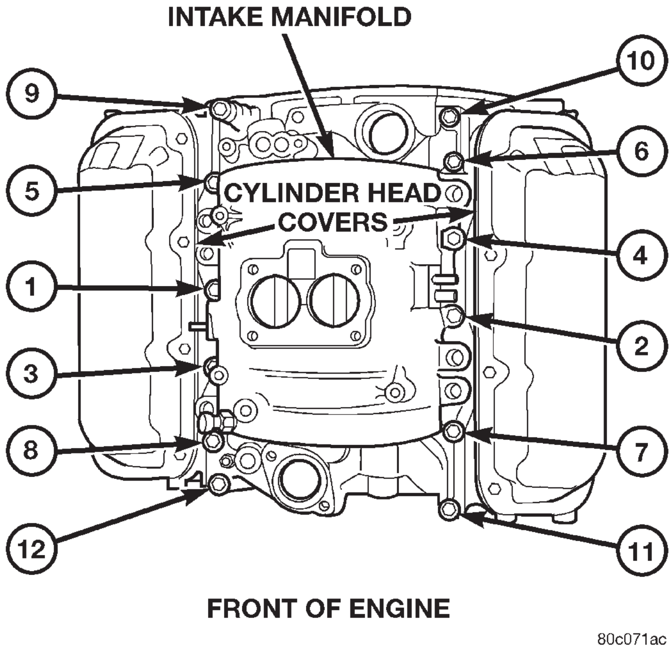


Fig. 7 Intake Manifold with Tightening Sequence—3.9L Engine

CYLINDER HEAD

DESCRIPTION

The cast iron cylinder heads (Fig. 8) are mounted to the cylinder block using eight bolts. The spark plugs are located in the peak of the wedge between the valves.

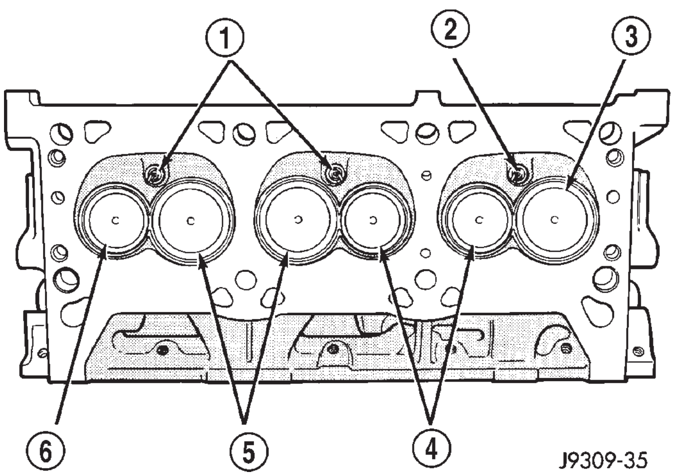


Fig. 8 Cylinder Head Assembly—3.9L Engine

1 – SPARK PLUGS
2 – SPARK PLUG
3 – INTAKE VALVE
4 – EXHAUST VALVES
5 – INTAKE VALVES
6 – EXHAUST VALVE

OPERATION

The cylinder head closes the combustion chamber allowing the pistons to compress the air fuel mixture to the correct ratio for ignition. The valves located in the cylinder head open and close to either allow clean air into the combustion chamber or to allow the exhaust gases out, depending on the stroke of the engine.

VALVES AND VALVE SPRINGS

DESCRIPTION

Both the intake and exhaust valves are made of steel. The intake valve is 48.768 mm (1.92 inches) in diameter and the exhaust valve is 41.148 mm (1.62 inches) in diameter and has a 2.032 mm (0.080 inch) wafer interia welded to the tip for durability. These valves are not splayed.

TIMING CHAIN TENSIONER

DESCRIPTION

The timing chain tensioner is a stamped steel constant tension mechanical design. It is mounted to the front of the engine, behind the timing chain drive.

OPERATION

The timing chain tension is maintained by routing the timing chain through the tensioner assembly. A nylon covered spring steel arm presses on the timing chain maintaining the correct chain tension.

PISTON AND CONNECTING ROD

DESCRIPTION

The pistons are made of aluminum and have three ring grooves, the top two grooves are for the compression rings and the bottom groove is for the oil control ring. The connecting rods are forged steel and are coined prior to heat treat. The piston pins are press fit.

CRANKSHAFT

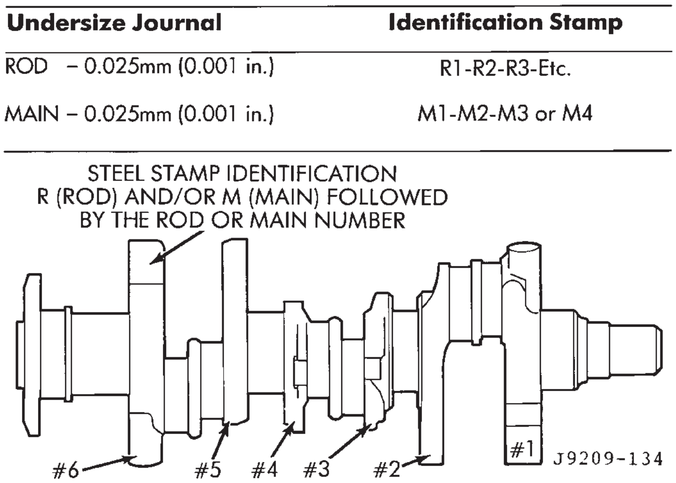
DESCRIPTION

The crankshaft is of a forged steel splayed type design, with four main bearing journals (Fig. 9). The crankshaft is located at the bottom of the engine block and is held in place with four main bearing caps.

OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flywheel or flexplate.

DESCRIPTION AND OPERATION (Continued)



Undersize Journal	Identification Stamp
ROD - 0.025mm (0.001 in.)	R1-R2-R3-Etc.
MAIN - 0.025mm (0.001 in.)	M1-M2-M3 or M4

Fig. 9 Crankshaft—3.9L Engine

CRANKSHAFT MAIN BEARINGS

DESCRIPTION

Main bearings are located in the cylinder block. One half of the main bearing is located in the crankshaft main bore the other half of the matching bearing is located in the main bearing cap (Fig. 10). There are four main bearings. Number two main bearing is flanged, this flange controls crankshaft thrust.

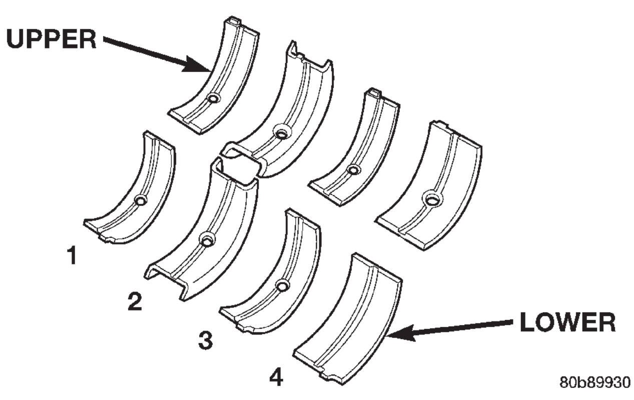


Fig. 10 Main Bearing Orientation

OPERATION

The main bearings encircle the crankshaft main bearing journals, this aligns the crankshaft to the centerline of the engine and allows the crankshaft to turn without wobbling or shaking therefore eliminating vibration. The main bearings are available in standard and undersizes.

CRANKSHAFT OIL SEALS

DESCRIPTION

The crankshaft rear seal is a two piece viton seal. The crankshaft front seal is a one piece viton seal with a steel housing. The front seal is located in the engine front cover. One part of the two piece rear seal is located in a slot in the number four (4) crankshaft main bore, the second part of the two piece seal is located in the number four (4) main bearing cap.

OPERATION

The crankshaft seals prevent oil from leaking from around the crankshaft, either from the rear of the engine or from the engine front cover.

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS—INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Service Diagnosis—Mechanical Chart and the Service Diagnosis—Performance Chart, for possible causes and corrections of malfunctions. Refer to FUEL SYSTEM for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Lash Adjuster (Tappet) Noise Diagnosis
- Engine Oil Leak Inspection

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—GASOLINE ENGINES

PERFORMANCE DIAGNOSIS CHART—GASOLINE ENGINES

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK	1. Weak or dead battery	1. Charge/Replace Battery. Refer to Group 8A, Battery, for correct procedures. Check charging system. Refer to Group 8C, Charging Systems, for correct procedures.
	2. Corroded or loose battery connections	2. Clean/tighten suspect battery/ starter connections
	3. Faulty starter or related circuit(s)	3. Check starting system. Refer to Group 8B, Starting Systems, for correct diagnostics/procedures
	4. Seized accessory drive component	4. Remove accessory drive belt and attempt to start engine. If engine starts, repair/replace seized component.
	5. Engine internal mechanical failure or hydro-static lock	5. Refer to Group 9, Engine, for correct diagnostics/procedures
ENGINE CRANKS BUT WILL NOT START	1. No spark	1. Check for spark. Refer to Group 8D, Ignition System, for correct procedures.
	2. No fuel	2. Perform fuel pressure test, and if necessary, inspect fuel injector(s) and driver circuits. Refer to Group 14, Fuel System, for correct procedures.
	3. Low or no engine compression	3. Perform cylinder compression pressure test. Refer to Group 9, Engine, for correct procedures.
ENGINE LOSS OF POWER	1. Worn or burned distributor rotor	1. Install new distributor rotor
	2. Worn distributor shaft	2. Remove and repair distributor (Refer to group 8D, Ignition System
	3. Worn or incorrect gapped spark plugs	3. Clean plugs and set gap. (Refer to group 8D, Ignition System)
	4. Dirt or water in fuel system	4. Clean system and replace fuel filter
	5. Faulty fuel pump	5. Install new fuel pump
	6. Incorrect valve timing	6. Correct valve timing
	7. Blown cylinder head gasket	7. Install new cylinder head gasket
	8. Low compression	8. Test cylinder compression
	9. Burned, warped, or pitted valves	9. Install/Reface valves as necessary
	10. Plugged or restricted exhaust system	10. Install new parts as necessary
	11. Faulty ignition cables	11. Replace any cracked or shorted cables
	12. Faulty ignition coil	12. Test and replace, as necessary (Refer to Group 8D, ignition system)

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE STALLS OR ROUGH IDLE	1. Carbon build-up on throttle plate	1. Remove throttle body and de-carbon. (Refer to Group 14 for correct procedures)
	2. Engine idle speed too low	2. Check Idle Air Control circuit. (Refer to Group 14, Fuel System)
	3. Worn or incorrectly gapped spark plugs	3. Replace or clean and re-gap spark plugs (Refer to group 8D, Ignition System)
	4. Worn or burned distributor rotor	4. Install new distributor rotor
	5. Spark plug cables defective or crossed	5. Check for correct firing order or replace spark plug cables. (Refer to Group 8D, Ignition System for correct procedures.)
	6. Faulty coil	6. Test and replace, if necessary (Refer to group 8D, Ignition System)
	7. Intake manifold vacuum leak	7. Inspect intake manifold gasket and vacuum hoses. Replace if necessary
	8. EGR valve leaking or stuck open	8. Test and replace, if necessary (Refer to group 25, Emission Control Systems)
ENGINE MISSES ON ACCELERATION	1. Worn or incorrectly gapped spark plugs	1. Replace spark plugs or clean and set gap. (Refer to group 8D, Ignition System)
	2. Spark plug cables defective or crossed	2. Replace or rewire secondary ignition cables. Refer to Group 8D, Ignition System
	3. Dirt in fuel system	3. Clean fuel system
	4. Burned, warped or pitted valves	4. Install new valves
	5. Faulty coil	5. Test and replace as necessary (refer to group 8D, Ignition System)

MECHANICAL DIAGNOSIS CHART—GASOLINE ENGINES

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES/LIFTERS	1. High or low oil level in crankcase	1. Check for correct oil level. Adjust oil level by draining or adding as needed
	2. Thin or diluted oil	2. Change oil (Refer to Engine Oil Service in this group)
	3. Low oil pressure	3. Check engine oil level. If ok, Perform oil pressure test. Refer to this group for engine oil pressure test/specifications
	4. Dirt in tappets/lash adjusters	4. Clean/replace hydraulic tappets/ lash adjusters
	5. Bent push rod(s)	5. Install new push rods

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Worn rocker arms	6. Inspect oil supply to rocker arms and replace worn arms as needed
	7. Worn tappets/lash adjusters	7. Install new hydraulic tappets/lash adjusters
	8. Worn valve guides	8. Inspect all valve guides and replace as necessary
	9. Excessive runout of valve seats or valve faces	9. Grind valves and seats
CONNECTING ROD NOISE	1. Insufficient oil supply	1. Check engine oil level. (Refer to group 0, Lubrication and Maintenance)
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. Refer to this group for engine oil pressure test/specifications
	3. Thin or diluted oil	3. Change oil to correct viscosity. Refer to this group for correct procedure/engine oil specifications
	4. Excessive connecting rod bearing clearance	Measure bearings for correct clearance with plasti-gage. Repair as necessary
	5. Connecting rod journal out of round	5. Replace crankshaft or grind journals
	6. Misaligned connecting rods	6. Replace bent connecting rods
MAIN BEARING NOISE	1. Insufficient oil supply	1. Check engine oil level. (Refer to group 0, Lubrication and Maintenance)
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. Refer to this group for engine oil pressure test/specifications
	3. Thin or diluted oil	3. Change oil to correct viscosity. Refer to this group for correct procedure/engine oil specifications
	4. Excessive main bearing clearance	4. Measure bearings for correct clearance. Repair as necessary
	5. Excessive end play	5. Check crankshaft thrust bearing for excessive wear on flanges
	6. Crankshaft main journal out of round or worn	6. Grind journals or replace crankshaft
	7. Loose flywheel or torque converter	7. Inspect crankshaft, flexplate/ flywheel and bolts for damage. Tighten to correct torque
LOW OIL PRESSURE	1. Low oil level	1. Check oil level and fill if necessary
	2. Faulty oil pressure sending unit	2. Install new sending unit
	3. Clogged oil filter	3. Install new oil filter

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Worn oil pump	4. Replace worn gears or oil pump assy
	5. Thin or diluted oil	5. Change oil to correct viscosity. Refer to this group for correct procedure/engine oil specifications
	6. Excessive bearing clearance	6. Measure bearings for correct clearance
	7. Oil pump relief valve stuck	7. Remove valve to inspect, clean and reinstall
	8. Oil pump suction tube loose, broken, bent or clogged	8. Inspect suction tube and clean or replace if necessary
	9. Oil pump cover warped or cracked	9. Install new oil pump
OIL LEAKS	1. Misaligned or deteriorated gaskets	1. Replace gasket
	2. Loose fastener, broken or porous metal part	2. Tighten, repair or replace the part
	3. Front or rear crankshaft oil seal leaking	3. Replace seal
	4. Leaking oil gallery plug or cup plug	4. Remove and reseal threaded plug. Replace cup style plug
	5. Leaking intake manifold cross-over gaskets	5. Replace gaskets
EXCESSIVE OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. PCV System malfunction	1. Refer to group 25, Emission Control System for correct operation
	2. Intake manifold plenum pan gasket failure	2. Replace plenum pan gasket
	3. Defective valve stem seal(s)	3. Replace seals
	4. Worn or broken piston rings	4. Hone cylinder bores. Install new rings
	5. Scuffed pistons/cylinder walls	5. Hone cylinder bores and replace pistons as required
	6. Carbon in oil control ring groove	6. Remove rings and de-carbon piston
	7. Worn valve guides	6. Repair as necessary
	8. Piston rings fitted too tightly in grooves	8. Remove rings and check ring end gap and side clearance. Replace if necessary

DIAGNOSIS AND TESTING (Continued)

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS, OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.
(2) Spray a small stream of water at the suspected leak area.
(3) If a change in RPMs, the area of the suspected leak has been found.
(4) Repair as required.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise, the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.
(2) Remove the spark plugs.
(3) Secure the throttle in the wide-open position.
(4) Disconnect the ignition coil.
(5) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
(6) Record the compression pressure on the third revolution. Continue the test for the remaining cylinders.

Refer to Engine Specifications for the correct engine compression pressures.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

- Possible indications of the cylinder head gasket leaking between adjacent cylinders are:
- Loss of engine power
- Engine misfiring
- Poor fuel economy
- Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:
- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test in this section. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating)
- Leaks between adjacent cylinders or into water jacket
- Any causes for combustion/compression pressure loss

DIAGNOSIS AND TESTING (Continued)

WARNING: DO NOT REMOVE THE RADIATOR CAP WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM HOT COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the radiator cap.

Start and operate the engine until it attains normal operating temperature, then turn OFF the engine.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

Perform the test procedure on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe or oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to the Cylinder Combustion Pressure Leakage Test Diagnosis chart.

INSPECTION (ENGINE OIL LEAKS IN GENERAL)

Begin with a through visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil-soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to be sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light source.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat previous step.

(5) If the oil leak source is not positively identified at this time, proceed with the air leak detection test method as follows:

(6) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(7) Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.

(8) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(9) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

(10) If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(11) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose. Proceed to next step.

(12) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

REAR SEAL AREA LEAKS—INSPECTION

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Group 9, Engines, for proper repair procedures of these items.

(4) If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

DIAGNOSIS AND TESTING (Continued)

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. Refer to the service Diagnosis—Mechanical, under the Oil Leak row, for components inspections on possible causes and corrections.

(7) After the oil leak root cause and appropriate corrective action have been identified, Refer to Group 9, Engines—Crankshaft Rear Oil Seals, for proper replacement procedures.

HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, check the oil pressure. If vehicle has no oil pressure gauge, install a reliable gauge at the pressure sending-unit. The pressure should be between 207-552 kPa (30-80 psi) at 3,000 RPM.

Check the oil level after the engine reaches normal operating temperature. Allow 5 minutes to stabilize oil level, check dipstick. The oil level in the pan should never be above the FULL mark or below the ADD OIL mark on dipstick. Either of these two conditions could be responsible for noisy tappets.

OIL LEVEL

HIGH

If oil level is above the FULL mark, it is possible for the connecting rods to dip into the oil. With the engine running, this condition could create foam in the oil pan. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

LOW

Low oil level may allow oil pump to take in air. When air is fed to the tappets, they lose length, which allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected, operate the engine at fast idle. Run engine for a sufficient time to allow all of the air inside the tappets to be bled out.

TAPPET NOISE DIAGNOSIS

(1) To determine source of tappet noise, operate engine at idle with cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger, or by the plunger partially sticking in the tappet body cylinder. The tappet should be replaced. A heavy click is caused by a tappet check valve not seating, or by foreign particles wedged between the plunger and the tappet body. This will cause the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

(4) The valve train generates a noise very much like a light tappet noise during normal operation. Care must be taken to ensure that tappets are making the noise. If more than one tappet seems to be noisy, it's probably not the tappets.

LEAK-DOWN TEST

After cleaning and inspection, test each tappet for specified leak-down rate tolerance to ensure zero-lash operation (Fig. 11).

Swing the weighted arm of the hydraulic valve tappet tester away from the ram of the Universal Leak-Down Tester.

(1) Place a 7.925-7.950 mm (0.312-0.313 inch) diameter ball bearing on the plunger cap of the tappet.

(2) Lift the ram and position the tappet (with the ball bearing) inside the tester cup.

(3) Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. DO NOT tighten the hex nut on the ram.

DIAGNOSIS AND TESTING (Continued)

(4) Fill the tester cup with hydraulic valve tappet test oil until the tappet is completely submerged.

(5) Swing the weighted arm onto the push rod and pump the tappet plunger up and down to remove air. When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

(6) Adjust the nose of the ram to align the pointer with the SET mark on the scale of the tester and tighten the hex nut.

(7) Slowly swing the weighted arm onto the push rod.

(8) Rotate the cup by turning the handle at the base of the tester clockwise one revolution every 2 seconds.

(9) Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark. A normally functioning tappet will require 20-110 seconds to leak-down. Discard tappets with leak-down time interval not within this specification.

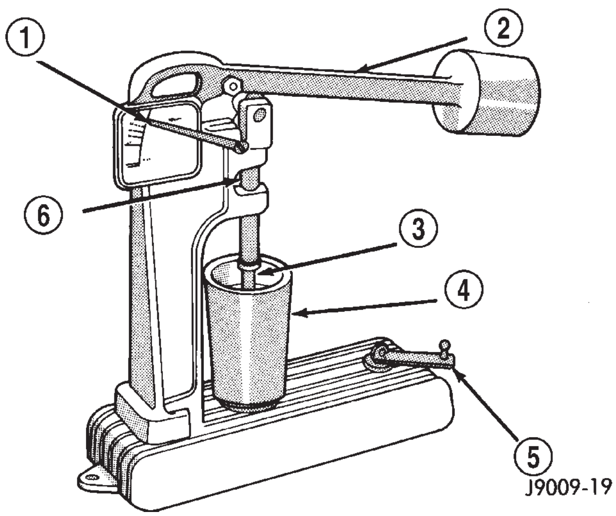


Fig. 11 Leak-Down Tester

1 – POINTER
2 – WEIGHTED ARM
3 – RAM
4 – CUP
5 – HANDLE
6 – PUSH ROD

ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit.

(2) Install Oil Pressure Line and Gauge Tool C-3292. Start engine and record pressure. Refer to Oil Pressure in Engine Specifications for the proper pressures.

SERVICE PROCEDURES

FORM-IN-PLACE GASKETS

There are several places where form-in-place gaskets are used on the engine. **DO NOT use form-in-place gasket material unless specified.** Care must be taken when applying form-in-place gaskets. Bead size, continuity and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over. A continuous bead of the proper width is essential to obtain a leak-free joint.

Two types of form-in-place gasket materials are used in the engine area (Mopar Silicone Rubber Adhesive Sealant and Mopar Gasket Maker). Each have different properties and cannot be used interchangeably.

MOPAR SILICONE RUBBER ADHESIVE SEALANT

Mopar Silicone Rubber Adhesive Sealant, normally black in color, is available in 3 ounce tubes. Moisture in the air causes the sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of a year and will not properly cure if over aged. Always inspect the package for the expiration date before use.

MOPAR GASKET MAKER

Mopar Gasket Maker, normally red in color, is available in 6 cc tubes. This anaerobic type gasket material cures in the absence of air when squeezed between smooth machined metallic surfaces. It will not cure if left in the uncovered tube. DO NOT use on flexible metal flanges.

SURFACE PREPARATION

Parts assembled with form-in-place gaskets may be disassembled without unusual effort. In some instances, it may be necessary to lightly tap the part with a mallet or other suitable tool to break the seal between the mating surfaces. A flat gasket scraper may also be lightly tapped into the joint but care must be taken not to damage the mating surfaces.

Scrape or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Flatten rails with a hammer on a flat plate, if required. Gasket surfaces must be free of oil and dirt. Make sure the old gasket material is removed from blind attaching holes.

SERVICE PROCEDURES (Continued)

GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care.

Mopar Silicone Rubber Adhesive Sealant should be applied in a continuous bead approximately 3 mm (0.12 inch) in diameter. All mounting holes must be circled. For corner sealing, a 3 or 6 mm (1/8 or 1/4 inch) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

Mopar Gasket Maker should be applied sparingly to one gasket surface. The sealant diameter should be 1.00 mm (0.04 inch) or less. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY.

ENGINE OIL SPECIFICATION

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine failure can result.

API SERVICE GRADE CERTIFIED

In gasoline engines, use an engine oil that is API Service Grade Certified (Fig. 12). Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans. MOPAR only provides engine oil that conforms to this certification.

Fig. 12 Engine Oil Container Standard Notations

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 10W-30 specifies a multiple viscosity engine oil. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. When choosing an engine oil, consider the range of temperatures the vehicle will be operated in before the next oil change. Select an engine oil that is best suited to your area's particular ambient temperature range and variation (Fig. 13).

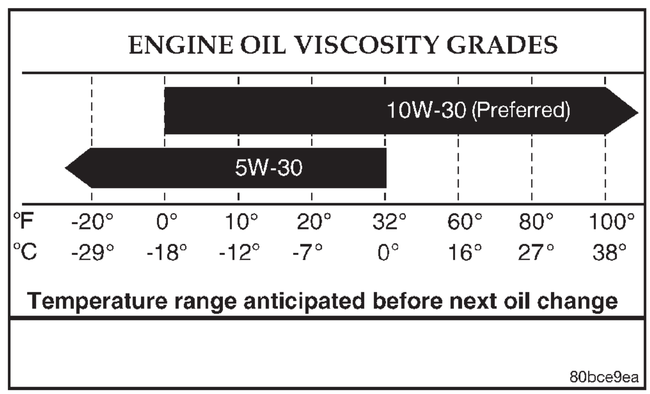


Fig. 13 Temperature/Engine Oil Viscosity Recommendation

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

OIL LEVEL INDICATOR (DIPSTICK)

The engine oil level indicator is located at the right front of the engine, left of the generator on 3.9L engines (Fig. 14).

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, oil foaming and oil pressure loss can result.

SERVICE PROCEDURES (Continued)

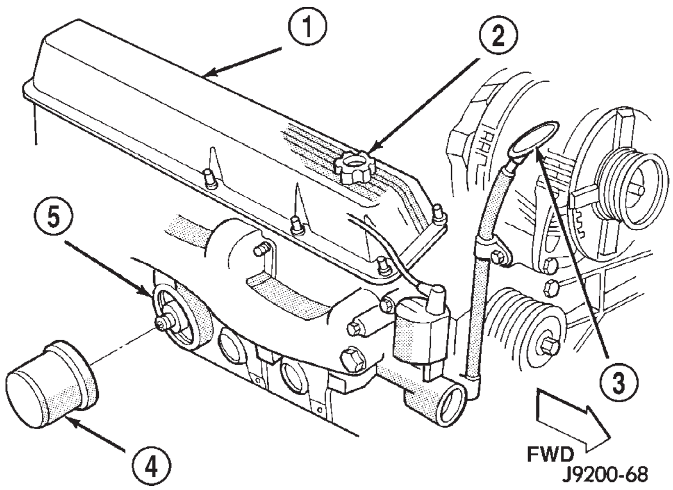


Fig. 14 Engine Oil Dipstick Location—3.9L Engines

1 – CYLINDER HEAD COVER
2 – ENGINE OIL FILL-HOLE CAP
3 – DIPSTICK
4 – ENGINE OIL FILTER
5 – FILTER BOSS

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

(5) Remove dipstick, with handle held above the tip, take oil level reading.

(6) Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule. This information can be found in your owner's manual.

TO CHANGE ENGINE OIL

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE OIL FILTER CHANGE

FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar or equivalent oil filter be used.

OIL FILTER REMOVAL

(1) Position a drain pan under the oil filter.

(2) Using a suitable oil filter wrench loosen filter.

(3) Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss (Fig. 15).

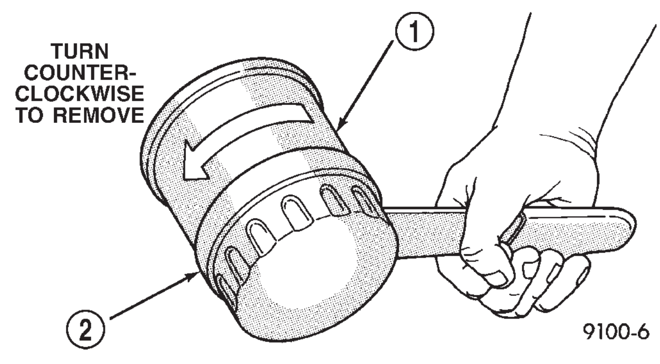


Fig. 15 Oil Filter Removal—Typical

1 – ENGINE OIL FILTER
2 – OIL FILTER WRENCH

(4) When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(5) With a wiping cloth, clean the gasket sealing surface (Fig. 16) of oil and grime.

OIL FILTER INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil or chassis grease.

(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 16) hand tighten filter one full turn, do not over tighten.

(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

SERVICE PROCEDURES (Continued)

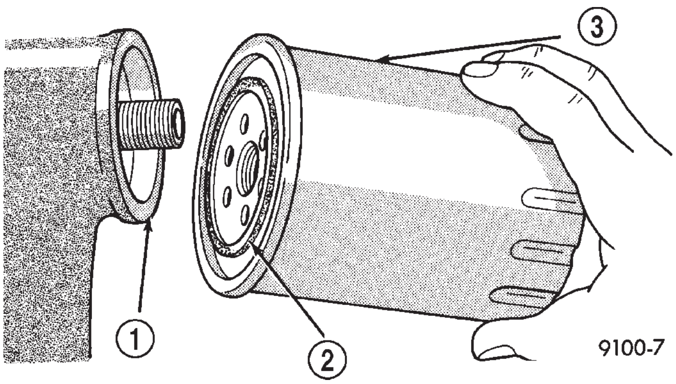


Fig. 16 Oil Filter Sealing Surface—Typical

1 – SEALING SURFACE
2 – RUBBER GASKET
3 – OIL FILTER

REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

CYLINDER BORE—HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

(1) Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

(2) Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings (Fig. 17).

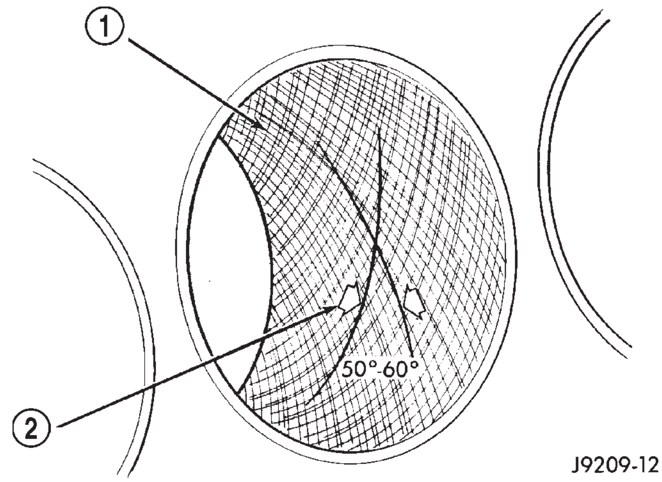


Fig. 17 Cylinder Bore Crosshatch Pattern

1 – CROSSHATCH PATTERN
2 – INTERSECT ANGLE

(4) A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.

(5) After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

HYDROSTATIC LOCK

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Perform the Fuel Pressure Release Procedure (refer to Group 14, Fuel System).

(2) Disconnect the battery negative cable.

(3) Inspect air cleaner, induction system and intake manifold to ensure system is dry and clear of foreign material.

(4) Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the plugs from the engine.

SERVICE PROCEDURES (Continued)

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

(5) With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.

(6) Identify the fluid in the cylinders (i.e. coolant, fuel, oil, etc.).

(7) Make sure all fluid has been removed from the cylinders.

(8) Repair engine or components as necessary to prevent this problem from occurring again.

(9) Squirt engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.

(10) Install new spark plugs.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil.

(15) Connect the negative cable to the battery.

(16) Start the engine and check for any leaks.

VALVE TIMING

(1) Turn crankshaft until the No. 6 exhaust valve is closing and No. 6 intake valve is opening.

(2) Insert a 6.350 mm (1/4 in.) spacer between rocker arm pad and stem tip of No. 1 intake valve. Allow spring load to bleed tappet down giving, in effect, a solid tappet.

(3) Install a dial indicator so plunger contacts valve spring retainer as nearly perpendicular as possible. Zero the indicator.

(4) Rotate the crankshaft clockwise (normal running direction) until the valve has lifted 0.254 mm (0.010 inch). The timing of the crankshaft should now read from 10° before top dead center to 2° after top dead center. Remove spacer.

CAUTION: DO NOT turn crankshaft any further clockwise, as valve spring might bottom and result in serious damage.

(5) If reading is not within specified limits:

(a) Check sprocket index marks.

(b) Inspect timing chain for wear.

(c) Check accuracy of TDC mark on timing indicator.

VALVES, GUIDES AND SPRINGS

VALVE CLEANING

Clean valves thoroughly. Discard burned, warped, or cracked valves.

Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

VALVE GUIDES

Measure valve stems for wear. If wear exceeds 0.051 mm (0.002 in.), replace the valve.

Measure valve stem guide clearance as follows:

(1) Install Valve Guide Sleeve Tool C-3973 over valve stem and install valve (Fig. 18). The special sleeve places the valve at the correct height for checking with a dial indicator.

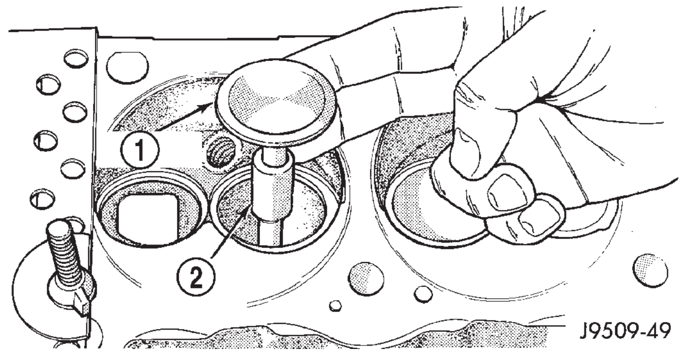


Fig. 18 Positioning Valve with Tool C-3973

1 – VALVE
2 – SPACER TOOL

(2) Attach dial indicator Tool C-3339 to cylinder head and set it at right angles to valve stem being measured (Fig. 19).

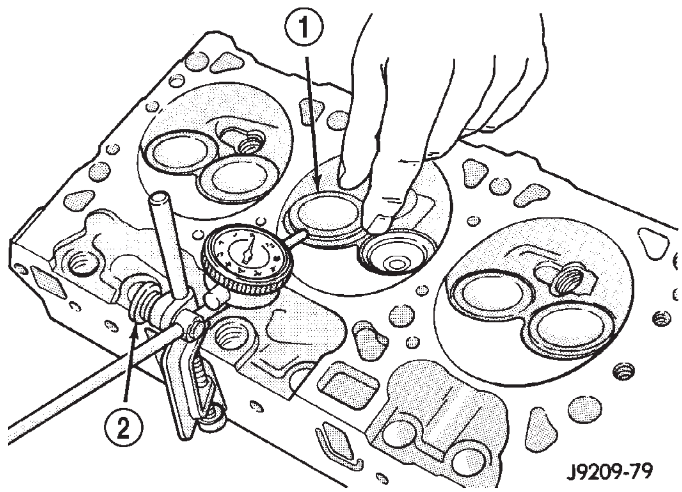


Fig. 19 Measuring Valve Guide Wear

1 – VALVE
2 – SPECIAL TOOL C-3339

(3) Move valve to and from the indicator. The total dial indicator reading should not exceed 0.432 mm (0.017 in.). Ream the guides for valves with oversize stems if dial indicator reading is excessive or if the stems are scuffed or scored.

SERVICE PROCEDURES (Continued)

VALVE GUIDES

Service valves with oversize stems are available. Refer to the table below.

REAMER SIZES CHART

REAMER O/S	VALVE GUIDE SIZE
0.076 mm (0.003 in.)	8.026 - 8.052 mm (0.316 - 0.317 in.)
0.381 mm (0.015 in.)	8.331 - 8.357 mm (0.328 - 0.329 in.)

(1) Slowly turn reamer by hand and clean guide thoroughly before installing new valve. **Ream the valve guides from standard to 0.381 mm (0.015 in.). Use a two step procedure so the valve guides are reamed true in relation to the valve seat:**

- Step 1—Ream to 0.0763 mm (0.003 inch).
- Step 2—Ream to 0.381 mm (0.015 inch).

REFACING VALVES AND VALVE SEATS

The intake and exhaust valves have a 43-1/4° to 43-3/4° face angle and a 44-1/4° to 44-3/4° seat angle (Fig. 20).

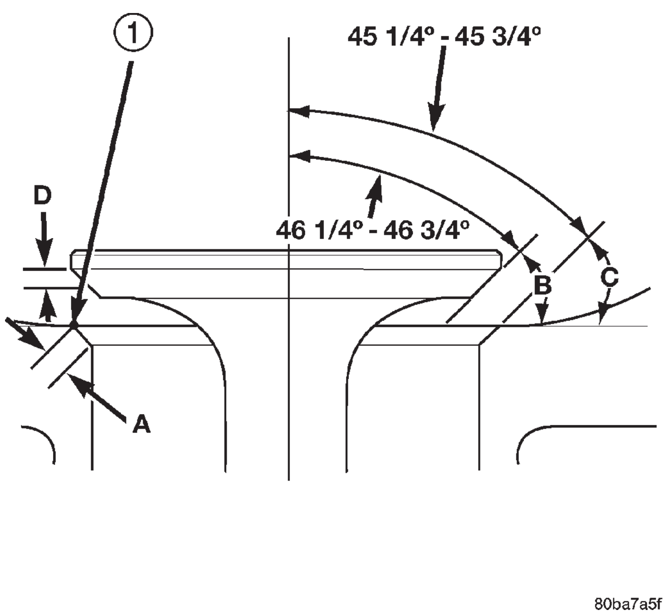


Fig. 20 Valve Face and Seat Angles

1 – CONTACT POINT

VALVES

Inspect the remaining margin after the valves are refaced (Fig. 21). Valves with less than 1.190 mm (0.047 in.) margin should be discarded.

VALVE FACE AND VALVE SEAT ANGLE CHART

ITEM	DESCRIPTION	SPECIFICATION
A	SEAT WIDTH	
	INTAKE	1.016 - 1.524 mm (0.040 - 0.060 in.)
	EXHAUST	1.524 - 2.032 mm (0.060 - 0.080 in.)
B	FACE ANGLE (INT. AND EXT.)	43¼° - 43¾°
C	SEAT ANGLE (INT. AND EXT.)	44¼° - 44¾°
D	CONTACT SURFACE	—

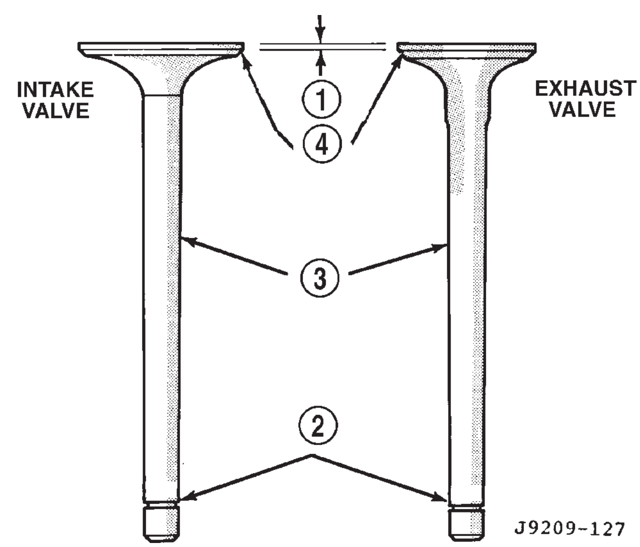


Fig. 21 Intake and Exhaust Valves

1 – MARGIN
2 – VALVE SPRING RETAINER LOCK GROOVE
3 – STEM
4 – FACE

VALVE SEATS

CAUTION: DO NOT un-shroud valves during valve seat refacing (Fig. 22).

(1) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(2) Measure the concentricity of valve seat using a dial indicator. Total runout should not exceed 0.051 mm (0.002 in.) total indicator reading.

SERVICE PROCEDURES (Continued)

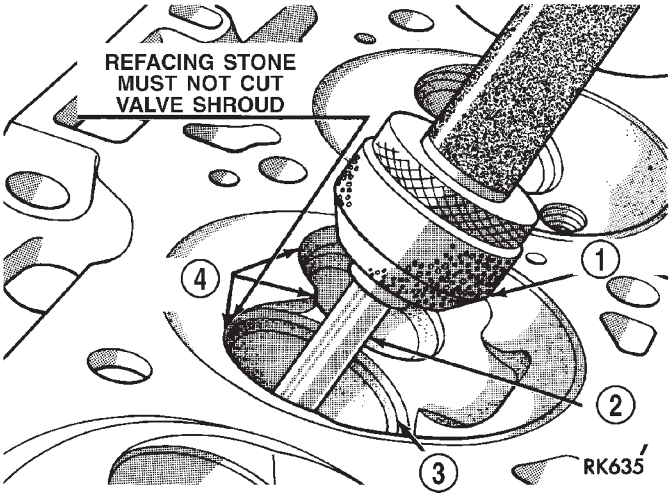


Fig. 22 Refacing Valve Seats

1 – STONE
2 – PILOT
3 – VALVE SEAT
4 – SHROUD

(3) Inspect the valve seat with Prussian blue, to determine where the valve contacts the seat. To do this, coat valve seat LIGHTLY with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to the top edge of valve face, lower valve seat with a 15° stone. If the blue is transferred to bottom edge of valve face raise valve seat with a 60° stone.

(4) When seat is properly positioned the width of intake seats should be 1.016-1.524 mm (0.040-0.060 in.). The width of the exhaust seats should be 1.524-2.032 mm (0.060-0.080 in.).

VALVE SPRINGS

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. As an example the compression length of the spring to be tested is 1-5/16 in.. Turn table of Universal Valve Spring Tester Tool until surface is in line with the 1-5/16 in. mark on the threaded stud. Be sure the zero mark is to the front (Fig. 23). Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by 2. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to specifications to obtain specified height and allowable tensions. Discard the springs that do not meet specifications.

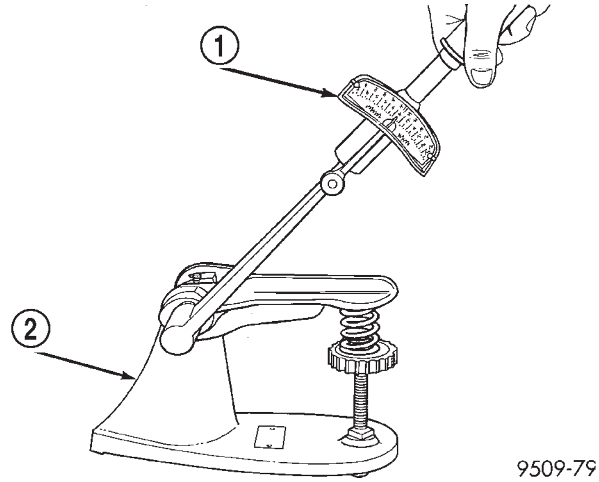


Fig. 23 Testing Valve Spring for Compressed Length

1 – TORQUE WRENCH
2 – VALVE SPRING TESTER

TIMING CHAIN STRETCH—MEASURING

NOTE: Timing chain tensioner must be removed for this operation.

(1) Place a scale next to the timing chain so that any movement of the chain can be measured.

(2) Place a torque wrench and socket over camshaft sprocket attaching bolt. Apply torque in the direction of crankshaft rotation to take up slack; 41 N·m (30 ft. lbs.) torque with cylinder head installed or 20 N·m (15 ft. lbs.) torque with cylinder head removed. With torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block the crankshaft to prevent rotation.

(3) Hold a scale with dimensional reading even with the edge of a chain link. With cylinder heads installed, apply 14 N·m (30 ft. lbs.) torque in the reverse direction. With the cylinder heads removed, apply 20 N·m (15 ft. lbs.) torque in the reverse direction. Note the amount of chain movement (Fig. 24).

(4) Install a new timing chain, if its movement exceeds 3.175 mm (1/8 inch).

PISTON—FITTING

Check the cylinder block bore for out-of-round, taper, scoring, or scuffing.

Check the pistons for taper and elliptical shape before they are fitted into the cylinder bore (Fig. 25).

Piston and cylinder wall must be clean and dry. Specified clearance between the piston and the cylinder wall is 0.013-0.038 mm (0.0005-0.0015 in.) at 21°C (70°F).

SERVICE PROCEDURES (Continued)

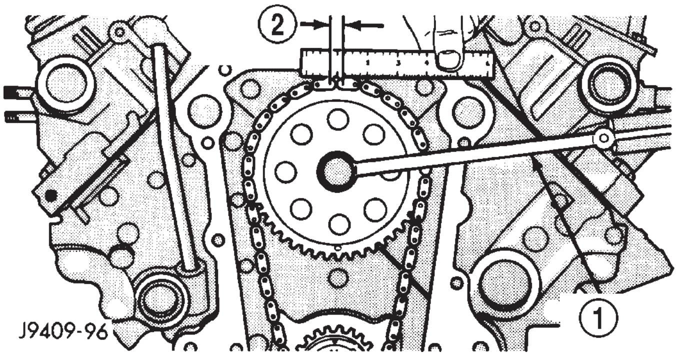


Fig. 24 Measuring Timing Chain Wear and Stretch

1 – TORQUE WRENCH
2 – 3.175 MM (0.125 IN.)

Piston diameter should be measured at the top of skirt, 90° to piston pin axis. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line.

Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).

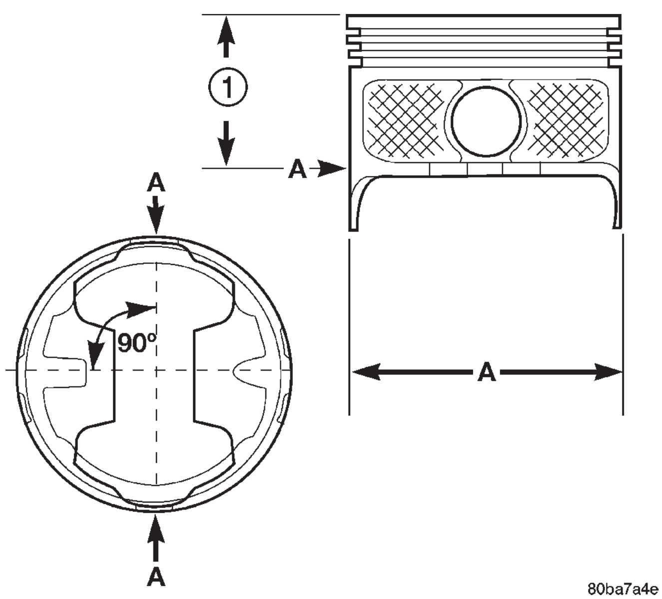


Fig. 25 Piston Measurements

1 – 62.230 mm (2.45 IN.)

PISTON RINGS—FITTING

(1) Measurement of end gaps:

(a) Measure piston ring gap 2 in. from bottom of cylinder bore. An inverted piston can be used to push the rings down to ensure positioning rings squarely in the cylinder bore before measuring.

(b) Insert feeler gauge in the gap. The top compression ring gap should be between 0.254-0.508 mm (0.010-0.020 in.). The second compression ring gap should be between 0.508-0.762 mm (0.020-0.030 in.). The oil ring gap should be 0.254-1.270 mm (0.010-0.050 in.).

(c) Rings with insufficient end gap may be properly filed to the correct dimension. Rings with excess gaps should not be used.

(2) Install rings, and confirm ring side clearance:

(a) Install oil rings being careful not to nick or scratch the piston. Install the oil control rings according to instructions in the package. It is not necessary to use a tool to install the upper and lower rails. Insert oil rail spacer first, then side rails.

(b) Install the second compression rings using Installation Tool C-4184. The compression rings

PISTON MEASUREMENTS CHART

PISTON	A = PISTON DIAMETER		BORE DIAMETER	
	MIN. mm (in.)	MAX. mm (in.)	MIN. mm (in.)	MAX. mm (in.)
A	99.280 (3.9087)	99.294 (3.9092)	99.308 (3.9098)	99.320 (3.9103)
B	99.294 (3.9092)	99.306 (3.9097)	99.320 (3.9103)	99.333 (3.9108)
C	99.306 (3.9097)	99.319 (3.9102)	99.333 (3.9108)	99.345 (3.9113)
D	99.319 (3.9102)	99.332 (3.9107)	99.346 (3.9113)	99.358 (3.9118)
E	99.332 (3.9107)	99.344 (3.9112)	99.358 (3.9118)	99.371 (3.9123)
DESCRIPTION		SPECIFICATION		
PISTON PIN BORE		25.007 - 25.014 mm (.9845 -.9848 in.)		
RING GROOVE HEIGHT (OIL RAIL)		4.0309 - 4.0538 mm (.1587 -.1596 in.)		
(COMPRESSION RAIL)		2.0294 - 2.0548 mm (.0799 -.0809 in.)		
TOTAL FINISHED WEIGHT		594.6 ± 2 grams (20.974 ±.0706 ounces)		

SERVICE PROCEDURES (Continued)

must be installed with the identification mark face up (toward top of piston) and chamfer facing down. An identification mark on the ring is a drill point, a stamped letter “O”, an oval depression, or the word “TOP” (Fig. 26) (Fig. 28).

(c) Using a ring installer, install the top compression ring with the chamfer facing up (Fig. 27) (Fig. 28). An identification mark on the ring is a drill point, a stamped letter “O”, an oval depression or the word “TOP” facing up.

(d) Measure side clearance between piston ring and ring land. Clearance should be 0.074-0.097 mm (0.0029-0.0038 in.) for the compression rings. The steel rail oil ring should be free in groove, but should not exceed 0.246 mm (0.0097 in.) side clearance.

(e) Pistons with insufficient, or excessive, side clearance should be replaced.

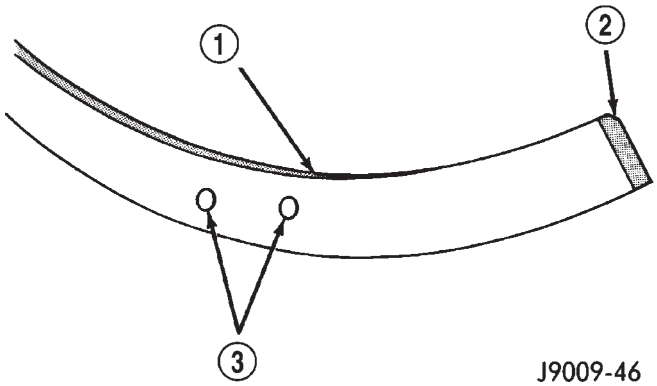


Fig. 26 Second Compression Ring Identification (Typical)

1 – SECOND COMPRESSION RING (BLACK CAST IRON)
2 – CHAMFER
3 – TWO DOTS

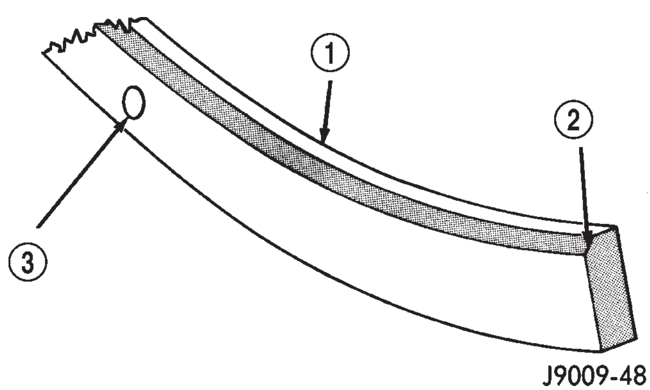


Fig. 27 Top Compression Ring Identification (Typical)

1 – TOP COMPRESSION RING (GRAY IN COLOR)
2 – CHAMFER
3 – ONE DOT

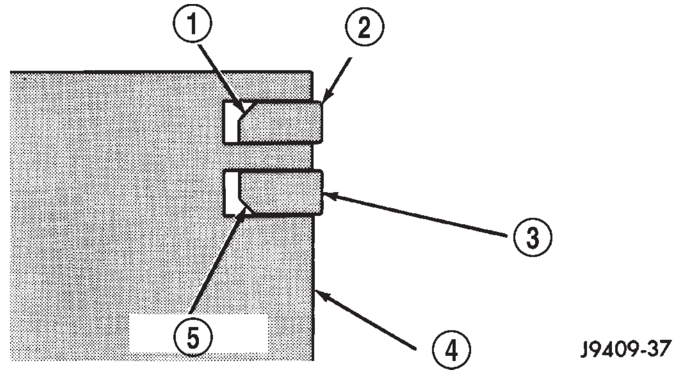


Fig. 28 Compression Ring Chamfer Location (Typical)

1 – CHAMFER
2 – TOP COMPRESSION RING
3 – SECOND COMPRESSION RING
4 – PISTON
5 – CHAMFER

(3) Orient the rings:

(a) Arrange top compression ring 90° counterclockwise from the oil ring rail gap (Fig. 29).

(b) Arrange second compression ring 90° clockwise from the oil ring rail gap (Fig. 29).

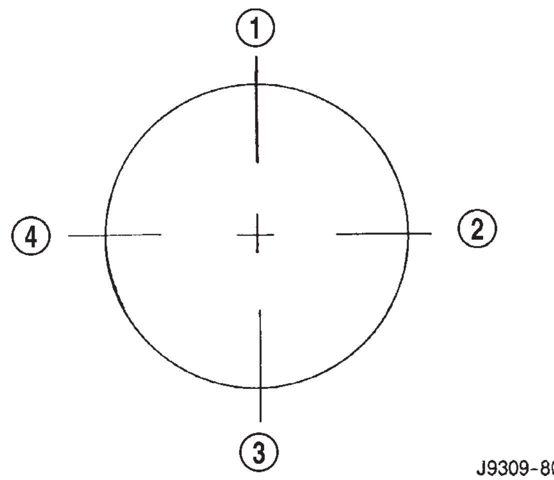


Fig. 29 Proper Ring Installation

1 – OIL RING SPACER GAP
2 – SECOND COMPRESSION RING GAP OIL RING RAIL GAP (TOP)
3 – OIL RING RAIL GAP (BOTTOM)
4 – TOP COMPRESSION RING GAP

CONNECTING ROD BEARINGS—FITTING

Fit all rods on a bank until completed. DO NOT alternate from one bank to another, because connecting rods and pistons are not interchangeable from one bank to another.

The bearing caps are not interchangeable and should be marked at removal to ensure correct assembly.

SERVICE PROCEDURES (Continued)

Each bearing cap has a small V-groove across the parting face. When installing the lower bearing shell, be certain that the V-groove in the shell is in line with the V-groove in the cap. This provides lubrication of the cylinder wall in the opposite bank.

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

Limits of taper or out-of-round on any crankshaft journals should be held to 0.025 mm (0.001 in.). Bearings are available in 0.025 mm (0.001 in.), 0.051 mm (0.002 in.), 0.076 mm (0.003 in.), 0.254 mm (0.010 in.) and 0.305 mm (0.012 in.) undersize. **Install the bearings in pairs. DO NOT use a new bearing half with an old bearing half. DO NOT file the rods or bearing caps.**

CRANKSHAFT MAIN BEARINGS—FITTING

Bearing caps are NOT interchangeable and should be marked at removal to ensure correct assembly. Upper and lower bearing halves are NOT interchangeable. Lower main bearing halves of No. 1 and 3 are interchangeable.

Upper and lower No. 2 bearing halves are flanged to carry the crankshaft thrust loads. They are NOT interchangeable with any other bearing halves in the engine (Fig. 30). Bearing shells are available in standard and the following undersizes: 0.25 mm (0.001 in.), 0.051 mm (0.002 in.), 0.076 mm (0.003 in.), 0.254 mm (0.010 in.) and 0.305 mm (0.012 in.). Never install an undersize bearing that will reduce clearance below specifications.

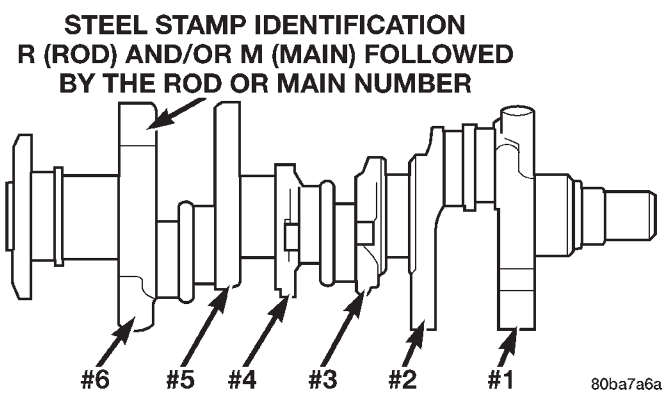


Fig. 30 Main Bearing Identification

CRANKSHAFT IDENTIFICATION LOCATION CHART

ITEM	MEASUREMENT	IDENTIFICATION
ROD U/S	0.025 mm (0.001 in.)	R1-R2-R3 ect. indicates rod journal No. 1, 2 and 3.
MAIN U/S	0.025 mm (0.001 in.)	M1-M2-M3 or M4 indicates main journal No. 1, 2, 3, and 4.

REMOVAL AND INSTALLATION

ENGINE FRONT MOUNTS

REMOVAL—2WD

(1) Disconnect the negative cable from the battery.

(2) Raise hood and position fan to assure clearance for radiator top tank and hose.

CAUTION: DO NOT lift the engine by the intake manifold.

(3) Install engine lifting fixture.

(4) Raise vehicle on hoist.

(5) Remove the insulator through bolt (Fig. 31) (Fig. 32).

(6) Raise engine with lifting fixture SLIGHTLY. Remove insulator retaining bolts and remove the insulator assembly.

(7) Remove insulator heat shield and transfer to new insulator.

INSTALLATION—2WD

(1) With the engine raised SLIGHTLY, position insulator assembly onto the engine block and install bolts (Fig. 31) (Fig. 32). Tighten the bolts to 41 N·m (30 ft. lbs.) torque.

(2) Lower engine with lifting fixture while guiding insulator assembly into the engine insulator bracket (Fig. 33).

(3) Install insulator to bracket thru-bolt. Tighten the thru-bolt nut to 68 N·m (50 ft. lbs.) torque.

(4) Remove lifting fixture.

(5) Connect the negative cable to the battery.

REMOVAL AND INSTALLATION (Continued)

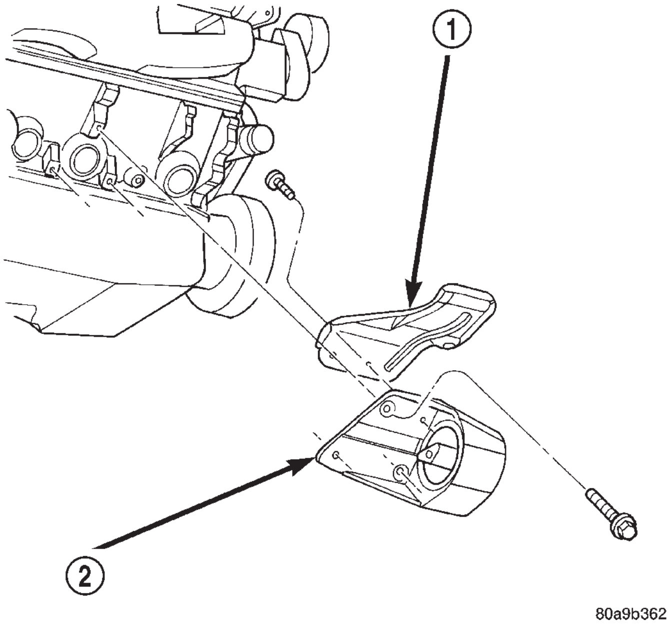


Fig. 31 Engine Right Front Insulator Mount—2WD Vehicles

1 – HEAT SHIELD
2 – INSULATOR

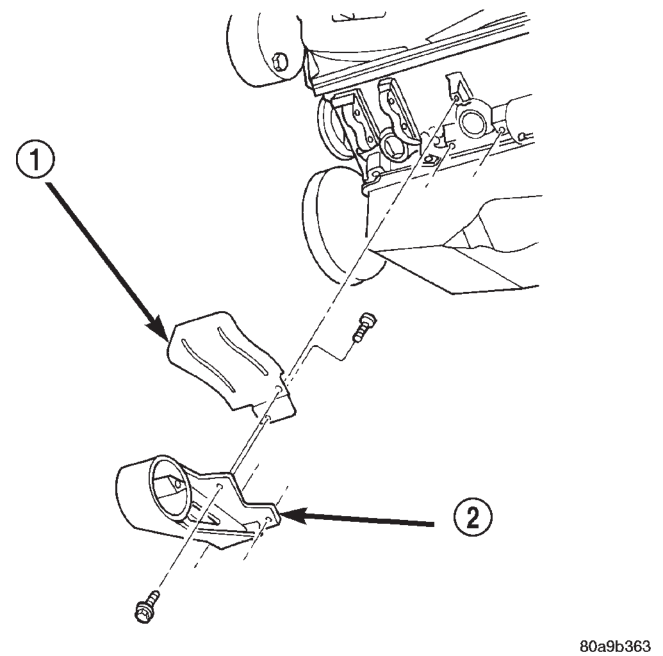


Fig. 32 Engine Left Front Insulator Mount—2WD Vehicles

1 – HEAT SHIELD
2 – INSULATOR

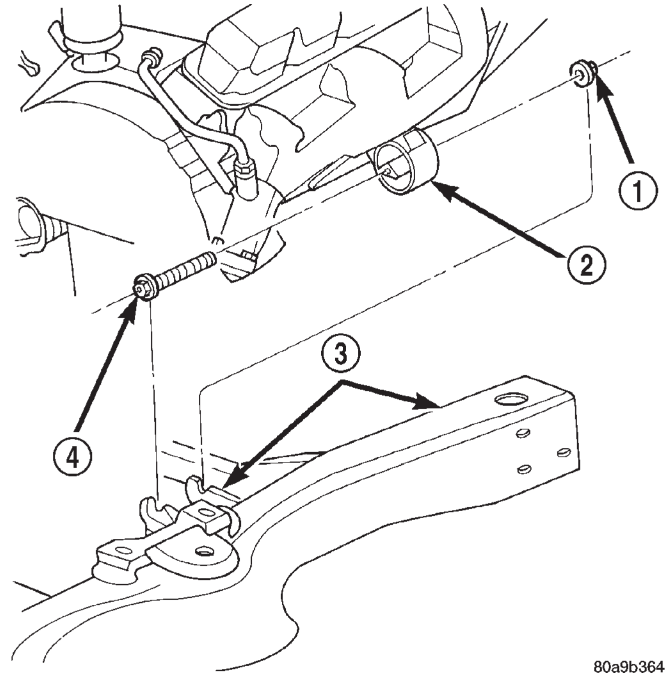


Fig. 33 Engine Mount Insulator at Frame

1 – NUT
2 – INSULATOR
3 – FRAME
4 – THROUGH BOLT

REMOVAL—4WD

On 4-WD vehicles the engine front support brackets attach directly to engine block and the axle housing. The brackets provide a solid interconnection for these units (Fig. 34) (Fig. 35). Engine and front axle must be supported during any service procedures involving the front support assemblies.

(1) Disconnect the negative cable from the battery.

(2) Raise vehicle on hoist.

(3) Install engine lifting (support) fixture.

(4) Remove front axle. (Refer to Group 3, Differential and Driveline in this publication.)

(5) **Left mount insulator only.** Remove starter wires and starter motor assembly.

(6) Remove insulator to frame throught bolt (Fig. 36).

(7) Raise engine slightly.

(8) Remove upper insulator to support bracket stud nut and insulator to support through bolt.

(9) Remove engine mount insulator. (Fig. 34) (Fig. 35).

REMOVAL AND INSTALLATION (Continued)

(10) If engine support bracket is to be removed/replaced, remove support bracket to transmission bell housing bolt(s) and three (3) support bracket to engine block bolts. Remove support bracket (Fig. 34) (Fig. 35).

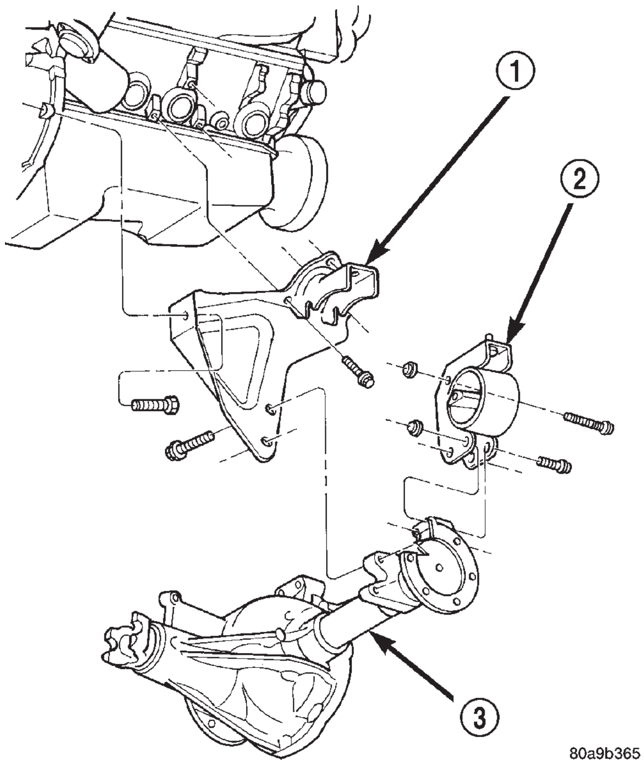


Fig. 34 Right Engine Mount Insulator and Support Bracket—4WD Vehicles

1 – ENGINE SUPPORT BRACKET
2 – INSULATOR
3 – FRONT AXLE

INSTALLATION—4WD

(1) If engine support brackets were removed, intall them and their fasteners (Fig. 34) (Fig. 35). Tighten support bracket to block bolts to 41 N·m (30 ft. lbs.). Tighten support bracket to transmission bellhousing bolt(s) to 88 N·m (65 ft. lbs.)

(2) Install Engine mount insulator and tighten insulator to support bracket nut to 41 N·m (30 ft. lbs.). Tighten insulator to support bracket through bolt nut to 102 N·m (75 ft. lbs.)

(3) Lower engine and install insulator to frame through bolt and nut (Fig. 36). Tighten nut to 95 N·m (70 ft. lbs.)

(4) Install starter motor and mounting bolts. Tighten bolts to 68 N·m (50 ft. lbs.)

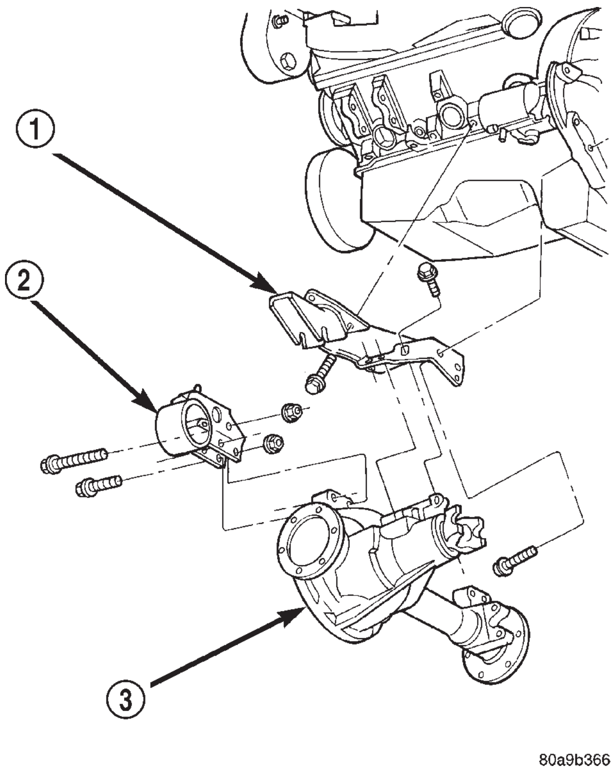


Fig. 35 Left Engine Mount Insulator and Support Bracket—4WD Vehicles

1 – ENGINE SUPPORT BRACKET
2 – INSULATOR
3 – FRONT AXLE

(5) Connect starter wires.
(6) Remove engine lifting (support) fixture.
(7) Install front axle assembly. (Refer to Group 3, Differential and Driveline)
(8) Lower the vehicle.
(9) Connect the negative cable to the battery.

ENGINE REAR SUPPORT

REMOVAL—2WD

(1) Disconnect the negative cable from the battery.
(2) Raise the vehicle on a hoist.
(3) Support the transmission with a jack.

NOTE: AUTOMATIC TRANSMISSION

- Remove engine support bracket—insulator thru-bolt (Fig. 37).
- Raise the transmission and engine slightly.
- Remove stud nuts attaching insulator to cross-member (Fig. 37). Remove insulator.

REMOVAL AND INSTALLATION (Continued)

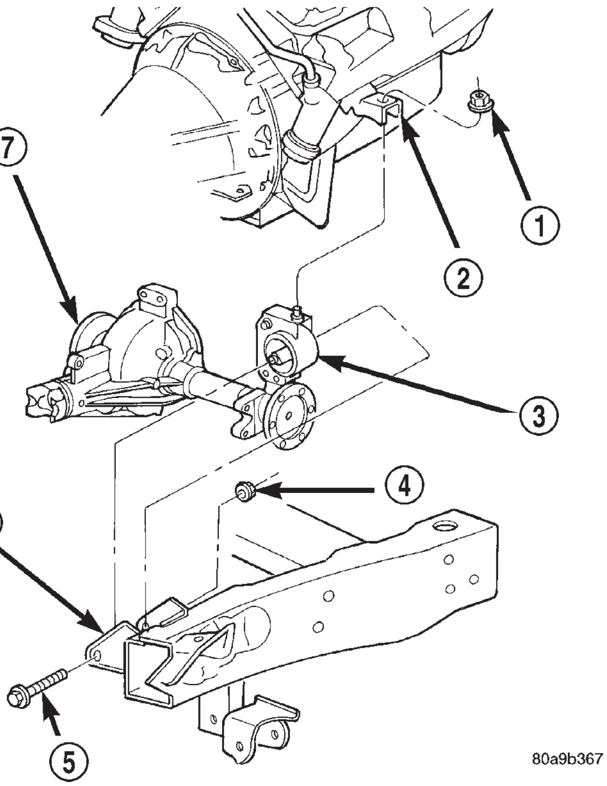


Fig. 36 Engine Mount Insulator at Frame—4WD Vehicles

1 – NUT
2 – ENGINE SUPPORT BRACKET
3 – INSULATOR
4 – NUT
5 – THROUGH BOLT
6 – FRAME
7 – FRONT AXLE

NOTE: MANUAL TRANSMISSION

• Remove the stud nuts attaching the insulator to the transmission extension (Fig. 38).
• Raise the transmission and engine slightly.
• Remove stud nuts attaching insulator to crossmember (Fig. 38). Remove insulator.

INSTALLATION—2WD

(1) If the engine support bracket (Automatic Transmissions) was removed, position the bracket to the transmission extension (Fig. 37). Tighten the bolts to 68 N·m (50 ft. lbs.) torque.

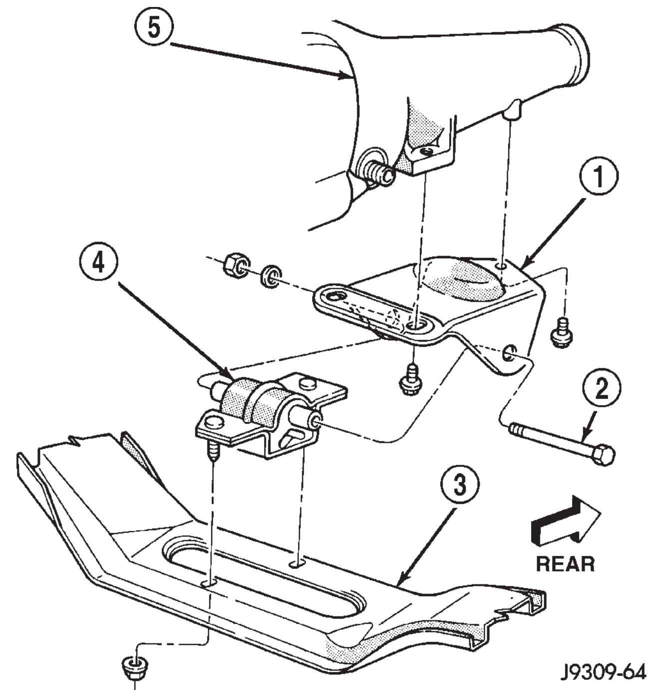


Fig. 37 Rear Insulator Automatic Transmission—2WD

1 – ENGINE SUPPORT BRACKET
2 – THROUGH BOLT
3 – CROSSMEMBER
4 – INSULATOR
5 – TRANSMISSION EXTENSION

NOTE: AUTOMATIC TRANSMISSION

• Install the insulator onto crossmember. Tighten the stud nuts to 41 N·m (30 ft. lbs) torque.
• Lower the transmission and engine while aligning the engine support bracket to the insulator.
• Install thru-bolt in bracket and insulator. Tighten thru-bolt nut to 68 N·m (50 ft. lbs.) torque.

NOTE: MANUAL TRANSMISSION

• Install the insulator onto crossmember. Tighten the stud nuts to 41 N·m (30 ft. lbs) torque.
• Lower the transmission and engine while aligning the insulator studs into the transmission extension.
• Install the stud nuts. Tighten the stud nuts to 41 N·m (30 ft. lbs) torque.
(2) Remove transmission jack.
(3) Lower the vehicle.
(4) Connect the negative cable to the battery.

REMOVAL AND INSTALLATION (Continued)

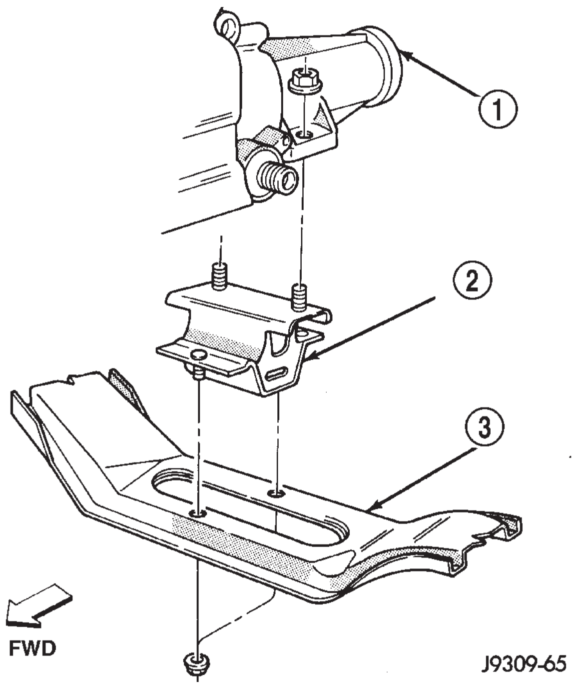


Fig. 38 Rear Insulator Manual Transmission—2WD

1 – TRANSMISSION EXTENSION
2 – INSULATOR
3 – CROSSMEMBER

REMOVAL—4WD

(1) Disconnect the negative cable from the battery.

(2) Raise the vehicle on a hoist.

(3) Support the transmission with a transmission jack.

NOTE: AUTOMATIC TRANSMISSION

- Remove stud nuts holding the insulator to the crossmember (Fig. 39).
- Raise rear of transmission SLIGHTLY.
- Remove bolts holding the insulator to the insulator bracket (Fig. 39). Remove the insulator.

NOTE: MANUAL TRANSMISSION

- Remove stud nuts holding the insulator to the crossmember (Fig. 40).
- Raise rear of transmission SLIGHTLY.
- Remove bolts holding the insulator to the transmission (Fig. 40). Remove the insulator.

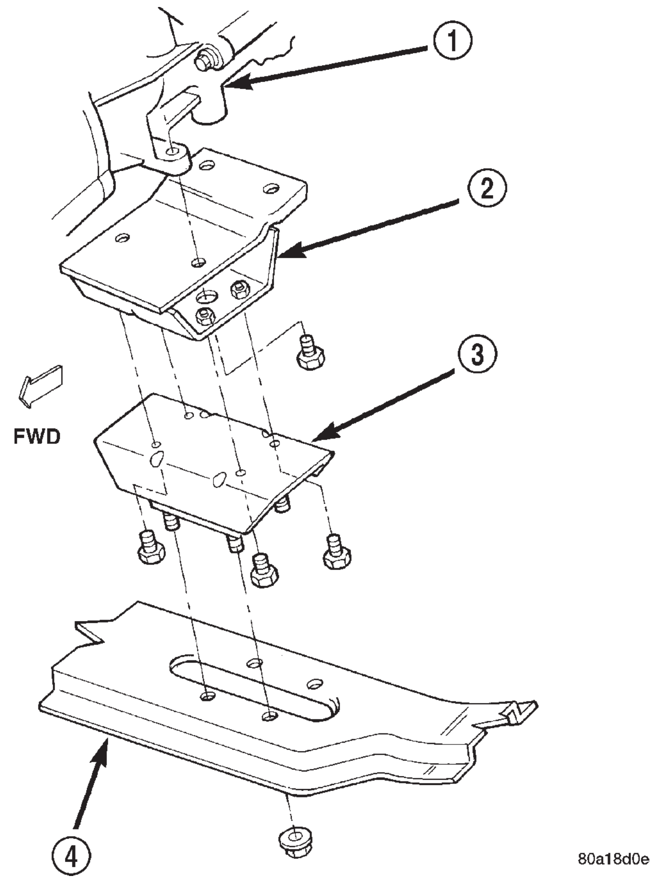


Fig. 39 Rear Insulator Automatic Transmission—4WD

1 – AUTOMATIC TRANSMISSION
2 – INSULATOR BRACKET
3 – INSULATOR
4 – CROSSMEMBER

INSTALLATION—4WD

NOTE: AUTOMATIC TRANSMISSION

- If the insulator bracket was removed, install the bracket to the transmission (Fig. 39). Tighten the bolts to 68 N·m (50 ft. lbs.) torque.
- Install the bolts holding insulator to insulator bracket. Tighten the bolts to 68 N·m (50 ft. lbs.) torque.
- Lower rear of transmission while aligning the insulator studs into the mounting support bracket. Install stud nuts and tighten to 68 N·m (50 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

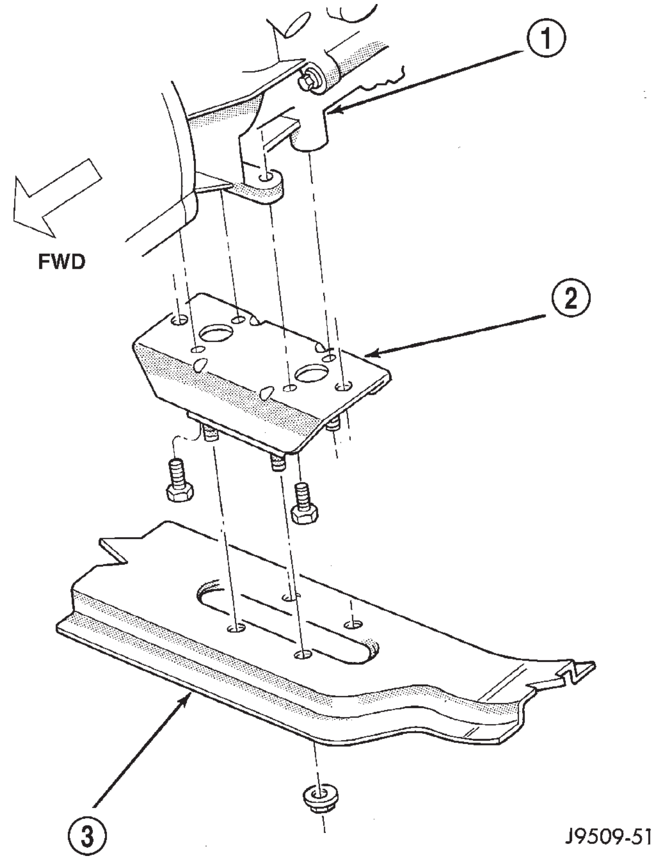


Fig. 40 Rear Insulator Manual Transmission—4WD

1 – MANUAL TRANSMISSION
2 – INSULATOR
3 – CROSSMEMBER

NOTE: MANUAL TRANSMISSION

• Install the bolts holding insulator to insulator bracket. Tighten the bolts to 68 N·m (50 ft. lbs.) torque.

• Lower rear of transmission while aligning the insulator studs into the mounting support bracket. Install stud nuts and tighten to 68 N·m (50 ft. lbs.) torque.

(1) Remove the transmission jack.
(2) Lower the vehicle.
(3) Connect the negative cable to the battery.

EXHAUST MANIFOLD

REMOVAL

(1) Disconnect the battery negative cable.
(2) Raise the vehicle.
(3) Remove the exhaust pipe to manifold nuts.
(4) Lower the vehicle.
(5) Remove two nuts, heat shield and washers from the right side exhaust manifold, if necessary (Fig. 41).
(6) Remove two nuts, heat shield and washers from the left side exhaust manifold, if necessary (Fig. 42).
(7) Remove bolts, nuts and washers attaching manifold to cylinder head.
(8) Remove manifold from the cylinder head.

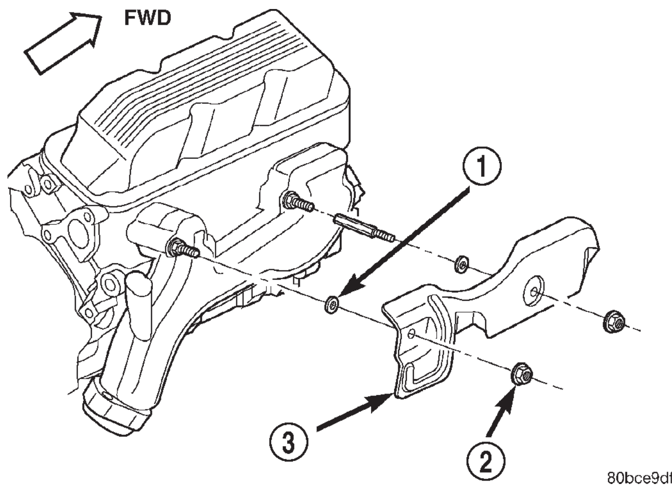


Fig. 41 Exhaust Manifold Heat Shield—Right Side

1 – WASHER
2 – NUT AND WASHER
3 – EXHAUST MANIFOLD HEAT SHIELD

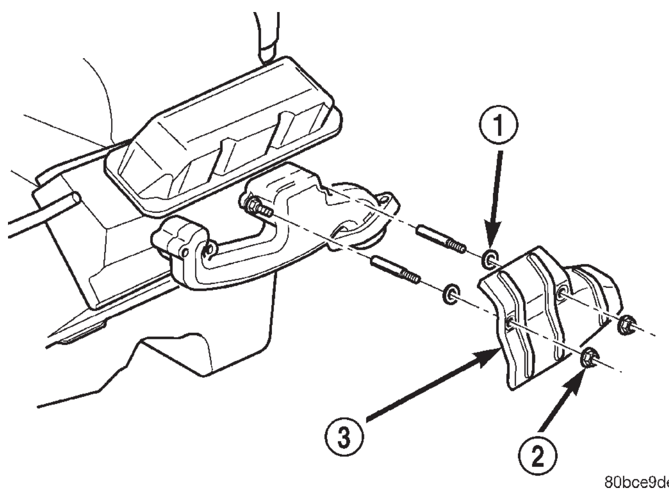


Fig. 42 Exhaust Manifold Heat Shield—Left Side

1 – WASHER
2 – NUT AND WASHER
3 – EXHAUST MANIFOLD HEAT SHIELD

INSTALLATION

CAUTION: If the studs came out with the nuts when removing the exhaust manifold, install new studs.

(1) Position the exhaust manifolds on the two studs located on the cylinder head. Install conical washers and nuts on these studs (Fig. 43).

REMOVAL AND INSTALLATION (Continued)

(2) Install new bolt and washer assemblies in the remaining holes (Fig. 43). Start at the center arm and work outward. Tighten the bolts and nuts to 24 N·m (18 ft. lbs.) torque.

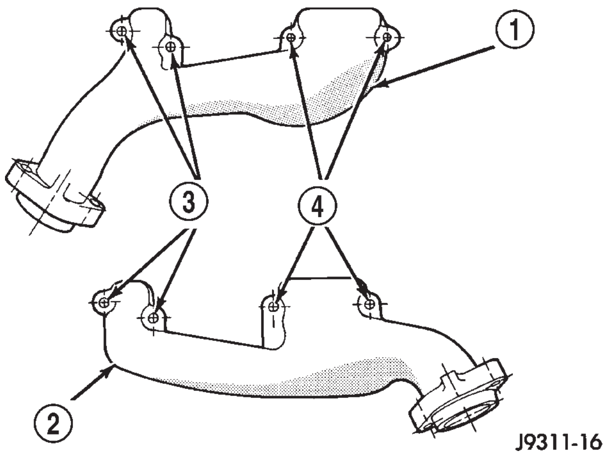


Fig. 43 Exhaust Manifold Installation—3.9L Engine

1 – EXHAUST MANIFOLD (RIGHT)
2 – EXHAUST MANIFOLD (LEFT)
3 – BOLTS & WASHERS
4 – NUTS & WASHERS

(3) Position two washers, heat shield and nuts onto the right side exhaust manifold. Tighten nuts to 24 N·m (18 ft. lbs.).

(4) Position two washers, heat shield and nuts onto the left side exhaust manifold. Tighten nuts to 24 N·m (18 ft. lbs.).

(5) Raise the vehicle.

(6) Assemble the exhaust pipe to the exhaust manifold and secure with bolts, nuts and washers. Tighten these nuts to 27 N·m (20 ft. lbs.) torque.

(7) Lower the vehicle.

(8) Connect the battery negative cable.

ENGINE ASSEMBLY

REMOVAL

(1) Scribe hood hinge outlines on hood. Remove the hood.

(2) Remove the battery.

(3) Drain cooling system. Refer to COOLING SYSTEM.

(4) Remove the air cleaner, air in-let hose and resonator assembly.

(5) Disconnect the radiator and heater hoses. Remove radiator. Refer to COOLING SYSTEM.

(6) Disconnect the vacuum lines from the intake manifold.

(7) Remove the distributor cap and wiring.

(8) Disconnect the accelerator linkage.

(9) Remove throttle body.

(10) Perform the Fuel System Pressure Release procedure. Refer to FUEL SYSTEM.

(11) Disconnect the starter wires.

(12) Disconnect the oil pressure wire.

(13) Discharge the air conditioning system, if equipped. Refer to HEATING and AIR CONDITIONING.

(14) Disconnect the air conditioning hoses.

(15) Disconnect the power steering hoses, if equipped.

(16) Remove starter motor. Refer to STARTING SYSTEMS.

(17) Remove the generator. Refer to CHARGING SYSTEM.

(18) Raise and support the vehicle on a hoist.

(19) Disconnect exhaust pipe at manifolds.

(20) RemoveTransmission. Refer to TRANSMISSION.

CAUTION: DO NOT lift the engine by the intake manifold.

(21) Install an engine lifting fixture.

(22) **2WD VEHICLES** —Remove engine front mount bolts.

(23) **4WD VEHICLES** —The engine and front driving axle (engine/axle/transmission) are connected through insulators and support brackets. Separate the engine as follows:

- **LEFT SIDE** —Remove 2 bolts attaching (engine/pinion nose/transmission) bracket to transmission bell housing. Remove 2 bracket to pinion nose adaptor bolts. Separate engine from insulator by removing upper nut washer assembly and bolt from engine support bracket.
- **RIGHT SIDE** —Remove 2 bracket to axle (disconnect housing) bolts and 1 bracket to bell housing bolt. Separate engine from insulator by removing upper nut washer assembly and bolt from engine support bracket.

(24) Lower the vehicle.

(25) On automatic transmission vehicles, disconnect the engine from the torque converter drive plate. On manual transmission vehicles, move engine forward until drive pinion shaft clears the clutch disc. Remove engine from engine compartment.

(26) Install engine assembly on engine repair stand.

INSTALLATION

(1) Remove engine from the repair stand and position in the engine compartment.

(2) Install an engine support fixture.

(3) Raise and support the vehicle on a hoist.

(4) Install transmission.

(5) Install the front engine mounts.

(6) Install exhaust pipe to manifold.

REMOVAL AND INSTALLATION (Continued)

(7) Lower the vehicle.
(8) Remove engine lifting fixture.
(9) Install the generator.
(10) Install starter motor.
(11) Connect power steering hoses, if equipped.
(12) Connect air conditioning hoses.
(13) Evacuate and charge the air conditioning system, if equipped.
(14) Using a new gasket, install throttle body. Tighten the throttle body bolts to 23 N·m (200 in. lbs.) torque.
(15) Connect the accelerator linkage.
(16) Connect the starter wires.
(17) Connect the oil pressure wire.
(18) Install the distributor cap and wiring.
(19) Connect the vacuum lines.
(20) Connect the fuel supply line.
(21) Install the radiator. Connect the radiator hoses and heater hoses.
(22) Install fan shroud in position.
(23) Fill cooling system.
(24) Install the air cleaner, resonator assembly and air in-let hose. Tighten clamps to 4 N·m (35 in. lbs.).
(25) Install the battery.
(26) Warm engine and adjust.
(27) Install hood and line up with the scribe marks.
(28) Road test vehicle.

CYLINDER HEAD COVER

A steel-backed silicone gasket is used with the cylinder head cover (Fig. 44). This gasket can be used again.

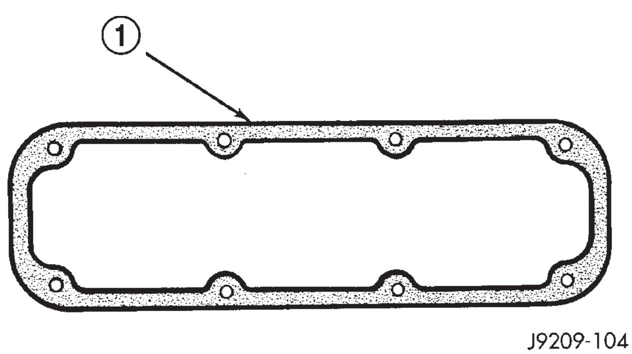


Fig. 44 Cylinder Head Cover Gasket
1 – CYLINDER HEAD COVER GASKET

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Disconnect closed ventilation system and evaporation control system from cylinder head cover.
(3) Remove cylinder head cover bolts, cover and gasket. The gasket may be used again.

INSTALLATION

(1) Position the cylinder head cover gasket onto the head rail.
(2) Position the cylinder head cover onto the gasket and install the bolts. Tighten the bolts to 11 N·m (95 in. lbs.) torque.
(3) Install closed crankcase ventilation system and evaporation control system.
(4) Connect the negative cable to the battery.
(5) Start engine and check for leaks.

CYLINDER HEAD COMPONENTS—IN VEHICLE SERVICE

ROCKER ARMS AND PUSH RODS

REMOVAL

(1) Remove the air in-let hose.
(2) Disconnect spark plug wires from plugs.
(3) Remove cylinder head cover and gasket.
(4) Remove the rocker arm bolts and pivots (Fig. 45). Place them on a bench in the same order as removed.
(5) Remove the push rods and place them on a bench in the same order as removed.

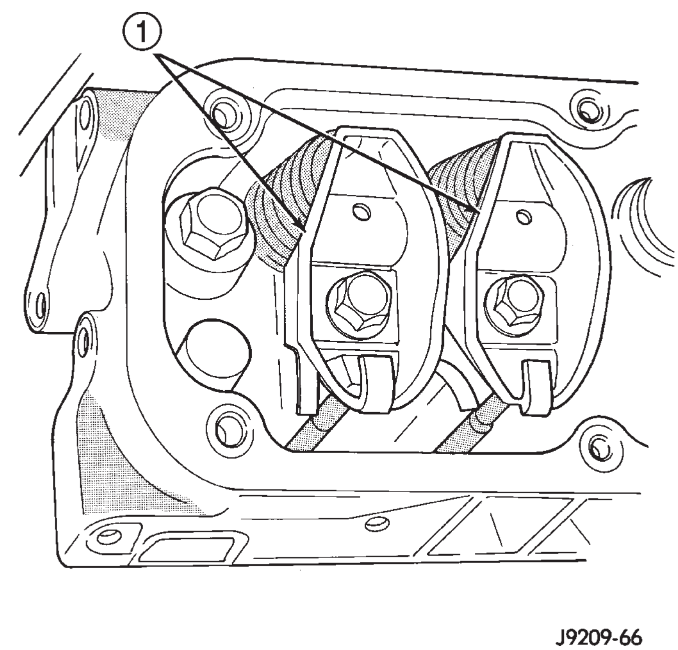


Fig. 45 Rocker Arms
1 – ROCKER ARMS

INSTALLATION

(1) Rotate the crankshaft until the V6 mark lines up with the TDC mark on the timing chain case cover. This mark is located 147° ATDC from the No.1 firing position.

REMOVAL AND INSTALLATION (Continued)

CAUTION: DO NOT rotate or crank the engine during or immediately after rocker arm installation. Allow the hydraulic roller tappets adequate time to bleed down (about 5 minutes).

(2) Install the push rods in the same order as removed.

(3) Install rocker arm and pivot assemblies in the same order as removed. Tighten the rocker arm bolts to 28 N·m (21 ft. lbs.) torque.

(4) Install cylinder head cover.

(5) Connect spark plug wires.

(6) Install air in-let hose. Tighten clamps 4 N·m (35 in. lbs.).

VALVE STEM SHIELDS AND SPRINGS

REMOVAL

(1) Set engine basic timing to Top Dead Center (TDC).

(2) Remove the air cleaner, air in-let hose and resonator assembly..

(3) Remove cylinder head covers and spark plugs.

(4) Using suitable socket and flex handle at crankshaft retaining bolt, turn engine so the No.1 piston is at TDC on the compression stroke.

(5) Remove rocker arms.

(6) With air hose attached to an adapter installed in No.1 spark plug hole, apply 620-689 kPa (90-100 psi) air pressure.

(7) Using Valve Spring Compressor Tool MD-998772A and adapter 6716A, compress valve spring and remove retainer valve locks and valve spring.

(8) Remove the valve stem seals.

INSTALLATION

(1) Install seals on the exhaust valve stem and position down against valve guides.

(2) The intake valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as a guide. DO NOT force seal against top of guide. When installing the valve retainer locks, compress the spring only enough to install the locks.

(3) Follow the same procedure on the remaining 5 cylinders using the firing sequence 1-6-5-4-3-2. Make sure piston in cylinder is at TDC on the valve spring that is being removed.

(4) Remove adapter from the No.1 spark plug hole.

(5) Install rocker arms.

(6) Install cylinder head covers.

(7) Install resonator assembly, air in-let hose and air cleaner.

(8) Road test vehicle.

CYLINDER HEADS

The alloy cast iron cylinder heads (Fig. 46) are held in place by eight bolts. The spark plugs are located at the peak of the wedge between the valves.

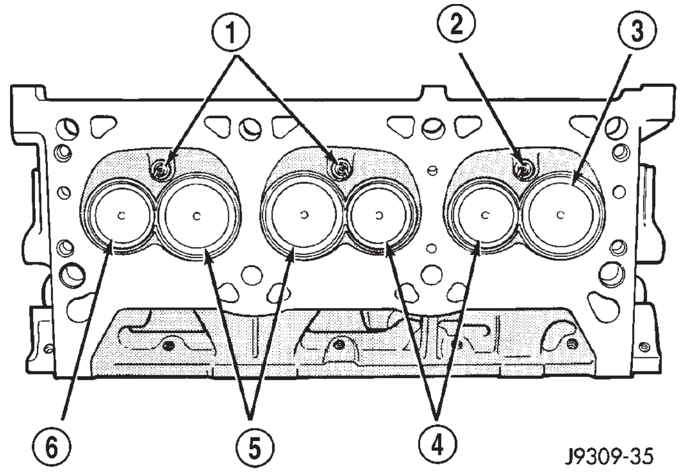


Fig. 46 Cylinder Head Assembly

1 – SPARK PLUGS
2 – SPARK PLUG
3 – INTAKE VALVE
4 – EXHAUST VALVES
5 – INTAKE VALVES
6 – EXHAUST VALVE

REMOVAL

(1) Disconnect the battery negative cable from the battery.

(2) Drain cooling system. Refer to COOLING SYSTEM.

(3) Remove the intake manifold-to-generator bracket support rod. Remove the generator.

(4) Remove closed crankcase ventilation system.

(5) Disconnect the evaporation control system.

(6) Remove the air cleaner, air in-let hose and resonator.

(7) Perform fuel system pressure release procedure. Refer to FUEL SYSTEMS.

(8) Disconnect the fuel supply line from the fuel rail. Refer to FUEL SYSTEMS.

(9) Disconnect accelerator linkage and if so equipped, the speed control and transmission kickdown cables.

(10) Remove distributor cap and wires.

(11) Disconnect the coil wires.

(12) Disconnect coolant temperature sending unit wire.

(13) Disconnect heater hoses and bypass hose.

(14) Disconnect the vacuum supply hoses from the intake manifold.

(15) Disconnect the fuel injector harness and secure out of the way.

(16) Remove cylinder head covers and gaskets.

REMOVAL AND INSTALLATION (Continued)

(17) Remove intake manifold and throttle body as an assembly. Discard the flange side gaskets and the front and rear cross-over gaskets.

(18) Remove exhaust manifolds.

(19) Remove rocker arm assemblies and push rods. Identify to ensure installation in original locations.

(20) Remove the head bolts from each cylinder head and remove cylinder heads. Discard the cylinder head gasket.

(21) Remove spark plugs.

INSTALLATION

(1) Position the new cylinder head gaskets onto the cylinder block.

(2) Position the cylinder heads onto head gaskets and cylinder block.

(3) Starting at top center, tighten all cylinder head bolts, in sequence, to 68 N·m (50 ft. lbs.) torque (Fig. 47). Repeat procedure, tighten all cylinder head bolts to 143 N·m (105 ft. lbs.) torque. Repeat procedure to confirm that all bolts are at 143 N·m (105 ft. lbs.) torque.

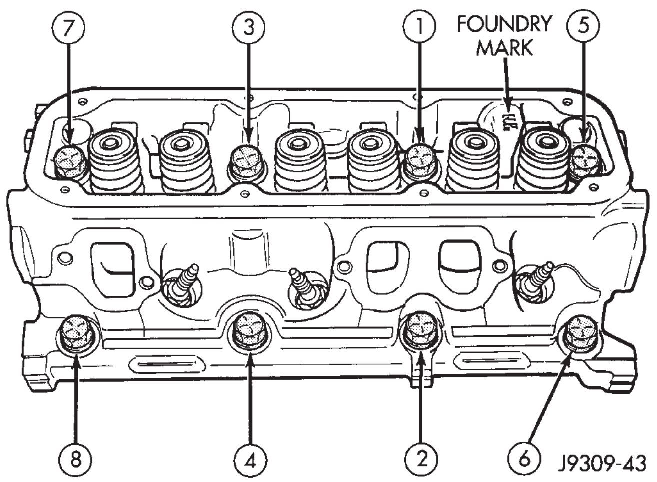


Fig. 47 Cylinder Head Bolt -Tightening Sequence

CAUTION: When tightening the rocker arm bolts, be sure the piston in that cylinder is NOT at TDC. Contact between the valves and piston could occur.

(4) Install push rods and rocker arm assemblies in their original positions. Tighten the bolts to 28 N·m (21 ft. lbs.) torque.

(5) Install the intake manifold and throttle body assembly.

(6) Install exhaust manifolds. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

(7) Adjust spark plugs to specifications. Install the plugs and tighten to 41 N·m (30 ft. lbs.) torque.

(8) Install coil wires.

(9) Connect coolant temperature sending unit wire.

(10) Connect the fuel injector harness.

(11) Connect the vacuum supply hoses to the intake manifold.

(12) Connect the heater hoses and bypass hose.

(13) Install distributor cap and wires.

(14) Connect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

(15) Install the fuel supply line.

(16) Install the generator and accessory drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque.

(17) Install the intake manifold-to-generator bracket support rod. Tighten the bolts.

(18) Place the cylinder head cover gaskets in position and install cylinder head covers. Tighten the bolts to 11 N·m (95 in. lbs.) torque.

(19) Install closed crankcase ventilation system.

(20) Connect the evaporation control system.

(21) Install the resonator assembly, air in-let hose and air cleaner.

(22) Install the heat shields. Tighten the bolts to 41 N·m (30 ft. lbs.) torque.

(23) Fill cooling system.

(24) Connect the battery negative cable.

VALVES AND VALVE SPRINGS—CYLINDER HEAD REMOVED

REMOVAL

(1) Compress valve springs using Valve Spring Compressor Tool MD-998772-A and adapter 6716A.

(2) Remove valve retaining locks, valve spring retainers, valve stem seals, and valve springs.

(3) Before removing valves, remove any burrs from valve stem lock grooves to prevent damage to the valve guides. Identify valves to ensure installation in original locations.

INSTALLATION

(1) Coat valve stems with lubrication oil and insert them in cylinder head.

(2) If valves or seats are reground, check valve stem height. If valve is too long, replace cylinder head.

(3) Install new seals on all valve guides. Install valve springs and valve retainers.

(4) Compress valve springs with Valve Spring Compressor Tool MD-998772A and adapter 6716A, install locks and release tool. If valves and/or seats are ground, measure the installed height of springs. Be sure the measurement is taken from bottom of spring seat in cylinder head to the bottom surface of spring retainer. If spacers are installed, measure from the top of spacer. If height is greater than 42.86 mm (1-11/16 inches), install a 1.587 mm (1/16 in.) spacer in head counterbore. This should bring spring height back to normal 41.27 to 42.86 mm (1-5/8 to 1-11/16 in.).

REMOVAL AND INSTALLATION (Continued)

HYDRAULIC TAPPETS

REMOVAL

(1) Remove the air cleaner assembly and air in-let hose.

(2) Remove cylinder head cover. Refer to Cylinder Head Cover in this section for correct procedure.

(3) Remove rocker assembly and push rods. Identify push rods to ensure installation in original locations.

(4) Remove intake manifold. Refer to Intake Manifold in this section for correct procedure.

(5) Remove yoke retainer and aligning yokes.

(6) Slide Hydraulic Tappet Remover/Installer Tool C-4129-A through opening in cylinder head and seat tool firmly in the head of tappet.

(7) Pull tappet out of bore with a twisting motion. If all tappets are to be removed, identify tappets to ensure installation in original location.

(8) If the tappet or bore in cylinder block is scored, scuffed, or shows signs of sticking, ream the bore to next oversize. Replace with oversize tappet.

INSTALLATION

(1) Lubricate tappets.

(2) Install tappets and push rods in their original positions. Ensure that the oil feed hole in the side of the tappet body faces up (away from the crankshaft).

(3) Install aligning yokes with ARROW toward camshaft.

(4) Install yoke retainer. Tighten the bolts to 23 N·m (200 in. lbs.) torque. Install intake manifold.

(5) Install push rods in original positions.

(6) Install rocker arms.

(7) Install cylinder head cover.

(8) Install air cleaner assembly and air in-let hose.

(9) Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

INTAKE MANIFOLD

REMOVAL

(1) Disconnect the battery negative cable.

(2) Drain the cooling system. Refer to COOLING SYSTEM.

(3) Remove the A/C compressor. Refer to HEATING and AIR CONDITIONING.

(4) Remove the generator. Refer to CHARGING SYSTEM.

(5) Remove the accessory drive bracket.

(6) Remove the air cleaner assembly and air in-let hose.

(7) Perform the fuel pressure release procedure. Refer to FUEL SYSTEM.

(8) Disconnect the fuel supply line from the fuel rail. Refer to FUEL SYSTEM.

(9) Disconnect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

(10) Remove the distributor cap and wires.

(11) Disconnect the coil wires.

(12) Disconnect the coolant temperature sending unit wire.

(13) Disconnect the heater hoses and bypass hose.

(14) Remove the closed crankcase ventilation and evaporation control systems.

(15) Remove intake manifold bolts.

(16) Lift the intake manifold and throttle body out of the engine compartment as an assembly.

(17) Remove and discard the flange side gaskets and the front and rear cross-over gaskets.

(18) Remove the throttle body bolts and lift the throttle body off the intake manifold (Fig. 48). Discard the throttle body gasket.

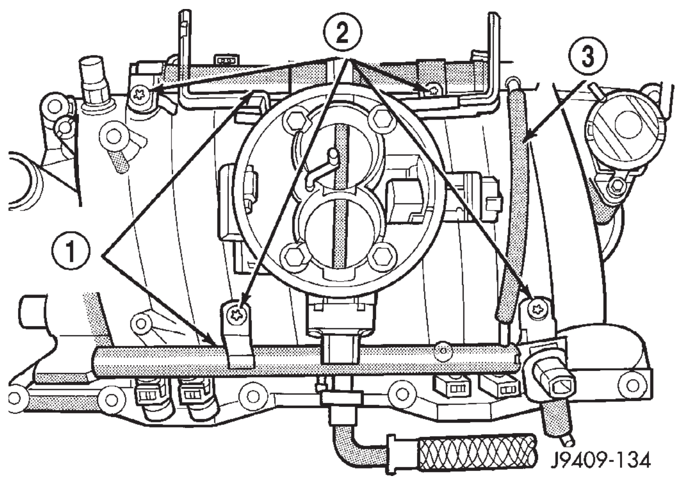


Fig. 48 Throttle Body Assembly—Typical

1 – FUEL RAIL ASSEMBLY
2 – FUEL RAIL MOUNTING BOLTS
3 – FUEL RAIL CONNECTING HOSES

(19) Remove the plenum pan as follows:

(a) Turn the intake manifold upside down. Support the manifold.

(b) Remove the bolts and lift the pan off the manifold. Discard the gasket.

INSTALLATION

(1) Install the plenum pan, if removed, as follows:

(a) Turn the intake manifold upside down. Support the manifold.

REMOVAL AND INSTALLATION (Continued)

(b) Place a new plenum pan gasket onto the seal rail of the intake manifold. Position the pan over the gasket. Align all the gasket and pan holes with the intake manifold.

(c) Hand start all bolts.

(d) Tighten the bolts, in sequence (Fig. 49), as follows:

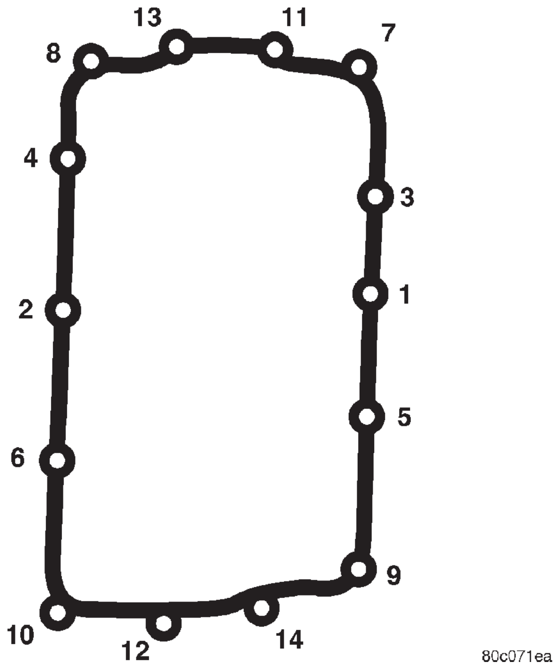


Fig. 49 Plenum Pan Bolt Tightening Sequence

- Step 1—Tighten bolts to 2.7 N·m (24 in. lbs.) torque.
- Step 2—Tighten bolts to 5.4 N·m (48 in. lbs.) torque.
- Step 3—Tighten bolts to 9.5 N·m (84 in. lbs.) torque.
- Step 4—Check that all bolts are tightened to 9.5 N·m (84 in. lbs.) torque.

(2) Using a new gasket, install the throttle body onto the intake manifold. Tighten the bolts to 23 N·m (200 in. lbs.) torque.

(3) Apply a bead of Mopar® Silicone Rubber Adhesive Sealant, or equivalent, to the four corner joints. The sealant bead height should be slightly higher than the cross-over gaskets, approximately 5 mm (0.2 in). An excessive amount of sealant is not required to ensure a leak proof seal, and an excessive amount of sealant may reduce the effectiveness of the flange gasket.

(4) Install the front and rear cross-over gaskets onto the engine (Fig. 50).

(5) Install the flange gaskets. Ensure that the vertical port alignment tab is resting on the deck face of the block. Also the horizontal alignment tabs must be in position with the mating cylinder head gasket tabs

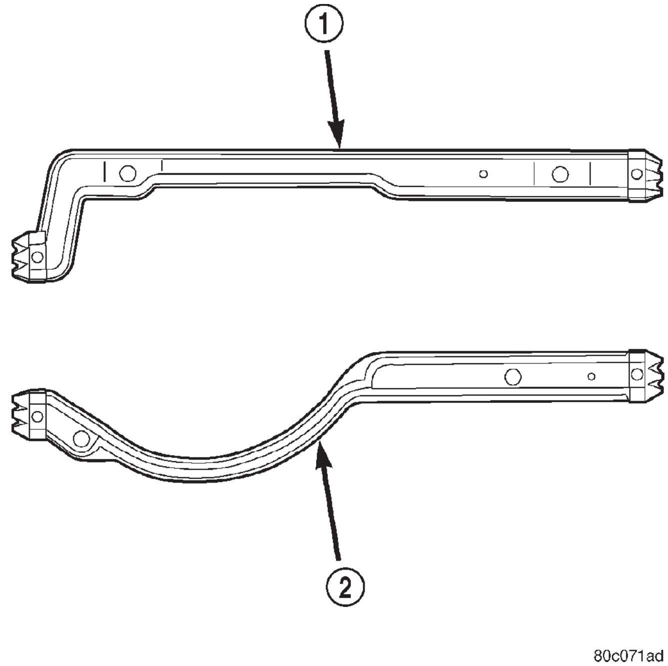


Fig. 50 Cross-Over Gaskets

1 – FRONT CROSS-OVER GASKET
2 – REAR CROSS-OVER GASKET

(Fig. 51). The words MANIFOLD SIDE should be visible on the center of each flange gasket.

(6) Carefully lower intake manifold into position on the cylinder block and cylinder heads. long studs at the front and rear of the manifold will help to align the intake manifold. After intake manifold is in place, inspect to make sure seals are in place. Remove alignment studs if used.

(7) The following torque sequence duplicates the expected results of the automated assembly system (Fig. 52).

- Step 1—Tighten bolts 1 and 2 to 8 N·m (72 in. lbs.) torque. Tighten in alternating steps 1.4 N·m (12 in. lbs.) torque at a time.
- Step 2—Tighten bolts 3 thru 12, in sequence, to 8 N·m (72 in. lbs.) torque.
- Step 3—Check that all bolts are tightened to 8 N·m (72 in. lbs.) torque.
- Step 4—Tighten all bolts, in sequence, to 16 N·m (12 ft. lbs.) torque.
- Step 5—Check that all bolts are tightened to 16 N·m (12 ft. lbs.) torque.

(8) Install closed crankcase ventilation and evaporation control systems.

(9) Install the coil wires.

(10) Connect the coolant temperature sending unit wire.

(11) Connect the heater hoses and bypass hose.

(12) Install distributor cap and wires.

REMOVAL AND INSTALLATION (Continued)

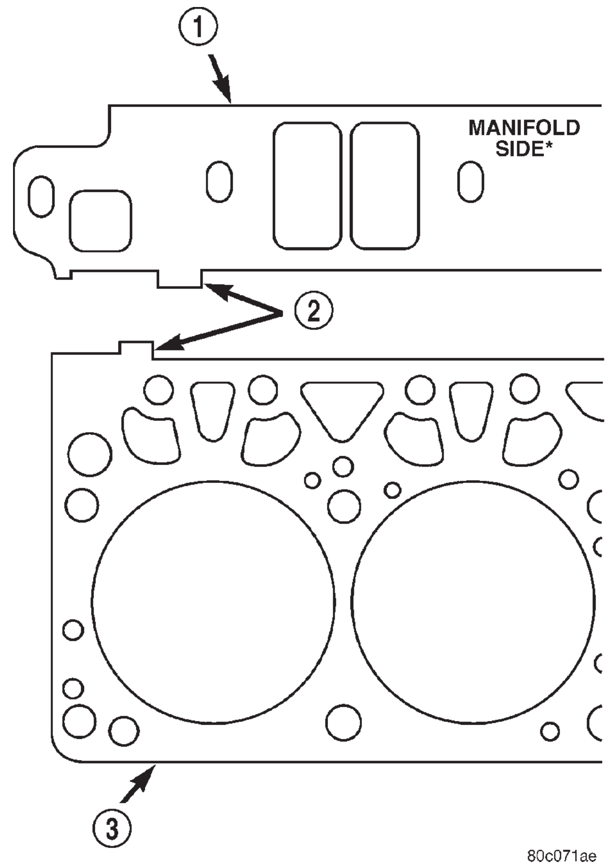


Fig. 51 Intake Manifold Flange Gasket Alignment

1 – FLANGE GASKET
2 – ALIGNMENT TABS
3 – CYLINDER HEAD GASKET

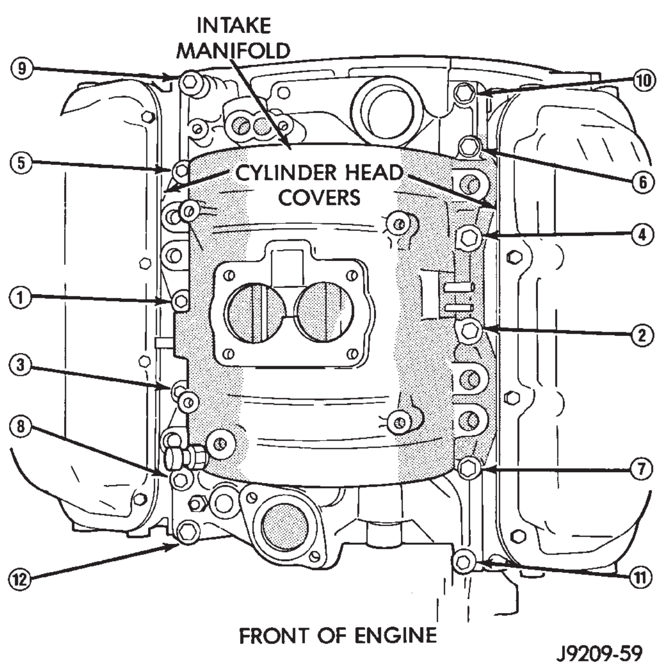


Fig. 52 Intake Manifold Bolt Tightening Sequence

(13) Connect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

(14) Install the fuel supply line to the fuel rail.

(15) Install the accessory drive bracket and A/C compressor.

(16) Install the generator and accessory drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque.

(17) Install the air cleaner assembly and air in-let hose.

(18) Fill cooling system.

(19) Connect the battery negative cable.

DISTRIBUTOR DRIVE SHAFT BUSHING

REMOVAL

(1) Remove distributor. Refer to Group 8D, Ignition Systems for the proper procedure.

(2) Remove the intake manifold. Refer to Intake Manifold in this section for correct procedure.

(3) Insert Distributor Drive Shaft Bushing Puller Tool C-3052 into old bushing and thread down until a tight fit is obtained (Fig. 53).

(4) Hold puller screw and tighten puller nut until bushing is removed.

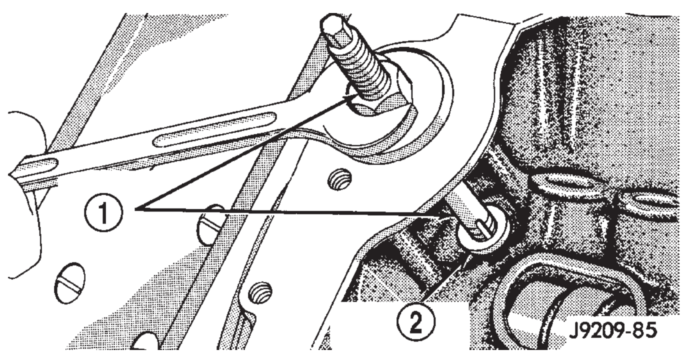


Fig. 53 Distributor Driveshaft Bushing Removal

1 – SPECIAL TOOL C-3052
2 – BUSHING

INSTALLATION

(1) Slide new bushing over burnishing end of Distributor Drive Shaft Bushing Driver/Burnisher Tool C-3053. Insert the tool and bushing into the bore.

(2) Drive bushing and tool into position, using a hammer (Fig. 54).

(3) As the burnisher is pulled through the bushing, the bushing is expanded tight in the block and burnished to correct size (Fig. 55). **DO NOT ream this bushing.**

CAUTION: This procedure MUST be followed when installing a new bushing or seizure to shaft may occur.

REMOVAL AND INSTALLATION (Continued)

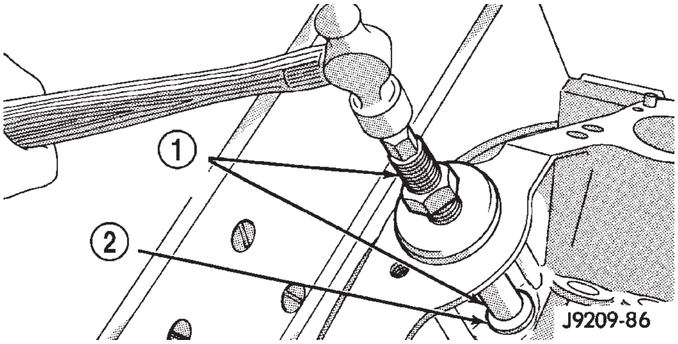


Fig. 54 Distributor Driveshaft Bushing Installation

1 – SPECIAL TOOL C-3053
2 – BUSHING

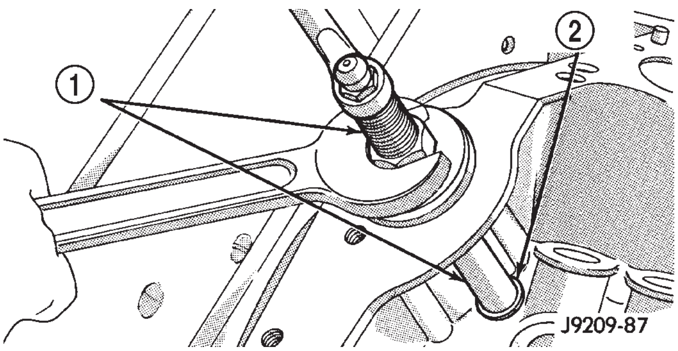


Fig. 55 Burnishing Distributor Driveshaft Bushing

1 – SPECIAL TOOL C-3053
2 – BUSHING

(4) Install the intake manifold. Refer to Intake Manifold in this section for correct procedure.

DISTRIBUTOR INSTALLATION

NOTE: Before installing the distributor, the oil pump drive shaft must be aligned to number one cylinder.

(1) Rotate crankshaft until No. 1 cylinder is at top dead center on the firing stroke.

(2) When in this position, the timing mark of vibration damper should be under “0” on the timing indicator.

(3) Install the shaft so that after the gear spirals into place, it will index with the oil pump shaft. The slot on top of oil pump shaft should be aligned toward the left front intake manifold attaching bolt hole (Fig. 56).

(4) Install distributor. Refer to Group 8D, Ignition Systems for the proper procedure.

After the distributor has been installed, its rotational position must be set using the **SET SYNC** mode of the DRB scan tool. Refer to Checking Distributor Position following the Distributor Installation section in Group 8D, Ignition System.

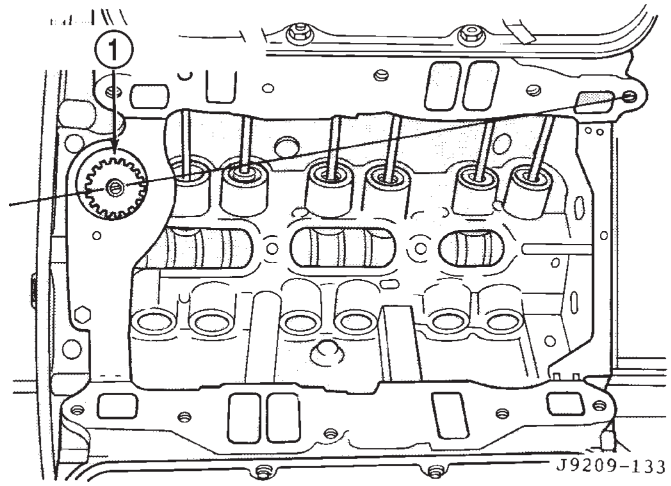


Fig. 56 Position of Oil Pump Shaft Slot

1 – DISTRIBUTOR DRIVE

Do not attempt to adjust ignition timing by rotating the distributor. It has no effect on ignition timing. Adjusting distributor position will affect fuel synchronization only.

VIBRATION DAMPER

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Remove fan, and fan drive. Refer to COOLING SYSTEM.

(3) Remove the accessory drive belt. Refer to COOLING SYSTEM.

(4) Remove the vibration damper pulley.

(5) Remove vibration damper bolt and washer from end of crankshaft.

(6) Install bar and screw from Puller Tool Set C-3688. Install two bolts with washers through the puller tool and into the vibration damper (Fig. 57).

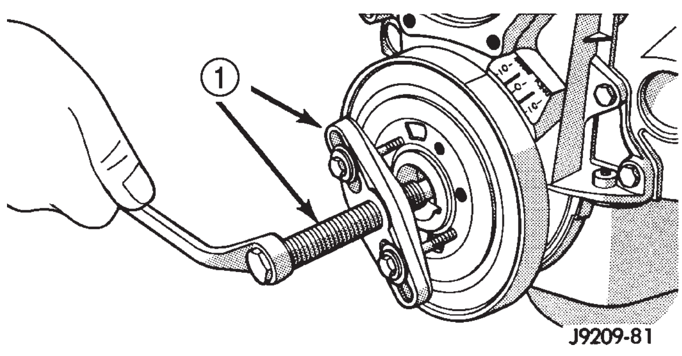


Fig. 57 Vibration Damper Assembly

1 – SPECIAL TOOL C-3688

(7) Pull vibration damper off of the crankshaft.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position the vibration damper onto the crankshaft.

(2) Place installing tool, part of Puller Tool Set C-3688, in position and press the vibration damper onto the crankshaft (Fig. 58).

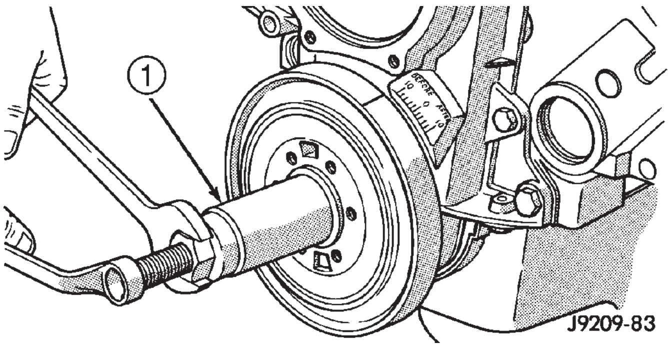


Fig. 58 Installing Vibration Damper

1 – SPECIAL TOOL C-3688

(3) Install the crankshaft bolt and washer. Tighten the bolt to 244 N·m (180 ft. lbs.) torque.

(4) Install the crankshaft pulley. Tighten the pulley bolts to 23 N·m (200 in. lbs.) torque.

(5) Install the serpentine belt.

(6) Install the cooling system fan.

(7) Install the fan shroud.

(8) Connect the negative cable to the battery.

TIMING CHAIN COVER

REMOVAL

(1) Disconnect the battery negative cable.

(2) Drain cooling system. Refer to Group 7, Cooling System.

(3) Remove the serpentine belt. Refer to Group 7, Cooling System.

(4) Remove water pump. Refer to Group 7, Cooling System.

(5) Remove power steering pump. Refer to Group 19, Steering.

(6) Remove vibration damper.

(7) Loosen oil pan bolts and remove the front bolt at each side.

(8) Remove the cover bolts.

(9) Remove chain case cover and gasket using extreme caution to avoid damaging oil pan gasket.

(10) From the inside of the cover tap the front crankshaft oil seal outward. Be careful not to damage the timing cover sealing surface.

INSTALLATION

(1) Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs.

(2) Using a new cover gasket, carefully install chain case cover to avoid damaging oil pan gasket. Use a small amount of Mopar Silicone Rubber Adhesive Sealant, or equivalent, at the joint between timing chain cover gasket and the oil pan gasket. Finger tighten the timing chain cover bolts at this time.

CAUTION: If chain cover is replaced for any reason, be sure the oil hole (passenger side of cover) is plugged.

(3) Place the smaller diameter of the oil seal over Front Oil Seal Installation Tool 6635 (Fig. 59). Seat the oil seal in the groove of the tool.

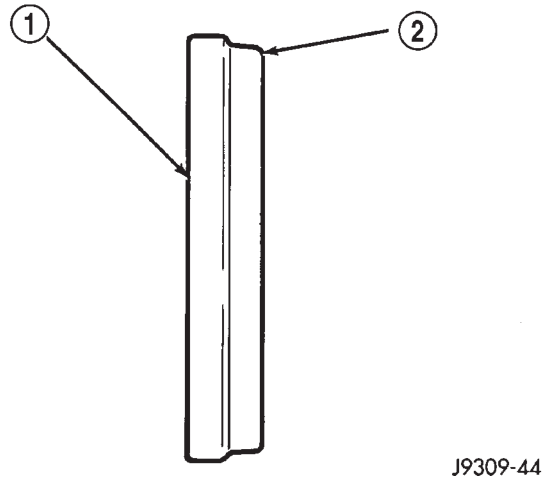


Fig. 59 Placing Oil Seal on Installation Tool 6635

1 – CRANKSHAFT FRONT OIL SEAL

2 – INSTALL THIS END INTO SPECIAL TOOL 6635

(4) Position the seal and tool onto the crankshaft (Fig. 60).

(5) Tighten the four lower chain case cover bolts to 13N·m (10 ft.lbs.) to prevent the cover from tipping during seal installation.

(6) Using the vibration damper bolt, tighten the bolt to draw the seal into position on the crankshaft (Fig. 61).

(7) Loosen the four bolts tightened in Step 4 to allow realignment of front cover assembly.

(8) Tighten chain case cover bolts to 41 N·m (30 ft. lbs.) torque. Tighten oil pan bolts to 24 N·m (215 in. lbs.) torque.

(9) Remove the vibration damper bolt and seal installation tool.

(10) Inspect the seal flange on the vibration damper.

(11) Install vibration damper.

(12) Install water pump and housing assembly using new gaskets. Refer to Group 7, Cooling System. Tighten bolts to 41 N·m (30 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

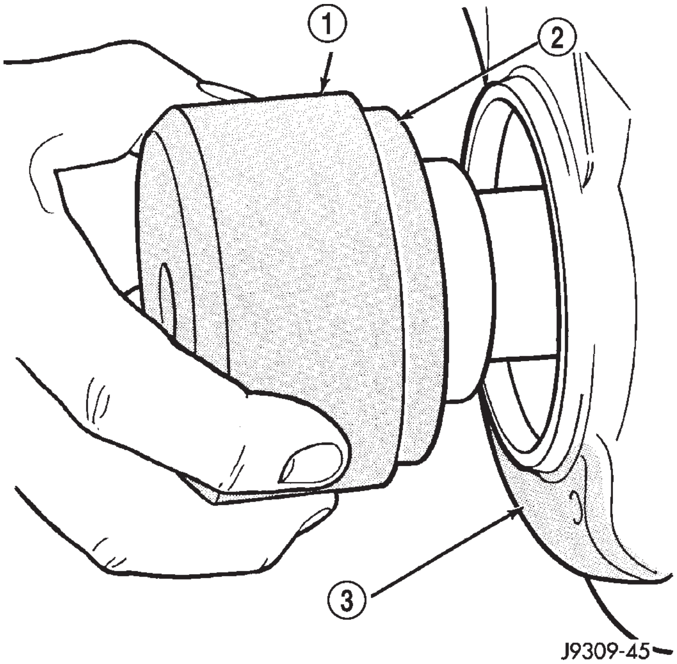


Fig. 60 Position Tool and Seal onto Crankshaft

1 – SPECIAL TOOL 6635
2 – OIL SEAL
3 – TIMING CHAIN COVER

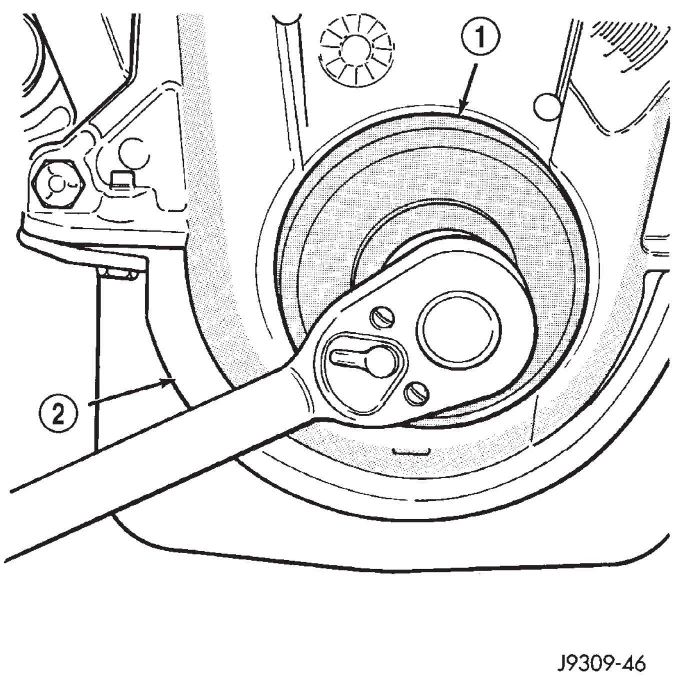


Fig. 61 Installing Oil Seal

1 – SPECIAL TOOL 6635
2 – TIMING CHAIN COVER

(13) Install power steering pump. Refer to Group 19, Steering.

(14) Install the serpentine belt. Refer to Group 7, Cooling System.

(15) Install the cooling system fan. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(16) Position the fan shroud and install the bolts. Tighten the bolts to 11 N·m (95 in. lbs.) torque.

(17) Fill cooling system. Refer to Group 7, Cooling System for the proper procedure.

(18) Connect the negative cable to the battery.

TIMING CHAIN AND TENSIONER

REMOVAL

(1) Disconnect battery negative cable.

(2) Drain cooling system. Refer to Group 7, Cooling System for the correct procedure.

(3) Remove timing chain cover. Refer to procedure in this group.

(4) Rotate crankshaft to align timing marks (Fig. 63) to #1 TDC.

(5) Remove camshaft sprocket attaching bolt and remove timing chain with crankshaft and camshaft sprockets.

(6) Slip crankshaft sprocket onto crankshaft and compress tensioner shoe by placing a large screwdriver between crankshaft sprocket and tensioner shoe (Fig. 62). Compress shoe until hole in shoe lines up with hole in bracket. Slide a suitable pin into the holes (Fig. 62) and remove screwdriver.

(7) If tensioner assembly is to be replaced, remove the three tensioner to block bolts and remove tensioner assembly.

INSTALLATION

(1) If tensioner assembly is being replaced, install tensioner and mounting bolts. Torque bolts to 24 N·m (210 in. lbs.).

(2) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on an exact imaginary center line through both camshaft and crankshaft bores.

(3) Place timing chain around both sprockets.

(4) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(5) Slide both sprockets evenly over their respective shafts and verify alignment of timing marks (Fig. 63) with a straight-edge if necessary.

(6) Install the camshaft bolt. Tighten the bolt to 68 N·m (50 ft. lbs.) torque.

(7) **Remove tensioner pin.** Again, verify alignment of timing marks.

(8) Install timing cover.

(9) Fill cooling system. Refer to Group 7, Cooling System for the correct procedure.

(10) Connect battery negative cable.

(11) Start engine and check for oil and coolant leaks.

REMOVAL AND INSTALLATION (Continued)

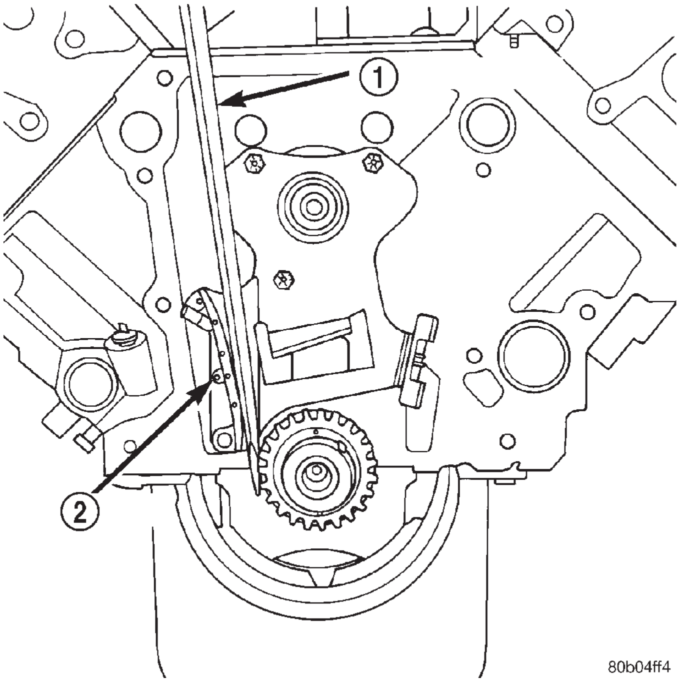


Fig. 62 Compressing Tensioner For Chain Installation

1 – SCREWDRIVER
2 – INSERT PIN HERE

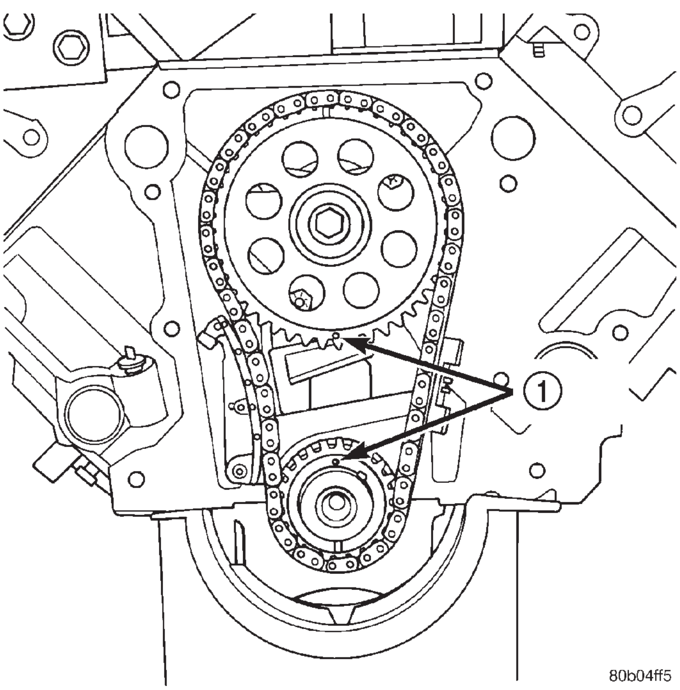


Fig. 63 Alignment of Timing Marks

1 – TIMING MARKS

CAMSHAFT

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove radiator. Refer to Group 7, Cooling for the correct procedure.

(3) Remove intake manifold. Refer to Intake Manifold in this section for the correct procedures.

(4) Remove distributor assembly. Refer to Group 8D, Ignition Systems for the correct procedure.

(5) Remove cylinder head covers.

(6) Remove rocker arms.

(7) Remove push rods and tappets. Identify each part so it can be installed in the original locations.

(8) Remove timing chain cover. Refer to Timing Chain Cover in this section for correct procedure.

(9) Align timing marks (Fig. 66) and remove timing chain and sprockets.

(10) Remove the three tensioner to block mounting bolts and remove tensioner.

(11) Install a long bolt into front of camshaft to aid in removal of the camshaft. Remove camshaft, being careful not to damage cam bearings with the cam lobes.

INSTALLATION

(1) Lubricate camshaft lobes and camshaft bearing journals and insert the camshaft to within 51 mm (2 inches) of its final position in cylinder block.

(2) Install Camshaft Gear Installer Tool C-3509 with tongue back of distributor drive gear (Fig. 64).

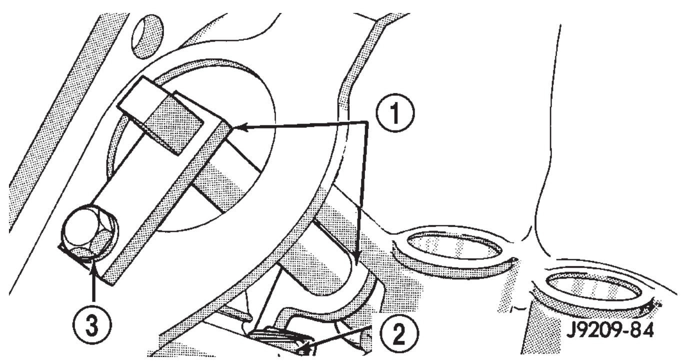


Fig. 64 Camshaft Holding Tool C-3509 (Installed Position)

1 – SPECIAL TOOL C-3509
2 – DRIVE GEAR
3 – DISTRIBUTOR LOCK BOLT

(3) Hold tool in position with a distributor lock-plate bolt. This tool will restrict camshaft from being pushed in too far and prevent knocking out the welch plug in rear of cylinder block. **Tool should remain installed until the camshaft and crankshaft sprockets and timing chain have been installed.**

REMOVAL AND INSTALLATION (Continued)

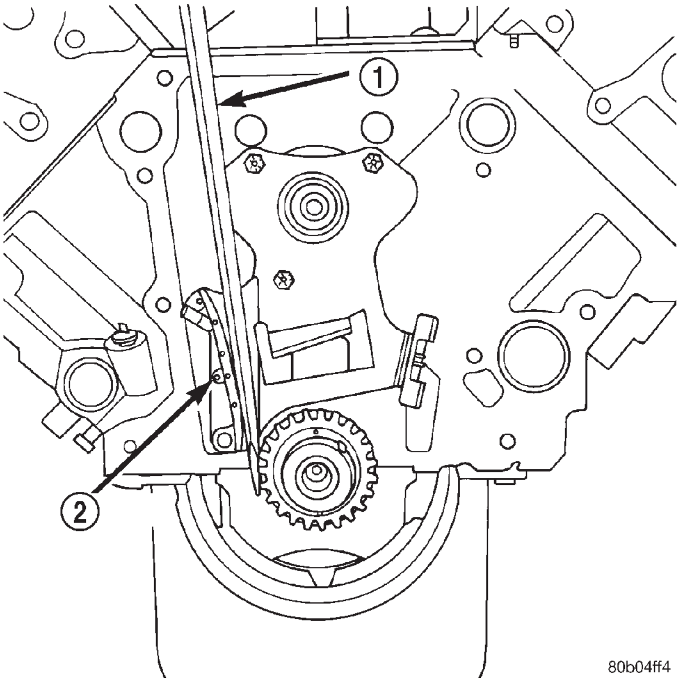


Fig. 65 Compressing Tensioner Shoe For Timing Chain Installation

1 – SCREWDRIVER
2 – INSERT PIN HERE

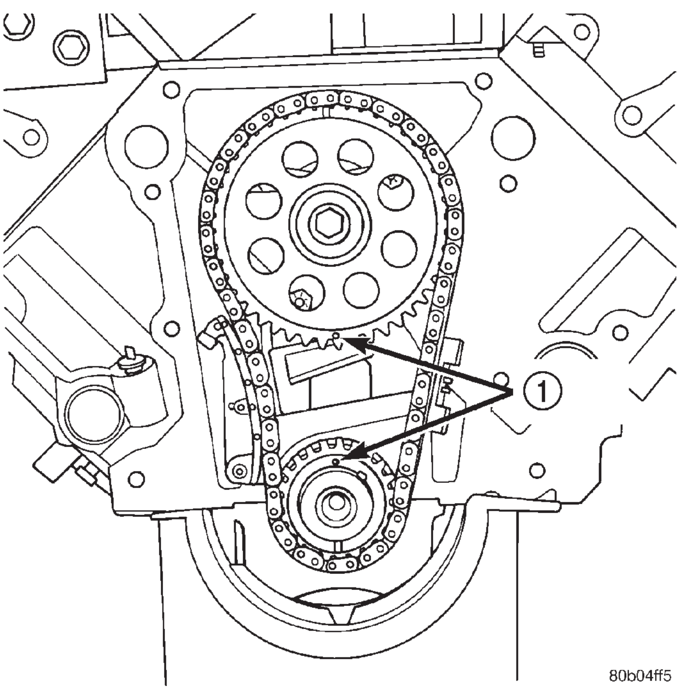


Fig. 66 Alignment of Timing Marks

1 – TIMING MARKS

(4) Install timing chain tensioner. Torque bolts to 24 N·m (210 in. lbs.) torque.

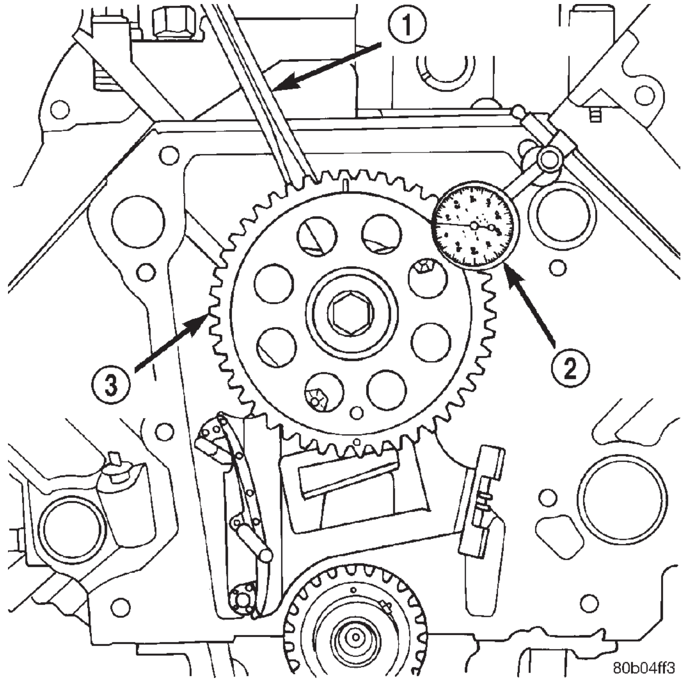


Fig. 67 Checking Camshaft End Play

1 – SCREWDRIVER
2 – DIAL INDICATOR
3 – CAM SPROCKET

(5) Compress tensioner shoe (Fig. 65) and install a suitable sized pin to retain shoe for chain installation.

(6) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on an exact imaginary center line through both camshaft and crankshaft bores.

(7) Place timing chain around both sprockets.

(8) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(9) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(10) Slide both sprockets evenly over their respective shafts and use a straightedge to check alignment of timing marks (Fig. 66).

(11) Install the camshaft bolt/cup washer. Tighten bolt to 68 N·m (50 ft. lbs.) torque.

(12) Measure camshaft end play (Fig. 67). Refer to Specifications for proper clearance. If not within limits, install a new timing chain tensioner.

(13) Each tappet reused must be installed in the same position at which it was removed. **When camshaft is replaced, all of the tappets must be replaced.**

(14) Install timing chain cover

(15) Install intake manifold.

(16) Install distributor. Refer to Group 8D, Ignition System for the correct procedure.

2000 AN Service Manual
Publication No. 81-370-0010
TSB 26-12-99 December, 1999

REMOVAL AND INSTALLATION (Continued)

(17) Install cylinder head covers.
(18) Install radiator.
(19) Fill cooling system. Refer to Group 7, Cooling System for the correct procedure.
(20) Connect battery negative cable.
(21) Start engine and check for leaks.

CAMSHAFT BEARINGS

REMOVAL

(1) With engine completely disassembled, drive out rear cam bearing core hole plug.
(2) Install proper size adapters and horseshoe washers (part of Camshaft Bearing Remover/Installer Tool C-3132-A) at back of each bearing shell. Drive out bearing shells (Fig. 68).

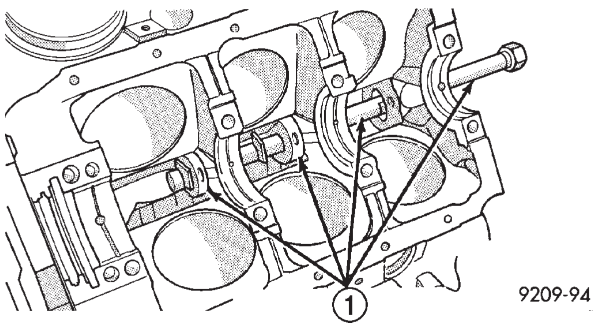


Fig. 68 Camshaft Bearings Removal and Installation with Tool C-3132-A

1 – SPECIAL TOOL C-3132A

INSTALLATION

(1) Install new camshaft bearings with Camshaft Bearing Remover/Installer Tool C-3132-A by sliding the new camshaft bearing shell over proper adapter.
(2) Position rear bearing in the tool. Install horseshoe lock and, by reversing removal procedure, carefully drive bearing shell into place.
(3) Install remaining bearings in the same manner. Bearings must be carefully aligned to bring oil holes into full register with oil passages from the main bearing. If the camshaft bearing shell oil holes are not in exact alignment, remove and install them correctly. Install a new core hole plug at the rear of camshaft. **Be sure this plug does not leak.**

CRANKSHAFT MAIN BEARINGS

REMOVAL

(1) Remove the oil pan. Refer to Oil Pan in this section for correct procedure.
(2) Remove the oil pump from the rear main bearing cap.
(3) Identify bearing caps before removal. Remove bearing caps one at a time.
(4) Remove upper half of bearing by inserting Crankshaft Main Bearing Remover/Installer Tool C-3059 into the oil hole of crankshaft (Fig. 69).
(5) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

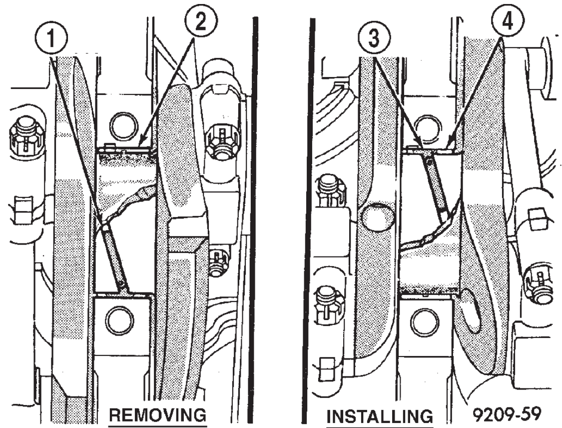


Fig. 69 Upper Main Bearing Removal and Installation with Tool C-3059

1 – SPECIAL TOOL C-3059
2 – BEARING
3 – SPECIAL TOOL C-3059
4 – BEARING

INSTALLATION

Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened. All bearing capbolts removed during service procedures are to be cleaned and oiled before installation. DO NOT use a new bearing half with an old bearing half.

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

(1) Start bearing in place, and insert Crankshaft Main Bearing Remover/Installer Tool C-3059 into oil hole of crankshaft (Fig. 69).
(2) Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Tool C-3059.
(3) Install the bearing caps. Clean and oil the bolts. Tighten the capbolts to 115 N·m (85 ft. lbs.) torque.
(4) Install the oil pump.
(5) Install the oil pan.

OIL PAN

REMOVAL

2WD

(1) Disconnect the negative cable from the battery.
(2) Remove air cleaner assembly.
(3) Remove engine oil dipstick.
(4) Disconnect distributor cap and position away from cowl.
(5) Remove the fan shroud. Refer to COOLING SYSTEM.
(6) Disconnect throttle valve cable from throttle body and mounting bracket (Fig. 69A).
(7) Raise vehicle.
(8) Drain engine oil.
(9) Remove exhaust pipe from exhaust manifolds.
(10) Remove engine mount insulator through bolts.
(11) Raise engine by way of oil pan using a block of wood between the jack and oil pan.
(12) When engine is high enough, place mount through bolts in the engine mount attaching points on the frame brackets.

2000 AN Service Manual
Publication No. 81-370-0010
TSB 26-12-99 December, 1999

REMOVAL AND INSTALLATION (Continued)

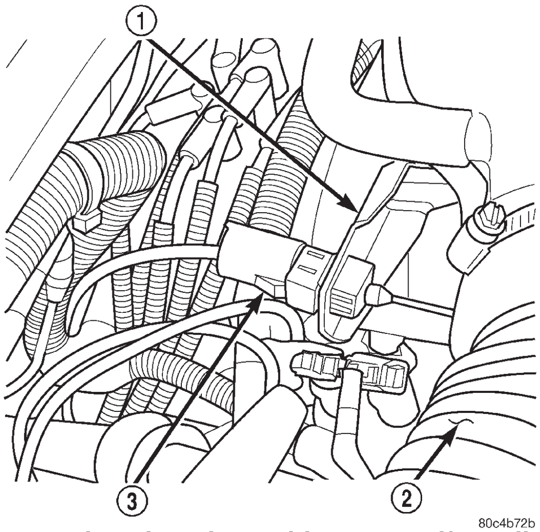


Fig. 69A Throttle Valve Cable Removal/Installation

1 – TRANSMISSION THROTTLE VALVE CABLE BRACKET
2 – AIR INLET DUCT
3 – TRANSMISSION THROTTLE VALVE CABLE

(13) Lower engine so bottom of engine mounts rest on the replacement bolts placed in the engine mount frame brackets.
(14) Remove transmission to engine braces.
(15) Remove starter. Refer to STARTING SYSTEMS.
(16) Remove transmission torque converter inspection cover.
(17) Disconnect rear support cushion from crossmember.
(18) Raise rear of transmission away from crossmember.
(19) Remove oil pan and one-piece gasket.

4WD

(1) Disconnect the negative cable from the battery.
(2) Remove engine oil dipstick.
(3) Raise vehicle.
(4) Drain engine oil.
(5) Remove front driving axle. Refer to DIFFERENTIAL and DRIVELINE.
(6) Remove both engine mount support brackets.
(7) Remove transmission torque converter inspection cover.
(8) Remove oil pan and one-piece gasket.

INSTALLATION

2WD

(1) Fabricate 4 alignment dowels from 5/16 x 1 1/2 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 70).
(2) Install the dowels in the cylinder block (Fig. 71).
(3) Apply small amount of Mopar Silicone Rubber Adhesive Sealant, or equivalent in the corner of the cap and the cylinder block.
(4) Slide the one-piece gasket over the dowels and onto the block.
(5) Position the oil pan over the dowels and onto the gasket.

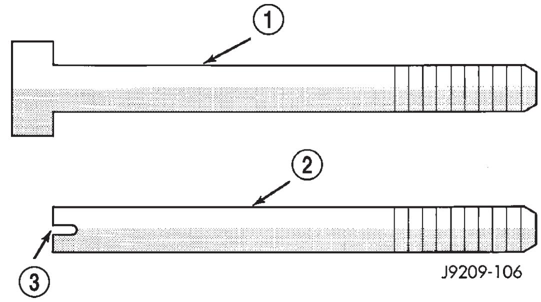


Fig. 70 Fabrication of Alignment Dowels

1 – 1 1/2” x 5/16” BOLT
2 – DOWEL
3 – SLOT

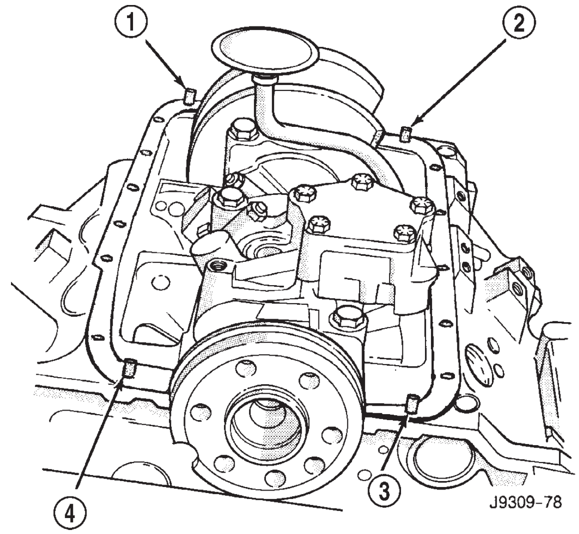


Fig. 71 Position of Dowels in Cylinder Block

1 – DOWEL
2 – DOWEL
3 – DOWEL
4 – DOWEL

(6) Install the oil pan bolts. Tighten the bolts to 24 N·m (215 in. lbs.) torque.
(7) Remove the dowels. Install the remaining oil pan bolts. Tighten these bolts to 24 N·m (215 in. lbs.) torque.
(8) Install the drain plug. Tighten drain plug to 34 N·m (25 ft. lbs.) torque.
(9) Lower transmission onto crossmember.
(10) Install rear support cushion mounting bolts. Tighten bolts 28 N·m (250 in. lbs.) torque.
(11) Raise engine by way of oil pan with a wood block placed between jack and oil pan.
(12) Remove through bolts from frame brackets and lower engine. Install mount insulator through bolts and tighten to 95 N·m (70 ft. lbs.).
(13) Install starter.
(14) Install transmission torque converter inspection cover.
(15) Install engine to transmission braces.
(16) Install exhaust pipe.
(17) Lower vehicle.
(18) Position throttle valve cable into bracket, then attach to throttle body (Fig. 69A).

2000 AN Service Manual
Publication No. 81-370-0010
TSB 26-12-99 December, 1999

REMOVAL AND INSTALLATION (Continued)

(19) Connect the distributor cap.
(20) Install dipstick.
(21) Install fan shroud.
(22) Install air cleaner assembly.
(23) Connect the negative cable to the battery.
(24) Fill crankcase with oil to proper level.

4WD

(1) Fabricate 4 alignment dowels from 1 1/2 x 5/16 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 70).
(2) Install the dowels in the cylinder block (Fig. 71).
(3) Apply small amount of Mopar Silicone Rubber Adhesive Sealant, or equivalent in the corner of the cap and the cylinder block.
(4) Slide the one-piece gasket over the dowels and onto the block.
(5) Position the oil pan over the dowels and onto the gasket.
(6) Install the oil pan bolts. Tighten the bolts to 24 N·m (215 in. lbs.) torque.
(7) Remove the dowels. Install the remaining oil pan bolts. Tighten these bolts to 24 N·m (215 in. lbs.) torque.
(8) Install the drain plug. Tighten drain plug to 34 N·m (25 ft. lbs.) torque.
(9) Install transmission inspection cover.
(10) Install engine mount support brackets and insulators.
(11) Install front drive axle. Refer to DIFFERENTIAL and DRIVELINE.
(12) Lower vehicle
(13) Connect the distributor cap.
(14) Install dipstick.
(15) Connect the negative cable to the battery.
(16) Fill crankcase with oil to proper level.

OIL PUMP

REMOVAL

(1) Remove the oil pan.
(2) Remove the oil pump from rear main bearing cap.

INSTALLATION

(1) Install oil pump. During installation, slowly rotate pump body to ensure driveshaft-to-pump rotor shaft engagement.
(2) Hold the oil pump base flush against mating surface on No. 4 main bearing cap. Finger-tighten pump attaching bolts. Tighten attaching bolts to 41 N·m (30 ft. lbs.) torque.
(3) Install the oil pan.

PISTON AND CONNECTING ROD ASSEMBLY

REMOVAL

(1) Remove the engine from the vehicle. Refer to Engine Assembly in this section for correct procedure.
(2) Remove the cylinder head.
(3) Remove the oil pan.
(4) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. Be sure to keep tops of pistons covered during this operation.
(5) Be sure each connecting rod and connecting rod cap is identified with the cylinder number. Remove connecting rod cap. Install connecting rod bolt guide set on connecting rod bolts.
(6) Pistons and connecting rods must be removed from top of cylinder block. When removing the assemblies from the engine, rotate crankshaft so that the connecting rod is centered in cylinder bore and at BDC. **Be careful not to nick crankshaft journals.**
(7) After removal, install bearing cap on the mating rod.

INSTALLATION

(1) Be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.
(2) Before installing the ring compressor, be sure the oil ring expander ends are butted and the rail gaps located properly (Fig. 72).

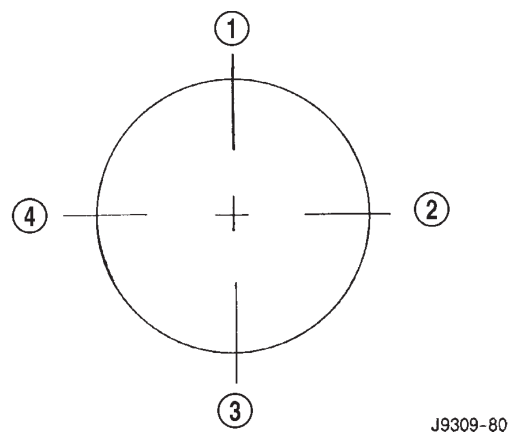


Fig. 72 Proper Ring Installation

1 – OIL RING SPACER GAP
2 – SECOND COMPRESSION RING GAP OIL RING RAIL GAP (TOP)
3 – OIL RING RAIL GAP (BOTTOM)
4 – TOP COMPRESSION RING GAP

(3) Immerse the piston head and rings in clean engine oil. Slide Piston Ring Compressor Tool C-385 over the piston and tighten with the special wrench (part of Tool C-385). **Be sure position of rings does not change during this operation.**
(4) Install connecting rod bolt protectors on rod bolts. The long protector should be installed on the numbered side of the connecting rod.
(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Be sure connecting rod and cylinder bore number are the same. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.
(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on crankshaft journal.
(7) The notch, or groove, on top of piston must be pointing toward front of engine. The larger chamfer

REMOVAL AND INSTALLATION (Continued)

of the connecting rod bore must be installed toward crankshaft journal fillet.

(8) Install rod caps. Be sure connecting rod, connecting rod cap, and cylinder bore number are the same. Install nuts on cleaned and oiled rod bolts and tighten nuts to 61 N·m (45 ft. lbs.) torque.

(9) Install the oil pan.

(10) Install the cylinder head.

(11) Install the engine into the vehicle.

CRANKSHAFT

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the vibration damper.

(4) Remove the timing chain cover.

(5) Identify bearing caps before removal. Remove bearing caps and bearings one at a time.

(6) Lift the crankshaft out of the block.

(7) Remove and discard the crankshaft rear oil seals.

(8) Remove and discard the front crankshaft oil seal.

INSTALLATION

(1) Lightly oil the new upper seal lips with engine oil.

(2) Install the new upper rear bearing oil seal with the white paint facing towards the rear of the engine.

(3) Position the crankshaft into the cylinder block.

(4) Lightly oil the new lower seal lips with engine oil.

(5) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(6) Apply 5 mm (0.20 in) drop of Loctite 518, or equivalent, on each side of the rear main bearing cap (Fig. 73). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

(7) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(8) Clean and oil all cap bolts. Install all main bearing caps. Install all cap bolts and alternately tighten to 115 N·m (85 ft. lbs.) torque.

(9) Install oil pump.

(10) Install the timing chain cover.

(11) Install the vibration damper.

(12) Apply Mopar Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 74). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(13) Install new front crankshaft oil seal.

(14) Immediately install the oil pan.

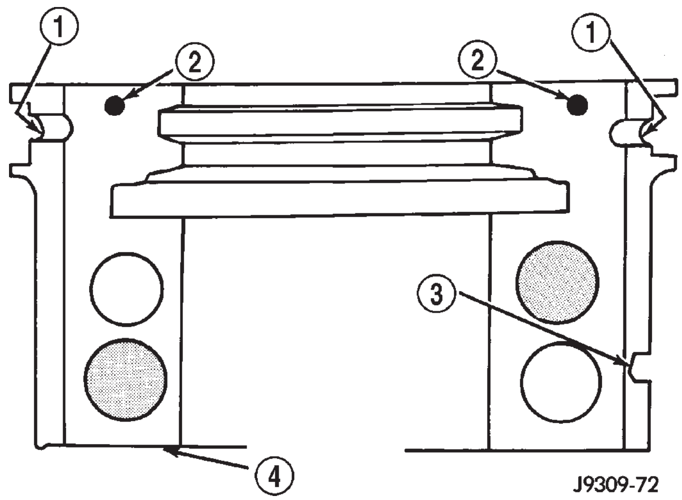


Fig. 73 Sealant Application to Bearing Cap

1 – MOPAR SILICONE RUBBER ADHESIVE SEALANT SLOTS
2 – LOCTITE 518 (OR EQUIVALENT)
3 – CAP ALIGNMENT SLOT
4 – REAR MAIN BEARING CAP

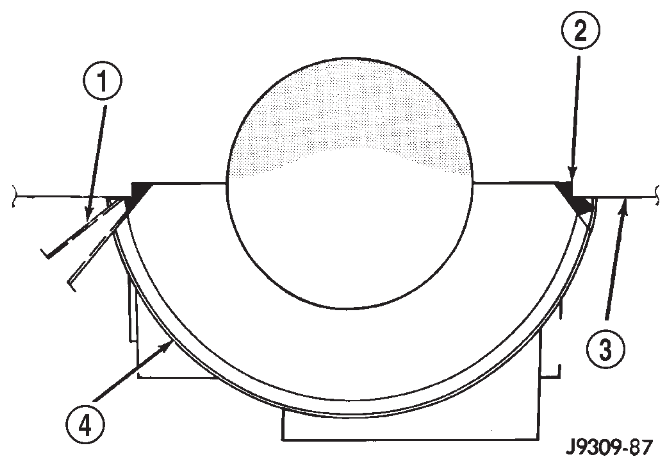


Fig. 74 Apply Sealant to Bearing Cap to Block Joint

1 – MOPAR SILICONE RUBBER ADHESIVE SEALANT NOZZLE TIP
2 – SEALANT APPLIED
3 – CYLINDER BLOCK
4 – REAR MAIN BEARING CAP

CRANKSHAFT FRONT OIL SEAL

REMOVAL

The oil seal can be replaced without removing the timing chain cover, provided that the cover is not misaligned.

(1) Disconnect the negative cable from the battery.

REMOVAL AND INSTALLATION (Continued)

(2) Remove vibration damper.

(3) If front seal is suspected of leaking, check front oil seal alignment to crankshaft. The seal installation/alignment Tool 6635, should fit with minimum interference. If tool does not fit, the cover must be removed and installed properly.

(4) Place a suitable tool behind the lips of the oil seal to pry the oil seal outward. Be careful not to damage the crankshaft seal bore of cover.

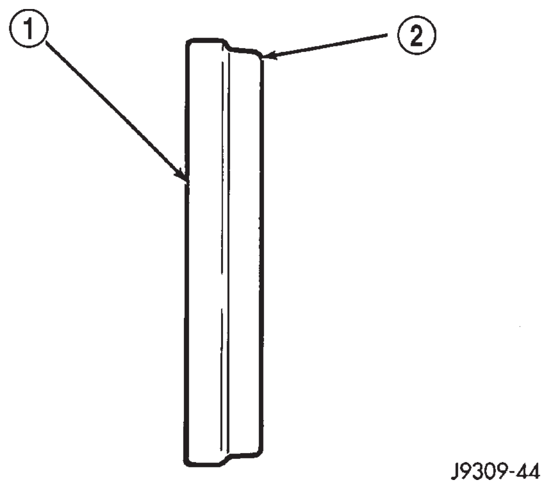


Fig. 75 Placing Oil Seal on Installation Tool 6635

1 – CRANKSHAFT FRONT OIL SEAL
2 – INSTALL THIS END INTO SPECIAL TOOL 6635

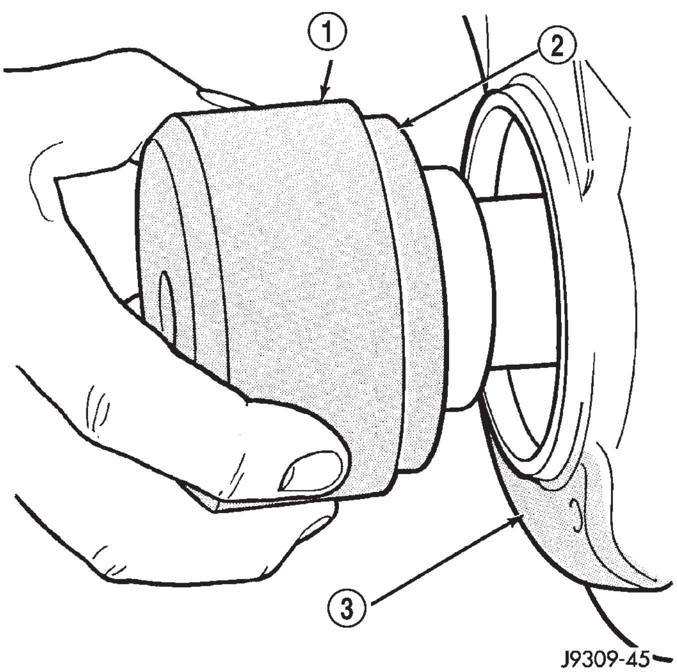


Fig. 76 Position Tool and Seal onto Crankshaft

1 – SPECIAL TOOL 6635
2 – OIL SEAL
3 – TIMING CHAIN COVER

INSTALLATION

(1) Place the smaller diameter of the oil seal over Front Oil Seal Installation Tool 6635 (Fig. 75). Seat the oil seal in the groove of the tool.

(2) Position the seal and tool onto the crankshaft (Fig. 76).

(3) Using the vibration damper bolt, tighten the bolt to draw the seal into position on the crankshaft (Fig. 77).

(4) Remove the vibration damper bolt and seal installation tool.

(5) Inspect the seal flange on the vibration damper.

(6) Install the vibration damper.

(7) Connect the negative cable to the battery.

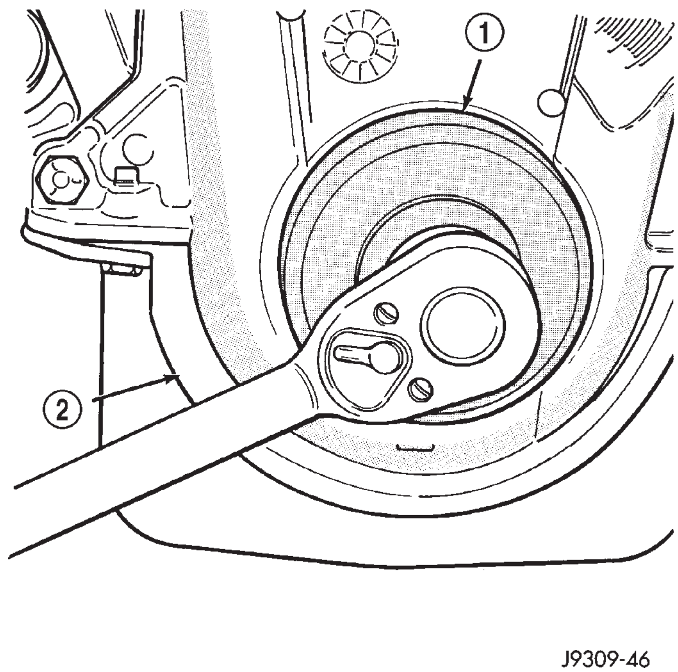


Fig. 77 Installing Oil Seal

1 – SPECIAL TOOL 6635
2 – TIMING CHAIN COVER

CRANKSHAFT REAR OIL SEALS

The service seal is a two piece, Viton seal. The upper seal half can be installed with crankshaft removed from engine or with crankshaft installed. When a new upper seal is installed, install a new lower seal. The lower seal half can be installed only with the rear main bearing cap removed.

UPPER SEAL —CRANKSHAFT REMOVED

REMOVAL

(1) Remove the crankshaft. Discard the old upper seal.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Clean the cylinder block rear cap mating surface. Be sure the seal groove is free of debris. Check for burrs at the oil hole on the cylinder block mating surface to rear cap.

(2) Lightly oil the new upper seal lips with engine oil.

(3) Install the new upper rear bearing oil seal with the white paint facing toward the rear of the engine.

(4) Position the crankshaft into the cylinder block.

(5) Lightly oil the new lower seal lips with engine oil.

(6) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(7) Apply 5 mm (0.20 in.) drop of Loctite 518, or equivalent, on each side of the rear main bearing cap (Fig. 78). DO NOT over-apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

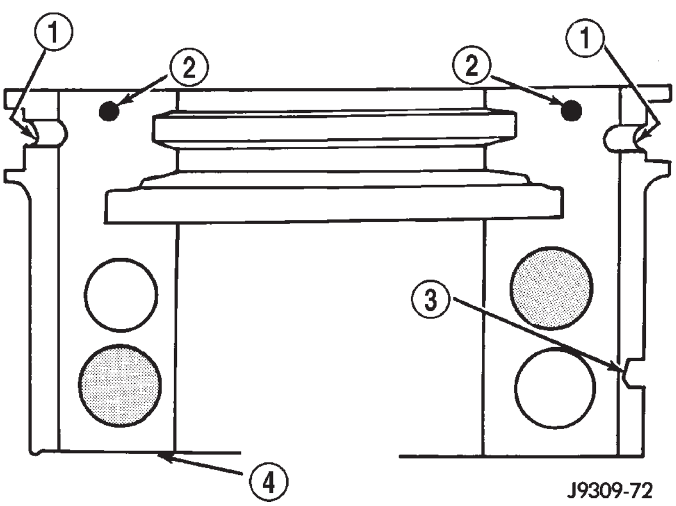


Fig. 78 Sealant Application to Bearing Cap

1 – MOPAR SILICONE RUBBER ADHESIVE SEALANT SLOTS
2 – LOCTITE 518 (OR EQUIVALENT)
3 – CAP ALIGNMENT SLOT
4 – REAR MAIN BEARING CAP

(8) To align the bearing cap, use cap slot, alignment dowel, and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than two times for proper engagement.

(9) Clean and oil all cap bolts. Install all main bearing caps. Install all cap bolts and alternately tighten to 115 N·m (85 ft. lbs.) torque.

(10) Install oil pump.

(11) Apply Mopar Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap-to-block joint to provide cap to block and oil pan sealing (Fig. 79). Apply enough sealant so that a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(12) Install new front crankshaft oil seal.

(13) Immediately install the oil pan.

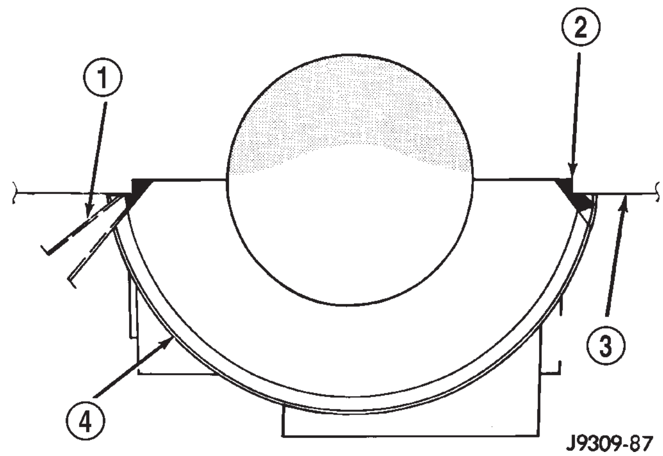


Fig. 79 Apply Sealant to Bearing Cap-to-Block Joint

1 – MOPAR SILICONE RUBBER ADHESIVE SEALANT NOZZLE TIP
2 – SEALANT APPLIED
3 – CYLINDER BLOCK
4 – REAR MAIN BEARING CAP

UPPER SEAL—CRANKSHAFT INSTALLED

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the rear main bearing cap. Remove and discard the old lower oil seal.

(4) Carefully remove and discard the old upper oil seal.

INSTALLATION

(1) Clean the cylinder block mating surfaces before oil seal installation. Check for burrs at the oil hole on the cylinder block mating surface to rear cap.

(2) Lightly oil the new upper seal lips with engine oil. To allow ease of installation of the seal, loosen at least the two main bearing caps forward of the rear bearing cap.

(3) Rotate the new upper seal into the cylinder block, being careful not to shave or cut the outer surface of the seal. To ensure proper installation, use the installation tool provided with the kit. Install the new seal with the white paint facing toward the rear of the engine.

(4) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing toward the rear of the engine.

(5) Apply 5 mm (0.20 in.) drop of Loctite 518, or equivalent, on each side of the rear main bearing cap

REMOVAL AND INSTALLATION (Continued)

(Fig. 78). DO NOT over-apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application. Be sure the white paint faces toward the rear of the engine.

(6) To align the bearing cap, use cap slot, alignment dowel, and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than two times for proper engagement.

(7) Install the rear main bearing cap with cleaned and oiled cap bolts. Alternately tighten ALL cap bolts to 115 N·m (85 ft. lbs.) torque.

(8) Install oil pump.

(9) Apply Mopar Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap-to-block joint to provide cap-to-block and oil pan sealing (Fig. 79). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(10) Immediately install the oil pan.

LOWER SEAL

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the rear main bearing cap and discard the old lower seal.

INSTALLATION

(1) Clean the rear main cap mating surfaces including the oil pan gasket groove.

(2) Carefully install a new upper seal. Refer to Upper Seal Replacement — Crankshaft Installed in this section for correct procedure.

(3) Lightly oil the new lower seal lips with engine oil.

(4) Install a new lower seal in bearing cap with the white paint facing the rear of engine.

(5) Apply 5 mm (0.20 in.) drop of Loctite 518, or equivalent, on each side of the rear main bearing cap (Fig. 78). DO NOT over-apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

(6) To align the bearing cap, use cap slot, alignment dowel, and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than two times for proper engagement.

(7) Install the rear main bearing cap with cleaned and oiled cap bolts. Alternately tighten the cap bolts to 115 N·m (85 ft. lbs.) torque.

(8) Install oil pump.

(9) Apply Mopar Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap-to-block joint to provide cap to block and oil pan sealing. Apply enough sealant so that a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(10) Immediately install the oil pan.

ENGINE CORE OIL AND CAMSHAFT PLUGS

Engine core plugs have been pressed into the oil galleries behind the camshaft thrust plate (Fig. 80). This will reduce internal leakage and help maintain higher oil pressure at idle.

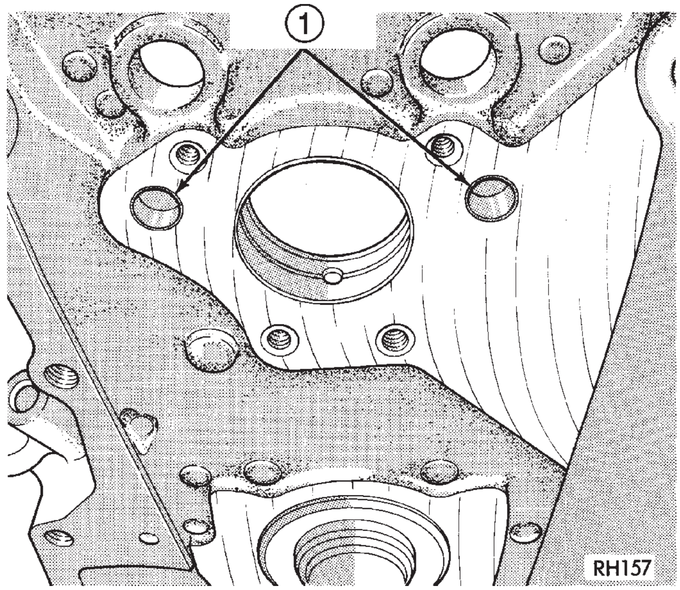


Fig. 80 Location of Cup Plugs in Oil Galleries
1 – CUP PLUGS

REMOVAL

(1) Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 81).

(2) With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 81).

INSTALLATION

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer.

Be certain the new plug is cleaned of all oil or grease.

(1) Coat edges of plug and core hole with Mopar® Gasket Maker, or equivalent.

CAUTION: DO NOT drive cup plug into the casting, as restricted coolant flow can result and cause serious engine problems.

REMOVAL AND INSTALLATION (Continued)

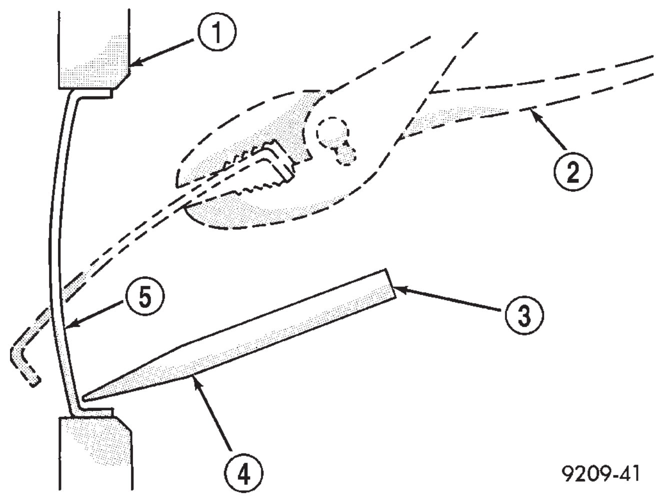


Fig. 81 Core Hole Plug Removal

1 – CYLINDER BLOCK
2 – REMOVE PLUG WITH PLIERS
3 – STRIKE HERE WITH HAMMER
4 – DRIFT PUNCH
5 – CUP PLUG

(2) Using proper plug drive, drive cup plug into hole. The sharp edge of the plug should be at least 0.50 mm (0.020 in.) inside the lead-in chamfer.

(3) It is not necessary to wait for curing of the sealant. The cooling system can be filled and the vehicle placed in service immediately.

DISASSEMBLY AND ASSEMBLY

OIL PUMP

DISASSEMBLE

(1) Remove the relief valve as follows:

(a) Remove cotter pin. Drill a 3.175 mm (1/8 in.) hole into the relief valve retainer cap and insert a self-threading sheet metal screw into cap.

(b) Clamp screw into a vise and while supporting oil pump, remove cap by tapping pump body using a soft hammer. Discard retainer cap and remove spring and relief valve (Fig. 82).

(2) Remove oil pump cover (Fig. 83).

(3) Remove pump outer rotor and inner rotor with shaft (Fig. 83).

(4) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

ASSEMBLE

(1) Install pump rotors and shaft, using new parts as required.

(2) Position the oil pump cover onto the pump body. Tighten cover bolts to 11 N·m (95 in. lbs.) torque.

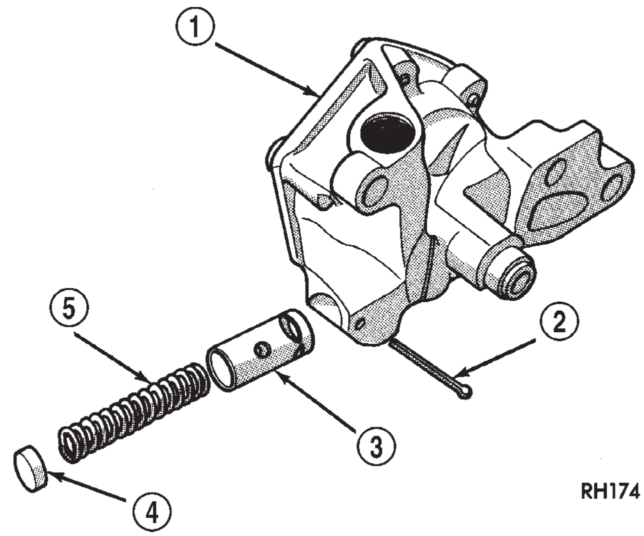


Fig. 82 Oil Pressure Relief Valve

1 – OIL PUMP ASSEMBLY
2 – COTTER PIN
3 – RELIEF VALVE
4 – RETAINER CAP
5 – SPRING

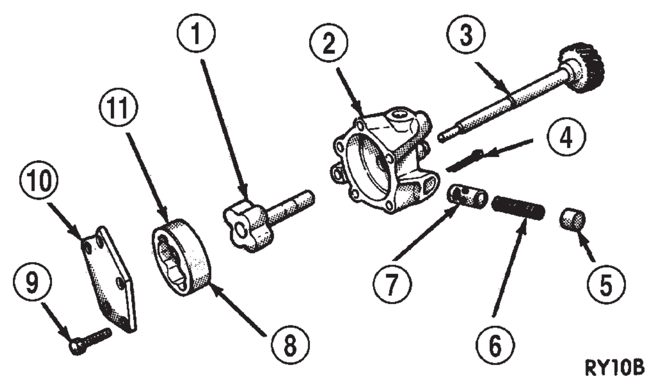


Fig. 83 Oil Pump

1 – INNER ROTOR AND SHAFT
2 – BODY
3 – DISTRIBUTOR DRIVESHAFT (REFERENCE)
4 – COTTER PIN
5 – RETAINER CAP
6 – SPRING
7 – RELIEF VALVE
8 – LARGE CHAMFERED EDGE
9 – BOLT
10 – COVER
11 – OUTER ROTOR

(3) Install the relief valve and spring. Insert the cotter pin.

(4) Tap on a new retainer cap.

(5) Prime oil pump before installation by filling rotor cavity with engine oil.

CLEANING AND INSPECTION

CYLINDER HEAD COVER

CLEANING

Clean cylinder head cover gasket surface.

Clean head rail, if necessary.

INSPECTION

Inspect cover for distortion and straighten, if necessary.

Check the gasket for use in head cover installation. If damaged, use a new gasket.

CYLINDER HEAD

CLEANING

Clean all surfaces of cylinder block and cylinder heads.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

INSPECTION

Inspect all surfaces with a straightedge if there is any reason to suspect leakage. If out-of-flatness exceeds 0.00075mm (0.0001in.) times the span length in any direction, either replace head or lightly machine the head surface.

FOR EXAMPLE: —A 305 mm (12 in.) span is 0.102 mm (0.004 in.) out-of-flat. The allowable out-of-flat is 305 x 0.00075 (12 x 0.00075) equals 0.23 mm (0.009 in.). This amount of out-of-flat is acceptable.

The cylinder head surface finish should be 1.78-3.00 microns (70-125 microinches).

Inspect push rods. Replace worn or bent rods.

PISTON AND CONNECTING ROD INSPECTION

CLEANING

Clean the piston and connecting rod assembly using a suitable solvent.

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring. Refer to Connecting Rod Bearings in the Service Procedures portion of this Section.

Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore. Refer to Fitting Pistons in the Service Procedures portion of this Section.

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

OIL PUMP

CLEANING

Use only mild solvents to clean the oil pump. Do not use any abrasive material to clean the oil pump housing or rotors.

INSPECTION

Mating surface of the oil pump cover should be smooth. Replace pump assembly if cover is scratched or grooved.

Lay a straightedge across the pump cover surface (Fig. 84). If a 0.038 mm (0.0015 in.) feeler gauge can be inserted between cover and straightedge, pump assembly should be replaced.

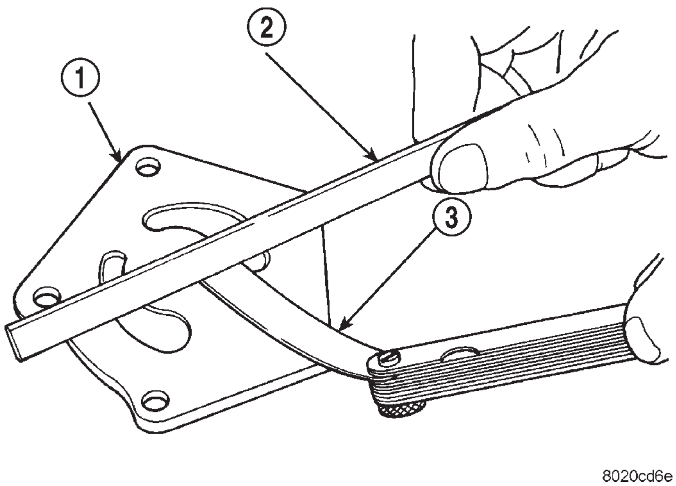


Fig. 84 Checking Oil Pump Cover Flatness

1 – COVER
2 – STRAIGHT EDGE
3 – FEELER GAUGE

Measure thickness and diameter of outer rotor. If outer rotor thickness measures 20.9 mm (0.825 in.) or less, or if the diameter is 62.7 mm (2.469 in.) or less, replace outer rotor (Fig. 85).

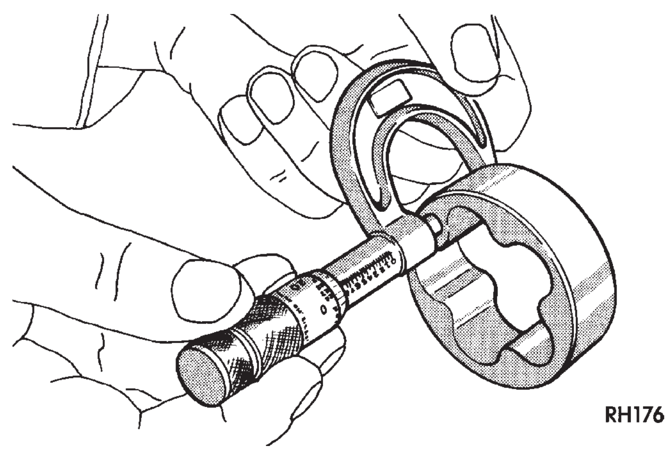


Fig. 85 Measuring Outer Rotor Thickness

CLEANING AND INSPECTION (Continued)

If inner rotor measures 20.9 mm (0.825 in.) or less, replace inner rotor and shaft assembly (Fig. 86).

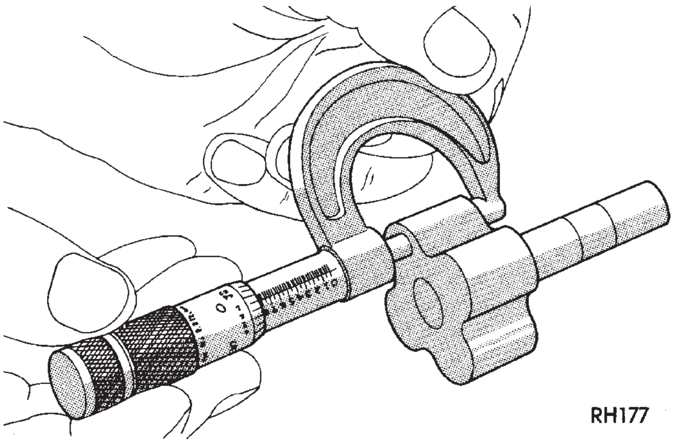


Fig. 86 Measuring Inner Rotor Thickness

Slide outer rotor into pump body. Press rotor to the side with your fingers and measure clearance between rotor and pump body (Fig. 87). If clearance is 0.356 mm (0.014 in.) or more, replace oil pump assembly.

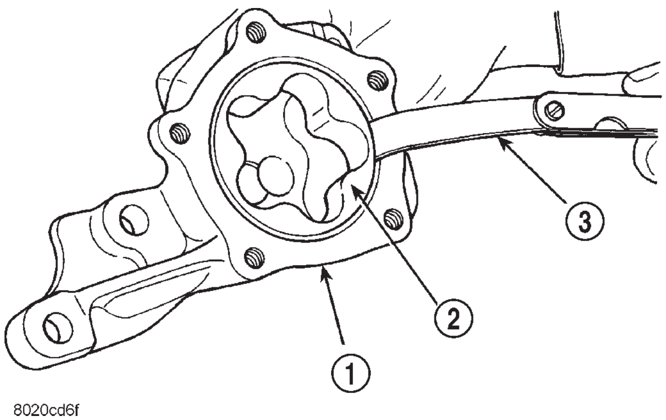


Fig. 87 Measuring Outer Rotor Clearance in Housing

1 – PUMP BODY
2 – OUTER ROTOR
3 – FEELER GAUGE

Install inner rotor and shaft into pump body. If clearance between inner and outer rotors is 0.203 mm (0.008 in.) or more, replace shaft and both rotors (Fig. 88).

Place a straightedge across the face of the pump, between bolt holes. If a feeler gauge of 0.102 mm (0.004 in.) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 89).

Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

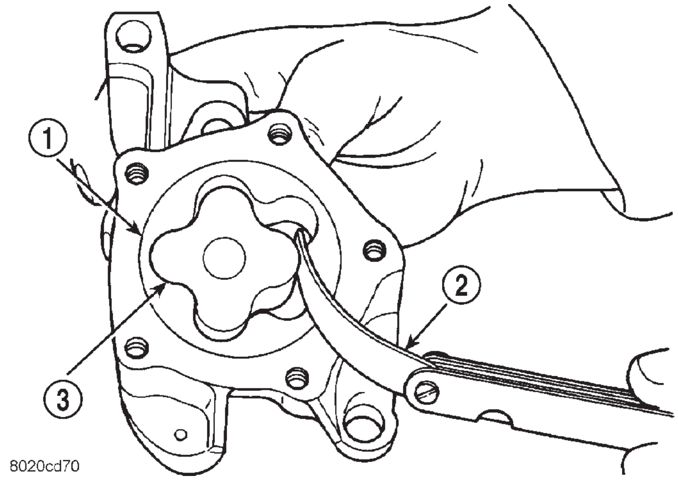


Fig. 88 Measuring Clearance Between Rotors

1 – OUTER ROTOR
2 – FEELER GAUGE
3 – INNER ROTOR

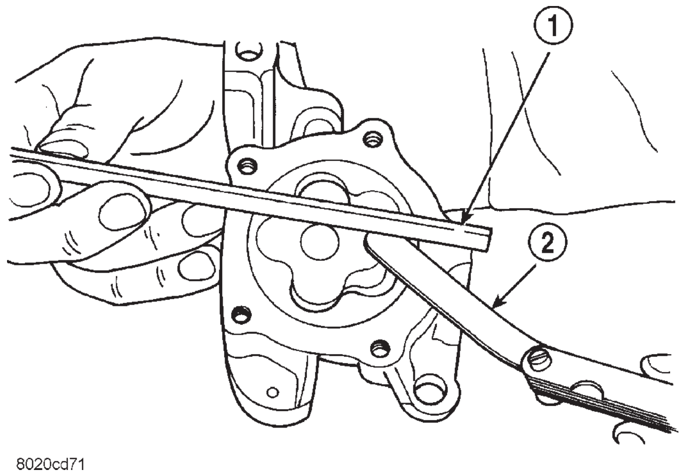


Fig. 89 Measuring Clearance Over Rotors

1 – STRAIGHT EDGE
2 – FEELER GAUGE

The relief valve spring has a free length of approximately 49.5 mm (1.95 in.). The spring should test between 19.5 and 20.5 pounds when compressed to 34 mm (1-11/32 in.). Replace spring that fails to meet these specifications (Fig. 90).

If oil pressure was low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

OIL PAN

CLEANING

Clean the block and pan gasket surfaces.

CLEANING AND INSPECTION (Continued)

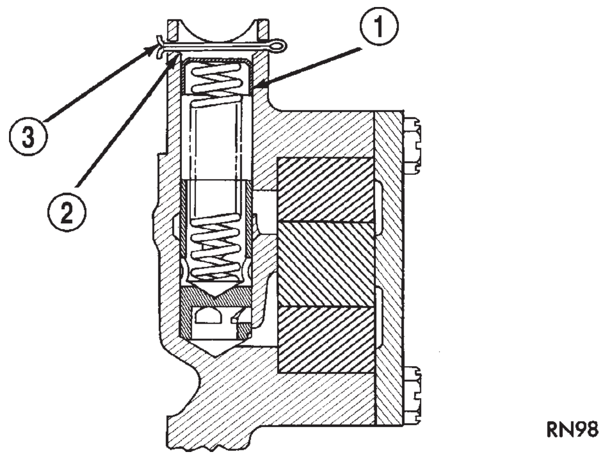


Fig. 90 Proper Installation of Retainer Cap

1 – RETAINER CAP
2 – CHAMFER
3 – COTTER KEY

Trim or remove excess sealant film in the rear main cap oil pan gasket groove. **DO NOT remove the sealant inside the rear main cap slots.**

If present, trim excess sealant from inside the engine.

Clean oil pan in solvent and wipe dry with a clean cloth.

Clean oil screen and pipe thoroughly in clean solvent. Inspect condition of screen.

INSPECTION

Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.

Inspect oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

CYLINDER BLOCK

CLEANING

Clean cylinder block thoroughly and check all core hole plugs for evidence of leakage.

INSPECTION

Examine block for cracks or fractures.

The cylinder walls should be checked for out-of-round and taper. Refer to Honing Cylinder Bores in the Service Procedures portion of this Section.

Inspect the oil line plug, the oil line plug is located in the vertical passage at the rear of the block between the oil-to-filter and oil-from-filter passages (Fig. 91). Improper installation or missing plug could cause erratic, low, or no oil pressure.

The oil plug must come out the bottom. Use flat dowel, down the oil pressure sending unit hole from the top, to remove oil plug.

(1) Remove oil pressure sending unit from back of block.

(2) Insert a 3.175 mm (1/8 in.) finish wire, or equivalent, into passage.

(3) Plug should be 190.0 to 195.2 mm (7-1/2 to 7-11/16 in.) from machined surface of block (Fig. 91). If plug is too high, use a suitable flat dowel to position properly.

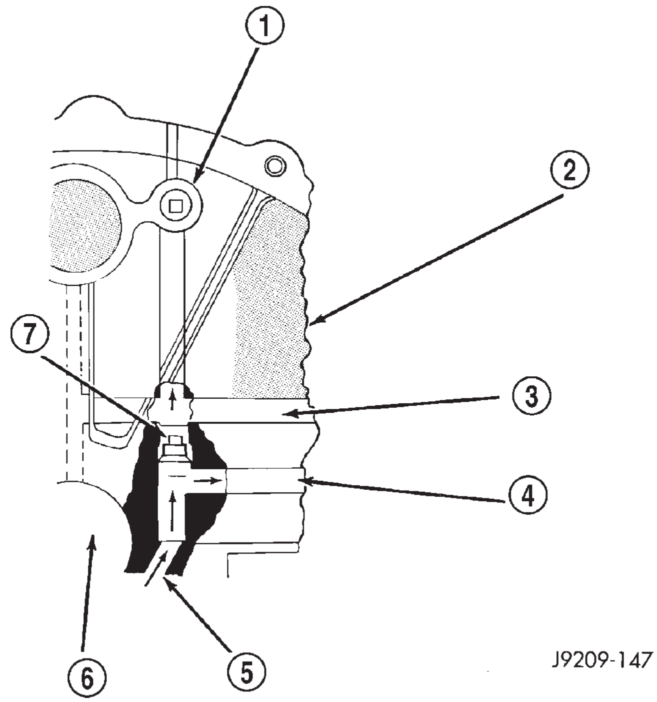


Fig. 91 Oil Line Plug

1 – RIGHT OIL GALLERY
2 – CYLINDER BLOCK
3 – OIL FROM FILTER TO SYSTEM
4 – OIL TO FILTER
5 – FROM OIL PUMP
6 – CRANKSHAFT
7 – PLUG

(4) If plug is too low, remove oil pan and No. 4 main bearing cap. Use suitable flat dowel to position properly. Coat outside diameter of plug with Mopar® Stud and Bearing Mount Adhesive. Plug should be 54.0 to 57.7 mm (2-1/8 to 2-5/16 in.) from bottom of the block.

INTAKE MANIFOLD

CLEANING

Clean manifold in solvent and blow dry with compressed air.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

The plenum pan rail must be clean and dry (free of all foreign material).

CLEANING AND INSPECTION (Continued)

INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straightedge.

EXHAUST MANIFOLD

CLEANING

Clean mating surfaces on cylinder head and manifold, wash with solvent and blow dry with compressed air.

INSPECTION

Inspect manifold for cracks, Inspect mating surfaces of manifold for flatness with a straight edge. Seal surfaces must be flat within 0.1 mm (0.004 inch) overall.

SPECIFICATIONS

3.9L ENGINE SPECIFICATIONS

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	90° V-6 OHV
Bore and Stroke	99.3 x 84.0 mm (3.91 x 3.31 in.)
Displacement	3.9L (238 c.i.)
Compression Ratio	9.1:1
Firing Order	1–6–5–4–3–2
Cylinder Compression Pressure (Min.)	689.5 kPa (100 psi)
CAMSHAFT	
Bearing Diameter (Inside)	
No. 1	50.800 - 50.825 mm (2.000 - 2.001 in.)
No. 2	50.394 - 50.825 mm (1.984 - 1.985 in.)
No. 3	49.606 - 49.632 mm (1.953 - 1.954 in.)
No. 4	39.688 - 39.713 mm (1.5265 - 1.5653 in.)
Journal Diameter	
No. 1	50.749 - 50.775 mm
	(1.998 - 1.999 in.)
No. 2	50.343 - 50.368 mm (1.982 - 1.983 in.)
No. 3	49.555 - 49.581 mm (1.951 - 1.952 in.)
No. 4	39.637 - 39.662 mm (1.5605 - 1.5615 in.)
Bearing to Journal Clearance	
Standard	0.0254 - 0.0762 mm (0.001 - 0.003 in.)
Max Allowable	0.127 mm (0.005 in.)
End Play	0.051 - 0.254 mm (0.002 - 0.010 in.)
CONNECTING RODS	
Piston Pin Bore Diameter	24.940 - 24.978 mm (0.9819 - 0.9834 in.)
Side Clearance (Two Rods)	0.152 - 0.356 mm (0.006 - 0.014 in.)
Total Weight	762 grams (25.61 oz.)
CRANKSHAFT	
Rod Journal Diameter	53.950 - 53.975 mm (2.124 - 2.125 in.)
Rod Journal Out of Round (Max)	0.0254 mm (0.001 in.)
Rod Journal Taper (Max)	0.0254 mm (0.001 in.)
Rod Journal Bearing Clearance	0.013 - 0.056 mm (0.0005 - 0.0022 in.)
Rod Journal Service Limit	0.08 mm (0.003 in.)
Main Journal Diameter	63.487 - 63.513 mm

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
	(2.4995 - 2.5005 in.)
Main Journal Out of Round (Max)	0.0254 mm (0.001 in.)
Main Journal Taper (Max)	0.0254 mm (0.001 in.)
Main Journal Beraing Clearance No. 1	0.013 - 0.038 mm (0.0005 - 0.0015 in.)
No. 2 - 4	0.013 - 0.051 mm (0.0005 - 0.0020 in.)
Service Limit	0.064 mm (0.0025 in.)
End Play	0.051 - 0.178 mm (0.002 - 0.007 in.)
End Play Service Limit	0.254 mm (0.010 in.)
CYLINDER BLOCK	
Cylinder Bore Diameter	99.308 - 99.371 mm (3.9098 - 3.9122 in.)
Cylinder Bore Out of Round and taper (Max)	0.025 mm (0.001 in.)
Lifter Bore Diameter	22.99 - 23.01 mm (0.9501 - 0.9059 in.)
Distributor Drive Bushing to Bore Interference (Press Fit)	0.0127 - 0.3556 mm (0.0005 - 0.0140 in.)
Distributor Shaft to Bushing Clearance	0.0178 - 0.0686 mm (0.0007 - 0.0027 in.)

DESCRIPTION	SPECIFICATION
CYLINDER HEAD and VALVES	
Valve Seat Angle	44.25° - 44.75°
Valve Seat Runout (Max)	0.0762 mm (0.003 in.)
Valve Seat Width (Finish) Intake	1.016 - 1.542 mm (0.040 - 0.060 in.)
Exhaust	1.524 - 2.032 mm (0.040 - 0.060 in.)
Valve Face Angle	43.25° - 43.75°
Valve Head Diameter Intake	48.666 mm (1.916 in.)
Exhaust	41.250 mm (1.624 in.)
Valve Length (Overall) Intake	124.28 - 125.92 mm (4.893 - 4.918 in.)
Exhaust	124.64 - 125.27 mm (4.907 - 4.932 in.)
Valve Lift (@ Zero Lash)	10.973 mm (0.432 in.)
Valve Stem Diameter	7.899 - 7.925 mm (0.311 - 0.312 in.)
Valve Guide Bore Diameter	7.950 - 7.976 mm (0.313 - 0.314 in.)
Valve Stem to Guide Clearance	0.0254 - 0.0762 mm (0.001 - 0.003 in.)
Valve Stem to Guide Clearance Service Limit (Rocking Method)	0.4318 mm (0.017 in.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
VALVE SPRINGS	
Free Length	49.962 mm (1.967 in.)
Spring Tension Valve Closed Valve Open	 378 N @ 41.66 mm (85 lbs. @ 1.64 in.) 890 N @ 30.89 mm (200 lbs. @ 1.212 in.)
Number of Coils	6.8
Installed Height	41.66 mm (1.64 in.)
Wire Diameter	4.50 mm (0.177 in.)
HYDRAULIC TAPPETS	
Body Diameter	22.949 - 22.962 mm (0.9035 - 0.9040 in.)
Clearance in Block	0.0279 - 0.0610 mm (0.0011 - 0.210 in.)
Dry Lash	1.524 - 5.334 mm (0.060 - 0.210 in.)
Push Rod Length	175.64 - 176.15 mm (6.915 - 6.935 in.)
OIL PRESSURE	
@ Curb Idle (Min.)* @ 3000 rpm	41.4 kPa (6 psi) 207 - 552 kPa (30 - 80 psi)
Bypass Valve Setting	62 - 103 kPa (9 - 15 psi)
Switch Actuating Pressure	34.5 - 48.3 kPa (5 - 7 psi)
*** If oil pressure is zero at curb idle, DO NOT RUN ENGINE.**	

DESCRIPTION	SPECIFICATION
OIL PUMP	
Clearance Over Rotors (Max)	 0.1016 mm (0.004 in.)
Cover Out of Flat (Max)	 0.0381 mm (0.0015 in.)
Inner Rotor Thickness (Min)	 20.955 mm (0.825 in.)
Outer Rotor Clearance (Max)	 0.3556 mm (0.014 in.)
Outer Rotor Diameter (Min)	 62.7126 mm (2.469 in.)
Outer Rotor Thickness (Min)	 20.955 mm (0.825 in.)
Tip Clearance Between Rotors (Max)	 0.2032 mm (0.008 in.)
PISTONS	
Clearance at Top of Skirt	0.0127 - 0.0381 mm (0.0005 - 0.0015 in.)
Land Clearance (Diameter)	0.635 - 1.016 mm (0.025 - 0.040 in.)
Piston Length	86.360 mm (3.40 in.)
Ring Groove Depth #1 & 2 #3	 4.572 - 4.826 mm (0.180 - 0.190 in.) 3.810 - 4.064 mm (0.150 - 0.160 in.)
Weight	592.6 - 596.6 grams (20.90 - 21.04 oz.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
PISTON PINS	
Clearance in Piston	0.0064 - 0.0191 mm (0.00025 - 0.00075 in.)
Clearance in Rod (Interference)	0.0178 - 0.0356 mm (0.0007 - 0.0014 in.)
Diameter	24.996 - 25.001 mm (0.9841 - 0.9843 in.)
End Play	None
Length	75.946 - 76.454 mm (2.990 - 3.010 in.)
PISTON RINGS	
Ring Gap	
Compression Rings	0.254 - 0.508 mm (0.010 - 0.020 in.)
Oil Control (Steel Rails)	0.254 - 1.270 mm (0.010 - 0.050 in.)
Ring Side Clearance	
Compression Rings	0.038 - 0.076 mm (0.0015 - 0.0030 in.)
Oil Control (Steel Rails)	0.06 - 0.21 mm (0.002 - 0.008 in.)
Ring Width	
Compression Rings	1.971 - 1.989 mm (0.0776 - 0.0783 in.)
Oil Control (Steel Rails)	3.848 - 3.975 mm (0.1515 - 0.1565 in.)
VALVE TIMING	
Exhaust Valve	
Closes	16° (ATDC)
Opens	52° (BBDC)
Duration	248°
Intake Valve	
Closes	50° (ABDC)
Opens	10° (BTDC)
Duration	240°
Valve Overlap	26°

OVERSIZE AND UNDERSIZE ENGINE COMPONENT MARKINGS CHART

OS-US	Item	Identification	Location of Identification
U/S .0254 MM (.001 IN.)	Crankshaft	R or M M-2-3 ect. (indicating No. 2 & 3 main bearing journal) and/or R-1-4 ect. (indicating No. 1 & 4 connecting rod journal)	Milled flat on No. eight crankshaft counterweight.
O/S .2032 mm (.008 in.)	Tappets	♦	3/8″ diamound -shaped stamp Top pad — Front of engine and flat ground on outside surface of each O/S tappet bore.
O/S .127 mm (0.005 in.)	Valve Stems	X	Milled pad adjacent to two 3/8” tapped holes on each end of cylinder head.

SPECIFICATIONS (Continued)

TORQUE SPECIFICATIONS

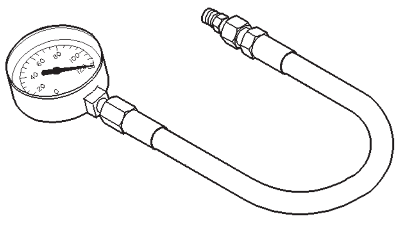
TORQUE CHART 3.9L ENGINE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Sprocket—Bolt	68	50	—
Camshaft Thrust Plate—Bolts	24	—	210
Timing Chain Case Cover— Bolts	41	30	—
Connecting Rod Cap—Bolts	61	45	—
Main Bearing Cap—Bolts	115	85	—
Crankshaft Pulley—Bolts	24	—	210
Cylinder Head—Bolts			
Step 1	68	50	—
Step 2	143	105	—
Cylinder Head Cover—Bolts	11	—	95
Engine Support Bracket to Block (4wd)—Bolts	41	30	—
Exhaust Manifold to Cylinder Head—bolts/nuts	34	25	—
Flywheel—Bolts	75	55	—
Front Insulator—through Bolts	95	70	—
Front Insulator to Support Bracket (4wd)			
—Stud Nut	41	30	—
—Through Bolt/Nut	102	75	—
Front Insulator to Block— Bolts (2wd)	95	70	—
Generator—Mounting Bolt	41	30	—
Intake Manifold—Bolts	Refer to Procedure		
Oil Pan—Bolts	24	—	215
Oil Pan—Drain Plug	34	25	—
Oil Pump—Mounting Bolts	41	30	—
Oil Pump Cover—Bolts	11	—	95
Rear Insulator to Bracket—	68	50	—

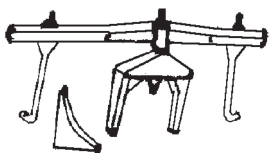
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Through-Bolt (2WD)			
Rear Insulator to Crossmember Support Bracket—Nut (2WD)	41	30	—
Rear Insulator to Crossmember—Nuts (4WD)	68	50	—
Rear Insulator to Transmission — Bolts (4WD)	68	50	—
Rear Insulator Bracket—Bolts (4WD Automatic)	68	50	—
Rear Support Bracket to Crossmember Flange—Nuts	41	30	—
Rear Support Plate to Transfer Case—Bolts	41	30	—
Rocker Arm—Bolts	28	21	—
Spark Plugs	41	30	—
Starter Motor—Mounting Bolts	68	50	—
Thermostat Housing—Bolts	25	—	225
Throttle Body—Bolts	23	—	200
Torque Converter Drive Plate— Bolts	31	—	270
Transfer Case to Insulator Mounting Plate—Nuts	204	150	—
Transmission Support Bracket —Bolts (2WD)	68	50	—
Vibration Damper—Bolt	183	135	—
Water Pump to Timing Chain Case Cover— Bolts	41	30	—

SPECIAL TOOLS

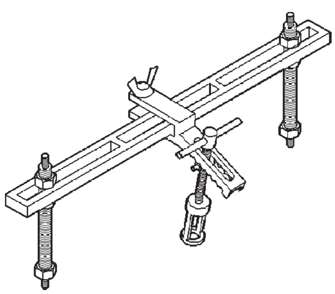
3.9L ENGINE



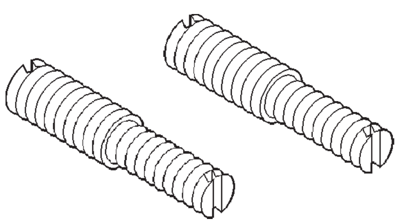
Oil Pressure Gauge C-3292



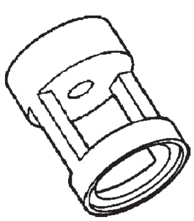
Engine Support Fixture C-3487–A



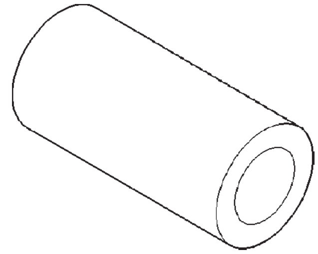
Valve Spring Compressor MD-998772–A



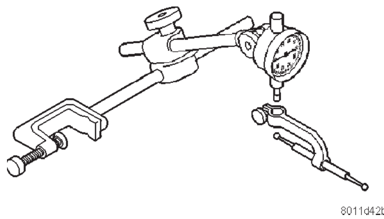
Adapter 6633



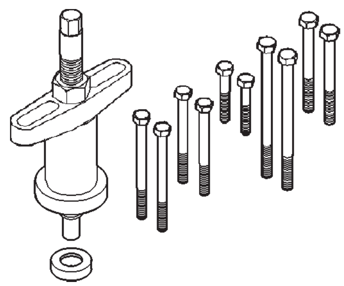
Adapter 6716A



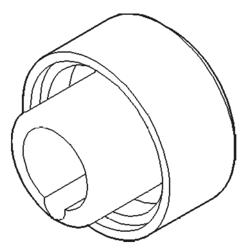
Valve Guide Sleeve C-3973



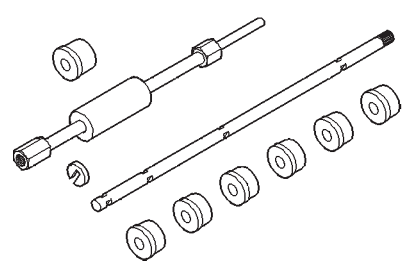
Dial Indicator C-3339



Puller C-3688

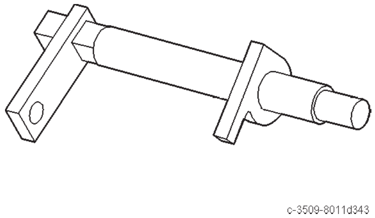


Front Oil Seal Installer 6635

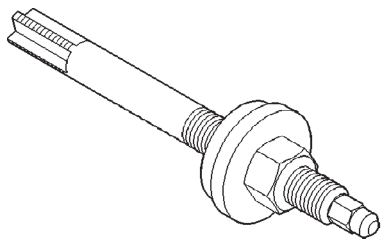


Cam Bearing Remover/Installer C-3132–A

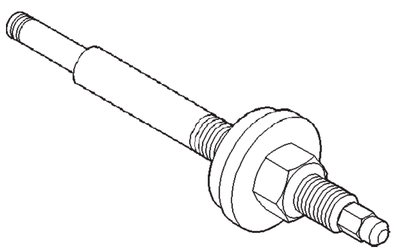
SPECIAL TOOLS (Continued)



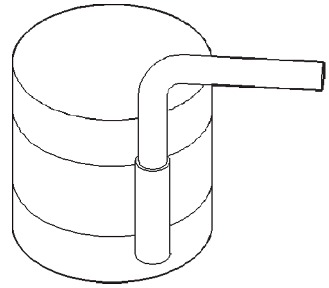
Camshaft Holder C-3509



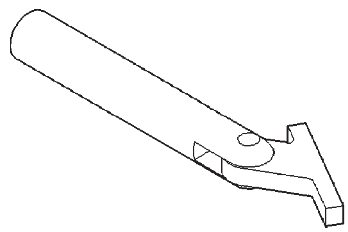
Distributor Bushing Puller C-3052



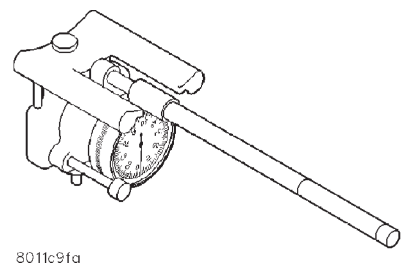
Distributor Bushing Driver/Burnisher C-3053



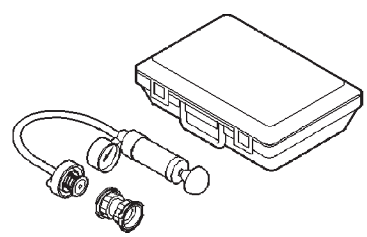
Piston Ring Compressor C-385



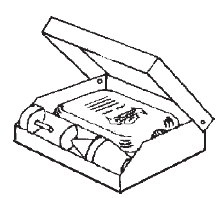
Crankshaft Main Bearing Remover C-3059



Cylinder Bore Gauge C-119



Pressure Tester Kit 7700



Bloc–Chek–Kit C-3685–A

4.7L ENGINE

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
- ENGINE 119
- ENGINE LUBRICATION SYSTEM 120
- CYLINDER BLOCK. 122
- CRANKSHAFT 122
- PISTON AND CONNECTING ROD 123
- CYLINDER HEAD. 123
- VALVE GUIDES 123
- VALVES 123
- VALVE STEM SEAL 123
- VALVE SPRING 123
- HYDRAULIC LASH ADJUSTER. 123
- TIMING DRIVE SYSTEM 123
- CAMSHAFT 124
- ROCKER ARM 124
- CYLINDER HEAD COVER 124
- OIL PAN. 124
- STRUCTURAL DUST COVER. 124
- INTAKE MANIFOLD 124
- EXHAUST MANIFOLD 124

DIAGNOSIS AND TESTING
- ENGINE DIAGNOSIS—INTRODUCTION. 125
- SERVICE DIAGNOSIS—PERFORMANCE. 125
- SERVICE DIAGNOSIS—MECHANICAL. 127
- SERVICE DIAGNOSIS—LUBRICATION 128
- INTAKE MANIFOLD LEAKAGE DIAGNOSIS 128
- CYLINDER COMPRESSION PRESSURE TEST . 128
- CYLINDER HEAD GASKET FAILURE DIAGNOSIS. 129
- CYLINDER COMBUSTION PRESSURE LEAKAGE TEST 129
- ENGINE OIL LEAK INSPECTION 130
- REAR SEAL AREA LEAKS—INSPECTION 131
- HYDRAULIC LASH ADJUSTER NOISE DIAGNOSIS. 131
- CHECKING ENGINE OIL PRESSURE. 132

SERVICE PROCEDURES
- FORM-IN-PLACE GASKETS. 132
- ENGINE OIL. 133
- REPAIR DAMAGED OR WORN THREADS 135
- CYLINDER BORE—HONING 135
- HYDROSTATIC LOCK. 136
- VALVE SERVICE 136
- ENGINE TIMING—VERIFICATION 137
- TIMING CHAIN—MEASURING WEAR 139
- PISTONS—FITTING 139
- PISTON RINGS—FITTING 140
- CONNECTING ROD BEARINGS—FITTING. 142
- CRANKSHAFT MAIN BEARINGS 144

REMOVAL AND INSTALLATION
- ENGINE MOUNTS—LEFT AND RIGHT. 145
- ENGINE MOUNT—REAR 146
- STRUCTURAL COVER. 147
- ENGINE ASSEMBLY. 148
- INTAKE MANIFOLD 152
- EXHAUST MANIFOLDS 153
- CYLINDER HEAD COVER 155
- ROCKER ARMS 157
- CYLINDER HEADS. 158
- VALVE SPRINGS AND SEALS 163
- HYDRAULIC LASH ADJUSTER. 164
- CRANKSHAFT DAMPER 164
- TIMING CHAIN COVER 165
- TIMING CHAIN AND SPROCKETS 166
- IDLER SHAFT—TIMING DRIVE 172
- CAMSHAFTS—IN VEHICLE 173
- CRANKSHAFT MAIN BEARINGS 180
- OIL PAN 4X2 VEHICLE. 180
- OIL PAN 4X4 VEHICLE. 182
- PISTON AND CONNECTING ROD 182
- CRANKSHAFT 185
- FLEXPLATE 187
- OIL PUMP 187
- ENGINE OIL PRESSURE SENDING UNIT 188
- CRANKSHAFT OIL SEAL—FRONT. 189
- CRANKSHAFT OIL SEAL—REAR. 191
- ENGINE CORE PLUGS 191

DISASSEMBLY AND ASSEMBLY
- OIL PUMP 192

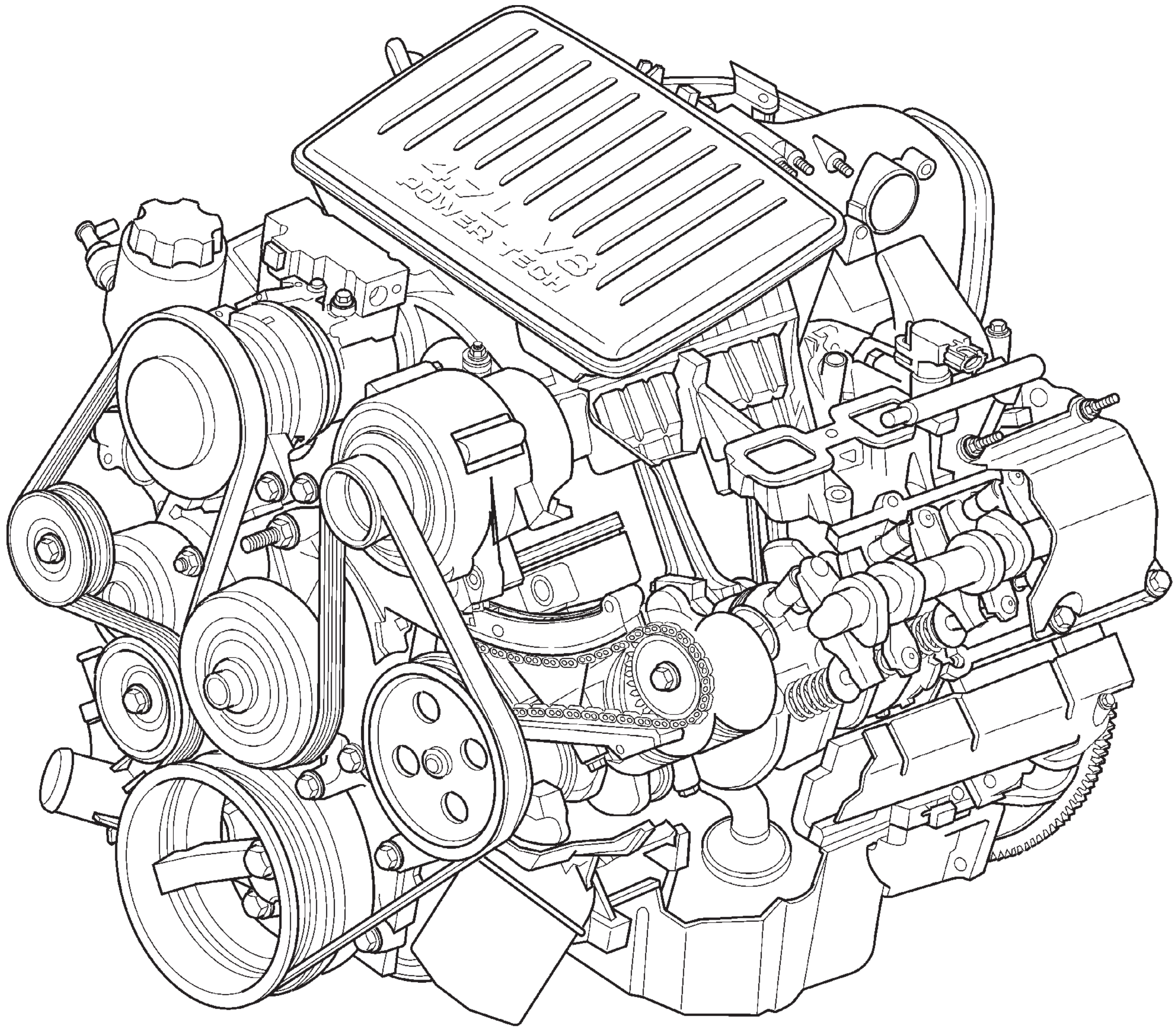
CLEANING AND INSPECTION
- INTAKE MANIFOLD 192
- EXHAUST MANIFOLD 193
- CYLINDER HEADS. 193
- PISTON AND CONNECTING ROD 193
- OIL PAN. 193
- OIL PUMP 194
- CYLINDER BLOCK. 195

SPECIFICATIONS
- 4.7L ENGINE 196
- TORQUE 199

SPECIAL TOOLS
- 4.7L ENGINE 200

DESCRIPTION AND OPERATION

ENGINE



80b3b148

DESCRIPTION AND OPERATION (Continued)

DESCRIPTION

The 4.7 liter (287 CID) eight-cylinder engine is an 90° single overhead camshaft engine. The cast iron cylinder block is made up of two different components; the first component is the cylinder bore and upper block, the second component is the bedplate that comprises the lower portion of the cylinder block and houses the lower half of the crankshaft main bearings. The cylinders are numbered from front to rear with the left bank being numbered 1,3,5 and 7, and the right bank being numbered 2,4,6 and 8. The firing order is 1–8–4–3–6–5–7–2. The engine serial number is located at the right front side of the engine block (Fig. 1)

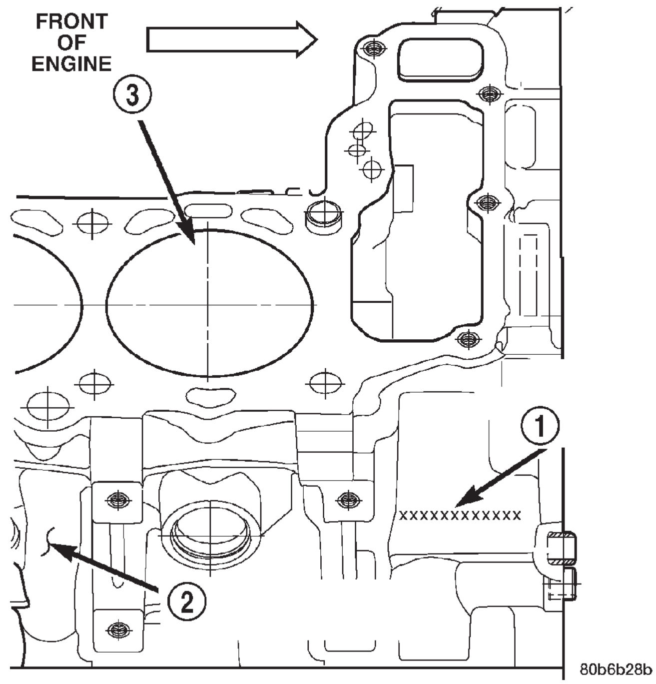


Fig. 1 Engine Identification Location.

1 – VEHICLE VIN NUMBER LOCATION
2 – CYLINDER BLOCK RIGHT HAND SIDE
3 – CYLINDER BORE #2

ENGINE LUBRICATION SYSTEM

DESCRIPTION

The lubrication system (Fig. 2) is a full flow filtration pressure feed type.

DESCRIPTION AND OPERATION (Continued)

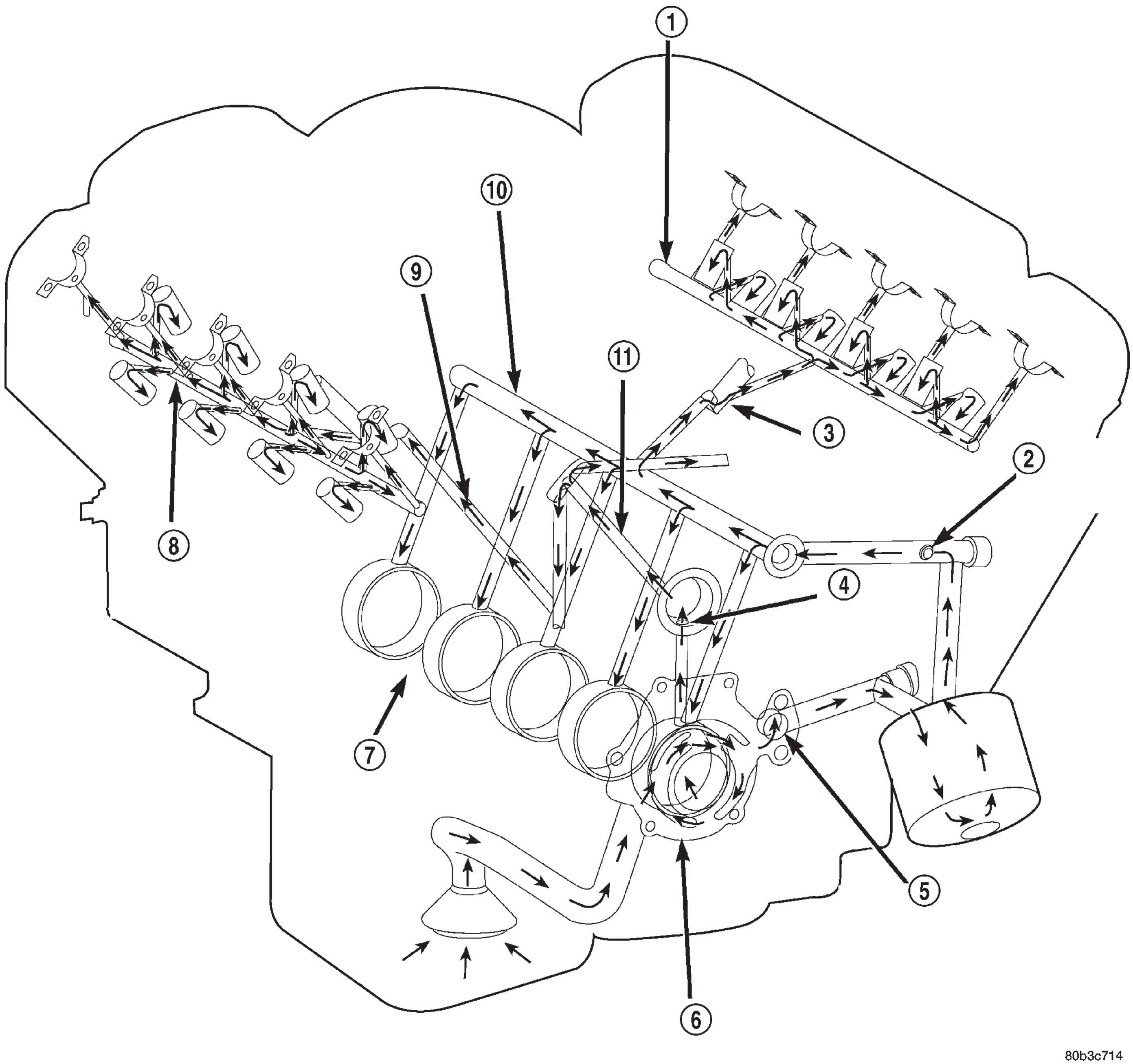


Fig. 2 Engine Oil Lubrication System

1 – LEFT CYLINDER HEAD OIL GALLERY
2 – OIL PRESSURE SENSOR LOCATION
3 – TO LEFT CYLINDER HEAD
4 – OIL FEED TO IDLER SHAFT
5 – OIL PUMP OUTLET TO BLOCK
6 – OIL PUMP
7 – TO CRANKSHAFT MAIN JOURNALS
8 – RIGHT CYLINDER HEAD OIL GALLERY
9 – TO RIGHT CYLINDER HEAD
10 – CYLINDER BLOCK MAIN GALLERY
11 – OIL FEED TO BOTH SECONDARY TENSIONERS

DESCRIPTION AND OPERATION (Continued)

OPERATION

Oil from the oil pan is pumped by a gerotor type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing. For lubrication flow refer to (Fig. 2).

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orentation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the number 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

ENGINE LUBRICATION FLOW CHART—BLOCK: TABLE 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head*
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1. Front Timing Chain Idler Shaft 2. Both Secondary Chain Tensioners
Left Cylinder Head	See Table 2
Right Cylinder Head	See Table 2
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads.	

ENGINE LUBRICATION FLOW CHART—CYLINDER HEADS: TABLE 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

CYLINDER BLOCK

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

CRANKSHAFT

DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a crosshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by five select main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number eight counterweight has provisions for

crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.

PISTON AND CONNECTING ROD

DESCRIPTION

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

EARLY BUILD

The pistons are made of a high strength aluminum alloy with an anodized top ring groove and crown. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of forged powdered metal, with a “fractured cap” design. A pressed fit piston pin is used to attach the piston and connecting rod.

LATE BUILD

The pistons are made of high strength aluminum alloy. The top ring groove and crown are **Not** anodized, instead the top ring is coated with an anti-scuff coating to reduce friction on the top ring. The piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of forged powdered metal, with a “fractured cap” design. A pressed fit piston pin is used to attach the piston and connecting rod.

CYLINDER HEAD

DESCRIPTION

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

VALVE GUIDES

DESCRIPTION

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

VALVES

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

VALVE STEM SEAL

DESCRIPTION

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

VALVE SPRING

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

HYDRAULIC LASH ADJUSTER

DESCRIPTION

Valve lash is controlled by hydraulic lash adjusters that are stationary mounted in the cylinder heads. The lash adjusters have a hole in the ball plunger that feeds oil through the rocker arm squirt holes for rocker arm roller and camshaft lobe lubrication.

TIMING DRIVE SYSTEM

DESCRIPTION

The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain and two secondary timing chain drives.

OPERATION

The primary timing chain is a single inverted tooth type. The primary chain drives the large fifty tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and oil pump leakage. The idler sprocket assembly connects the primary and secondary chain drives. The idler sprocket assembly consists of two integral thirty tooth sprockets and a fifty tooth sprocket that is splined to the assembly. The spline joint is a non – serviceable press fit anti rattle type. A spiral ring is installed on the outboard side of the fifty tooth sprocket to prevent spline disengagement. The idler sprocket assembly spins on a station-

DESCRIPTION AND OPERATION (Continued)

ary idler shaft. The idler shaft is press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, both are inverted tooth type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a thirty tooth cam sprocket directly from the thirty tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

CAMSHAFT

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

ROCKER ARM

DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

CYLINDER HEAD COVER

DESCRIPTION

The cylinder head covers are made of die cast magnesium, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

OIL PAN

DESCRIPTION

The engine oil pan is made of laminated steel and has a single plane sealing surface. The sandwich style oil pan gasket has an integrated windage tray and steel carrier. The sealing area of the gasket is molded with rubber and is designed to be reused as long as the gasket is not cut, torn or ripped.

STRUCTURAL DUST COVER

DESCRIPTION

The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

OPERATION

The structural cover provides additional power-train stiffness and reduces noise and vibration.

INTAKE MANIFOLD

DESCRIPTION

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks. Eight studs and two bolts are used to fasten the intake to the head.

EXHAUST MANIFOLD

DESCRIPTION

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS—INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

Refer to the Service Diagnosis—Performance chart and the Service Diagnosis—Mechanical chart for possible causes and corrections of malfunctions. Refer to Group 14, Fuel System for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test.
- Cylinder Combustion Pressure Leakage Test.
- Engine Cylinder Head Gasket Failure Diagnosis.
- Intake Manifold Leakage Diagnosis.

SERVICE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. Refer to Group 8A, Battery/ Starter/ Charging System Diagnostics.
	4. Moisture on ignition wires and distributor cap.	4. Wipe wires and cap clean and dry.
	5. Faulty ignition cables.	5. Replace as necessary.
	6. Faulty coil or control unit.	6. Refer to Group 8D, Ignition System.
	7. Incorrect spark plug gap.	7. Refer to Group 8D, Ignition System.
	8. Incorrect ignition timing.	8. Refer to Group 8D, Ignition System.
	9. Dirt or water in fuel system.	9. Clean system and replace fuel filter.
	10. Faulty fuel pump, relay or wiring.	10. Refer to Group 14, Fuel System.
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set to low.	1. Refer to Group 14, Fuel System.
	2. Idle mixture to lean or to rich.	2. Refer to Group 14, Fuel System.
	3. Vacuum leak.	3. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	4. Worn or burned distributor rotor.	4. Replace distributor rotor.
	5. Incorrect ignition wiring.	5. Install correct wiring.
	6. Faulty coil.	6. Refer to Group 8D, Ignition System.
	7. EGR valve leaking.	7. Refer to Group 25, Emissions Control System.
	8. Incorrect cam timing.	8. Refer to Valve Timing in this section.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE LOSS OF POWER	1. Incorrect ignition timing.	1. Refer to Group 8D, Ignition System.
	2. Worn or burned distributor rotor.	2. Replace distributor rotor.
	3. Worn distributor shaft.	3. Refer to Group 8D, Ignition System.
	4. Dirty or incorrectly gapped spark plugs.	4. Refer to Group 8D, Ignition System.
	5. Dirt or water in fuel system.	5. Clean system and replace fuel filter.
	6. Faulty fuel pump.	6. Refer to Group 14, Fuel System.
	7. Blown cylinder head gasket.	7. Replace cylinder head gasket.
	8. Low compression.	8. Test compression, repair as necessary.
	9. Burned, warped or pitted valves.	9. Replace as necessary.
	10. Plugged or restricted exhaust system.	10. Inspect and replace as necessary.
	11. Faulty ignition cables.	11. Replace as necessary.
	12. Faulty coil.	12. Refer to Group 8D, Ignition System.
	13. Incorrect cam timing.	13. Refer to Valve Timing in this section.
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. Refer to Group 8D, Ignition System.
	2. Incorrect ignition timing.	2. Refer to Group 8D, Ignition System.
	3. Dirt in fuel system.	3. Clean fuel system.
	4. Burned, warped or pitted valves.	4. Replcae as necessary.
	5. Faulty coil.	5. Refer to Group 8D, Ignition System.
	6. Incorrect cam timing.	6. Refer to Valve Timing in this section.
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. Refer to Group 8D, Ignition System.
	2. Worn Distributor Shaft.	2. Refer to Group 8D, Ignition System.
	3. Worn or burned distributor rotor.	3. Replace distributor rotor.
	4. Faulty coil.	4. Refer to Group 8D, Ignition System.
	5. Incorrect ignition timing.	5. Refer to Group 8D, Ignition System.
	6. Dirt or water in fuel system.	6. Clean system and replace fuel filter.
	7. Incorrect cam timing.	7. Refer to Valve Timing in this section.

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. Refer to Group 0, Lubrication and Maintenance.
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Clean lash adjusters.
	5. Bent push rods.	5. Replace as necessary.
	6. Worn rocker arms.	6. Replace as necessary.
	7. Worn tappets	7. Replace as necessary.
	8. Worn valve guides.	8. Refer to Valve Service in this section.
	9. Excessive runout of valve seats on valve faces.	9. Service valves and valve seats. Refer to Valve Service in this section.
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Refer to Group 0, Lubrication and maintenance.
	2. Low oil pressure.	2. Refer to Group 0, Lubrication and maintenance.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Refer to Group 0, Lubrication and maintenance.
	2. Low oil pressure.	2. Refer to Group 0, Lubrication and maintenance.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check No. 3 main bearing for wear on flanges.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings.	1.
	(a) Misaligned or damaged.	(a) Replace as necessary.
	(b) Loose fasteners, broken or porous metal parts.	(b) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear seal	2. Replace as necessary.
	3. Crankshaft seal flange. Scratched, nicked or grooved.	3. Polish or replace crankshaft.
	4. Oil pan flange cracked.	4. Replace oil pan.
	5. Timing chain cover seal, damaged or misaligned.	5. Replace seal.
	6. Scratched or damaged vibration damper hub.	6. Polish or replace damper.
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure sending unit.	2. Replace sending unit.
	3. Low oil pressure.	3. Check pump and bearing clearance.
	4. Clogged oil filter.	4. Replace oil filter.
	5. Worn oil pump.	5. Replace as necessary.
	6. Thin or diluted oil.	6. Change oil and filter.
	7. Excessive bearing clearance.	7. Replace as necessary.
	8. Oil pump relief valve stuck.	8. Clean or replace relief valve.
	9. Oil pump suction tube loose or damaged.	9. Replace as necessary.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings.
	2. Carbon in oil ring slots.	2. Replace rings.
	3. Incorrect ring size installed.	3. Replace rings.
	4. Worn valve guides.	4. Ream guides and replace valves.
	5. Leaking intake gasket.	5. Replace intake gaskets.
	6. Leaking valve guide seals.	6. Replace valve guide seals.

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.

(2) Spray a small stream of water at the suspected leak area.

(3) If a change in RPM is observed the area of the suspected leak has been found.

(4) Repair as required.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

DIAGNOSIS AND TESTING (Continued)

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.

(2) Remove the spark plugs.

(3) Secure the throttle in the wide-open position.

(4) Disable the fuel system. (Refer to Group 14, Fuel System for the correct procedure)

(5) Disconnect the ignition coil.

(6) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.

(7) Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.

Refer to Engine Specifications for the correct engine compression pressures.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

- Possible indications of the cylinder head gasket leaking between adjacent cylinders are:
- Loss of engine power
- Engine misfiring
- Poor fuel economy
- Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:
- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test in this section. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

(1) Check the coolant level and fill as required. DO NOT install the radiator cap.

(2) Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

(3) Remove the spark plugs.

(4) Remove the oil filler cap.

(5) Remove the air cleaner.

(6) Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

(7) Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to the Cylinder Combustion Pressure Leakage Test Diagnosis chart.

DIAGNOSIS AND TESTING (Continued)

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat inspection.

(4) **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

Air Leak Detection Test Method

(1) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(2) Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.

(3) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(4) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

(5) If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(6) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.

(7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil

DIAGNOSIS AND TESTING (Continued)

filter runoff, and main bearing cap to cylinder block mating surfaces.

(4) If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general).

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

REAR SEAL AREA LEAKS—INSPECTION

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Group 9, Engines, for proper repair procedures of these items.

(4) If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. Refer to the service Diagnosis—Mechanical, under the Oil Leak row, for components inspections on possible causes and corrections.

(7) After the oil leak root cause and appropriate corrective action have been identified, Refer to Group 9, Engines—Crankshaft Rear Oil Seals, for proper replacement procedures.

HYDRAULIC LASH ADJUSTER NOISE DIAGNOSIS

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

(3) Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Rocker arm ears contacting valve spring retainer.

(9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(10) Faulty lash adjuster.

a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

b. Remove suspected lash adjusters, and replace.

c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

DIAGNOSIS AND TESTING (Continued)

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit (Fig. 3) and install gauge assembly C-3292.

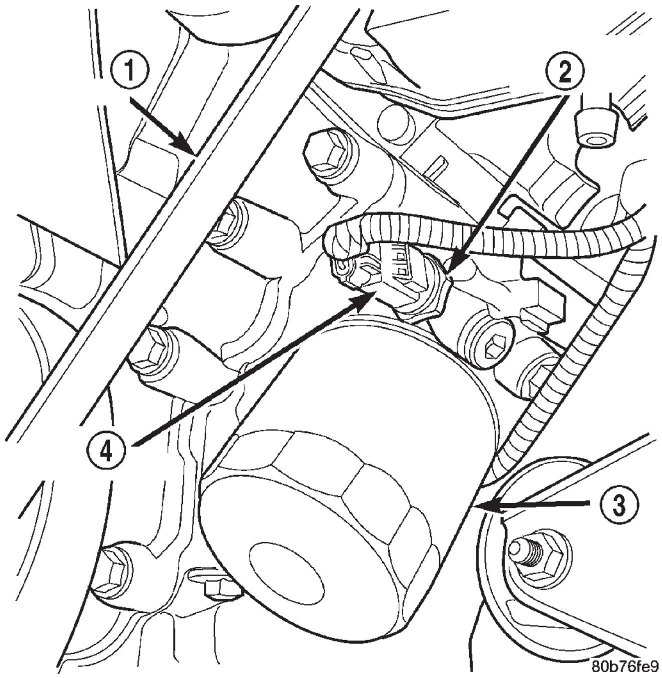


Fig. 3 Oil Pressure Sending Unit

1 – BELT
2 – OIL PRESSURE SENSOR
3 – OIL FILTER
4 – ELEC. CONNECTOR

(2) Run engine until thermostat opens.
(3) Oil Pressure:
- Curb Idle—25 Kpa (4 psi) minimum
- 3000 rpm—170 - 550 KPa (25 - 80 psi)

(4) If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.

SERVICE PROCEDURES

FORM-IN-PLACE GASKETS

There are several places where form-in-place gaskets are used on the engine. **DO NOT use form-in-place gasket material unless specified.** Care must be taken when applying form-in-place gaskets. Bead size, continuity and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over. A continuous bead of the proper width is essential to obtain a leak-free joint.

Two types of form-in-place gasket materials are used in the engine area (Mopar Silicone Rubber Adhesive Sealant and Mopar Gasket Maker). Each have different properties and cannot be used interchangeably.

MOPAR SILICONE RUBBER ADHESIVE SEALANT

Mopar Silicone Rubber Adhesive Sealant, normally black in color, is available in 3 ounce tubes. Moisture in the air causes the sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of a year and will not properly cure if over aged. Always inspect the package for the expiration date before use.

MOPAR GASKET MAKER

Mopar Gasket Maker, normally red in color, is available in 6 cc tubes. This anaerobic type gasket material cures in the absence of air when squeezed between smooth machined metallic surfaces. It will not cure if left in the uncovered tube. DO NOT use on flexible metal flanges.

SURFACE PREPARATION

Parts assembled with form-in-place gaskets may be disassembled without unusual effort. In some instances, it may be necessary to lightly tap the part with a mallet or other suitable tool to break the seal between the mating surfaces. A flat gasket scraper may also be lightly tapped into the joint but care must be taken not to damage the mating surfaces.

Scrape or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Flatten rails with a hammer on a flat plate, if required. Gasket surfaces must be free of oil and dirt. Make sure the old gasket material is removed from blind attaching holes.

GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care.

Mopar Silicone Rubber Adhesive Sealant should be applied in a continuous bead approximately 3 mm (0.12 inch) in diameter. All mounting holes must be circled. For corner sealing, a 3 or 6 mm (1/8 or 1/4 inch) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

Mopar Gasket Maker should be applied sparingly to one gasket surface. The sealant diameter should be 1.00 mm (0.04 inch) or less. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a

SERVICE PROCEDURES (Continued)

locating dowel is recommended during assembly to prevent smearing the material off location.

ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY.

ENGINE OIL SPECIFICATION

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine failure can result.

API SERVICE GRADE CERTIFIED

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conform to this service grade.

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30 in the 4.7L engines. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 4).

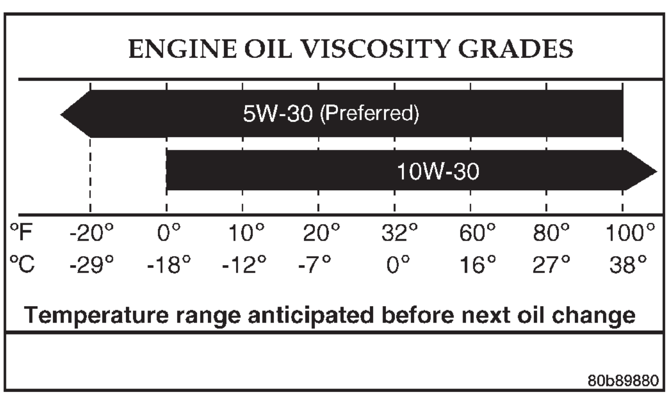


Fig. 4 Temperature/Engine Oil Viscosity—4.7L Engine

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 5).

Fig. 5 Engine Oil Container Standard Notations

OIL LEVEL INDICATOR (DIPSTICK)

The engine oil level indicator is located at the right rear of the engine on the 4.7L engines. (Fig. 6).

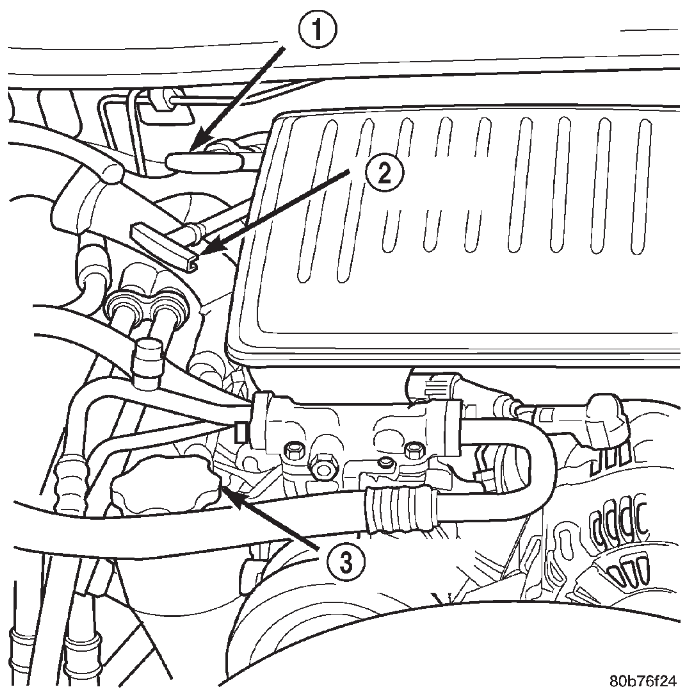


Fig. 6 Engine Oil Dipstick 4.7L Engine

1 – TRANSMISSION DIPSTICK
2 – ENGINE OIL DIPSTICK
3 – ENGINE OIL FILL CAP

SERVICE PROCEDURES (Continued)

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

(5) Remove dipstick, with handle held above the tip, take oil level reading.

(6) Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE OIL FILTER CHANGE

FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar or equivalent oil filter be used.

OIL FILTER REMOVAL

(1) Position a drain pan under the oil filter.

(2) Using a suitable oil filter wrench loosen filter.

(3) Rotate the oil filter counterclockwise (Fig. 7) to remove it from the cylinder block oil filter boss.

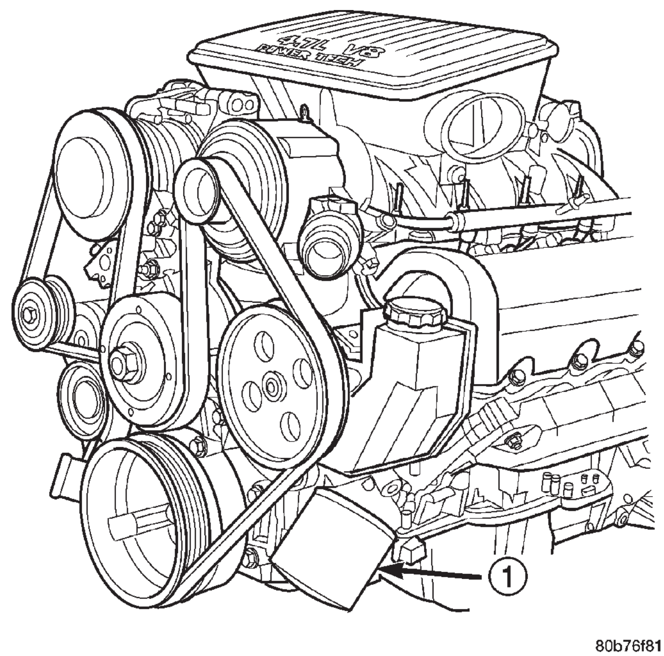


Fig. 7 Oil Filter—4.7L Engine

1 – ENGINE OIL FILTER

(4) When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(5) With a wiping cloth, clean the gasket sealing surface of oil and grime.

OIL FILTER INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil.

(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 8) hand tighten filter one full turn, do not over tighten.

(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

SERVICE PROCEDURES (Continued)

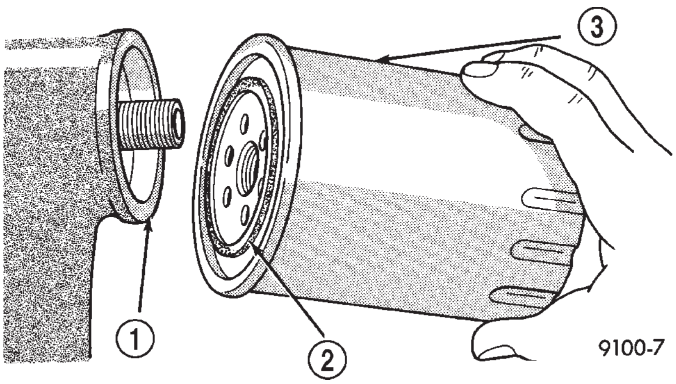


Fig. 8 Oil Filter Sealing Surface—Typical

1 – SEALING SURFACE
2 – RUBBER GASKET
3 – OIL FILTER

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

• Drilling out worn or damaged threads.

• Tapping the hole with a special Heli-Coil Tap, or equivalent.

• Installing an insert into the tapped hole to bring the hole back to its original thread size.

CYLINDER BORE—HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

(1) Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

(2) Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings (Fig. 9).

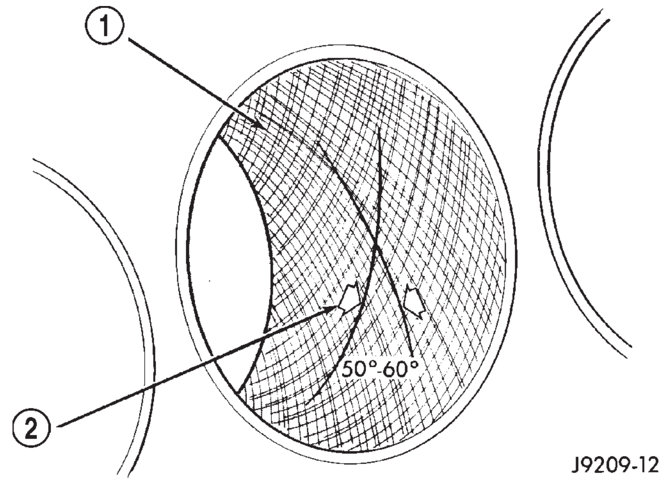


Fig. 9 Cylinder Bore Crosshatch Pattern

1 – CROSSHATCH PATTERN
2 – INTERSECT ANGLE

(4) A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.

(5) After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

SERVICE PROCEDURES (Continued)

HYDROSTATIC LOCK

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Perform the Fuel Pressure Release Procedure (refer to Group 14, Fuel System).

(2) Disconnect the battery negative cable.

(3) Inspect air cleaner, induction system and intake manifold to ensure system is dry and clear of foreign material.

(4) Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the plugs from the engine.

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

(5) With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.

(6) Identify the fluid in the cylinders (i.e. coolant, fuel, oil, etc.).

(7) Make sure all fluid has been removed from the cylinders.

(8) Repair engine or components as necessary to prevent this problem from occurring again.

(9) Squirt engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.

(10) Install new spark plugs.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil.

(15) Connect the negative cable to the battery.

(16) Start the engine and check for any leaks.

VALVE SERVICE

REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

NOTE: When refacing valves and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

(1) Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).

(2) Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.

(3) When the seat is properly positioned the width of the intake seat must be 1.75 – 2.36 mm (0.0689 – 0.0928 in.) and the exhaust seat must be 1.71 – 2.32 mm (0.0673 – 0.0911 in.).

(4) Check the valve spring installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 41.44 mm (1.6315 in.).

(5) The valve seat and valve face must maintain a face angle of 44.5 – 45 degrees angle.

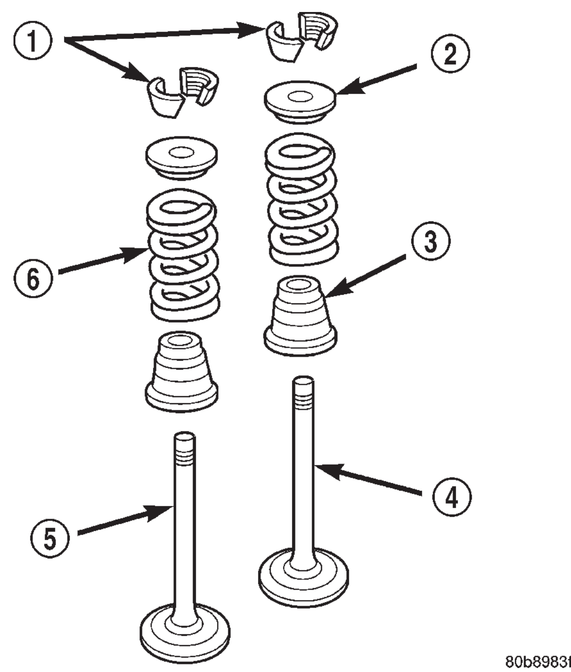


Fig. 10 Valve Assembly Configuration

1 – VALVE LOCKS (3–BEAD)
2 – RETAINER
3 – VALVE STEM OIL SEAL
4 – INTAKE VALVE
5 – EXHAUST VALVE
6 – VALVE SPRING

SERVICE PROCEDURES (Continued)

ENGINE TIMING—VERIFICATION

CAUTION: The 4.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

Engine base timing can be verified by the following procedure:

(1) Remove the cylinder head covers. Refer to the procedure in this section.

(2) Using a mirror, locate the TDC arrow on the front cover (Fig. 11). Rotate the crankshaft until the mark on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

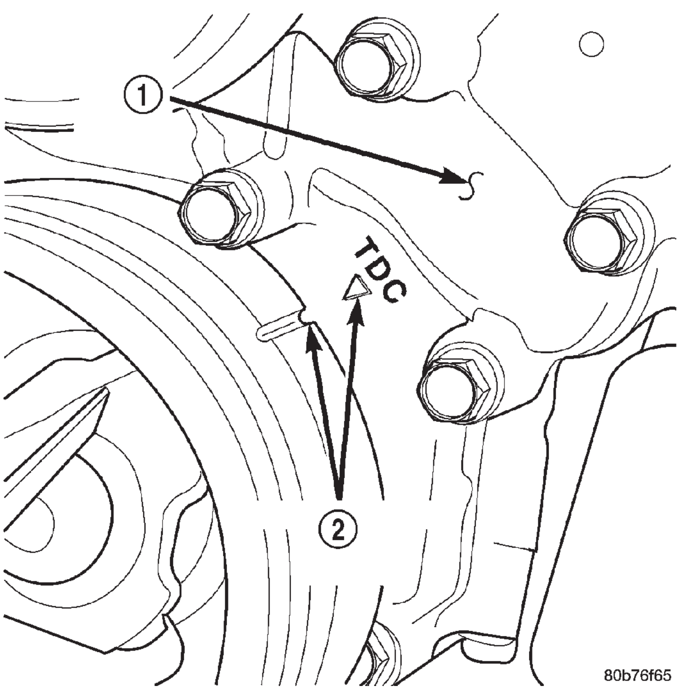


Fig. 11 Engine Top Dead Center (TDC) Indicator Mark

1 – TIMING CHAIN COVER
2 – CRANKSHAFT TIMING MARKS

(3) Note the location of the V8 mark stamped into the camshaft drive gears (Fig. 12). If the V8 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC on the exhaust stroke. If the V8 mark on each gear is at the six o'clock position, the engine is at TDC on the compression stroke.

(4) If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.

(5) If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.

(6) If both camshaft drive gear V8 marks are at the twelve o'clock or the six o' clock position the engine base timing is correct. Reinstall the cylinder head covers.

SINGLE CAMSHAFT TIMING

NOTE: to adjust the timing on one camshaft, preform the following procedure.

(1) Using Chain Tensioner Wedge, special tool 8350, stabilize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position (Fig. 13).

(2) Remove the camshaft drive gear retaining bolt.

(3) Carefully remove the camshaft drive gear from the camshaft.

(4) Re-index the camshaft drive gear in the chain until the V8 mark is at the same position as the V8 mark on the opposite camshaft drive gear.

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

(5) Using a suitable pair of adjustable pliers, rotate the camshaft until the alignment dowel on the camshaft is aligned with the slot in the camshaft drive gear (Fig. 14).

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.

SERVICE PROCEDURES (Continued)

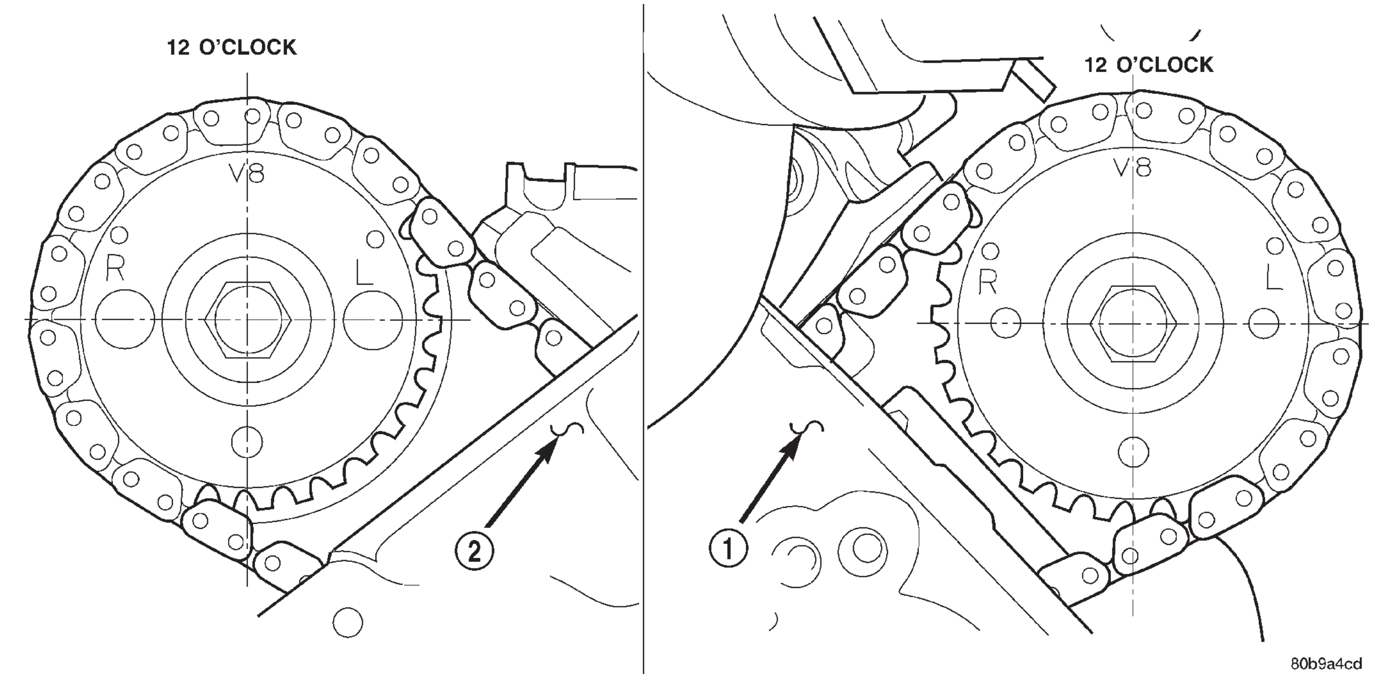


Fig. 12 Camshaft Sprocket V8 Marks

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD

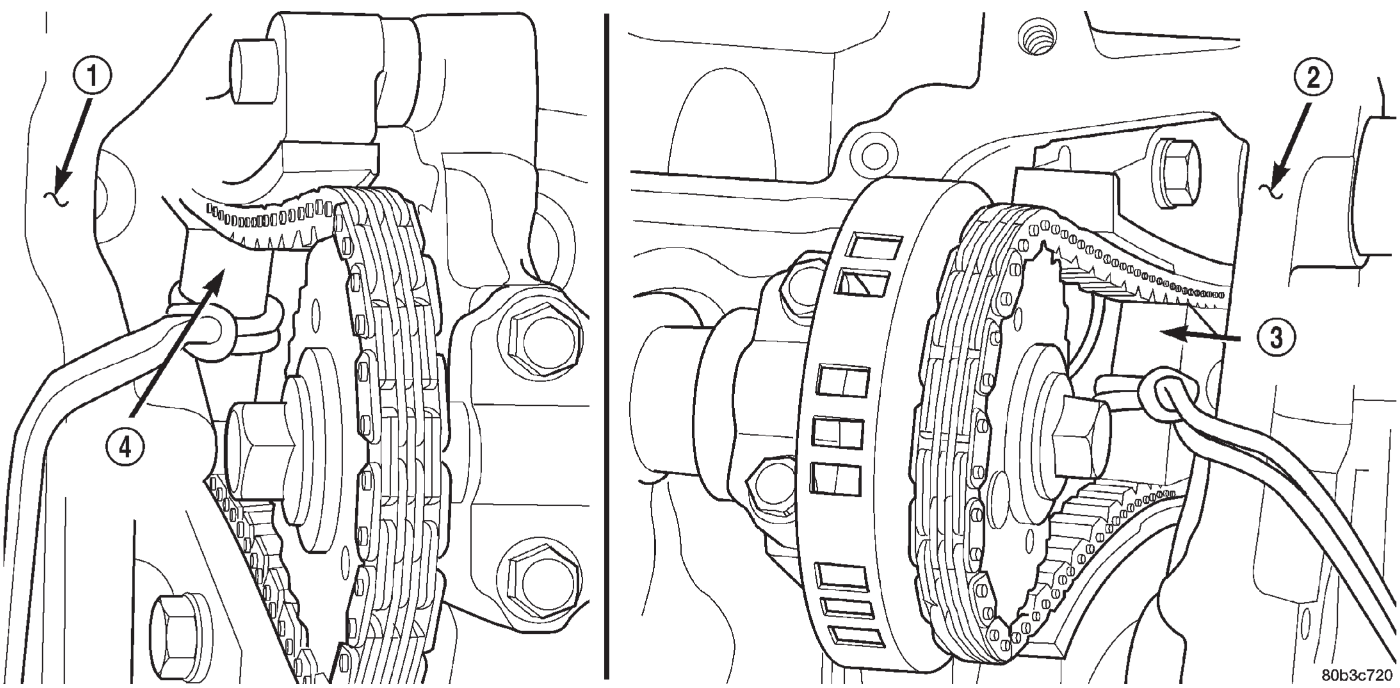


Fig. 13 Securing Timing Chain Tensioners Using Timing Chain Wedge

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD
3 – SPECIAL TOOL 8350 WEDGE
4 – SPECIAL TOOL 8350 WEDGE

SERVICE PROCEDURES (Continued)

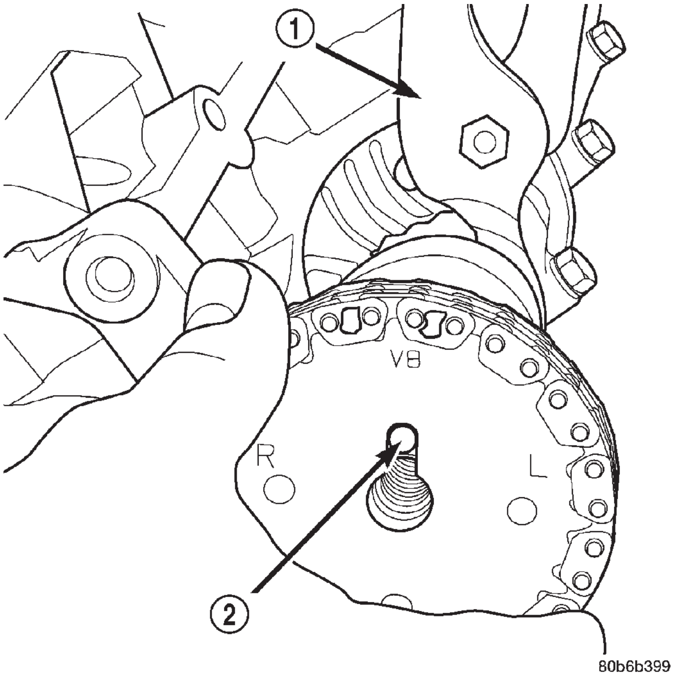


Fig. 14 Camshaft Dowel To Sprocket Alignment

1 – ADJUSTABLE PLIERS
2 – CAMSHAFT DOWEL

(6) Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 and a suitable torque wrench, Tighten retaining bolt to 122N·m (90 ft. Lbs.) (Fig. 15) (Fig. 16).

(7) Remove special tool 8350.

(8) Rotate the crankshaft two full revolutions, then reverify that the camshaft drive gear V8 marks are in fact aligned.

(9) Install the cylinder head covers. Refer to Cylinder Head Cover in this section.

TIMING CHAIN—MEASURING WEAR

NOTE: This procedure must be performed with the timing chain cover removed.

(1) Remove the timing chain cover. Refer to Timing Chain Cover in this section for procedure.

(2) To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston (Fig. 17). The measurement at point (A) must be less than 15mm (.5906 inches).

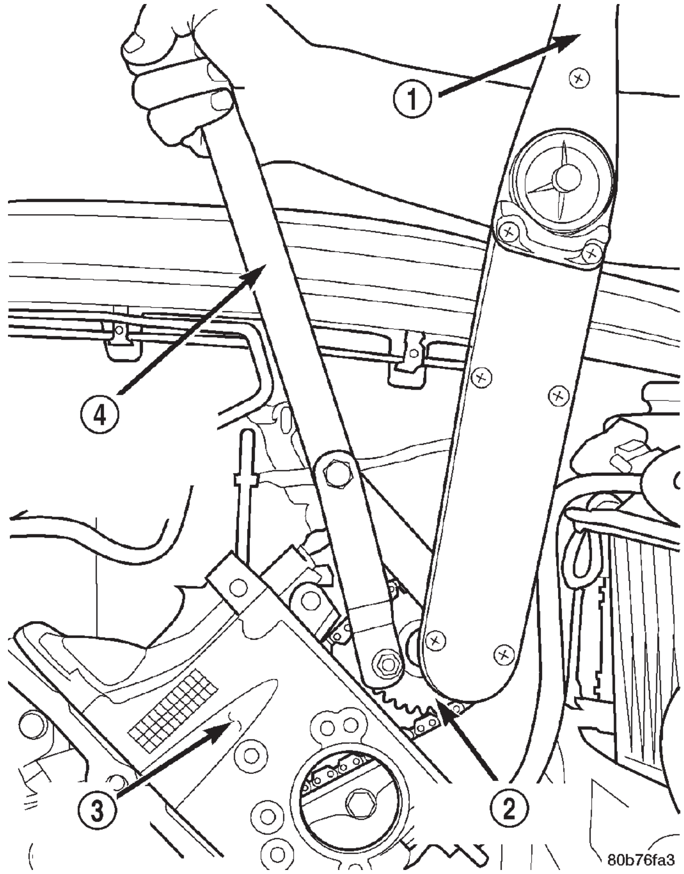


Fig. 15 Camshaft Sprocket Installation—Left Cylinder Head

1 – TORQUE WRENCH
2 – CAMSHAFT SPROCKET
3 – LEFT CYLINDER HEAD
4 – SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

(3) If the measurement exceeds the specification the secondary timing chains are worn and require replacement. Refer to Timing Chain and Sprockets in this section for procedure.

PISTONS—FITTING

BORE GAGE METHOD

(1) To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Measure the inside diameter of the cylinder bore at a point 49.5 mm (1-15/16 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B (Fig. 19).

(3) The coated pistons will be serviced with the piston pin and connecting rod pre-assembled. Tin coated pistons should not be used as replacements for coated pistons.

SERVICE PROCEDURES (Continued)

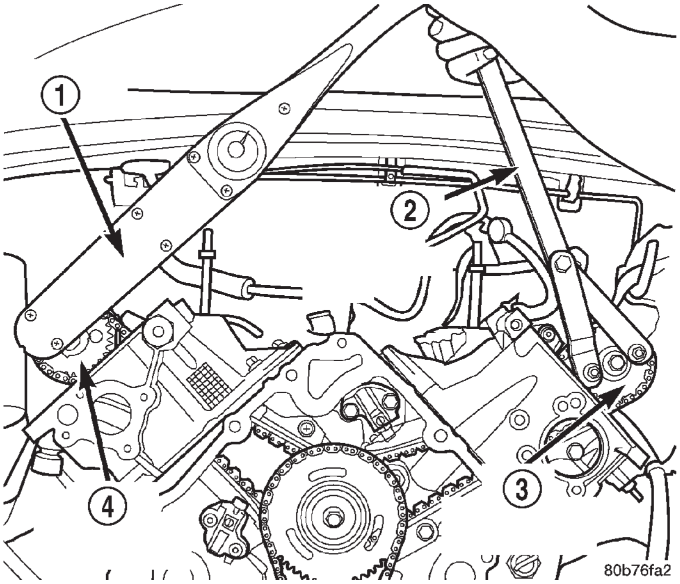


Fig. 16 Camshaft Sprocket Installation—Right Cylinder Head

1 – TORQUE WRENCH
2 – SPECIAL TOOL 6958 WITH ADAPTER PINS 8346
3 – LEFT CAMSHAFT SPROCKET
4 – RIGHT CAMSHAFT SPROCKET

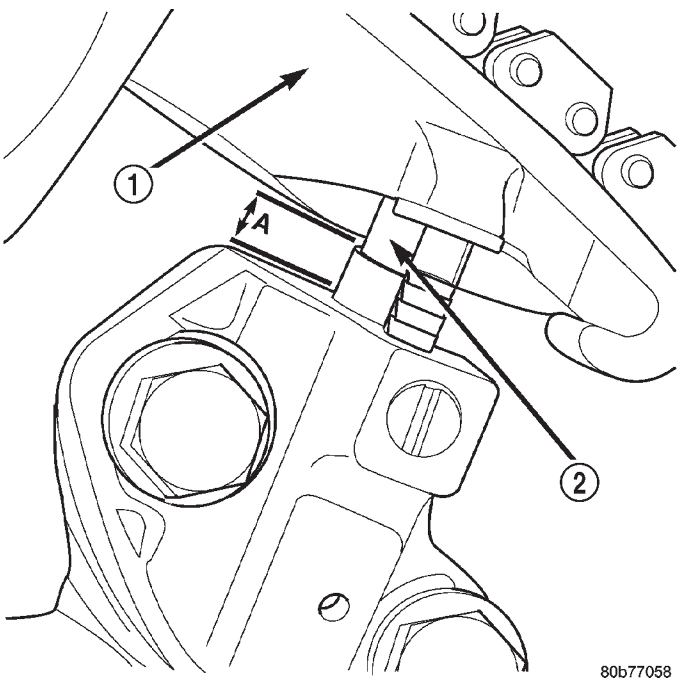


Fig. 17 Measuring Secondary Timing Chains For Stretch

1 – SECONDARY TENSIONER ARM
2 – SECONDARY CHAIN TENSIONER PISTON

(4) The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results (Fig. 18). Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.

(5) Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.

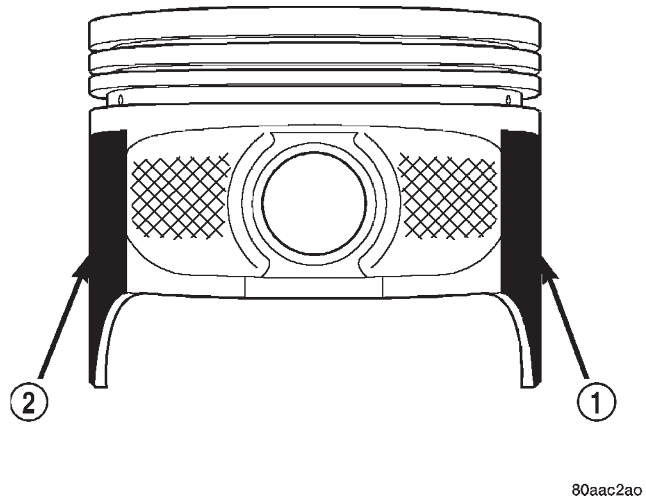


Fig. 18 Moly Coated Piston

1 – MOLY COATED
2 – MOLY COATED

PISTON RINGS—FITTING

RING END GAP

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

(1) Wipe the cylinder bore clean.

(2) Insert the ring in the cylinder bore.

NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

(3) Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.

(4) Using a feeler gauge check the ring end gap (Fig. 20). Replace any rings not within specification.

PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

(5) Measure the ring side clearance as shown (Fig. 21) make sure the feeler gauge fits snugly between the ring land and the ring. Replace any ring not within specification.

2000 AN Service Manual
Publication No. 81-370-0010
TSB 26-12-99 December, 1999

SERVICE PROCEDURES (Continued)

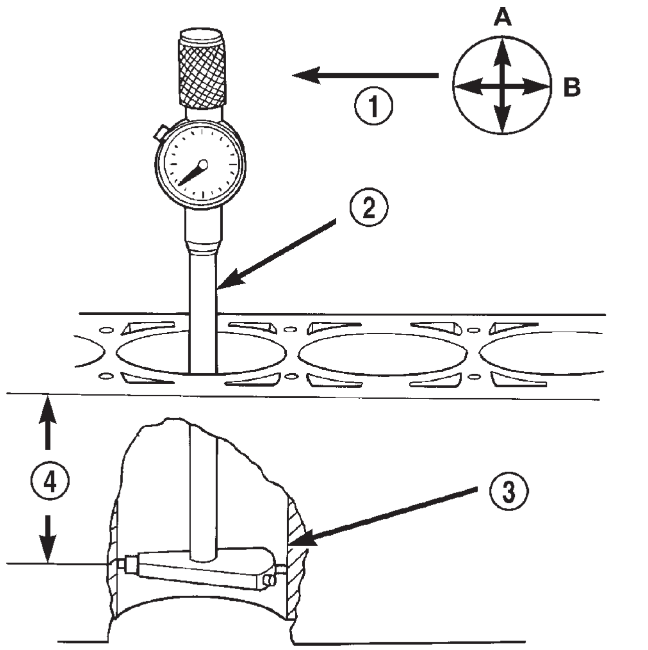


Fig. 19 Bore Gauge—Typical

1 – FRONT
2 – BORE GAUGE
3 – CYLINDER BORE
4 – 49.5 MM (1–15/16 in)

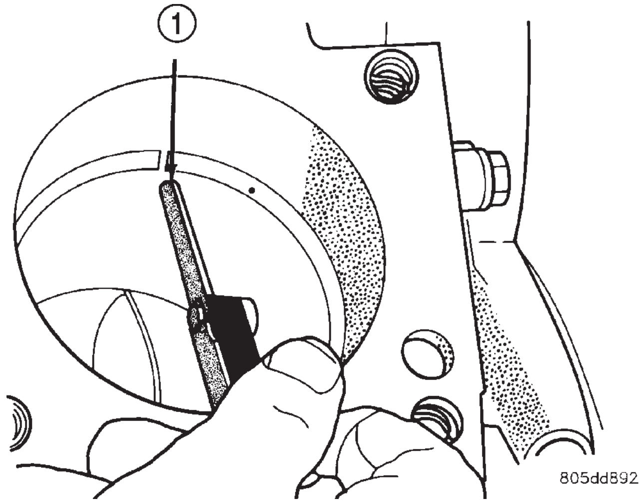


Fig. 20 Ring End Gap Measurement—Typical

1 – FEELER GAUGE

(6) Rotate the ring around the piston, the ring must rotate in the groove with out binding.

EARLY BUILD

(7) The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

LATE BUILD

The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston. On late build engines the piston top ring groove and crown are not anodized therefore, the No. 1 piston ring is coated with an anti-friction coating. Care must be used to ensure that when installing piston rings on late build engines that the correct No. 1 piston ring be installed, failure to use the correct piston ring can cause severe damage to the piston and/or cylinder block.

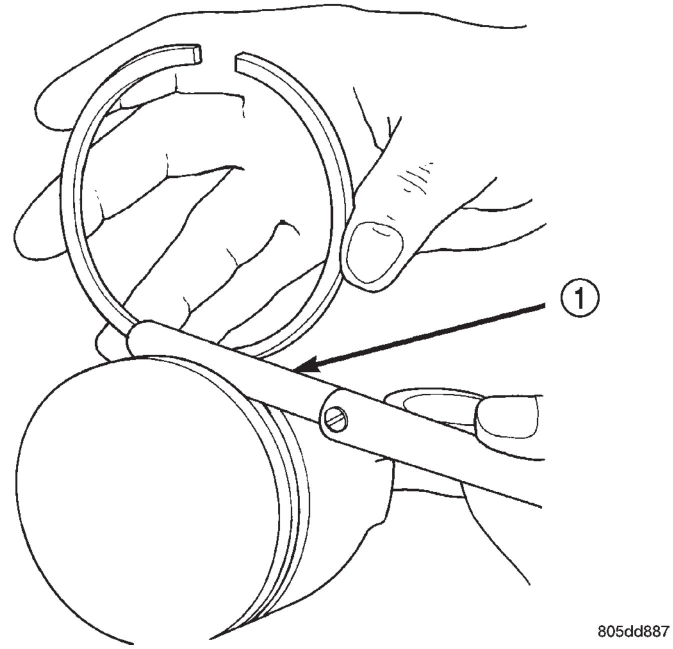


Fig. 21 Measuring Piston Ring Side Clearance

1 – FEELER GAUGE

PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	.051-.094mm (0.0020-.0037 in.)	0.11mm (0.004 in.)
Intermediate Ring	0.04-0.08mm (0.0016-0.0031 in.)	0.10mm (0.004 in.)
Oil Control Ring (Steel Rails)	.019-.229mm (.0007-.0090 in.)	.25mm (0.010 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring	0.20-0.36mm (0.008-0.014 in.)	0.40mm (0.0016in.)
Intermediate Ring	0.37-0.63mm (0.014-0.025 in.)	0.71mm (0.028in.)
Oil Control Ring (Steel Rail)	0.025-0.76mm (0.010- 0.030 in.)	1.52mm (0.060in.)

SERVICE PROCEDURES (Continued)

NOTE: Piston rings are installed in the following order:
- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

(8) Install the oil ring expander.

(9) Install upper side rail (Fig. 22) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

(10) Install No. 2 intermediate piston ring using a piston ring installer (Fig. 23).

(11) Install No. 1 upper piston ring using a piston ring installer (Fig. 23).

(12) Position piston ring end gaps as shown in (Fig. 24). It is important that expander ring gap is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

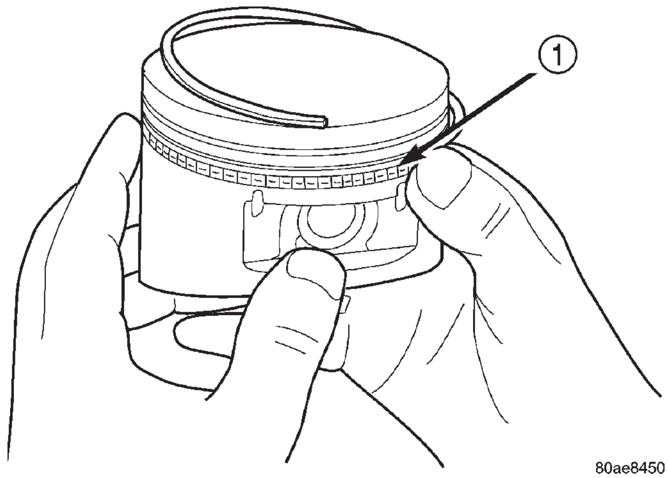


Fig. 22 Side Rail—Installation

1 – SIDE RAIL END

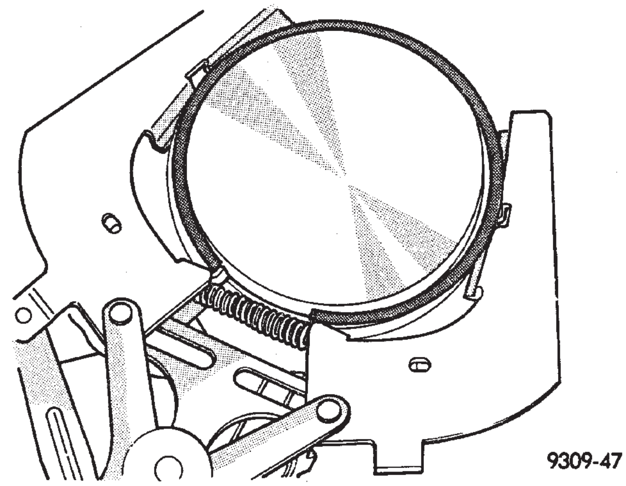


Fig. 23 Upper and Intermediate Rings—Installation

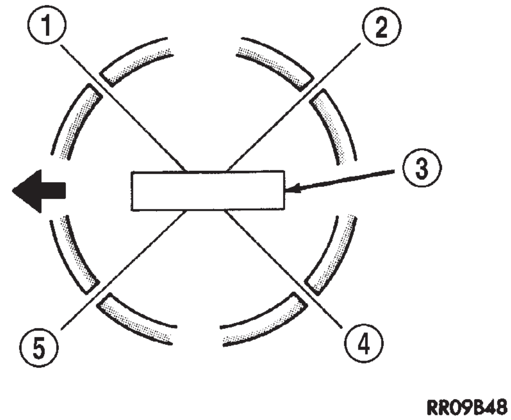


Fig. 24 Piston Ring End Gap Position

1 – SIDE RAIL UPPER
2 – NO. 1 RING GAP
3 – PISTON PIN
4 – SIDE RAIL LOWER
5 – NO. 2 RING GAP AND SPACER EXPANDER GAP

CONNECTING ROD BEARINGS—FITTING

Inspect the connecting rod bearings for scoring and bent alignment tabs (Fig. 25) (Fig. 26). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 27). Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

(1) Wipe the oil from the connecting rod journal.

(2) Lubricate the upper bearing insert and install in connecting rod.

(3) Use piston ring compressor and Guide Pins Special Tool 8507 (Fig. 28) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The “F”’s near the piston wrist pin bore should point to the front of the engine.

(4) Install the lower bearing insert in the bearing cap. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.

SERVICE PROCEDURES (Continued)

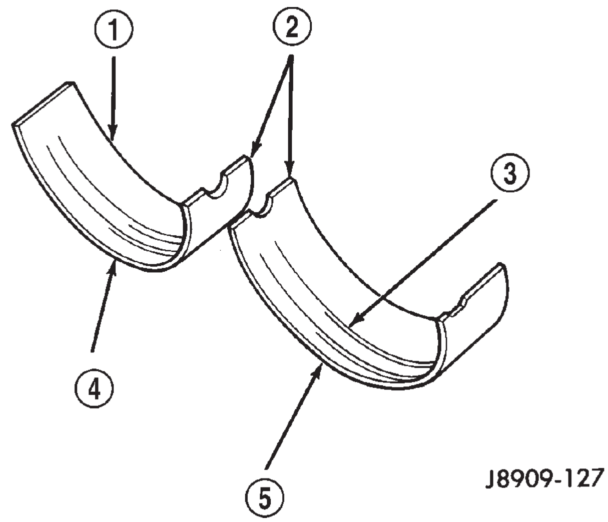


Fig. 25 Connecting Rod Bearing Inspection

1 – UPPER BEARING HALF
2 – MATING EDGES
3 – GROOVES CAUSED BY ROD BOLTS SCRATCHING JOURNAL DURING INSTALLATION
4 – WEAR PATTERN — ALWAYS GREATER ON UPPER BEARING
5 – LOWER BEARING HALF

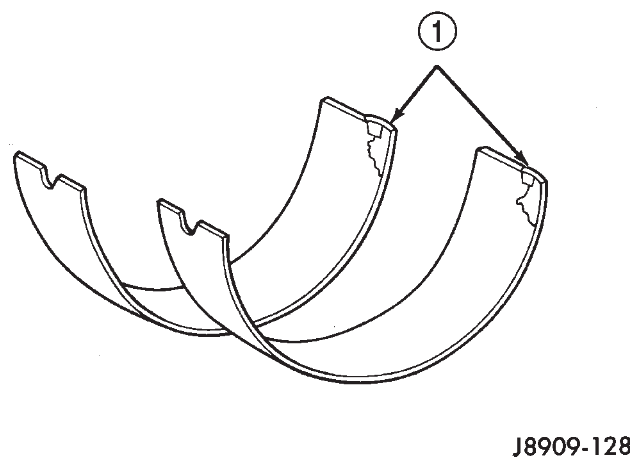


Fig. 26 Locking Tab Inspection

1 – ABNORMAL CONTACT AREA CAUSED BY LOCKING TABS NOT FULLY SEATED OR BEING BENT

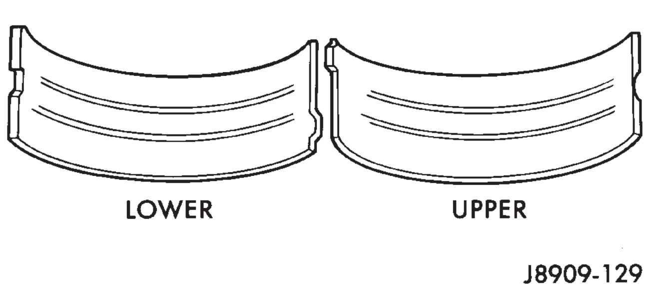


Fig. 27 Scoring Caused by Insufficient Lubrication or by Damaged Crankshaft Pin Journal

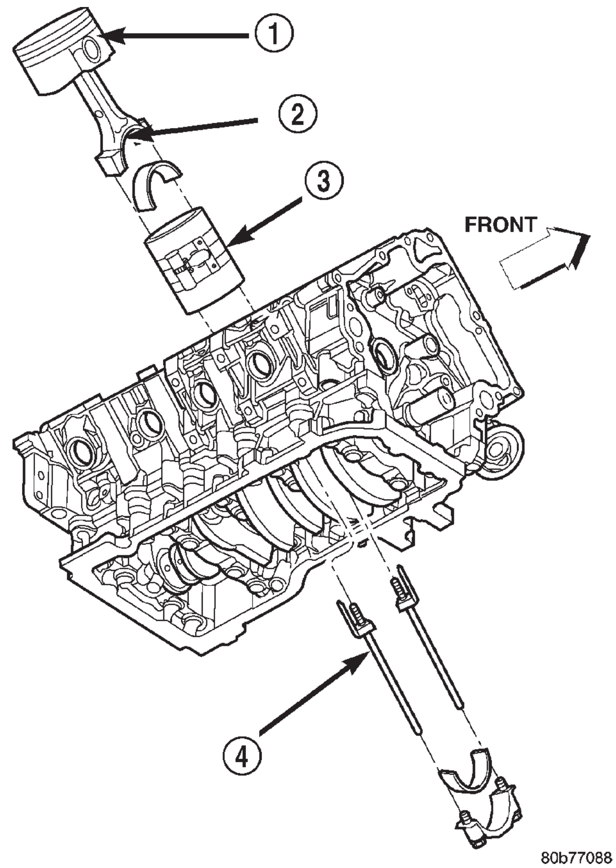


Fig. 28 Piston and Connecting Rod—Installation

1 – "F" TOWARD FRONT OF ENGINE
2 – OIL SLINGER SLOT
3 – RING COMPRESSOR
4 – SPECIAL TOOL 8507

(5) Install bearing cap and connecting rod on the journal and tighten bolts to 27 N·m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

(6) Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (Fig. 29). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**

SERVICE PROCEDURES (Continued)

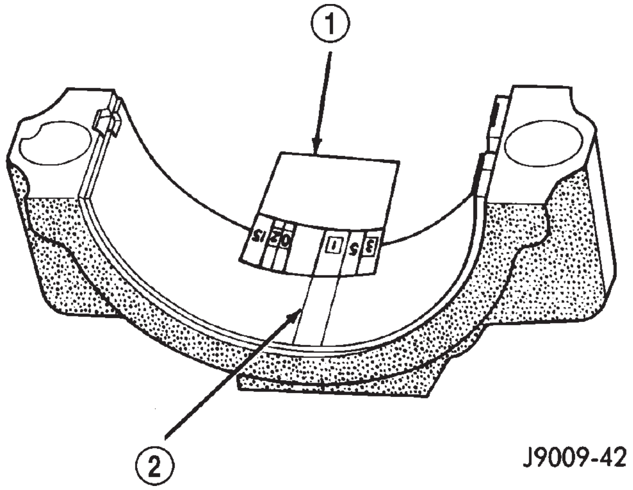


Fig. 29 Measuring Bearing Clearance with Plastigage

1 – PLASTIGAGE SCALE
2 – COMPRESSED PLASTIGAGE

(7) If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

(8) If bearing-to-journal clearance exceeds the specification, determin which services bearing set to use the bearing sizes are as follows:

Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.)	50.983-50.967 mm (2.0073-2.0066 in.)
Std.	STANDARD	50.992-51.008 mm (2.0076-2.0082 in.)
.250 US	.250 mm (.010 in.)	50.758-50.742 mm (1.9984-1.9978 in.)

(9) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(10) Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N·m (20 ft. lbs.) plus a 90° turn.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange (Fig. 30). Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

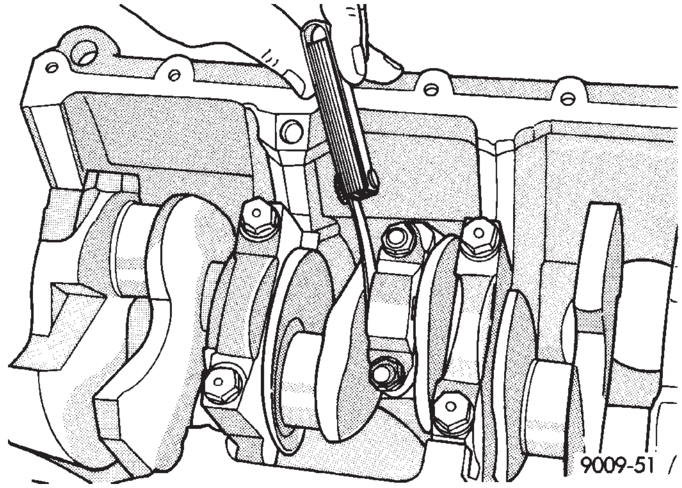


Fig. 30 Checking Connecting Rod Side Clearance—Typical

CRANKSHAFT MAIN BEARINGS

INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated (Fig. 31).

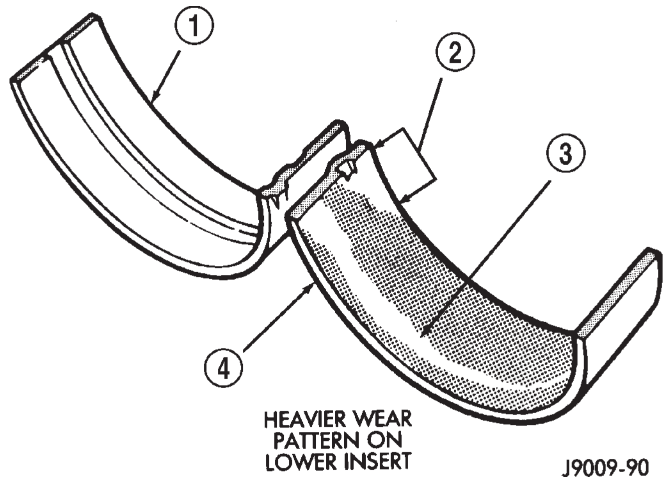


Fig. 31 Main Bearing Wear Patterns

1 – UPPER INSERT
2 – NO WEAR IN THIS AREA
3 – LOW AREA IN BEARING LINING
4 – LOWER INSERT

NOTE: If any of the crankshaft journals are scored, remove the engine for crankshaft repair.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

SERVICE PROCEDURES (Continued)

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block. Refer to Crankshaft in this section for procedure.

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

Install the crankshaft into the cylinder block. Refer to Crankshaft in this section for procedure.

CRANKSHAFT MAIN BEARING SELECTION

(1) Service main bearings are available in three grades. The chart below identifies the three service grades available.

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	.008 mm U/S (.0004 in.) U/S	63.488-63.496 mm (2.4996-2.4999 in.)
B	STANDARD	63.496-63.504 mm (2.4996-2.4999 in.)
C	.008 mm O/S (.0004 in.) O/S	63.504-63.512 mm (2.5002-2.5005 in.)

REMOVAL AND INSTALLATION

ENGINE MOUNTS—LEFT AND RIGHT

REMOVAL

(1) Disconnect the negative cable from the battery.

CAUTION: Remove the fan blade, fan clutch and fan shroud before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

(2) Remove the fan blade, fan clutch and fan shroud. Refer to Cooling System for procedure.

(3) Remove the engine oil filter.

(4) Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.

(5) Remove the four (4) cylinder block-to-insulator mount bolts and the nut from the engine insulator mount through bolt (4x2 Vehicles only) (Fig. 32) (Fig. 33).

(6) Remove the three (3) cylinder block-to-insulator mount bolts and loosen the nut from the engine insulator mount through bolt (4x4 Vehicles only) (Fig. 34) (Fig. 35).

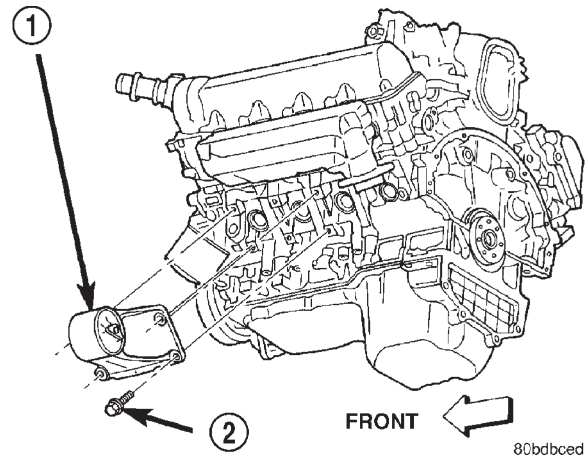


Fig. 32 Engine Insulator Mount 4x2 Vehicle—Left Side

1 – ENGINE INSULATOR MOUNT-LEFT SIDE
2 – MOUNTING BOLT

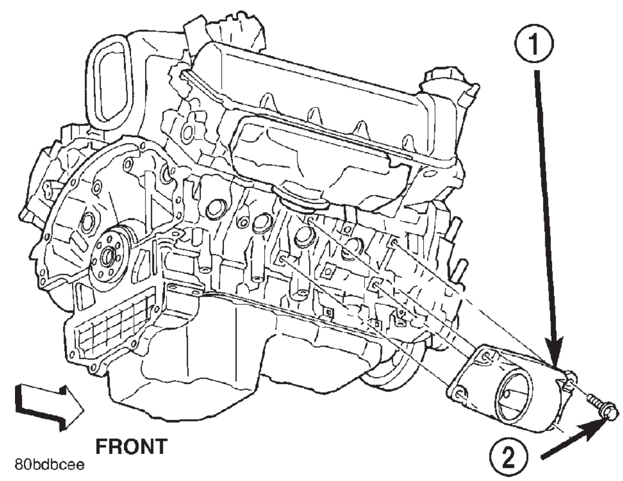


Fig. 33 Engine Insulator Mount 4x2 Vehicle—Right Side

1 – ENGINE INSULATOR MOUNT-RIGHT SIDE
2 – MOUNTING BOLT

(7) Using the jack, raise the engine high enough to remove the engine insulator mount through bolt and the insulator mount.

REMOVAL AND INSTALLATION (Continued)

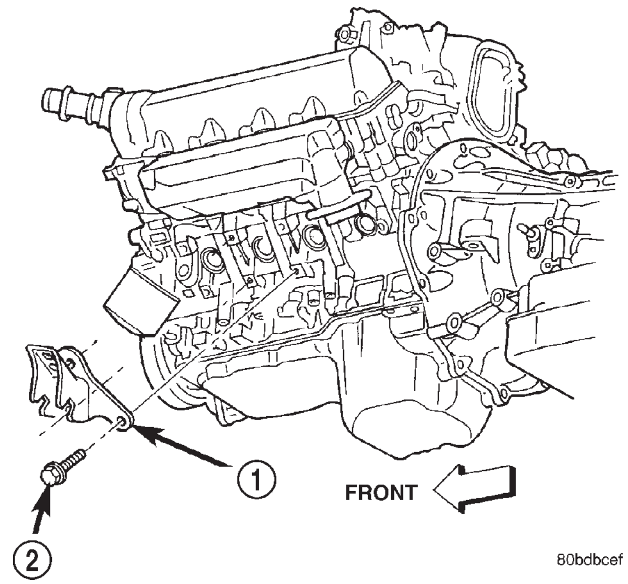


Fig. 34 Engine Insulator Mount 4x4 Vehicle—Left Side

1 – ENGINE INSULATOR MOUNT-LEFT SIDE
2 – MOUNTING BOLT

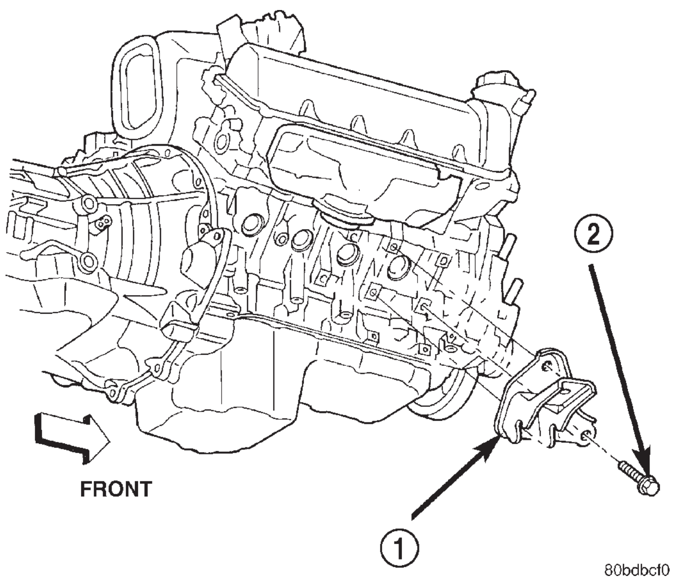


Fig. 35 Engine Insulator Mount 4x4 Vehicle—Right Side

1 – ENGINE INSULATOR MOUNT-RIGHT SIDE
2 – MOUNTING BOLT

INSTALLATION

(1) Position the insulator mount and install the insulator mount through bolt.

(2) Lower the engine until the four cylinder block-to-insulator mount bolts can be installed.

(3) Remove the jack and block of wood.

(4) Torque the cylinder block-to-insulator mount bolts to 61 N·m (45 ft. lbs.).

(5) Install and torque the through bolt retaining nut to 61 N·m (45 ft. lbs.).

(6) Install the fan blade, fan clutch and fan shroud.

ENGINE MOUNT—REAR

REMOVAL

(1) Raise vehicle on hoist.

(2) Using a suitable jack, support transmission.

(3) Remove the nut from the insulator mount through bolt (Manual transmission and 4x2 automatic transmission only) (Fig. 36) (Fig. 37).

(4) Remove the four bolts and washers retaining the mount to the transmission (4x4 automatic transmission only) (Fig. 38).

(5) Raise the transmission enough to remove the through bolt (Manual transmission and 4x2 automatic transmission only) (Fig. 36) (Fig. 37).

(6) Raise the transmission and remove the bolts retaining the mount to the crossmember (4x4 automatic transmission only) (Fig. 38).

(7) Remove the two nuts retaining the isolator to the crossmember (Manual transmission and 4x2 automatic transmission only) (Fig. 36) (Fig. 37).

(8) Remove the bolts (two bolts manual transmission)(three bolts 4x2 automatic transmission) retaining the insulator bracket to the transmission.

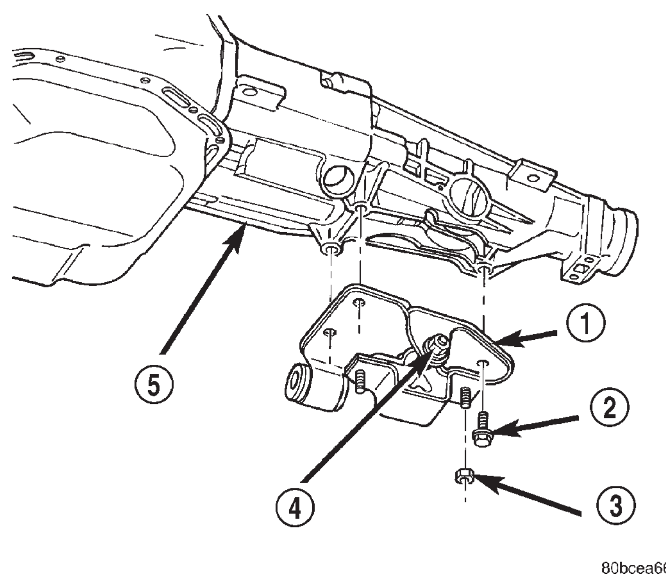


Fig. 36 Engine Rear Mount—4X2 Automatic Transmission

1 – ENGINE REAR MOUNT
2 – BOLT
3 – NUT
4 – THROUGH BOLT NUT
5 – TRANSMISSION

REMOVAL AND INSTALLATION (Continued)

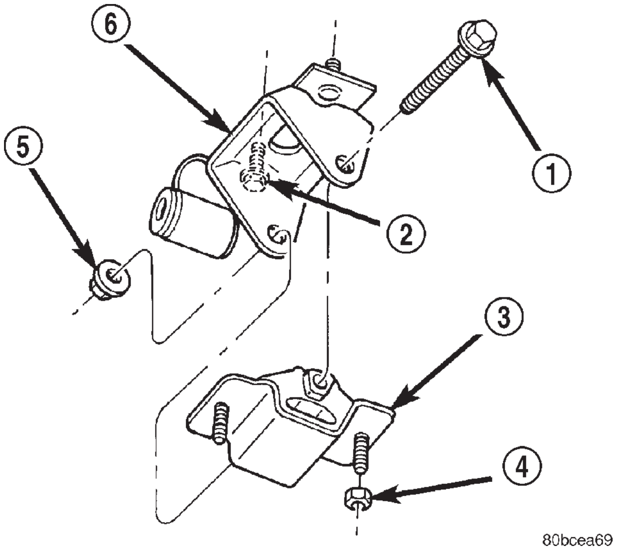


Fig. 37 Engine Rear Mount—4X2 and 4X4 Manual Transmission

1 – THROUGH BOLT
2 – BOLT
3 – INSULATOR SUPPORT
4 – NUT
5 – NUT AND WASHER
6 – INSULATOR BRACKET TO TRANSMISSION

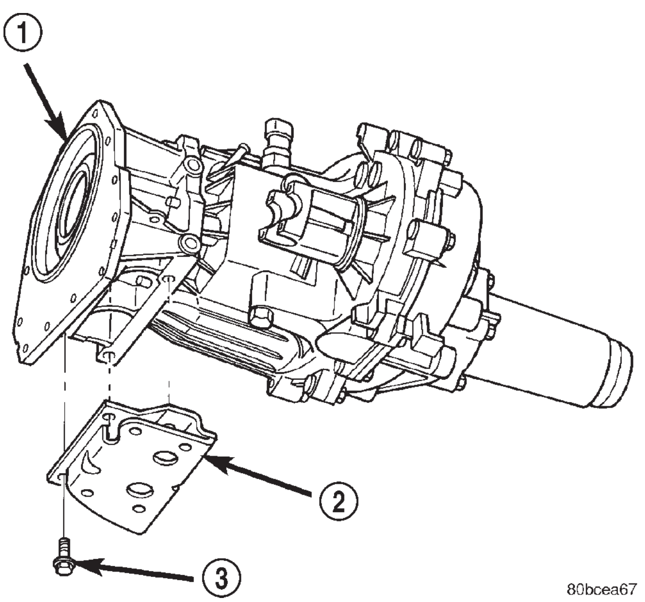


Fig. 38 Engine Rear Mount—4X4 Automatic Transmission

1 – TRANSMISSION
2 – ENGINE REAR MOUNT
3 – BOLT

INSTALLATION

(1) Follow the removal procedure in the reverse order.

(2) Tighten the through bolt retaining nut to 102 N·m (75 ft. lbs.).

(3) Tighten the isolator bracket to transmission retaining bolts (Manual transmission and 4x2 automatic transmission only) to 41 N·m (30 ft. lbs.).

(4) Tighten the mount bracket to transmission retaining bolts (4x4 automatic transmission only) to 68 N·m (50 ft. lbs.).

(5) Tighten the isolator mount to crossmember retaining nuts (Manual transmission and 4x2 automatic transmission only) to 28 N·m (250 in. lbs.).

(6) Tighten the mount bracket to crossmember retaining bolts (4x4 automatic transmission only) to 28 N·m (250 in. lbs.).

STRUCTURAL COVER

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove the left hand exhaust pipe from exhaust manifold. Refer to Group 11, Exhaust System.

(3) Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.

(4) Remove the eight bolts retaining structural cover (Fig. 39).

(5) Pivot the exhaust pipe downward and remove the structural cover.

INSTALLATION

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.

(1) Position the structural cover in the vehicle.

(2) Install all four bolts retaining the cover-to-engine. DO NOT tighten the bolts at this time.

(3) Install the four cover-to-transmission bolts. Do NOT tighten at this time.

CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

(4) Starting with the two rear cover-to-engine bolts, tighten bolts (1) (Fig. 39) to 54 N·m (40 ft. lbs.), then tighten bolts (2) (Fig. 39) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.

(5) Install the exhaust pipe on left hand exhaust manifold.

(6) Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20–26 N·m (15–20 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

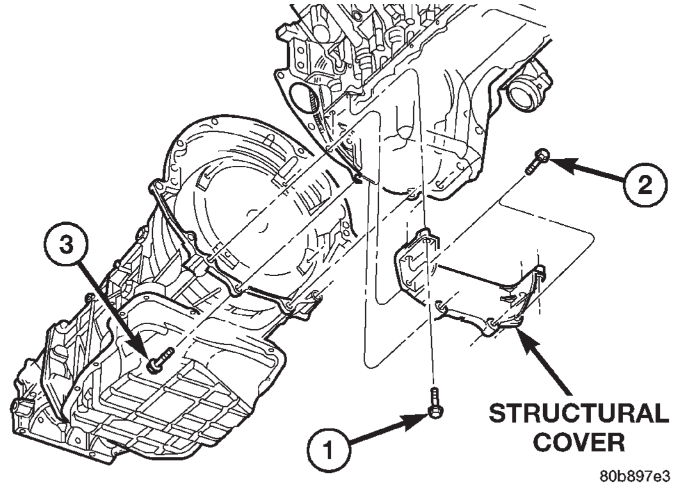


Fig. 39 Structural Cover

SEQUENCE	ITEM	TORQUE
1	BOLT (Qty 4)	54 N·m (40 ft. lbs.)
2	BOLT (Qty 2)	54 N·m (40 ft. lbs.)
3	BOLT (Qty 2)	54 N·m (40 ft. lbs.)

ENGINE ASSEMBLY

REMOVAL

NOTE: This procedure applies to both the 4X2 and 4X4 vehicles, steps that apply to the 4X4 vehicle only, are identified.

(1) Disconnect the battery negative and positive cables.

(2) Remove the battery and the battery tray. Refer to BATTERY.

(3) Raise vehicle on hoist.

(4) Remove exhaust crossover pipe from exhaust manifolds. Refer to EXHAUST SYSTEM.

(5) **4X4 vehicles** Disconnect axle vent tube from left side engine mount.

(6) Remove the through bolt retaining nut and bolt from both the left and right side engine mounts (Fig. 40) (Fig. 41).

(7) **4X4 vehicles** Remove locknut from left and right side engine mount brackets (Fig. 41).

(8) Disconnect two ground straps from the lower left hand side and one ground strap from the lower right hand side of the engine.

(9) Disconnect crankshaft position sensor (Fig. 43).

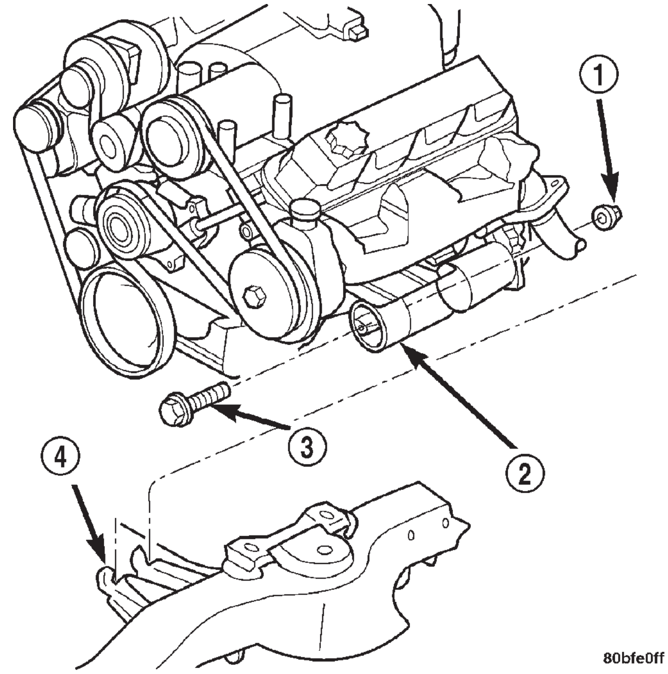


Fig. 40 Engine Mount Through Bolt and Nut Removal / Installation—4X2 Vehicles

1 – LOCKNUT AND WASHER
2 – ENGINE MOUNT/INSULATOR
3 – THROUGH BOLT
4 – FRAME

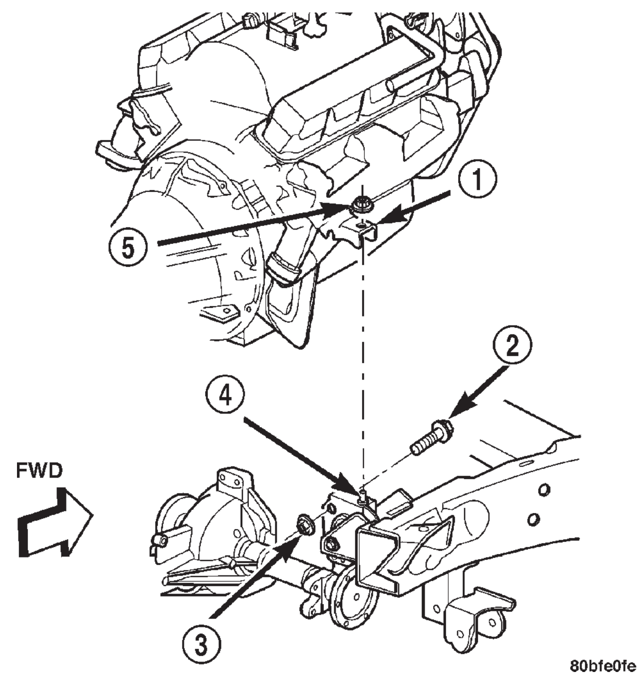


Fig. 41 Engine Mount Through Bolt and Nut Removal / Installation—4X4 Vehicles

1 – ENGINE MOUNT BRACKET (2)
2 – THROUGH BOLT (2)
3 – LOCKNUT AND WASHER (2)
4 – ENGINE ISOLATOR TO ENGINE MOUNT BRACKET STUD (2)
5 – LOCKNUT (2)

REMOVAL AND INSTALLATION (Continued)

NOTE: The following step applies to 4X4 vehicles equipped with automatic transmission only.

(10) **4X4 vehicles** Remove the axle isolator bracket from the engine, transmission and the axle (Fig. 42).

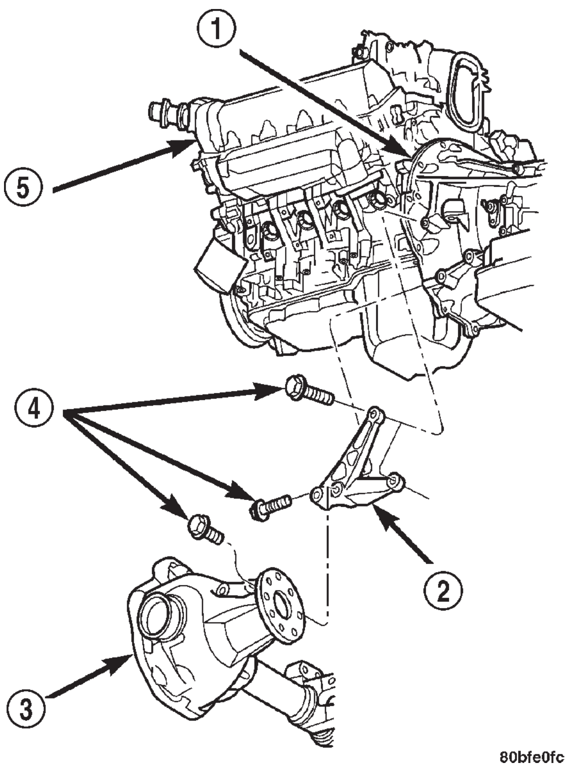


Fig. 42 Axle Isolator Bracket Removal / Installation—4X4 Vehicles With Automatic Transmission

1 – TRANSMISSION
2 – AXLE ISOLATOR BRACKET
3 – FRONT AXLE 4X4 VEHICLES
4 – BOLTS
5 – ENGINE

(11) Remove structural cover. Refer to Structural Cover in this section for procedure.

(12) Remove starter. Refer to STARTING SYSTEM.

(13) Drain cooling system. Refer to COOLING SYSTEM.

(14) Remove torque converter bolts (Automatic Transmission Only). Refer to TRANSMISSION.

(15) Remove transmission to engine mounting bolts.

(16) Disconnect the engine block heater power cable from the block heater, if equipped.

(17) Lower vehicle.

(18) Remove throttle body resonator assembly and air inlet hose.

(19) Disconnect throttle and speed control cables.

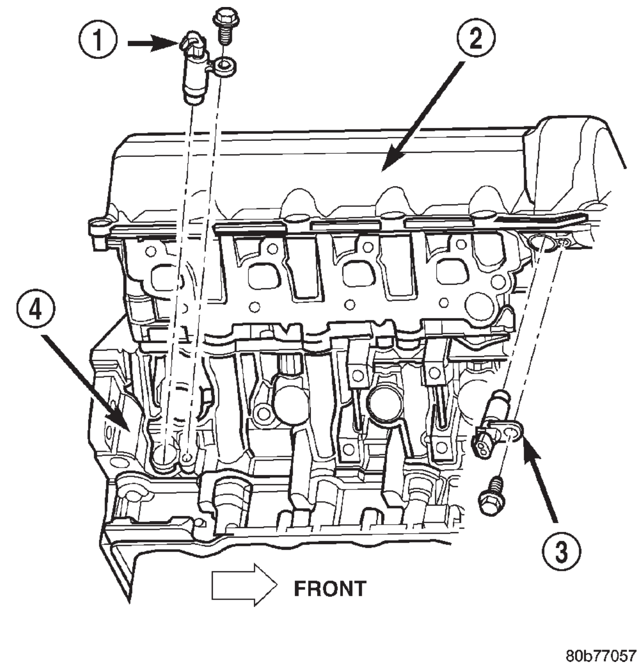


Fig. 43 Crankshaft Position Sensor

1 – CRANKSHAFT POSITION SENSOR
2 – CYLINDER HEAD COVER
3 – CAMSHAFT POSITION SENSOR
4 – RIGHT SIDE CYLINDER BLOCK

(20) Disconnect tube from both the left and right side crankcase breathers (Fig. 44), remove breathers.

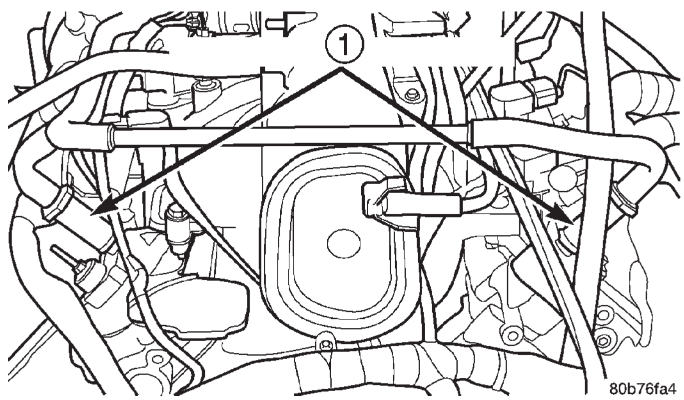


Fig. 44 Crankcase Breather Connection Points

1 – CRANKCASE BREATHERS

(21) Discharge A/C system. Refer to HEATING and AIR CONDITIONING.

(22) Remove A/C compressor.

(23) Remove shroud, fan assemblies and accessory drive belt. Refer to COOLING SYSTEM.

(24) Disconnect transmission oil cooler lines at the radiator.

(25) Disconnect radiator upper and lower hoses. Refer to COOLING SYSTEM.

(26) Remove radiator, A/C condenser and transmission oil cooler as an assembly. Refer to COOLING SYSTEM.

(27) Remove generator.

(28) Disconnect the two heater hoses from the timing chain cover and heater core.

(29) Unclip and remove heater hoses and tubes from the intake manifold (Fig. 45).

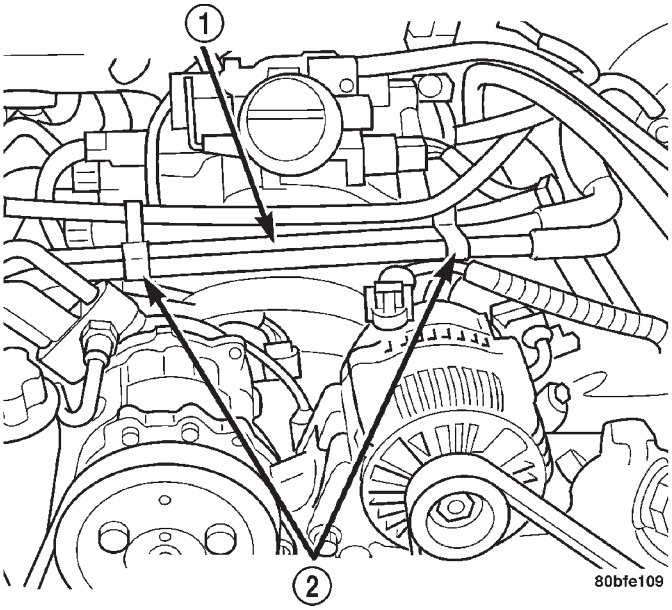


Fig. 45 Heater Hoses and Tubes Removal / Installation

1 – HEATER HOSES AND TUBES
2 – ROUTING/RETAINING CLIPS

(30) Disconnect engine harness at the following points:

- Intake air temperature (IAT) sensor (Fig. 46)
- Fuel Injectors
- Throttle Position (TPS) Switch
- Idle Air Control (IAC) Motor
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold absolute pressure (MAP) Sensor
- Camshaft Position (CMP) Sensor
- Coil Over Plugs

(31) Disconnect the vacuum lines at the throttle body and intake manifold.

(32) Release fuel rail pressure then disconnect the fuel supply quick connect fitting at the fuel rail. Refer to FUEL SYSTEM for procedure.

(33) Remove power steering pump and position out of the way.

(34) Install Special Tools 8400 Lifting Studs, into the cylinder heads.

(35) Install Engine Lifting Fixture Special Tool 8347 (Fig. 47) following these steps:

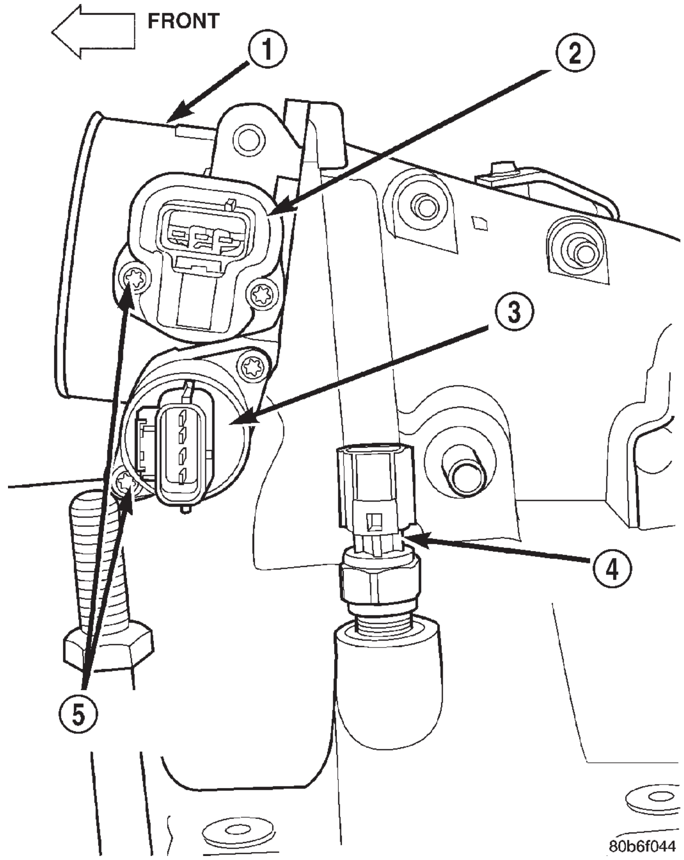


Fig. 46 Throttle Body Connection Points

1 – THROTTLE BODY
2 – TPS
3 – IAC MOTOR
4 – IAT SENSOR
5 – MOUNTING SCREWS

- Holding the lifting fixture at a slight angle, slide the large bore in the front plate over the hex portion of the lifting stud.
- Position the two remaining fixture arms onto the two Special Tools 8400 Lifting Studs, in the cylinder heads.
- Pull foward and upward on the lifting fixture so that the lifting stud rest in the slotted area below the large bore.
- Secure the lifting fixture to the three studs using three 7/16 – 14 N/C locknuts.
- Make sure the lifting loop in the lifting fixture is in the last hole (closest to the throttle body) to minimize the angle of engine during removal.

(36) Disconnect body ground strap at the right side cowl (Fig. 48).

(37) Disconnect body ground strap at the left side cowl (Fig. 49).

NOTE: It will be necessary to support the transmission in order to remove the engine.

REMOVAL AND INSTALLATION (Continued)

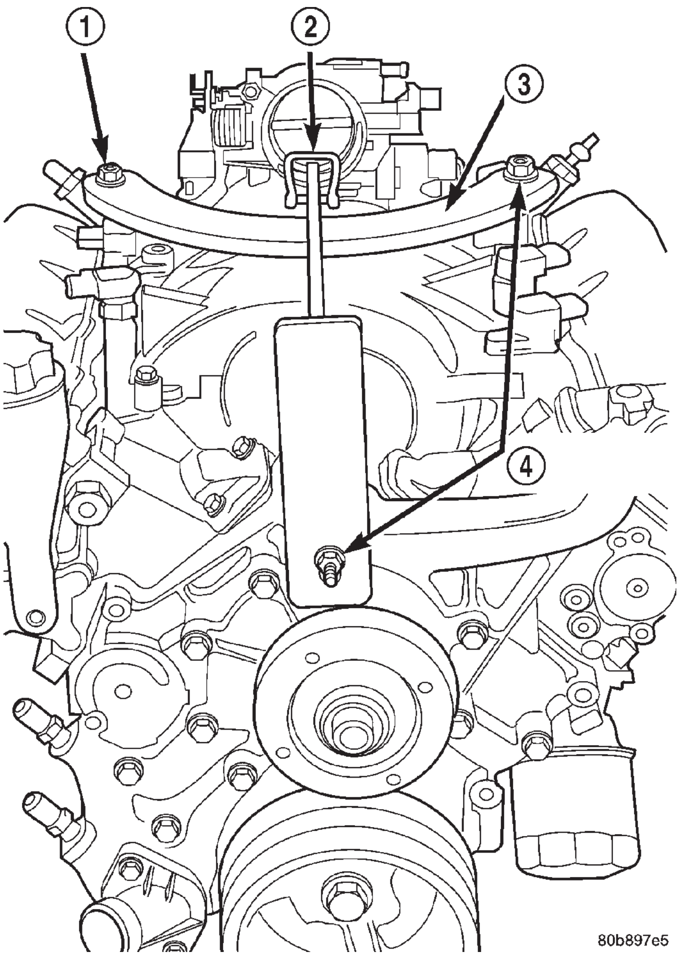


Fig. 47 Engine Lifting Fixture Attachment Locations

1 – ATTACHING LOCATION
2 – ADJUSTABLE HOOK
3 – SPECIAL TOOL 8347 ENGINE LIFT FIXTURE
4 – ATTACHING LOCATIONS

(38) Position a suitable jack under the transmission.

(39) Remove engine from the vehicle.

INSTALLATION

(1) Position engine in the vehicle.

Position both the left and right side engine mount brackets and install the through bolts and nuts. Tighten nuts to **4X2 vehicles** 95 N·m (70 ft. lbs.), **4X4 vehicles** 102 N·m (75 ft. lbs.).

(2) **4X4 vehicles** Install locknuts onto the engine mount brackets. Tighten locknuts to 41 N·m (30 ft. lbs.).

(3) Remove jack from under the transmission.

(4) Remove Engine Lifting Fixture Special Tool 8347 (Fig. 47).

(5) Remove Special Tools 8400 Lifting Studs.

(6) Position generator wiring behind the oil dipstick tube, then install the oil dipstick tube upper mounting bolt.

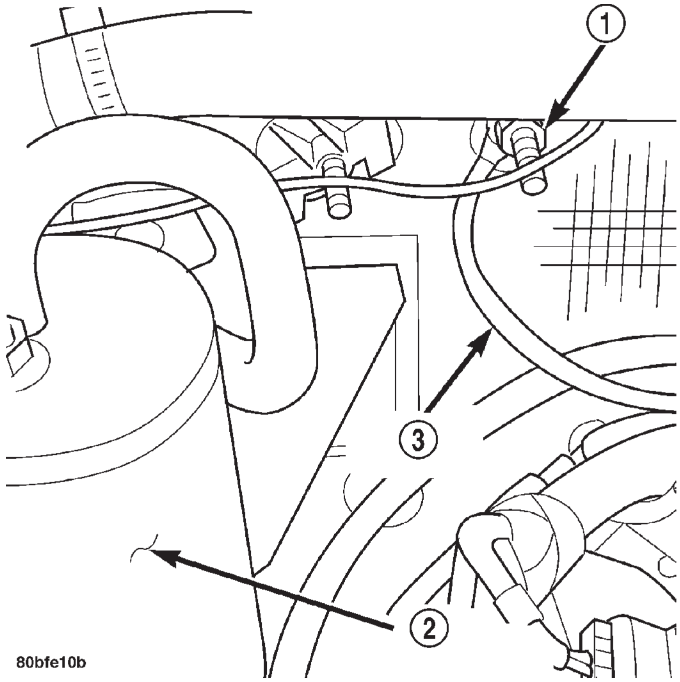


Fig. 48 Body Ground Strap—Right Side Removal / Installation

1 – NUT
2 – A/C ACCUMULATOR
3 – GROUND STRAP

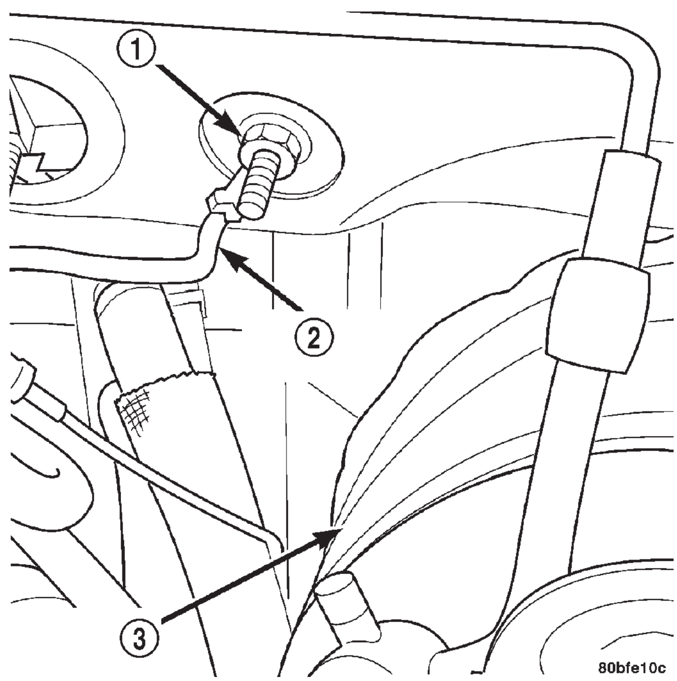


Fig. 49 Body Ground Strap—Left Side Removal / Installation

1 – NUT
2 – GROUND STRAP
3 – BRAKE BOOSTER

REMOVAL AND INSTALLATION (Continued)

(7) Connect both left and right side body ground straps.

(8) Install power steering pump.

(9) Connect fuel supply line quick connect fitting.

(10) Connect the vacuum lines at the throttle body and intake manifold.

(11) Connect engine harness at the following points (Fig. 46):

- Intake Air Temperature (IAT) Sensor
- Idle Air Control (IAC) Motor
- Fuel Injectors
- Throttle Position (TPS) Switch
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Camshaft Position (CMP) Sensor
- Coil Over Plugs

(12) Position and install heater hoses and tubes onto intake manifold.

(13) Install the heater hoses onto the heater core and the engine front cover.

(14) Install generator.

(15) Install A/C condenser, radiator and transmission oil cooler as an assembly.

(16) Connect radiator upper and lower hoses.

(17) Connect the transmission oil cooler lines to the radiator.

(18) Install accessory drive belt, fan assembly and shroud.

(19) Install A/C compressor. Tighten the A/C compressor and generator M10 mounting bolts 40–68N·M (30–50 ft. lbs.) and the M8 bolts 22–34 N·m (200–300 in. lbs.).

(20) Install both breathers. Connect tube to both crankcase breathers (Fig. 44).

(21) Connect throttle and speed control cables.

(22) Install throttle body resonator assembly and air inlet hose. Tighten clamps 4 N·m (35 in. lbs.).

(23) Raise vehicle.

(24) Install transmission to engine mounting bolts. Tighten the bolts to 41 N·m (30 ft. lbs.).

(25) Install torque converter bolts (Automatic Transmission Only).

(26) Connect crankshaft position sensor (Fig. 43).

(27) **4X4 vehicles** Position and install the axle isolator bracket onto the axle, transmission and engine block. Tighten bolts to specification. Refer to Specifications in this section.

(28) Install starter.

CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

(29) Install structural cover. Refer to Structural Cover in this section.

(30) Install exhaust crossover pipe.

(31) Install engine block heater power cable, If equipped.

(32) **4X4 vehicles** Connect axle vent tube to left side engine mount.

(33) Lower vehicle.

(34) Check and fill engine oil.

(35) Recharge the A/C system.

(36) Refill the engine cooling system. Refer to COOLING SYSTEM.

(37) Install the battery tray and battery.

(38) Connect the battery positive and negative cables.

(39) Start the engine and check for leaks.

INTAKE MANIFOLD

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove resonator assembly and air inlet hose.

(3) Disconnect throttle and speed control cables.

(4) Disconnect electrical connectors for the following components: Refer to FUEL SYSTEM for component locations.

- Manifold Absolute Pressure (MAP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Position (TPS) Sensor
- Coolant Temperature (CTS) Sensor
- Idle Air Control (IAC) Motor

(5) Disconnect vapor purge hose, brake booster hose, speed control servo hose, positive crankcase ventilation (PCV) hose.

(6) Disconnect generator electrical connections.

(7) Disconnect air conditioning compressor electrical connections.

(8) Disconnect left and right radio suppressor straps.

(9) Disconnect and remove ignition coil towers.

(10) Remove top oil dipstick tube retaining bolt and ground strap.

(11) Bleed fuel system. Refer to FUEL SYSTEM.

(12) Remove fuel rail.

(13) Remove throttle body assembly and mounting bracket.

(14) Drain cooling system below coolant temperature level. Refer to COOLING SYSTEM.

(15) Remove the heater hoses from the engine front cover and the heater core.

(16) Unclip and remove heater hoses and tubes from intake manifold (Fig. 50).

(17) Remove coolant temperature sensor. Refer to FUEL SYSTEM reverse order of tightening sequence (Fig. 51).

(18) Remove intake manifold retaining fasteners in reverse order of tightening sequence (Fig. 51).

(19) Remove intake manifold.

REMOVAL AND INSTALLATION (Continued)

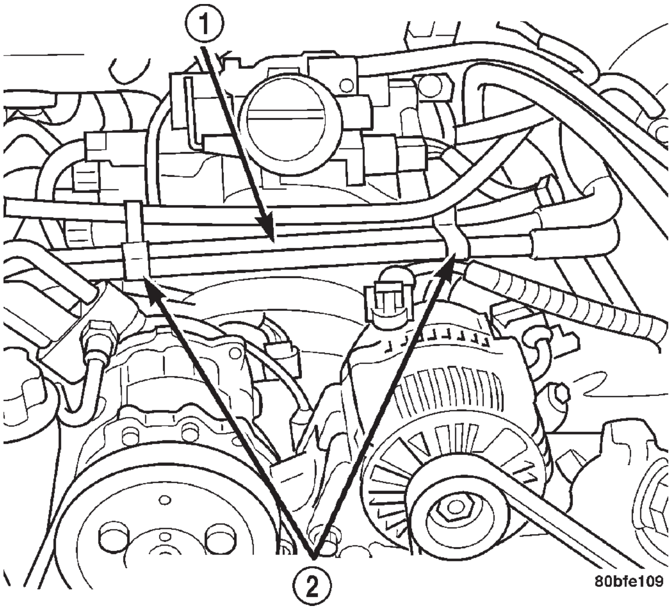


Fig. 50 Heater Hoses and Tubes Removal / Installation

1 – HEATER HOSES AND TUBES
2 – ROUTING/RETAINING CLIPS

INSTALLATION

(1) Install intake manifold gaskets.

(2) Install intake manifold.

(3) Install intake manifold retaining bolts and tighten in sequence shown in (Fig. 51) to 12 N·m (105 in. lbs.).

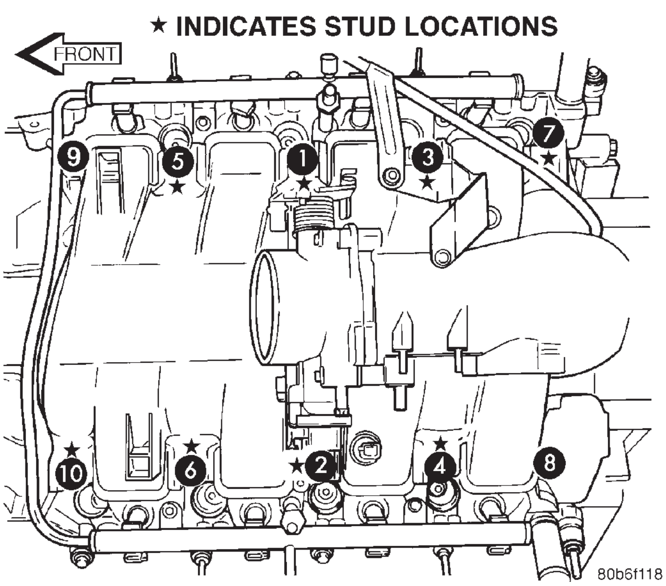


Fig. 51 Intake Manifold Tightening Sequence

(4) Install left and right radio suppressor straps.

(5) Install throttle body assembly.

(6) Install throttle cable bracket.

(7) Connect throttle cable and speed control cable to throttle body.

(8) Install fuel rail.

(9) Install ignition coil towers.

(10) Position and install heater hoses and tubes onto intake manifold.

(11) Install the heater hoses to the heater core and engine front cover.

(12) Connect electrical connectors for the following components:

- Manifold Absolute Pressure (MAP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Position (TPS) Sensor
- Coolant Temperature (CTS) Sensor
- Idle Air Control (IAC) Motor
- Ignition coil towers
- Fuel injectors

(13) Install top oil dipstick tube retaining bolt and ground strap.

(14) Connect generator electrical connections.

(15) Connect Vapor purge hose, Brake booster hose, Speed control servo hose, Positive crankcase ventilation (PCV) hose.

(16) Fill cooling system.

(17) Install resonator assembly and air inlet hose.

(18) Connect negative cable to battery.

EXHAUST MANIFOLDS

RIGHT EXHAUST MANIFOLD

REMOVAL

(1) Disconnect negative cable for battery.

(2) Remove air cleaner assembly, resonator assembly and air inlet hose.

(3) Remove accessory drive belt. Refer to COOLING SYSTEM.

(4) Remove A/C compressor from mounting and set aside.

(5) Remove A/C accumulator support bracket fastener.

(6) Drain coolant below heater hose level. Refer to COOLING SYSTEM.

(7) Remove heater hoses at engine.

(8) Remove fasteners attaching exhaust manifold heat shield.

(9) Remove heat shield.

(10) Remove upper exhaust manifold attaching fasteners.

(11) Raise vehicle on hoist.

(12) Disconnect exhaust pipe from manifold.

(13) Remove fasteners attaching starter. Move starter aside.

(14) Remove lower exhaust manifold attaching fasteners.

(15) Remove exhaust manifold and gasket (Fig. 52). Manifold is removed from below the engine compartment.

REMOVAL AND INSTALLATION (Continued)

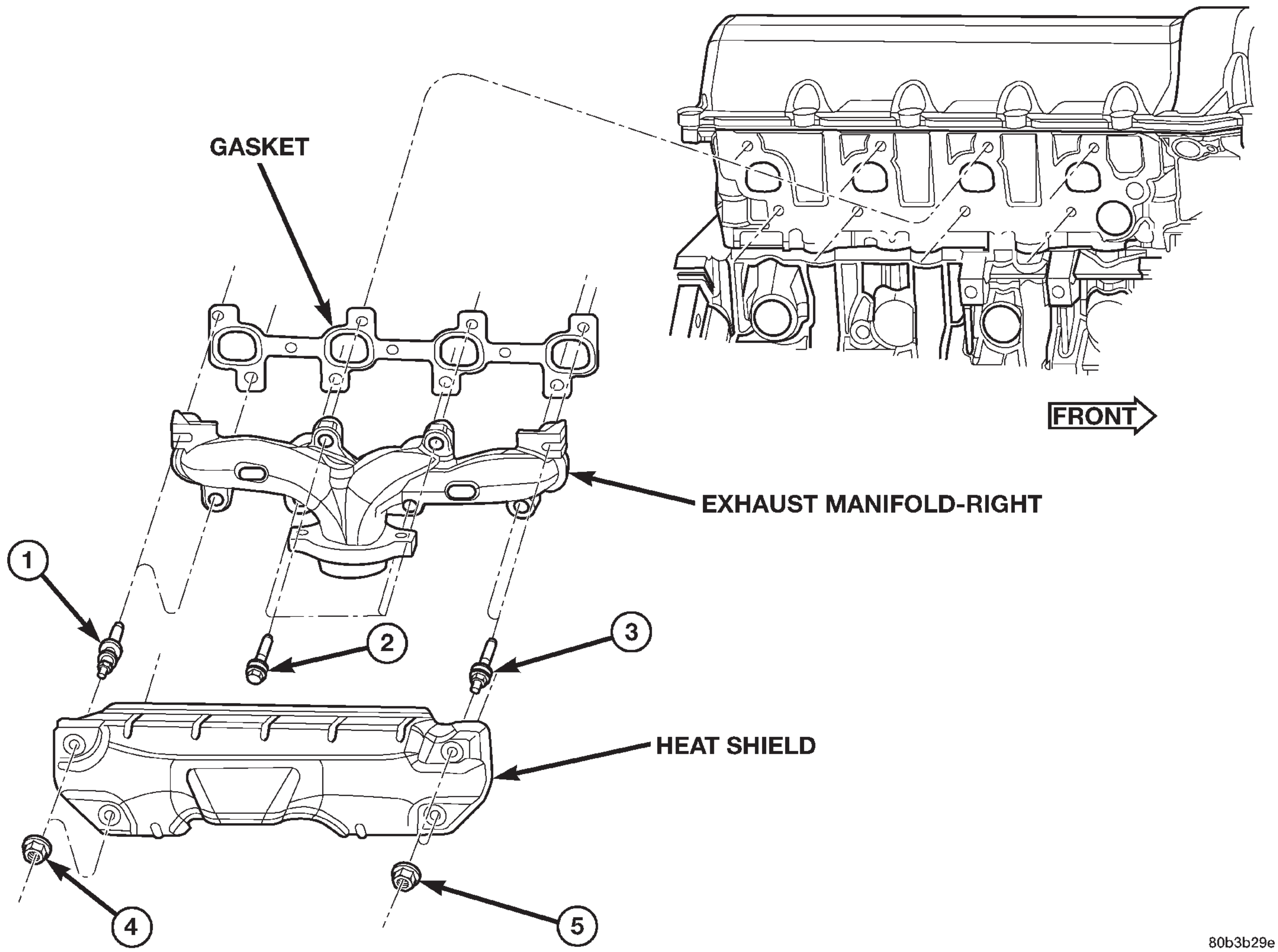


Fig. 52 Exhaust Manifold—Right

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N·m (18 ft. lbs.)	4	Nut (Qty 2)	8 N·m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

INSTALLATION

(1) Install exhaust manifold and gasket from below engine compartment.

(2) Install lower exhaust manifold fasteners. DO NOT tighten until all fasteners are in place.

(3) Lower vehicle and install upper exhaust manifold fasteners. Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

(4) Install exhaust manifold heat shield. Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.

(5) Install starter and fasteners.

(6) Connect exhaust pipe to manifold.

(7) Connect heater hoses at engine.

(8) Install fastener attaching A/C accumulator.

(9) Install A/C compressor and fasteners.

(10) Install accessory drive belt.

(11) Install air cleaner assembly, resonator assembly and air inlet hose.

(12) Install battery and connect cables.

(13) Fill cooling system.

REMOVAL AND INSTALLATION (Continued)

LEFT EXHAUST MANIFOLD

REMOVAL

(1) Disconnect negative cable for battery.
(2) Hoist vehicle.
(3) Disconnect exhaust pipe at manifold.
(4) Lower vehicle.
(5) Remove the front two exhaust heat shield retaining fasteners. Raise vehicle and remove the fasteners at rear of heat shield.
(6) Remove heat shield (Fig. 53).
(7) Lower vehicle and remove the upper exhaust manifold retaining bolts (Fig. 53).
(8) Raise vehicle and remove the lower exhaust manifold retaining bolts (Fig. 53).
(9) Remove exhaust manifold and gasket (Fig. 53). Manifold is removed from below the engine compartment.

INSTALLATION

(1) Install exhaust manifold and gasket from below engine compartment.
(2) Install lower exhaust manifold fasteners (Fig. 53). DO NOT tighten until all fasteners are in place.
(3) Lower vehicle and install upper exhaust manifold fasteners (Fig. 53). Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

(4) Install exhaust manifold heat shield (Fig. 53). Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.
(5) Connect exhaust pipe to manifold.
(6) Connect negative cable to battery.

CYLINDER HEAD COVER

REMOVAL

LEFT SIDE COVER

(1) Disconnect negative cable from battery.
(2) Remove the resonator assemble and air inlet hose.
(3) Disconnect injector connectors and un-clip the injector harness.
(4) Route injector harness in front of cylinder head cover.
(5) Disconnect the left side breather tube and remove the breather tube.
(6) Remove the cylinder head cover mounting bolts.
(7) Remove cylinder head cover and gasket.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

CAUTION: DO NOT allow other components including the wire harness to rest on or against the cylinder head cover. Prolonged contact with other objects may wear a hole in the engine cylinder head cover.

(1) Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
(2) Install cylinder head cover and hand start all fasteners. Verify that all studs are in the correct location shown in (Fig. 54).
(3) Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs.).
(4) Install left side breather and connect breather tube.
(5) Connect injector electrical connectors and injector harness retaining clips.
(6) Install the resonator and air inlet hose.
(7) Connect negative cable to battery.

REMOVAL

RIGHT SIDE COVER

(1) Disconnect battery negative cable.
(2) Remove air cleaner assembly, resonator assembly and air inlet hose.
(3) Drain cooling system, below the level of the heater hoses. Refer to COOLING SYSTEM.
(4) Remove accessory drive belt.
(5) Remove air conditioning compressor retaining bolts and move compressor to the left.
(6) Remove heater hoses.
(7) Disconnect injector and ignition coil connectors.
(8) Disconnect and remove positive crankcase ventilation (PCV) hose.
(9) Remove oil fill tube.
(10) Un-clip injector and ignition coil harness and move away from cylinder head cover.
(11) Remove right rear breather tube and filter assembly.
(12) Remove cylinder head cover retaining bolts.
(13) Remove cylinder head cover.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

REMOVAL AND INSTALLATION (Continued)

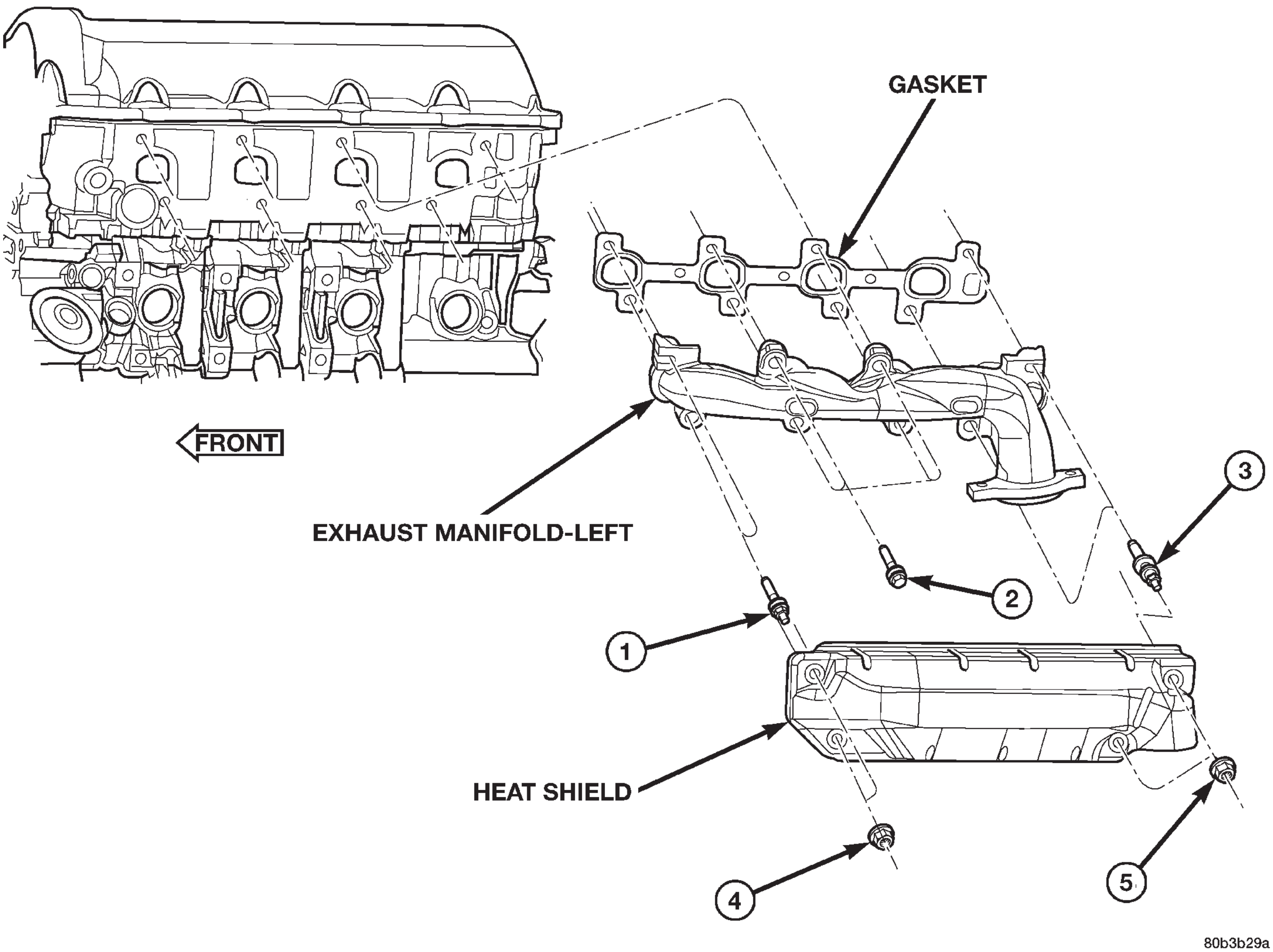


Fig. 53 Exhaust Manifold—Left

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N·m (18 ft. lbs.)	4	Nut (Qty 2)	8 N·m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

CAUTION: DO NOT allow other components including the wire harness to rest on or against the engine cylinder head cover. Prolonged contact with other objects may wear a hole in the cylinder head cover.

(1) Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.

(2) Install cylinder head cover and hand start all fasteners. Verify that all double ended studs are in the correct location shown in (Fig. 55).

(3) Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs).

(4) Install right rear breather tube and filter assembly.

(5) Connect injector, ignition coil electrical connectors and harness retaining clips.

(6) Install the oil fill tube.

REMOVAL AND INSTALLATION (Continued)

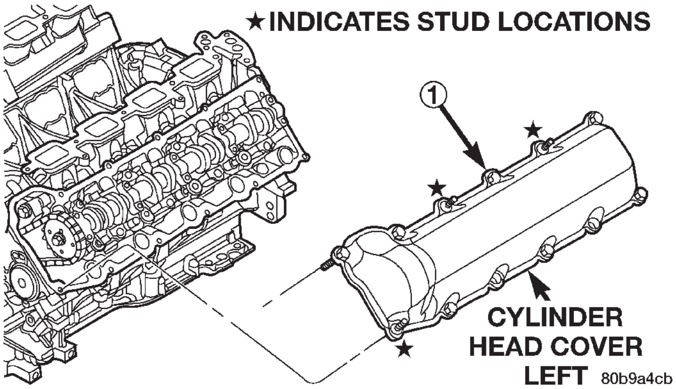


Fig. 54 Cylinder Head Cover—Left

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N·m (105 in. lbs.)

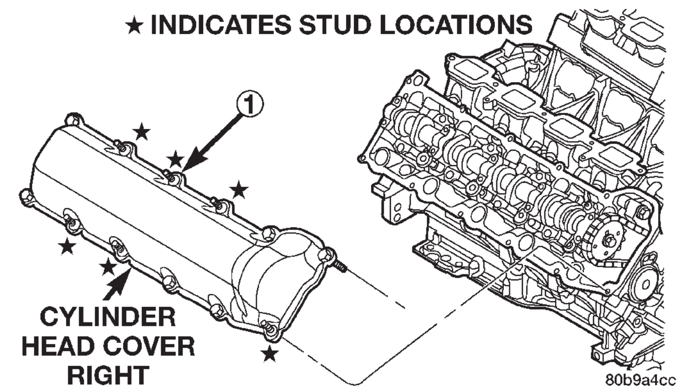


Fig. 55 Cylinder Head Cover—Right

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N·m (105 in. lbs.)

(7) Install PCV hose.
(8) Install heater hoses.
(9) Install air conditioning compressor retaining bolts.
(10) Install accessory drive belt
(11) Fill Cooling system
(12) Install air cleaner assembly, resonator assembly and air inlet hose.
(13) Connect battery negative cable.

ROCKER ARMS

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

(1) Remove the cylinder head cover. Refer to Cylinder Head Cover in this section.

(2) For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

(3) For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(4) For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

(5) For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

(6) Using special tool 8516 press downward on the valve spring, remove rocker arm (Fig. 56).

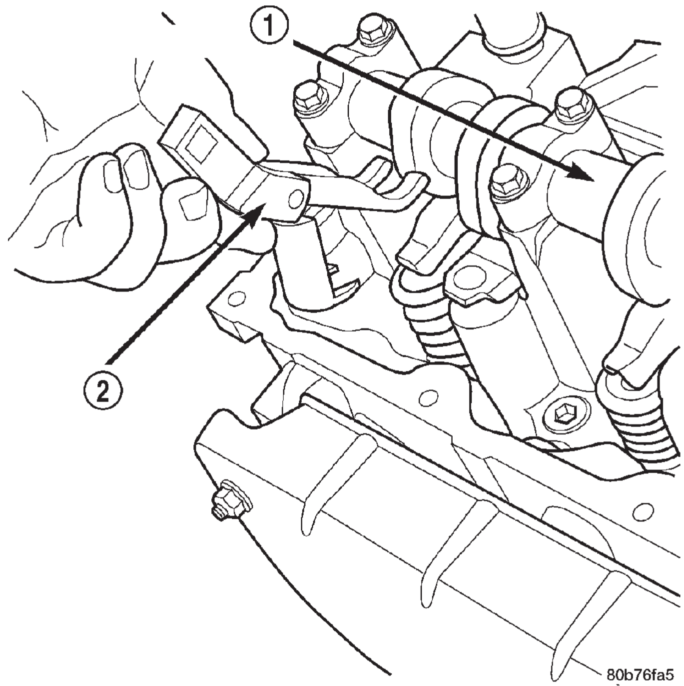


Fig. 56 Rocker Arm—Removal

1 – CAMSHAFT
2 – SPECIAL TOOL 8516

INSTALLATION

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.

(1) For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

REMOVAL AND INSTALLATION (Continued)

(2) For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(3) For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

(4) For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

(5) Using special tool 8516 press downward on the valve spring, install rocker arm (Fig. 56).

(6) Install the cylinder head cover.

CYLINDER HEADS

CYLINDER HEAD—LEFT

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise the vehicle on a hoist.

(3) Disconnect the exhaust pipe at the left side exhaust manifold.

(4) Drain the engine coolant. Refer to COOLING SYSTEM.

(5) Lower the vehicle.

(6) Remove the intake manifold. Refer to procedure in this section.

(7) Remove the cylinder head cover. Refer to procedure in this section.

(8) Remove the fan shroud and fan blade assembly. Refer to COOLING SYSTEM.

(9) Remove accessory drive belt. Refer to COOLING SYSTEM.

(10) Remove the power steering pump and set aside.

(11) Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (Fig. 57).

(12) Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (Fig. 59). Rotate the crankshaft one turn if necessary.

(13) Remove the crankshaft damper. Refer to Crankshaft Damper in this section.

(14) Remove the timing chain cover. Refer to procedure in this section.

(15) Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (Fig. 58).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

(16) Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear (Fig. 59).

(17) Remove the left side secondary chain tensioner. Refer to Timing Chain and Sprockets in this section.

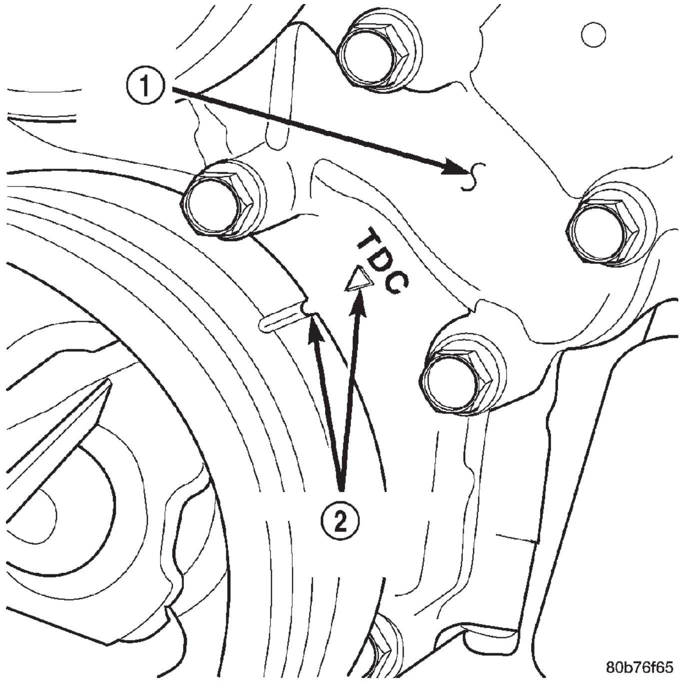


Fig. 57 Engine Top Dead Center (TDC) Indicator Mark

1 – TIMING CHAIN COVER
2 – CRANKSHAFT TIMING MARKS

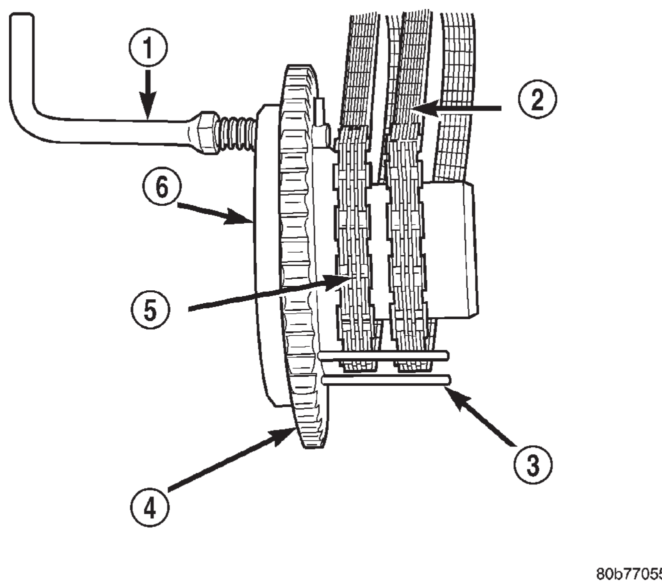


Fig. 58 Using Special Tool 8515 to Hold Chains to Idler Sprocket.

1 – LOCK ARM
2 – RIGHT CAMSHAFT CHAIN
3 – SECONDARY CHAINS RETAINING PINS (4)
4 – IDLER SPROCKET
5 – LEFT CAMSHAFT CHAIN
6 – SPECIAL TOOL 8515

REMOVAL AND INSTALLATION (Continued)

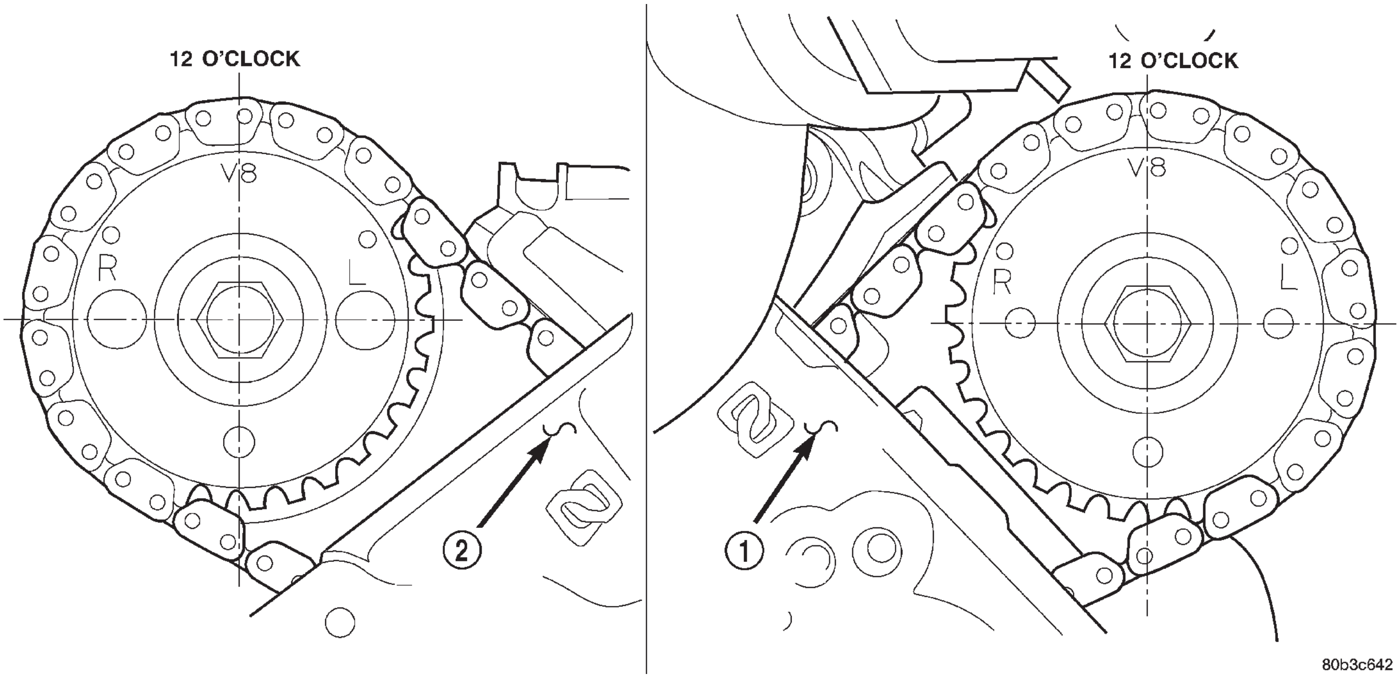


Fig. 59 Camshaft Sprocket V8 Marks

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD

(18) Remove the cylinder head access plug (Fig. 60).

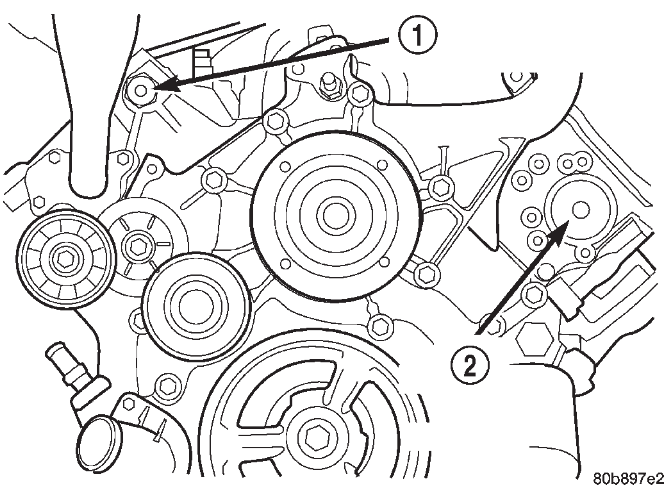


Fig. 60 Cylinder Head Access Plugs

1 – RIGHT CYLINDER HEAD ACCESS PLUG
2 – LEFT CYLINDER HEAD ACCESS PLUG

(19) Remove the left side secondary chain guide. Refer to Timing Chain and Sprockets in this section.

(20) Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

(21) Remove the cylinder head retaining bolts.

(22) Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

INSTALLATION

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced (Fig. 61).

REMOVAL AND INSTALLATION (Continued)

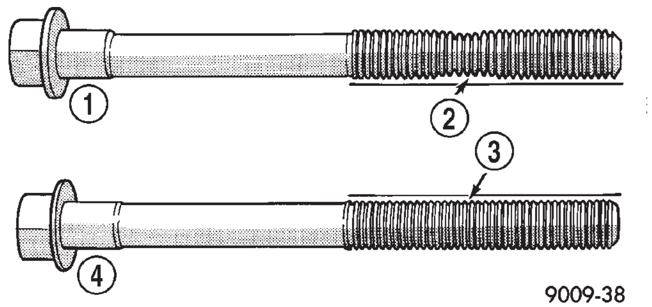


Fig. 61 Checking Cylinder Head Bolts for Stretching (Necking)

1 – STRETCHED BOLT
2 – THREADS ARE NOT STRAIGHT ON LINE
3 – THREADS ARE STRAIGHT ON LINE
4 – UNSTRETCHED BOLT

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper.

(1) Clean the cylinder head and cylinder block mating surfaces (Fig. 62).

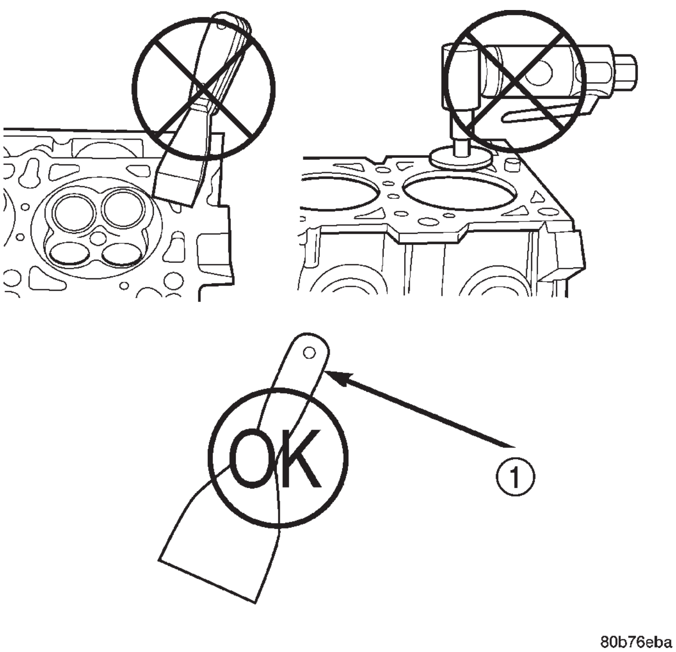


Fig. 62 Proper Tool Usage for Surface Preparation

1 – PLASTIC/WOOD SCRAPER

(2) Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

(3) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

(4) Lubricate the cylinder head bolt threads with clean engine oil and install the ten M11 bolts.

(5) Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

(6) Tighten the bolts in sequence (Fig. 63) using the following steps and torque values:

- Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
- Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
- Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

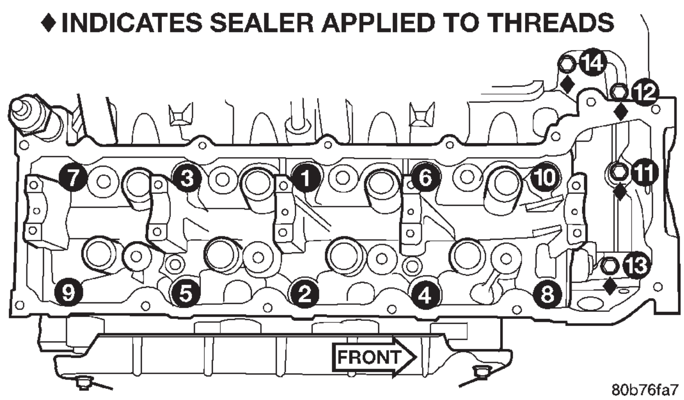


Fig. 63 Cylinder Head Tightening Sequence

(7) Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.

(8) Install the camshaft drive gear retaining bolt.

(9) Install the left side secondary chain guide.

(10) Install the cylinder head access plug.

(11) Re-set and Install the left side secondary chain tensioner.

(12) Remove Special Tool 8515.

(13) Install the timing chain cover.

(14) Install the crankshaft damper. Tighten damper bolt 175 N·m (130 Ft. Lbs.).

(15) Install the power steering pump.

(16) Install the fan blade assembly and fan shroud.

(17) Install the cylinder head cover.

REMOVAL AND INSTALLATION (Continued)

(18) Install the intake manifold.
(19) Refill the cooling system
(20) Raise the vehicle.
(21) Install the exhaust pipe onto the left exhaust manifold.
(22) Lower the vehicle.
(23) Connect the negative cable to the battery.
(24) Start the engine and check for leaks.

CYLINDER HEAD—RIGHT

REMOVAL

(1) Disconnect battery negitive cable.
(2) Raise the vehicle on a hoist.
(3) Disconnect the exhaust pipe at the right side exhaust manifold.
(4) Drain the engine coolant. Refer to COOLING SYSTEM.
(5) Lower the vehicle.
(6) Remove the intake manifold. Refer to procedure in this section.
(7) Remove the cylinder head cover. Refer to procedure in this section.
(8) Remove the fan shroud. Refer to COOLING SYSTEM.
(9) Remove oil fill housing from cylinder head.
(10) Remove accessory drive belt. Refer to COOLING SYSTEM.
(11) Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (Fig. 57).
(12) Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (Fig. 59). Rotate the crankshaft one turn if necessary.
(13) Remove the crankshaft damper. Refer to Crankshaft Damper in this section.
(14) Remove the timing chain cover. Refer to Timing Chain Cover in this section.
(15) Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (Fig. 58).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

(16) Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear (Fig. 59).
(17) Remove the right side secondary chain tensioner. Refer to Timing Chain and Sprockets in this section.
(18) Remove the cylinder head access plug (Fig. 64).
(19) Remove the right side secondary chain guide. Refer to Timing Chain and Sprockets in this section.
(20) Remove the retaining bolt and the camshaft drive gear.

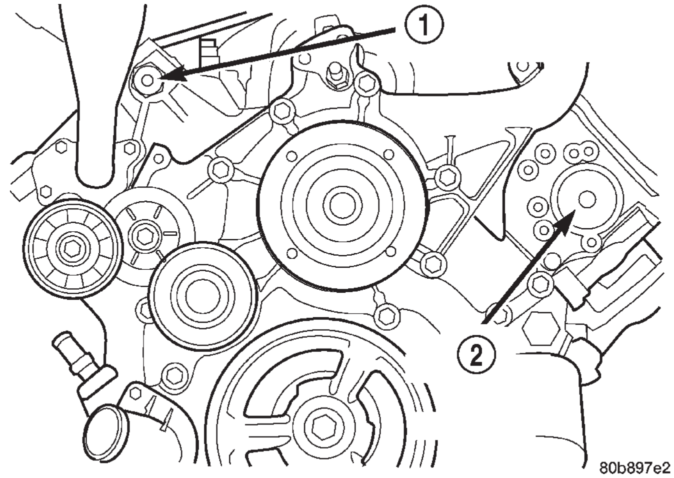


Fig. 64 Cylinder Head Access Plugs

1 – RIGHT CYLINDER HEAD ACCESS PLUG
2 – LEFT CYLINDER HEAD ACCESS PLUG

CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

(21) Remove the cylinder head retaining bolts.
(22) Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

INSTALLATION

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

REMOVAL AND INSTALLATION (Continued)

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced (Fig. 61).

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper.

(1) Clean the cylinder head and cylinder block mating surfaces (Fig. 65).

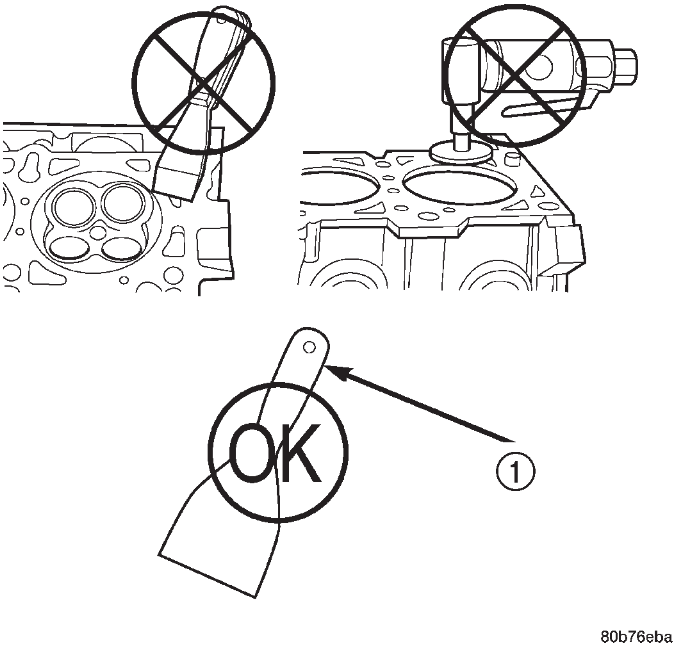


Fig. 65 Proper Tool Usage For Surface Preparation

1 – PLASTIC/WOOD SCRAPER

(2) Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

(3) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

(4) Lubricate the cylinder head bolt threads with clean engine oil and install the ten M10 bolts.

(5) Coat the four M8 cylinder head bolts with **Mopar Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

(6) Tighten the bolts in sequence (Fig. 66) using the following steps and torque values:

- Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
- Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
- Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

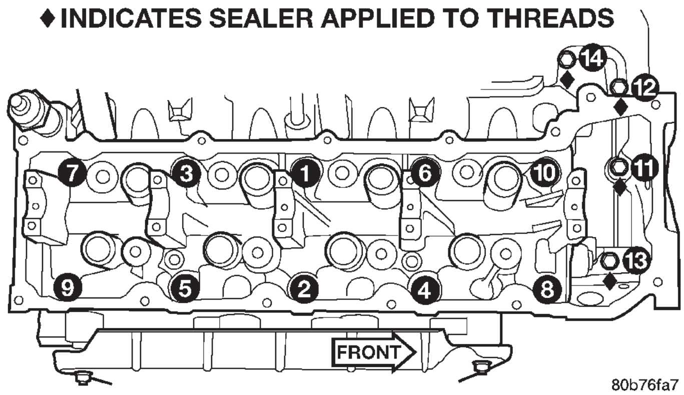


Fig. 66 Cylinder Head Tightening Sequence

(7) Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.

(8) Install the camshaft drive gear retaining bolt.

(9) Install the right side secondary chain guide.

(10) Install the cylinder head access plug.

(11) Re-set and install the right side secondary chain tensioner.

(12) Remove Special Tool 8515.

(13) Install the timing chain cover.

(14) Install the crankshaft damper. Tighten damper bolt 175 N·m (130 Ft. Lbs.).

(15) Install accessory drive belt.

(16) Install the fan shroud.

(17) Install the cylinder head cover.

(18) Install the intake manifold.

(19) Install oil fill housing onto cylinder head.

(20) Refill the cooling system.

(21) Raise the vehicle.

(22) Install the exhaust pipe onto the right exhaust manifold.

(23) Lower the vehicle.

(24) Reconnect battery negitive cable.

(25) Start the engine and check for leaks.

REMOVAL AND INSTALLATION (Continued)

VALVE SPRINGS AND SEALS

REMOVAL

(1) Remove the cylinder head cover. Refer to Cylinder Head Cover in this Section.

(2) Using Special Tool 8516 Valve Spring Compressor, remove the rocker arms and the hydraulic lash adjusters (Fig. 67).

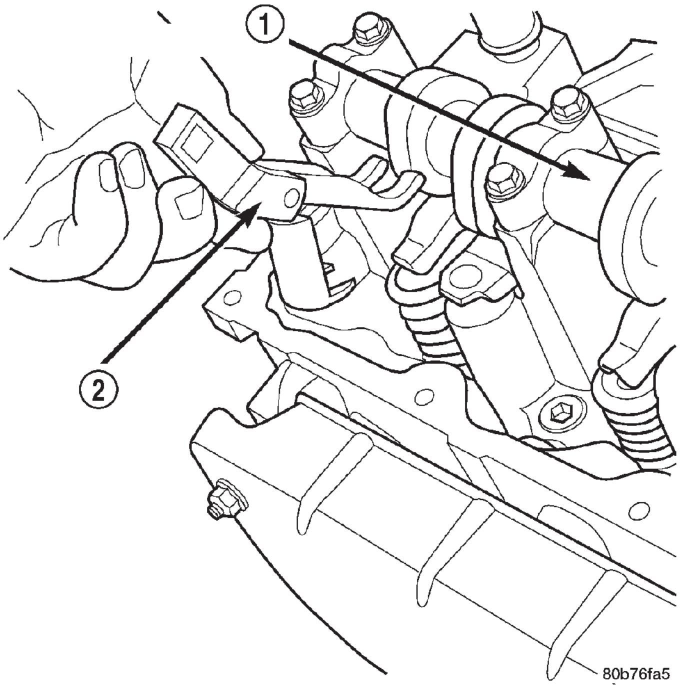


Fig. 67 Rocker Arm—Removal

1 – CAMSHAFT
2 – SPECIAL TOOL 8516

(3) Remove the spark plug for the cylinder the valve spring and seal are to be removed from.

(4) Apply shop air to the cylinder to hold the valves in place when the spring is removed.

(5) Remove the camshaft. Refer to Camshaft in this section.

NOTE: All eight valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

(6) Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

(7) Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

(8) Remove the valve spring compressor.

(9) Remove the spring retainer, and the spring.

(10) Remove the valve stem seal.

NOTE: The valve stem seals are common between intake and exhaust.

INSTALLATION

(1) coat the valve stem with clean engine oil and install the valve stem seal. make sure the seal is fully seated and that the garter spring at the top of the seal is intact.

(2) Install the spring and the spring retainer.

(3) Using Special Tool 8387 Valve Spring Compressor, compress the spring and install the two valve spring retainer halves.

(4) Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.

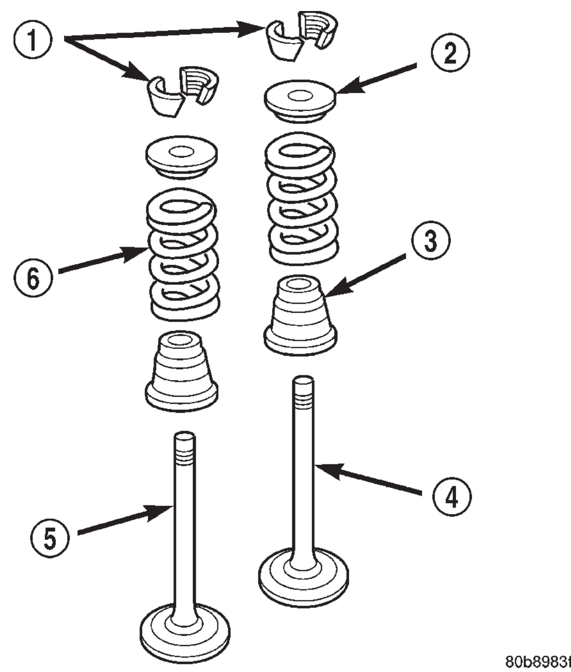


Fig. 68 Valve Assembly Configuration

1 – VALVE LOCKS (3–BEAD)
2 – RETAINER
3 – VALVE STEM OIL SEAL
4 – INTAKE VALVE
5 – EXHAUST VALVE
6 – VALVE SPRING

(5) Install the camshaft. Refer to Camshaft in this section.

(6) Position the hydraulic lash adjusters and rocker arms (Fig. 67).

(7) Install the cylinder head cover.

REMOVAL AND INSTALLATION (Continued)

HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove cylinder head cover(s). Refer to procedure in this section.

(2) Remove rocker arm(s). Refer to procedure in this section.

CAUTION: If lash adjusters and rocker arms are to be reused, always mark position for reassembly in their original positions.

(3) Remove lash adjuster(s).

INSTALLATION

(1) Install hydraulic lash adjuster making sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

(2) Install rocker arm(s). Refer to procedure in this section.

(3) Install cylinder head cover(s). Refer to procedure in this section.

CRANKSHAFT DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove accessory drive belt. Refer to COOLING SYSTEM.

(3) Drain cooling system. Refer to COOLING SYSTEM.

(4) Remove radiator upper hose.

(5) Remove upper fan shroud. Refer to COOLING SYSTEM.

(6) Using Special Tools 6958 Spanner with Adapter Pins 8346, loosen fan and viscous assembly from water pump (Fig. 69).

(7) Remove fan and viscous assembly.

(8) Disconnect electrical connector for fan mounted inside radiator shroud.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

(9) Remove crankshaft damper bolt.

(10) Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (Fig. 70).

INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

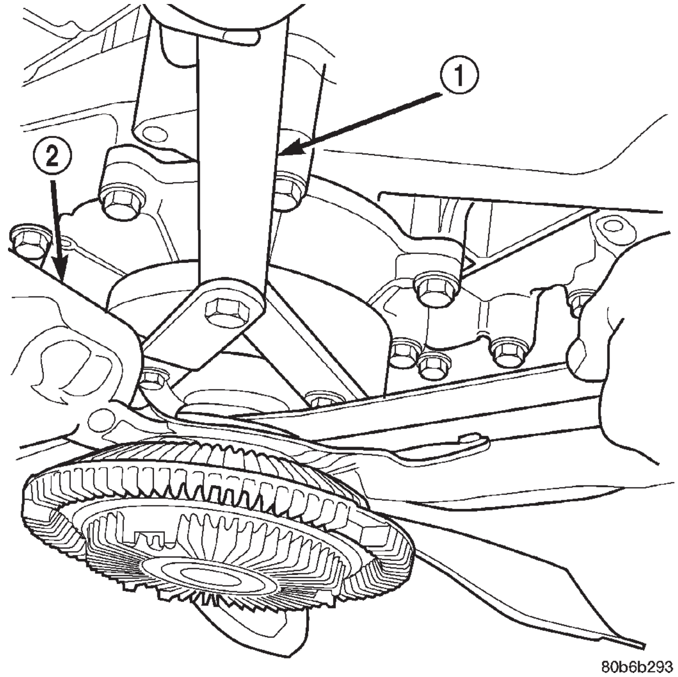


Fig. 69 Fan Assembly—Removal/Installation

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

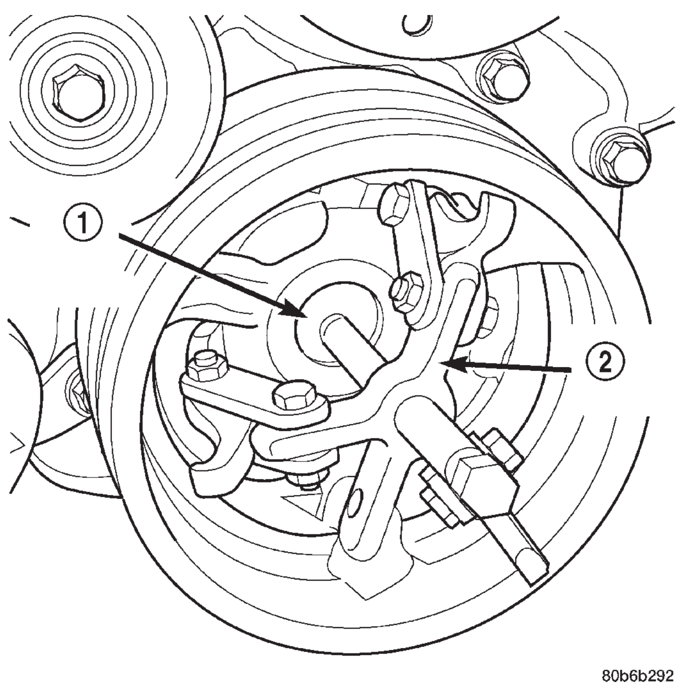


Fig. 70 Crankshaft Damper—Removal

1 – SPECIAL TOOL 8513 INSERT
2 – SPECIAL TOOL 1026

(1) Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Special Tool 8512, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.

(2) Assemble Special Tool 8512 as follows, The nut is threaded onto the shaft first. Then the roller bearing is placed onto the threaded rod (The hardened bearing surface of the bearing **MUST** face the nut). Then the hardened washer slides onto the threaded rod (Fig. 71). Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or (Loctite No. 771).

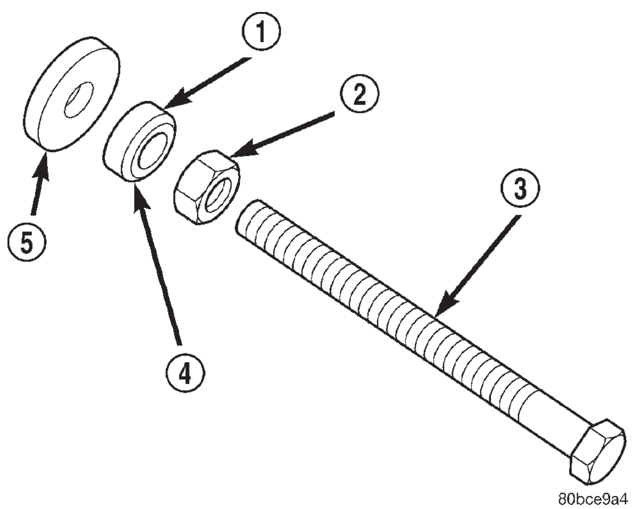


Fig. 71 Proper Assembly Method for Special Tool 8512

1 – BEARING
2 – NUT
3 – THREADED ROD
4 – BEARING HARDENED SURFACE (FACING NUT)
5 – HARDENED WASHER

(3) Using Special Tool 8512, press damper onto crankshaft (Fig. 72).

(4) Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).

(5) Install fan blade assembly.

(6) Install radiator upper shroud and tighten fasteners to 11 N·m (95 in. lbs.).

(7) Connect electrical connector for shroud fan.

(8) Install radiator upper hose.

(9) Install accessory drive belt.

(10) Refill cooling system.

(11) Connect negative cable to battery.

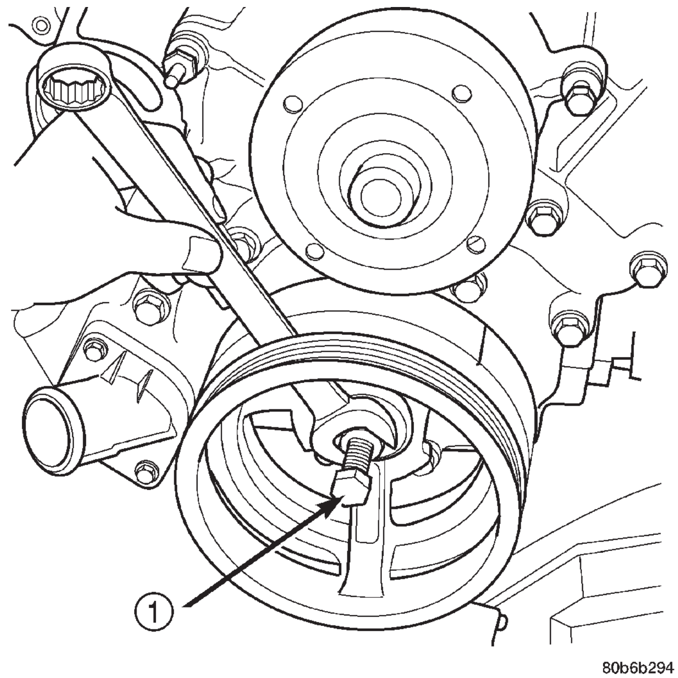


Fig. 72 Crankshaft Damper—Installation

1 – SPECIAL TOOL 8512

TIMING CHAIN COVER

REMOVAL

(1) Disconnect the battery negative cable.

(2) Drain cooling system and remove viscous fan drive assembly. Refer to Group 7, Cooling System for procedures.

(3) Remove radiator shroud. Refer to Group 7, Cooling System for procedure.

(4) Disconnect both heater hoses at timing cover.

(5) Disconnect lower radiator hose at engine.

(6) Remove crankshaft damper. Refer to procedure in this section.

(7) Remove accessory drive belt tensioner assembly (Fig. 73).

(8) Remove the generator and A/C compressor.

(9) Remove cover and gasket (Fig. 74).

INSTALLATION

(1) Clean timing chain cover and block surface. Inspect cover gasket and replace as necessary.

(2) Install cover and gasket. Tighten fasteners in sequence as shown in (Fig. 74) to 54 N·m (40 ft. lbs.).

(3) Install the A/C compressor and generator.

(4) Install crankshaft damper. Refer to procedure in this section.

(5) Install accessory drive belt tensioner assembly. Tighten fastener to 54 N·m (40 ft. lbs.).

(6) Install lower radiator hose.

(7) Install both heater hoses.

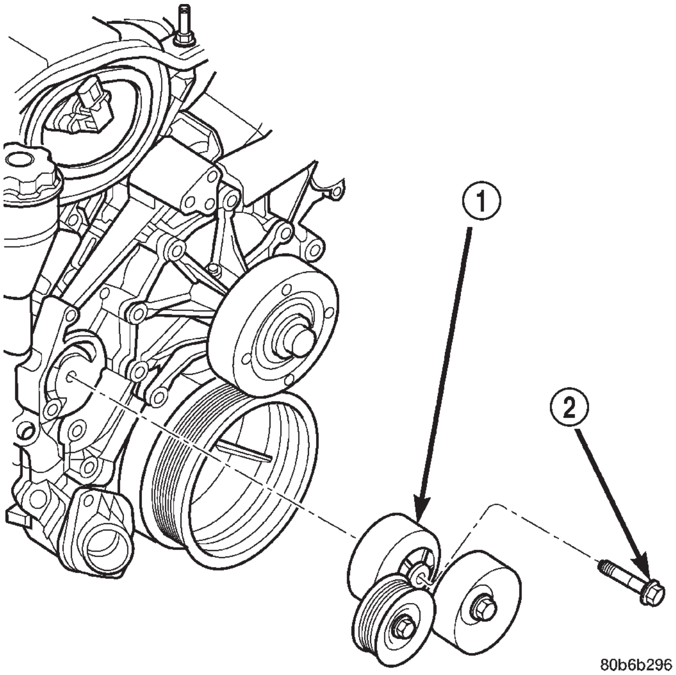


Fig. 73 Accessory Drive Belt Tensioner

1 – TENSIONER ASSEMBLY
2 – FASTENER TENSIONER TO FRONT COVER

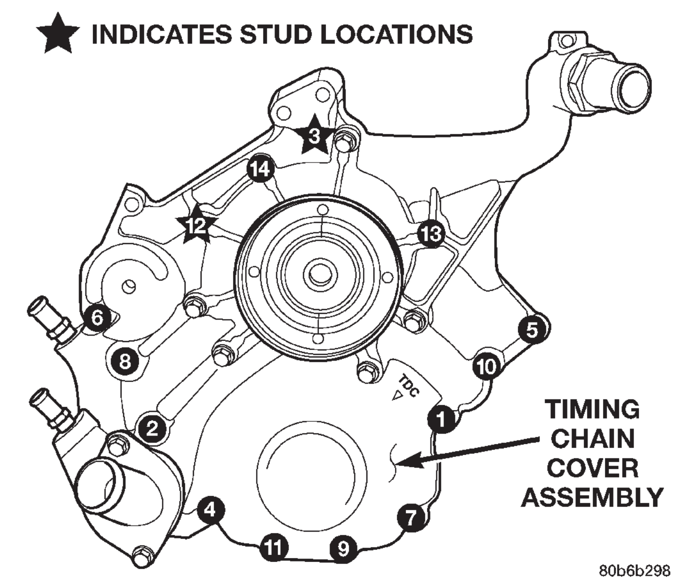


Fig. 74 Timing Chain Cover Fasteners

(8) Install radiator shroud and viscous fan drive assembly. Refer to Group 7, Cooling System for procedure.

(9) Fill cooling system. Refer to Group 7, Cooling System for procedures.

(10) Connect the battery negative cable.

TIMING CHAIN AND SPROCKETS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Drain cooling system. Refer to Group 7, Cooling System for procedures.

(3) Remove right and left cylinder head covers. Refer to procedure in this section.

(4) Remove radiator fan shroud. Refer to Group 7, Cooling System for procedure.

(5) Rotate engine until timing mark on crankshaft damper aligns with TDC mark on timing chain cover (Fig. 75) (#1 cylinder exhaust stroke) and the camshaft sprocket “V8” marks are at the 12 o'clock position (Fig. 76).

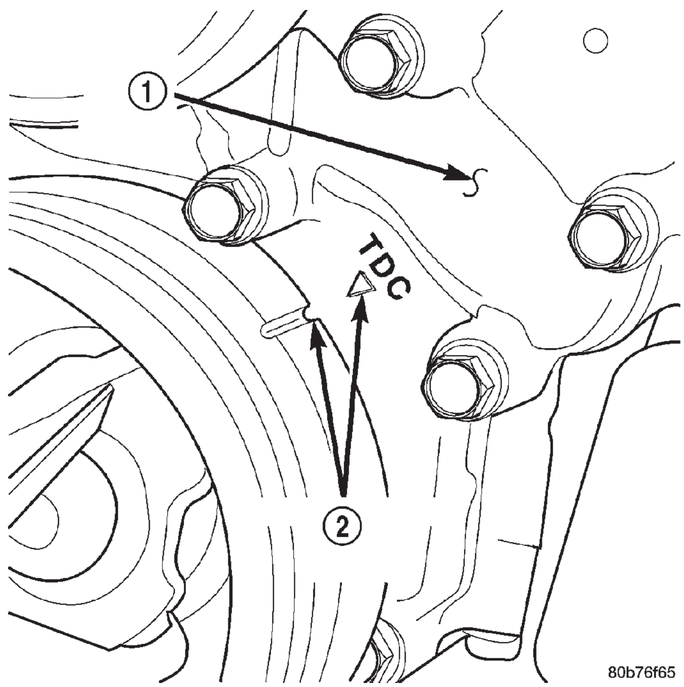


Fig. 75 Engine Top Dead Center (TDC) Indicator Mark

1 – TIMING CHAIN COVER
2 – CRANKSHAFT TIMING MARKS

(6) Remove power steering pump. Refer to Group 19, Steering for procedures.

(7) Remove access plugs (2) from left and right cylinder heads for access to chain guide fasteners (Fig. 77).

(8) Remove the oil fill housing to gain access to the right side tensioner arm fastener.

(9) Remove crankshaft damper and timing chain cover. Refer to procedures in this section.

(10) Collapse and pin primary chain tensioner (Fig. 78).

REMOVAL AND INSTALLATION (Continued)

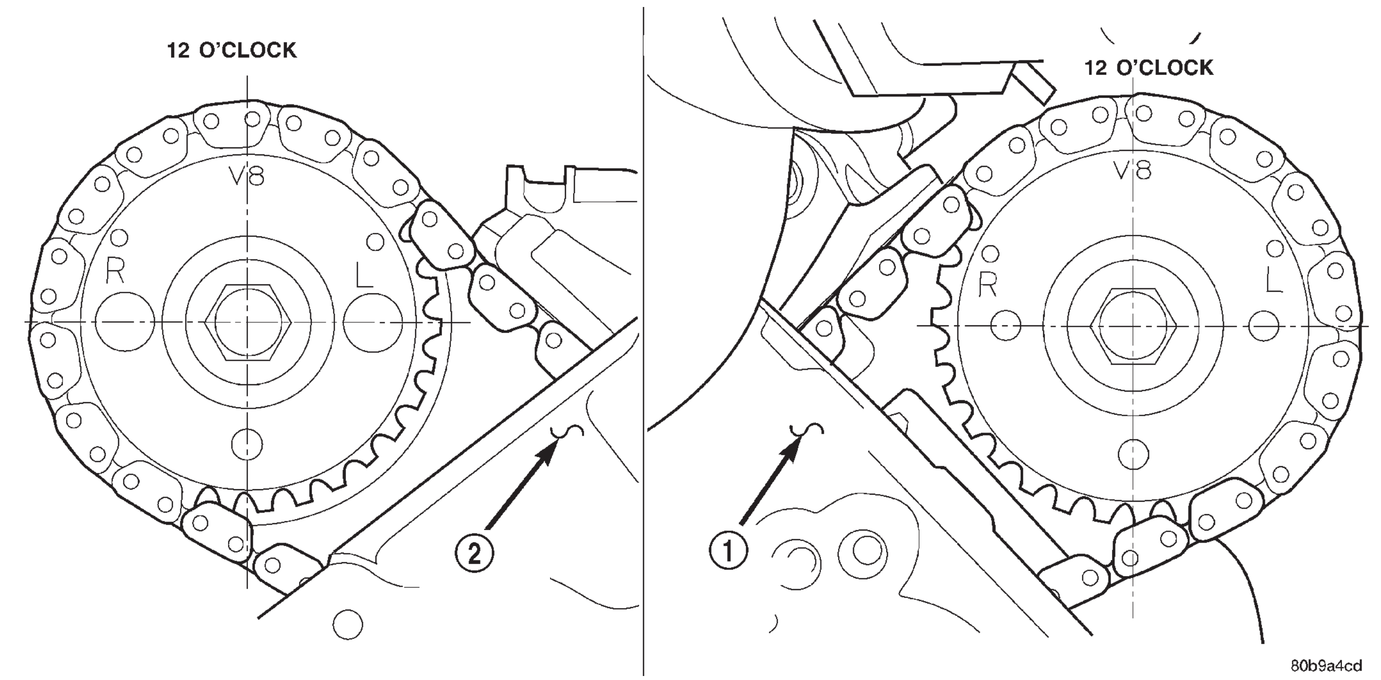


Fig. 76 Camshaft Sprocket V8 Marks

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD

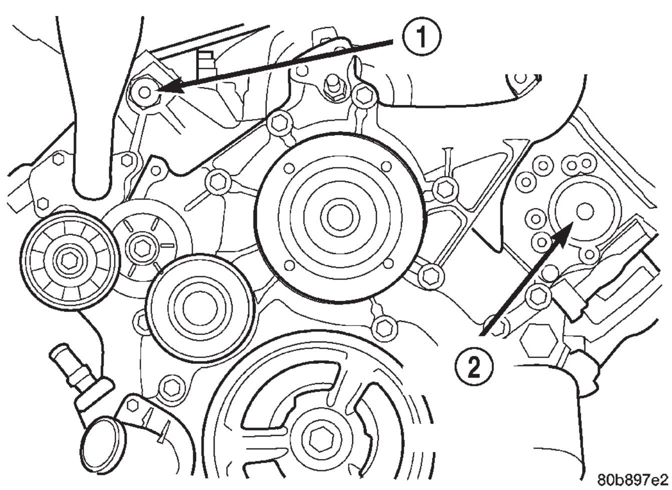


Fig. 77 Cylinder Head Access Plug Location

1 – RIGHT CYLINDER HEAD ACCESS PLUG
2 – LEFT CYLINDER HEAD ACCESS PLUG

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.

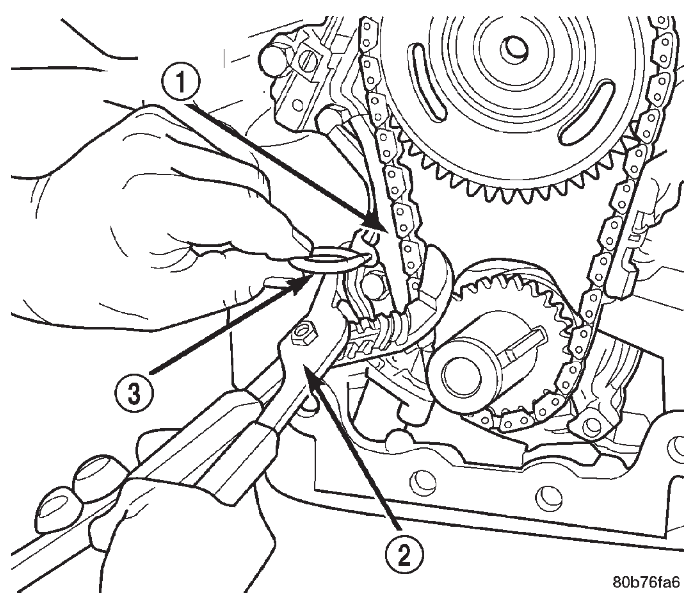


Fig. 78 Collapsing And Pinning Primary Chain Tensioner

1 – PRIMARY CHAIN TENSIONER
2 – ADJUSTABLE PLIERS
3 – SPECIAL TOOL 8514

REMOVAL AND INSTALLATION (Continued)

(11) Remove secondary chain tensioners.

(12) Remove camshaft position sensor from right cylinder head (Fig. 79).

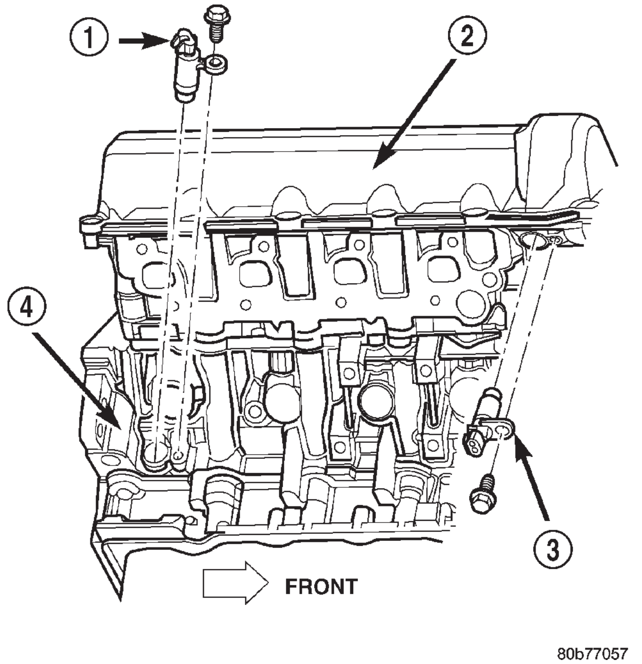


Fig. 79 Camshaft Position Sensor—Removal

1 – CRANKSHAFT POSITION SENSOR
2 – CYLINDER HEAD COVER
3 – CAMSHAFT POSITION SENSOR
4 – RIGHT SIDE CYLINDER BLOCK

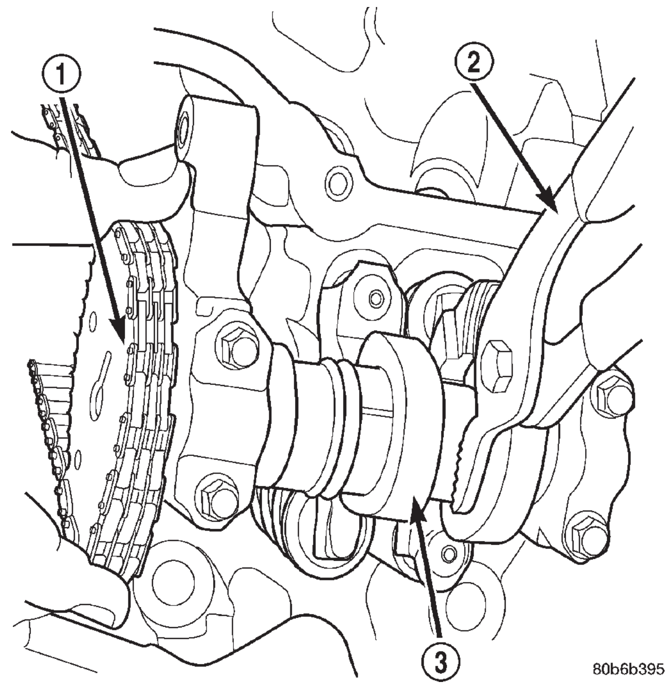


Fig. 80 Camshaft Rotation—Left Side

1 – CAMSHAFT SPROCKET AND CHAIN
2 – ADJUSTABLE PLIERS
3 – CAMSHAFT

CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental starter engagement.

(13) Remove left and right camshaft sprocket bolts.

(14) While holding the left camshaft steel tube with adjustable pliers, (Fig. 80) remove the left camshaft sprocket. Slowly rotate the camshaft approximately 15 degrees clockwise to a neutral position.

(15) While holding the right camshaft steel tube with adjustable pliers, (Fig. 81) remove the right camshaft sprocket. Slowly rotate the camshaft approximately 45 degrees counterclockwise to a neutral position.

(16) Remove idler sprocket assembly bolt.

(17) Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.

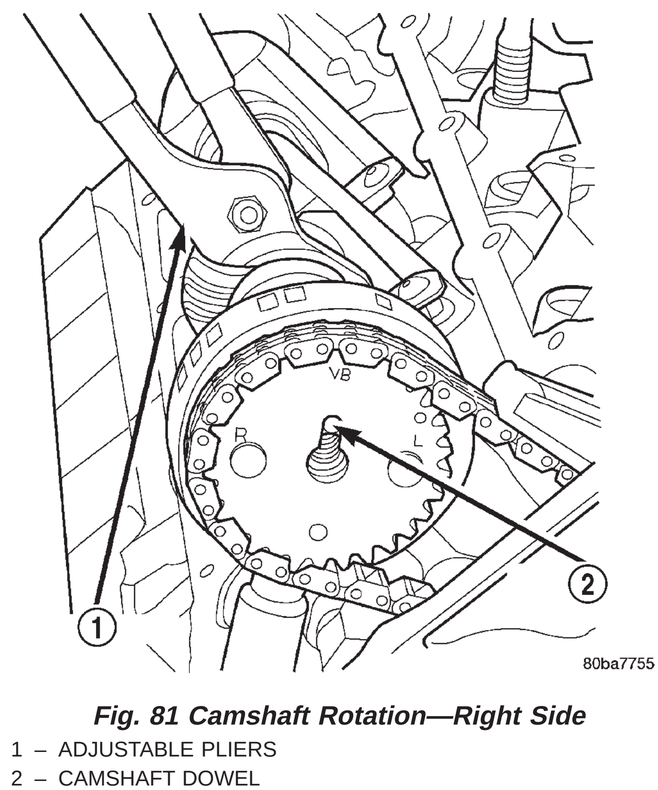


Fig. 81 Camshaft Rotation—Right Side

1 – ADJUSTABLE PLIERS
2 – CAMSHAFT DOWEL

(18) Remove both pivoting tensioner arms and chain guides.

(19) Remove chain tensioner.

REMOVAL AND INSTALLATION (Continued)

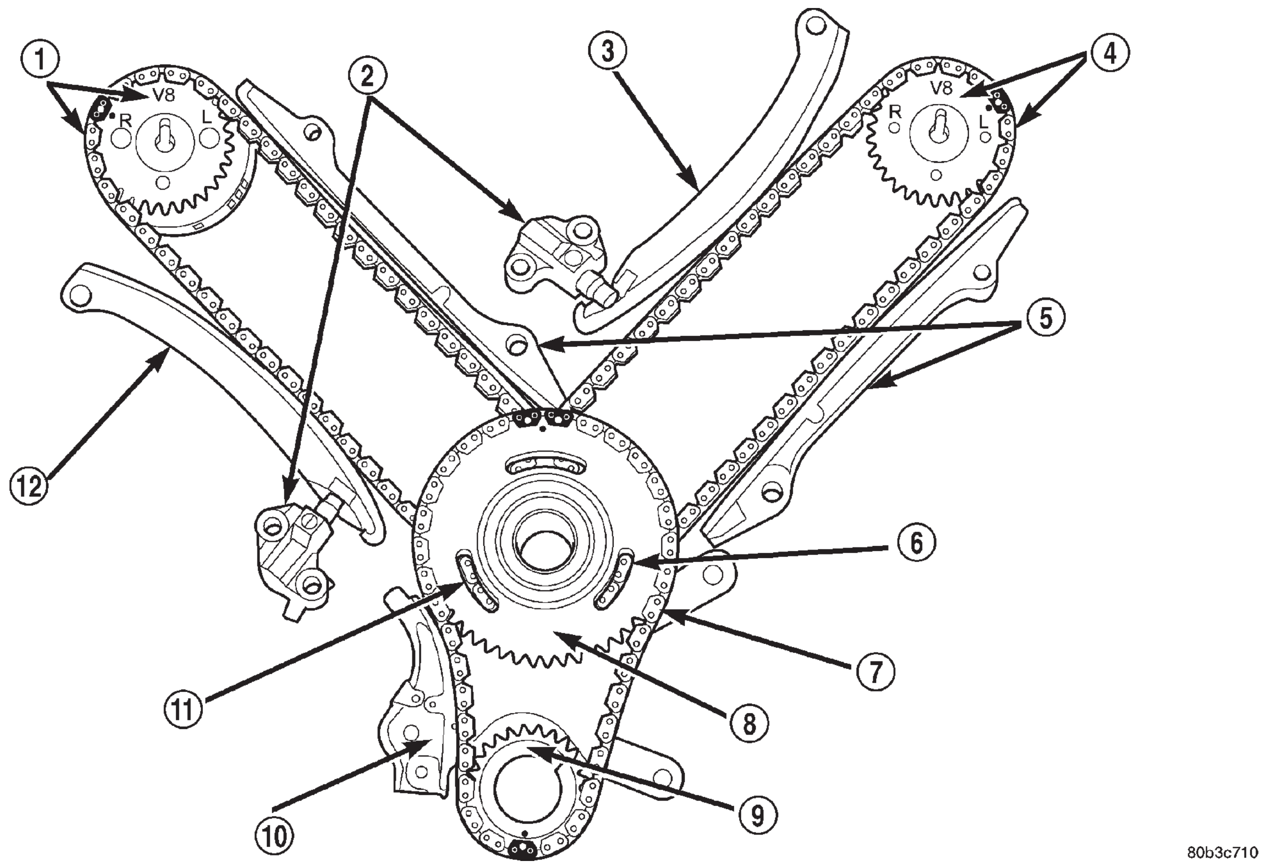


Fig. 82 Timing Chain System

1 – RIGHT CAMSHAFT SPROCKET AND SECONDARY CHAIN
2 – SECONDARY TIMING CHAIN TENSIONER
3 – SECONDARY TENSIONER ARM
4 – LEFT CAMSHAFT SPROCKET AND SECONDARY CHAIN
5 – CHAIN GUIDE
6 – TWO PLATED LINKS ON RIGHT CAMSHAFT CHAIN
7 – PRIMARY CHAIN
8 – IDLER SPROCKET
9 – CRANKSHAFT SPROCKET
10 – PRIMARY CHAIN TENSIONER
11 – TWO PLATED LINKS ON LEFT CAMSHAFT CHAIN
12 – SECONDARY TENSIONER ARM

INSPECTION OF COMPONENTS

Inspect the following components:

• Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.

• Idler sprocket assembly bushing and shaft for excessive wear.

• Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.

• Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.

• secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner tensioner arm and chain should be replaced.

• Primary chain tensioner plastic faces. Replace as required.

INSTALLATION

(1) Using a vise, lightly compress the secondary chain tensioner piston until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin into hole on front of tensioner. Slowly open vise to transfer piston spring force to lock pin (Fig. 83).

REMOVAL AND INSTALLATION (Continued)

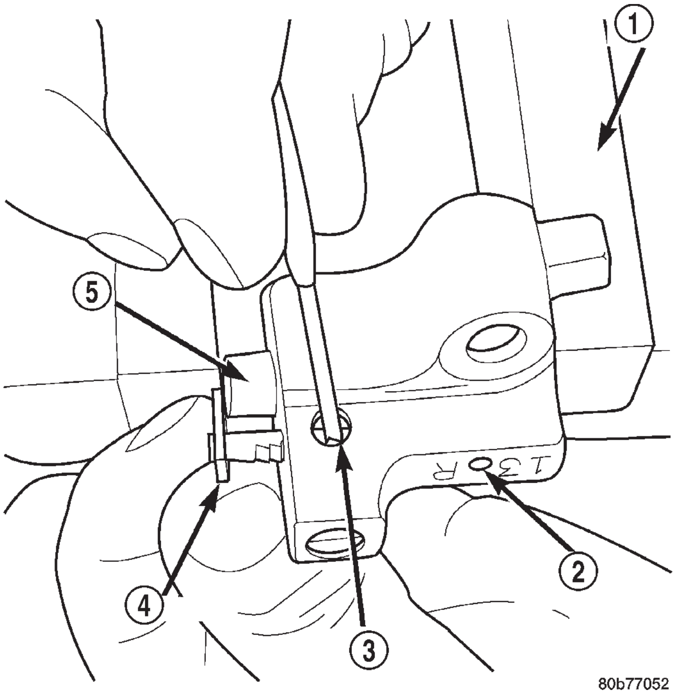


Fig. 83 Resetting Secondary Chain Tensioners

1 – VISE
2 – INSERT LOCK PIN
3 – RATCHET PAWL
4 – RATCHET
5 – PISTON

(2) Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

(3) Install right side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).

NOTE: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

(4) Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

(5) Install left side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).

(6) Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

(7) Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8515 to hold chains in place for installation (Fig. 84).

(8) Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket (Fig. 82).

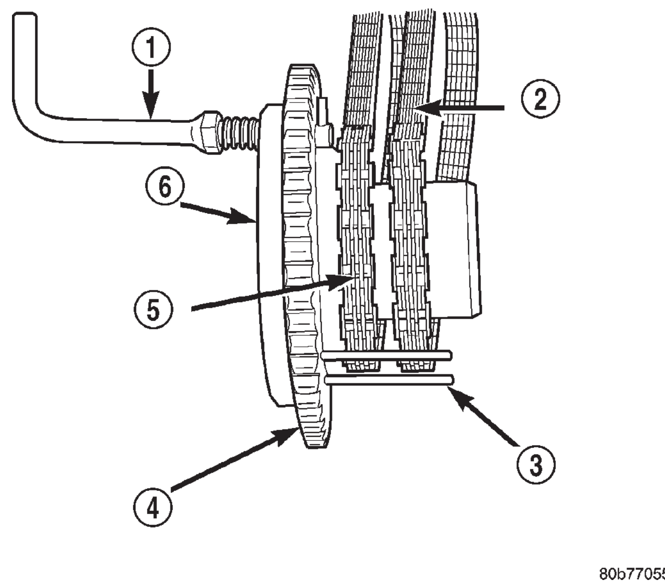


Fig. 84 Installing Secondary Timing Chains on Idler Sprocket

1 – LOCK ARM
2 – RIGHT CAMSHAFT CHAIN
3 – SECONDARY CHAINS RETAINING PINS (4)
4 – IDLER SPROCKET
5 – LEFT CAMSHAFT CHAIN
6 – SPECIAL TOOL 8515

(9) Lubricate idler shaft and bushings with clean engine oil.

(10) Install all chains, crankshaft sprocket, and idler sprocket as an assembly (Fig. 85). After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or the equivalent, This will maintain tension on chains to aid in installation.

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

(11) Align left camshaft sprocket "L" dot to plated link on chain.

(12) Align right camshaft sprocket "R" dot to plated link on chain.

REMOVAL AND INSTALLATION (Continued)

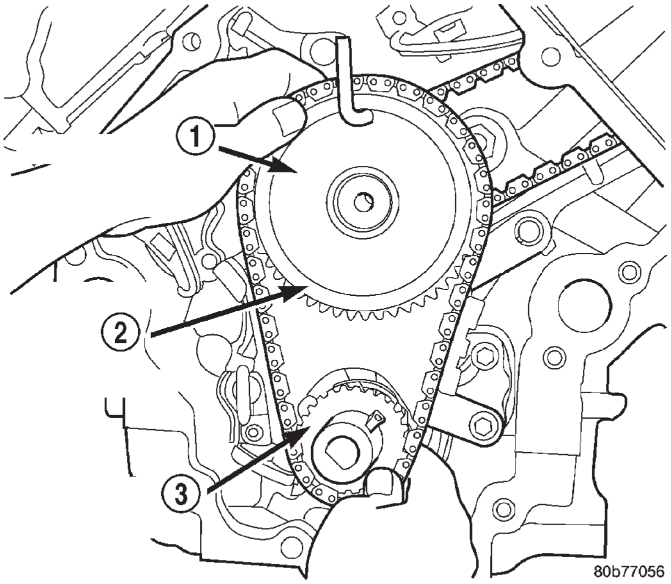


Fig. 85 Installing Idler Gear, Primary and Secondary Timing Chains

1 – SPECIAL TOOL 8515
2 – PRIMARY CHAIN IDLER SPROCKET
3 – CRANKSHAFT SPROCKET

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.

(13) Remove Special Tool 8515, then attach both sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.

(14) Verify that all plated links are aligned with the marks on all sprockets and the “V8” marks on camshaft sprockets are at the 12 o’clock position (Fig. 82).

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

(15) Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

(16) Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).

(17) Remove all locking pins (3) from tensioners.

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

(18) Using Special Tool 6958, Spanner with Adaptor Pins 8346, tighten left (Fig. 86) and right (Fig. 87). camshaft sprocket bolts to 122 N·m (90 ft. lbs.).

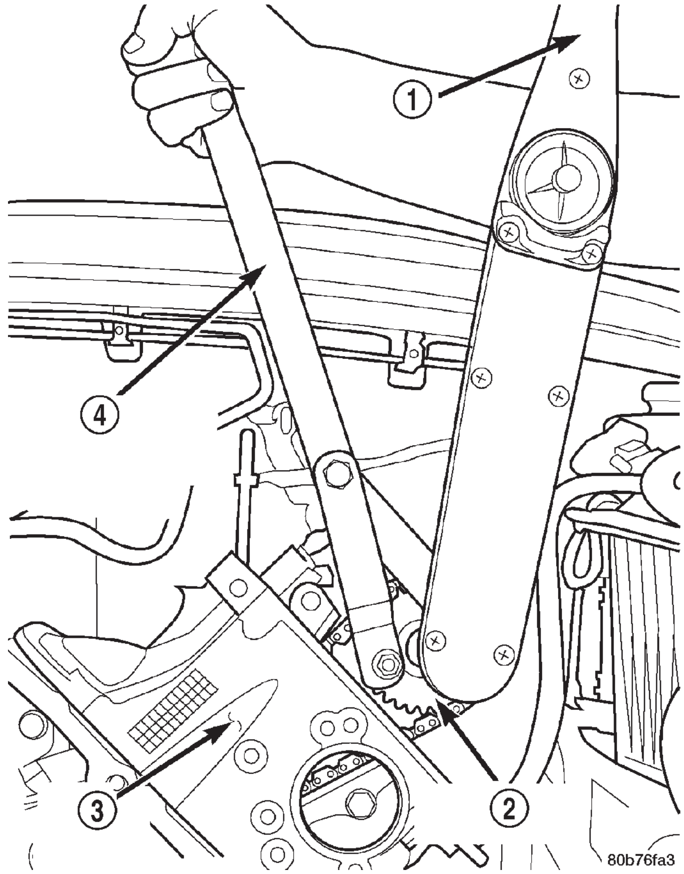


Fig. 86 Tightening Left Side Camshaft Sprocket Bolt

1 – TORQUE WRENCH
2 – CAMSHAFT SPROCKET
3 – LEFT CYLINDER HEAD
4 – SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

(19) Rotate engine two full revolutions. Verify timing marks are at the follow locations:

• primary chain idler sprocket dot is at 12 o’clock (Fig. 82)

• primary chain crankshaft sprocket dot is at 6 o’clock (Fig. 82)

• secondary chain camshaft sprockets “V8” marks are at 12 o’clock (Fig. 82)

(20) Lubricate all three chains with engine oil.

(21) After installing all chains, it is recommended that the idler gear end play be checked (Fig. 88). The end play must be within 0.10–0.25 mm (0.004–0.010 in.). If not within specification, the idler gear must be replaced.

(22) Install timing chain cover and crankshaft damper. Refer to procedures in this section.

(23) Install cylinder head covers. Refer to procedures in this section.

REMOVAL AND INSTALLATION (Continued)

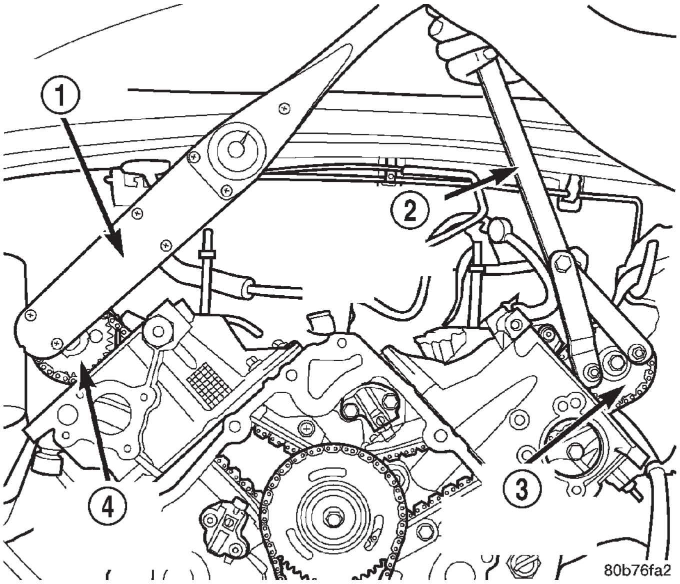


Fig. 87 Tightening Right Side Camshaft Sprocket Bolt

1 – TORQUE WRENCH
2 – SPECIAL TOOL 6958 WITH ADAPTER PINS 8346
3 – LEFT CAMSHAFT SPROCKET
4 – RIGHT CAMSHAFT SPROCKET

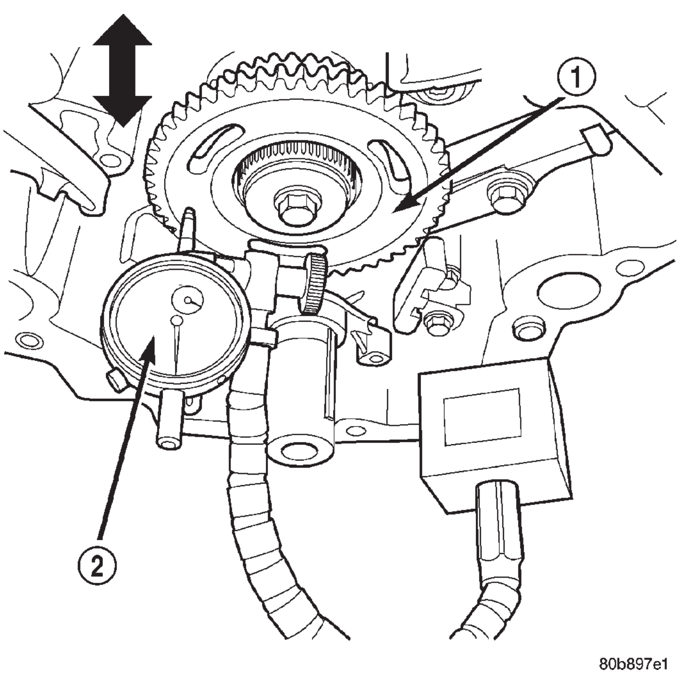


Fig. 88 Measuring Idler Gear End Play

1 – IDLER SPROCKET ASSEMBLY
2 – DIAL INDICATOR

NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

(24) Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head and tighten to 81 N·m (60 ft. lbs.) (Fig. 77).

(25) Install the oil fill housing.

(26) Install access plug in left cylinder head (Fig. 77).

(27) Install power steering pump. Refer to Group 19, Steering for procedure.

(28) Install radiator fan shroud. Refer to Group 7, Cooling System for procedure.

(29) Fill cooling system. Refer to Group 7, Cooling System for coolant fill procedure.

(30) Connect negative cable to battery.

IDLER SHAFT—TIMING DRIVE

REMOVAL

(1) Remove the timing chain and sprockets. Refer to procedure in this section.

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft to install the removal tool.

(2) Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore (Fig. 89).

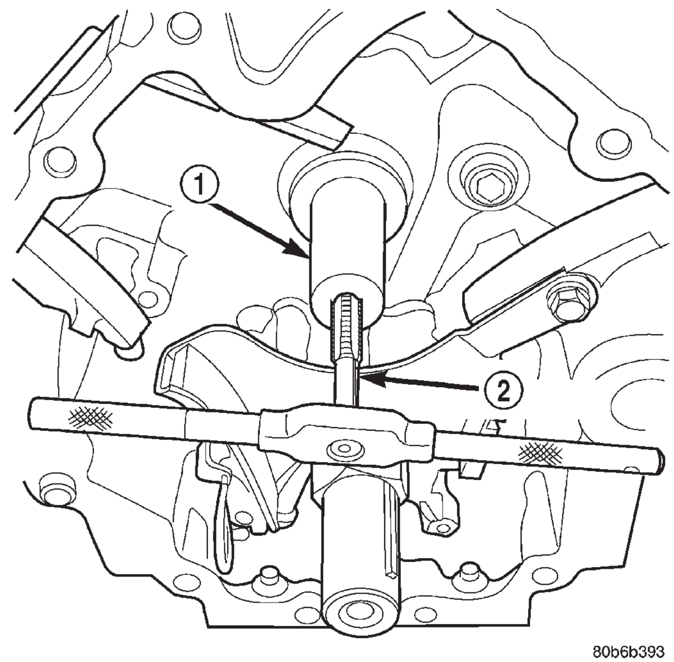


Fig. 89 Tapping Idler Shaft For Special Tool 8517

1 – IDLER SHAFT
2 – TAP 12mm X 1.75

(3) Cover the radiator core with a suitable cover.

CAUTION: Use care when removing idler shaft, DO NOT strike the radiator cooling fins with the slide hammer.

REMOVAL AND INSTALLATION (Continued)

(4) Using Special Tool 8517 Slide Hammer, remove the idler shaft (Fig. 90).

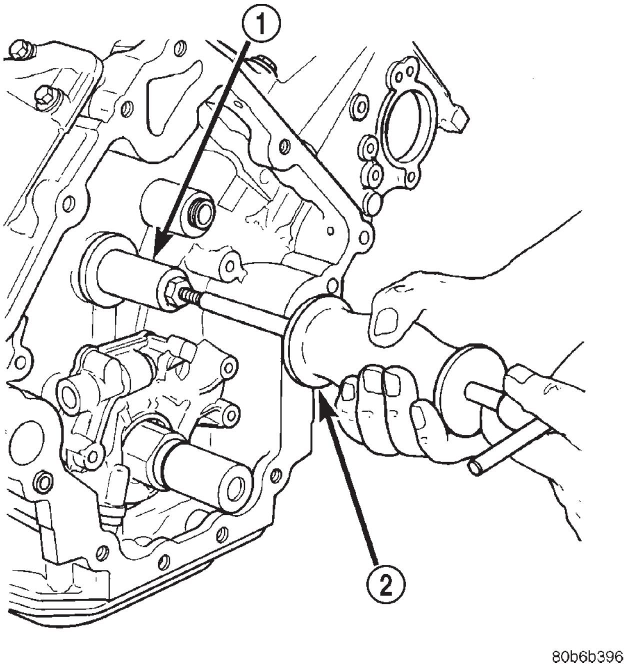


Fig. 90 Removing Idler Shaft

1 – IDLER SHAFT
2 – SPECIAL TOOL 8517

INSTALLATION

(1) Thoroughly clean the idler shaft bore.
(2) Position the idler shaft in the bore.

NOTE: The two lubrication holes in the idler shaft do not require any special alignment.

NOTE: Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft with clean engine oil.

(3) Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
(4) Coat the idler shaft with clean engine oil and install the timing chains and sprockets. Refer to procedure in this section.

CAMSHAFTS—IN VEHICLE

LEFT CAMSHAFT

REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8350 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

(1) Remove cylinder head cover. Refer to Cylinder Head Cover in this section.
(2) Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.
(3) Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

(4) Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

(5) Position Special Tool 8350 timing chain wedge between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide (Fig. 91).
(6) Hold the camshaft with adjustable pliers while removing the camshaft sprocket bolt and sprocket (Fig. 92).
(7) Using the pliers, gently allow the camshaft to rotate 15° clockwise until the camshaft is in the neutral position (no valve load).
(8) Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

REMOVAL AND INSTALLATION (Continued)

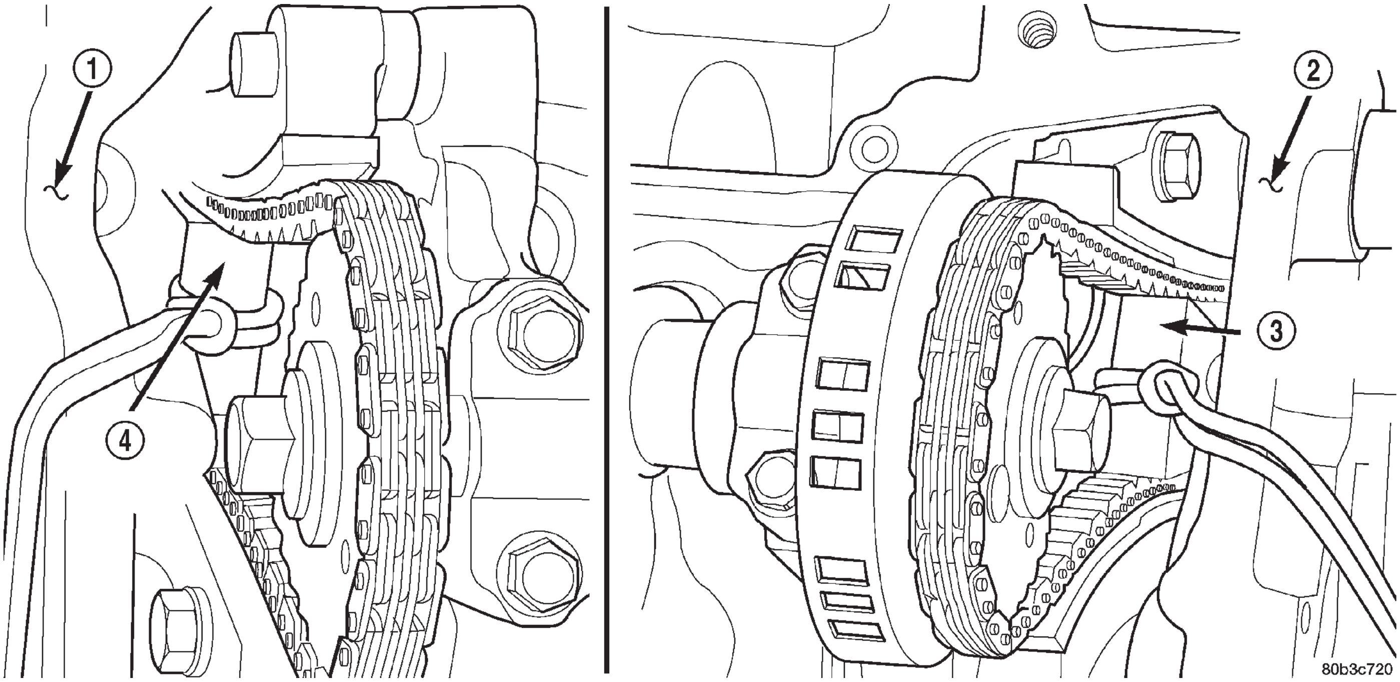


Fig. 91 Securing Timing Chain Tensioners Using Timing Chain Wedge

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD
3 – SPECIAL TOOL 8350 WEDGE
4 – SPECIAL TOOL 8350 WEDGE

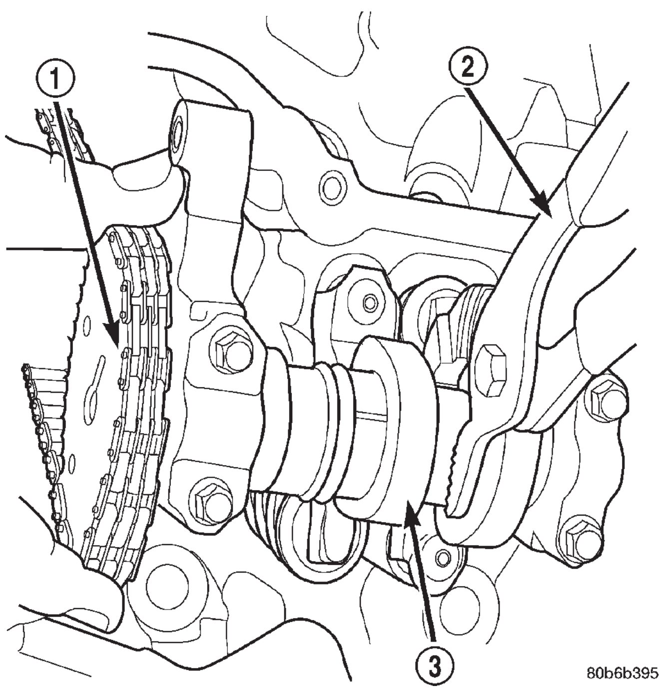


Fig. 92 Camshaft Sprocket and Chain

1 – CAMSHAFT SPROCKET AND CHAIN
2 – ADJUSTABLE PLIERS
3 – CAMSHAFT

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

(9) Remove the camshaft bearing caps and the camshaft.

INSTALLATION

(1) Lubricate camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

(2) Position the camshaft into the cylinder head.

(3) Install the camshaft bearing caps, hand tighten the retaining bolts.

(4) Working in ½ turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward (Fig. 93).

(5) Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).

(6) Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (Fig. 94).

REMOVAL AND INSTALLATION (Continued)

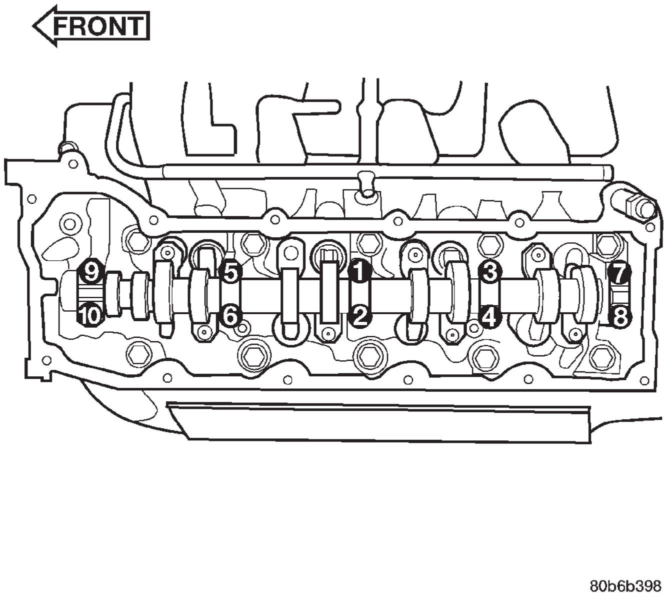


Fig. 93 Camshaft Bearing Caps Tightening Sequence

(7) Using the adjustable pliers, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft (Fig. 95).

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

(8) Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.

(9) Remove Special Tool 8350 timing chain wedge (Fig. 91).

(10) Using Special Tool 6958 spanner wrench with adapter pins 8346 (Fig. 96), torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).

(11) Install the cylinder head cover.

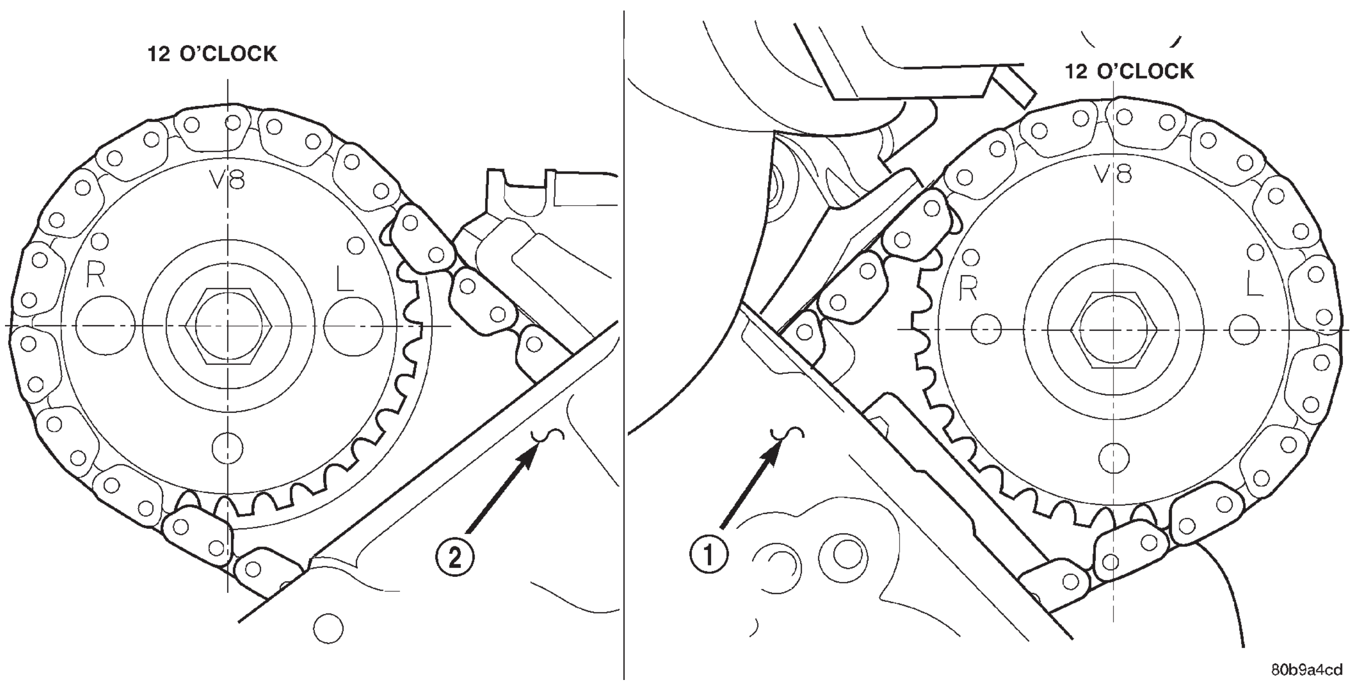


Fig. 94 Timing Chain to Sprocket Alignment

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD

REMOVAL AND INSTALLATION (Continued)

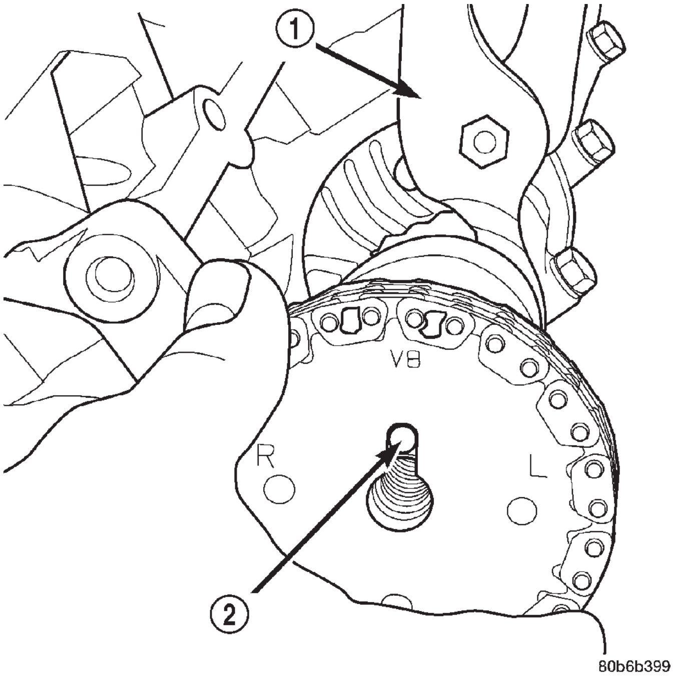


Fig. 95 Camshaft Sprocket Installation

1 – ADJUSTABLE PLIERS
2 – CAMSHAFT DOWEL

RIGHT CAMSHAFT

REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8350 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

(1) Remove the cylinder head covers. Refer to Cylinder Head Cover in this section.

(2) Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.

(3) Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

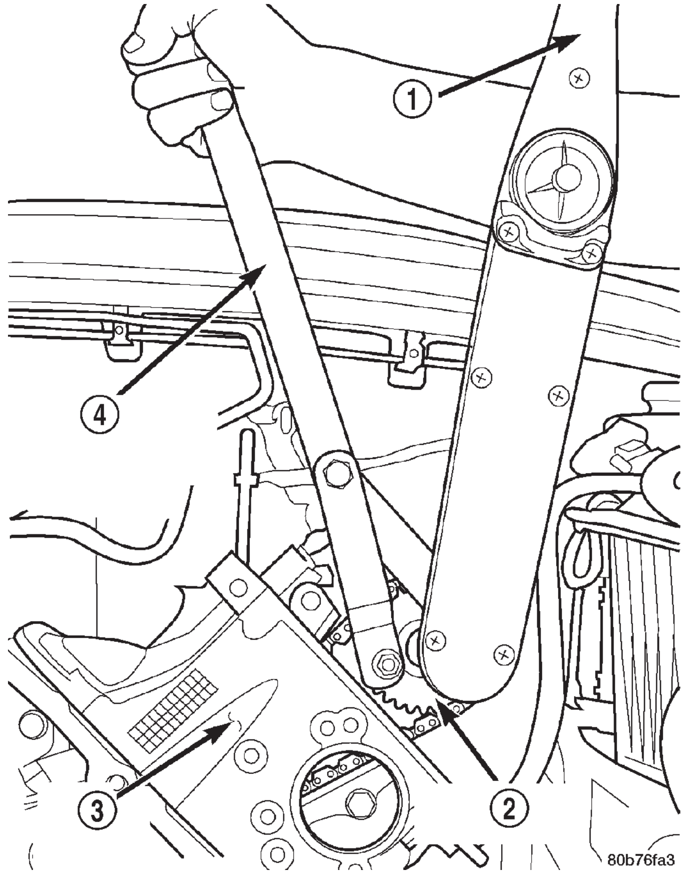


Fig. 96 Tightening Left Side Cam Sprocket Retaining Bolt

1 – TORQUE WRENCH
2 – CAMSHAFT SPROCKET
3 – LEFT CYLINDER HEAD
4 – SPECIAL TOOL 6958 SPANNER WITH ADAPTER PINS 8346

(4) Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

(5) Position Special Tool 8350 timing chain wedge between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide (Fig. 97).

(6) Remove the camshaft position sensor (Fig. 98).

REMOVAL AND INSTALLATION (Continued)

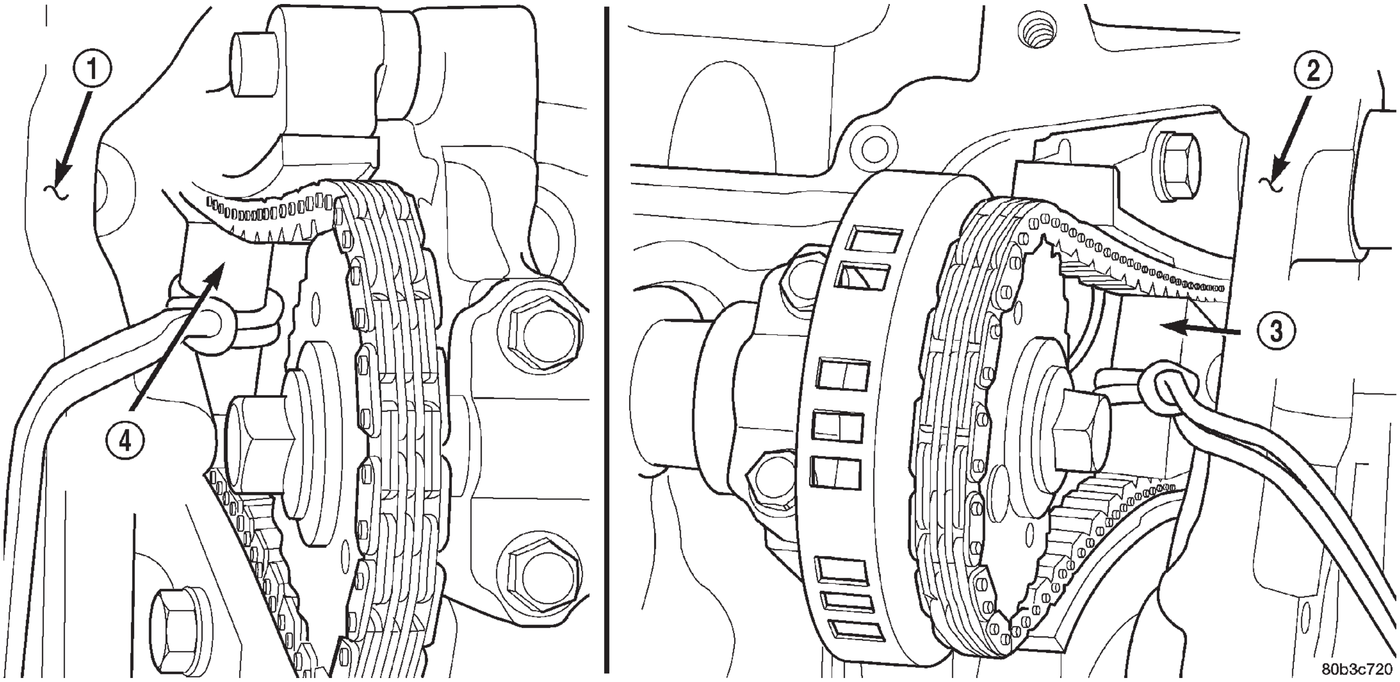


Fig. 97 Securing Timing Chain Tensioners Using Timing Chain Wedge

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD
3 – SPECIAL TOOL 8350 WEDGE
4 – SPECIAL TOOL 8350 WEDGE

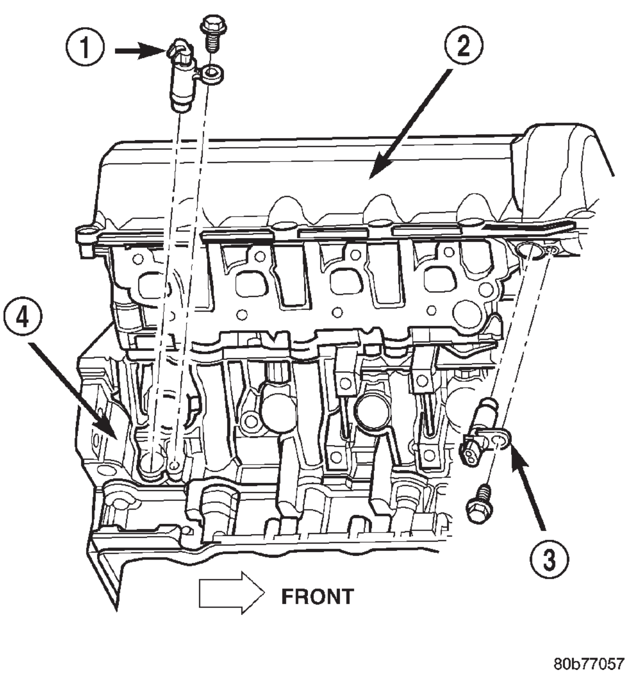


Fig. 98 Camshaft Position Sensor

1 – CRANKSHAFT POSITION SENSOR
2 – CYLINDER HEAD COVER
3 – CAMSHAFT POSITION SENSOR
4 – RIGHT SIDE CYLINDER BLOCK

(7) Hold the camshaft with adjustable pliers while removing the camshaft sprocket bolt and sprocket (Fig. 99).

(8) Using the pliers, gently allow the camshaft to rotate 45° counter-clockwise until the camshaft is in the neutral position (no valve load).

(9) Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

(10) Remove the camshaft bearing caps and the camshaft.

INSTALLATION

(1) Lubricate camshaft journals with clean engine oil.

REMOVAL AND INSTALLATION (Continued)

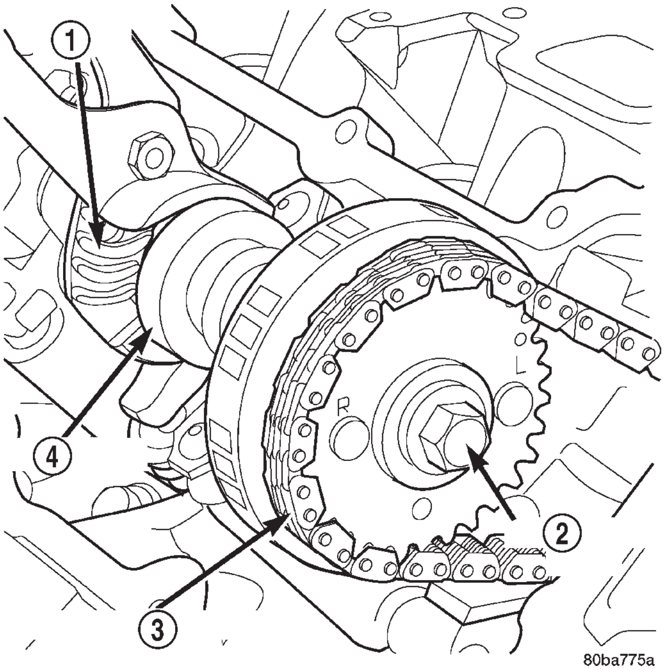


Fig. 99 Camshaft Sprocket and Chain

1 – ADJUSTABLE PLIERS
2 – SPROCKET BOLT
3 – CAMSHAFT SPROCKET AND CHAIN
4 – CAMSHAFT

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

(2) Position the camshaft into the cylinder head.
(3) Install the camshaft bearing caps, hand tighten the retaining bolts.
(4) Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward (Fig. 100).
(5) Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).
(6) Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (Fig. 101).

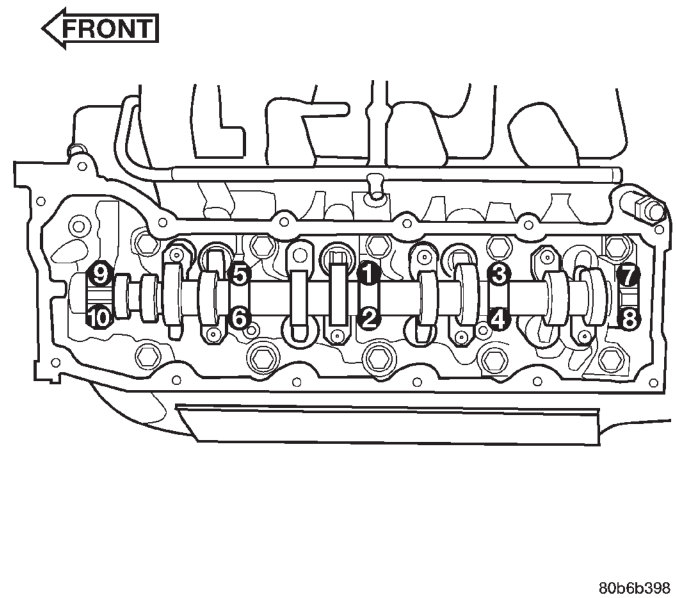


Fig. 100 Camshaft Bearing Caps Tightening Sequence

(7) Using the adjustable pliers, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft (Fig. 102).

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt overtorque resulting in bolt failure.

(8) Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.
(9) Remove timing chain wedge special tool 8350 (Fig. 97).
(10) Using Special Tool 6958 spanner wrench with adapter pins 8346 (Fig. 103), torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).
(11) Install the camshaft position sensor (Fig. 98).
(12) Install the cylinder head cover.

REMOVAL AND INSTALLATION (Continued)

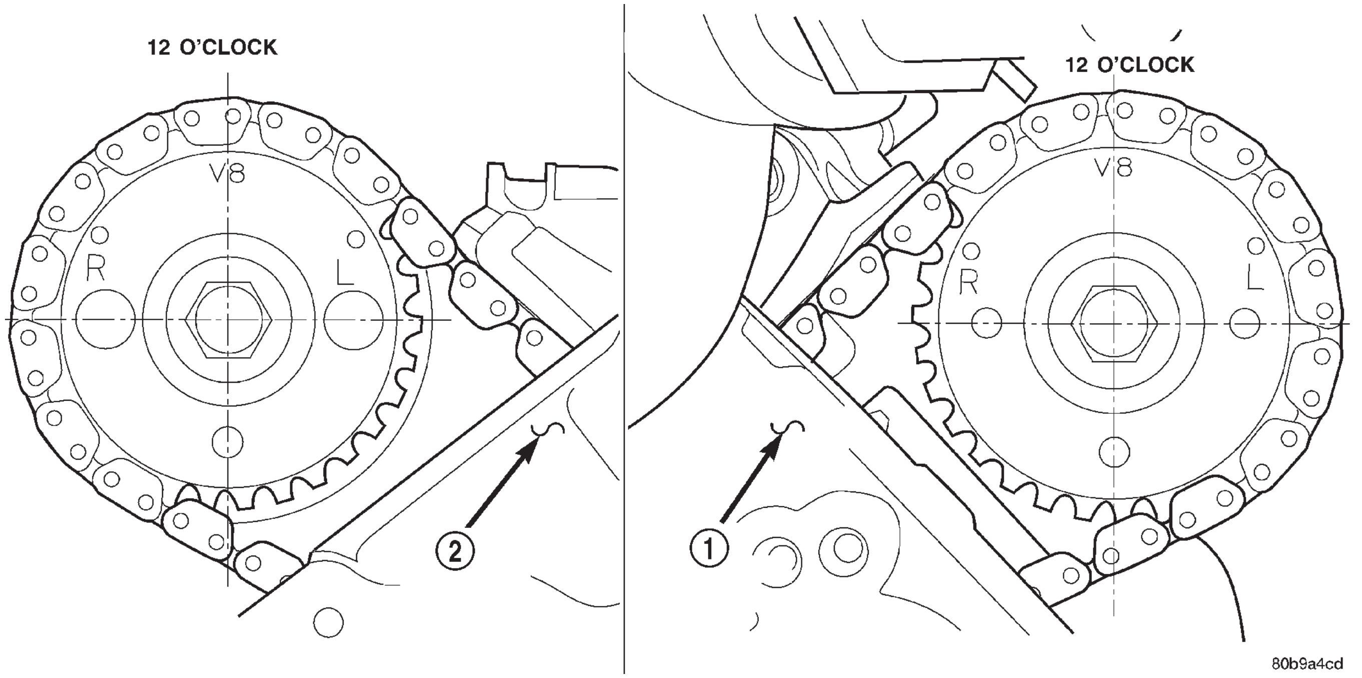


Fig. 101 Timing Chain to Sprocket Alignment

1 – LEFT CYLINDER HEAD
2 – RIGHT CYLINDER HEAD

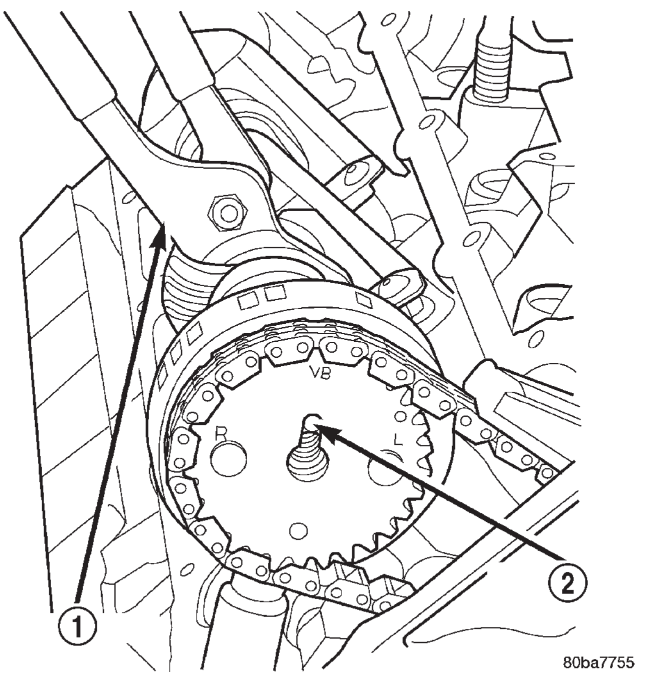


Fig. 102 Camshaft Sprocket Installation

1 – ADJUSTABLE PLIERS
2 – CAMSHAFT DOWEL

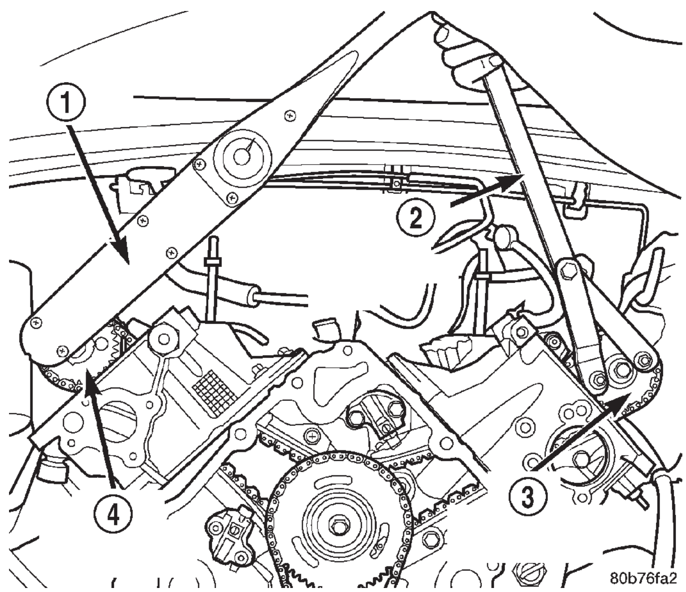


Fig. 103 Tightening Right Side Cam Sprocket Retaining Bolt

1 – TORQUE WRENCH
2 – SPECIAL TOOL 6958 WITH ADAPTER PINS 8346
3 – LEFT CAMSHAFT SPROCKET
4 – RIGHT CAMSHAFT SPROCKET

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT MAIN BEARINGS

CRANKSHAFT MAIN BEARING SELECTION

The main bearings are "select fit" to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel has grade identification marks stamped into it (Fig. 104). These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5. The crankshaft position sensor target wheel is mounted to the number 8 counter weight on the crankshaft.

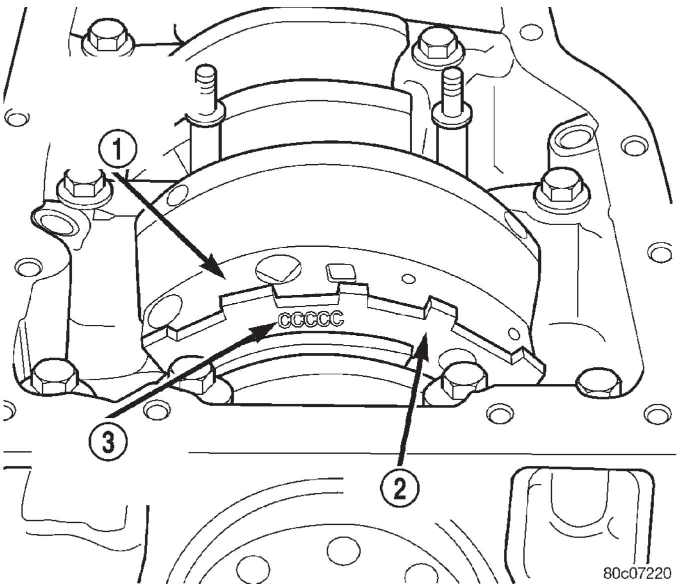


Fig. 104 Main Bearing Markings on Target Wheel

1 – REARMOST CRANKSHAFT COUNTER WEIGHT
2 – TARGET WHEEL
3 – MAIN BEARING SELECT FIT MARKINGS

NOTE: Service main bearings color coded. These color codes identify what size (grade) the bearing is.

CHECKING CRANKSHAFT END PLAY

(1) Mount a dial indicator to a stationary point at front of engine. Locate the probe perpendicular against nose of crankshaft (Fig. 105).

(2) Move the crankshaft all the way to the rear of it's travel.

(3) Zero the dial indicator.

(4) Move the crankshaft all the way to the front of it's travel and read the dial indicator. Refer to Crankshaft End Play Specification Chart.

OIL PAN 4X2 VEHICLE

REMOVAL

(1) Drain the cooling system. Refer to COOLING SYSTEM.

MAIN BEARING SELECTION CHART—4.7L

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	0.008 mm U/S (0.0004 in.) U/S	63.488–63.496 mm (2.4996–2.4999 in.)
B	NOMINAL	63.496–63.504 mm (2.4999–2.5002 in.)
C	0.008 mm O/S (0.0004 in.) O/S	63.504–63.512 mm (2.5002–2.5005 in.)

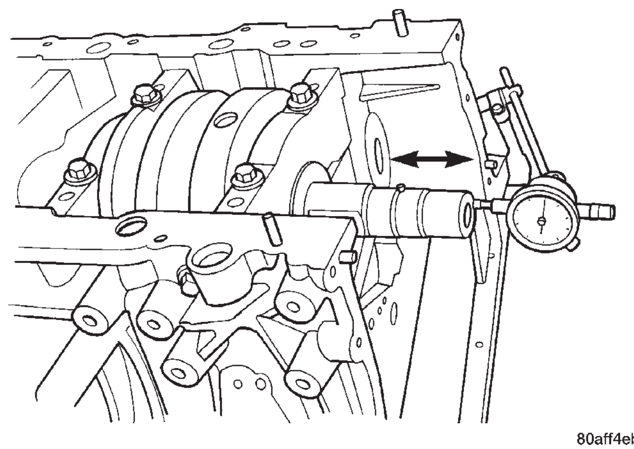


Fig. 105 Checking Crankshaft End Play—Typical

CRANKSHAFT END PLAY SPECIFICATION CHART

New Part: Specification	0.052 - 0.282mm (0.002 - 0.011 in.)
Wear Limit:	0.43mm (0.017 in.)

(2) Remove the upper fan shroud. Refer to procedure in this section.

(3) Remove the throttle body resonator and air inlet hose.

(4) Remove the intake manifold. Refer to procedure in this section.

(5) Raise vehicle on hoist.

(6) Disconnect exhaust pipe at exhaust manifolds. Refer to EXHAUST SYSTEM.

REMOVAL AND INSTALLATION (Continued)

(7) Remove the structural dust cover (Fig. 106). Refer to procedure in this section.

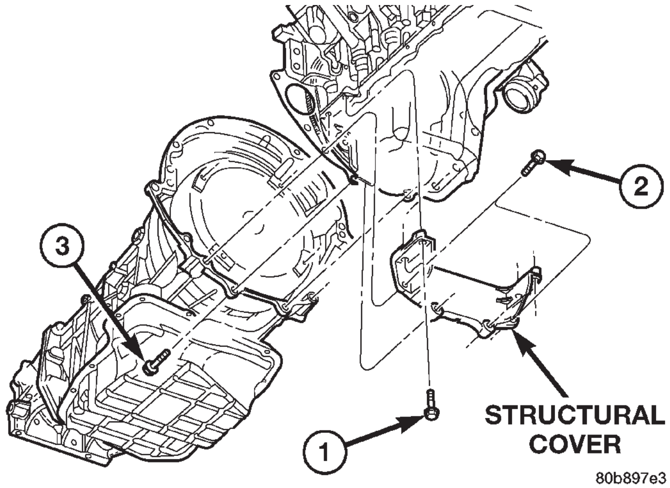


Fig. 106 Structural Dust Cover Removal / Installation

(8) Drain engine oil and remove oil filter.
(9) Position suitable jack under engine.
(10) Remove both left and right side engine mount through bolts (Fig. 107).

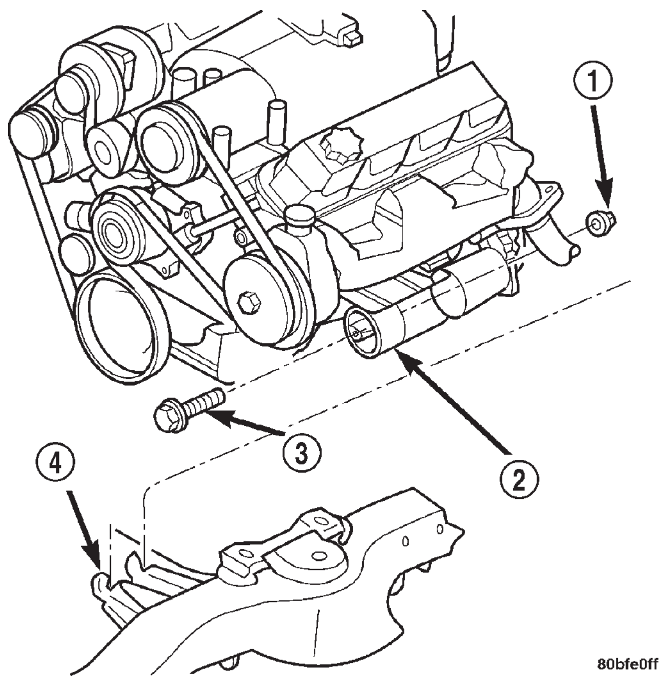


Fig. 107 Engine Mount Through Bolt and Nut Removal / Installation

1 – LOCKNUT AND WASHER
2 – ENGINE MOUNT/INSULATOR
3 – THROUGH BOLT
4 – FRAME

(11) Raise engine to provide clearance to remove oil pan.

(12) Place blocks of wood between engine brackets and lower mounts to provide stability to engine.

NOTE: Do not pry on oil pan or oil pan gasket. Gasket is mounted to engine and does not come out with oil pan.

(13) Remove the oil pan mounting bolts and oil pan (Fig. 108).

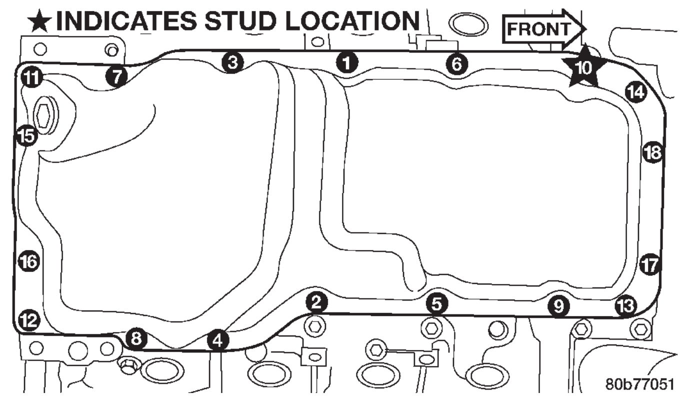


Fig. 108 Oil Pan Mounting Bolts and Oil Pan

(14) Unbolt oil pump pickup tube and remove tube and oil pan gasket from engine.

INSTALLATION

(1) Clean the oil pan gasket mating surface of the bedplate and oil pan.
(2) Position the oil pan gasket and pickup tube with new o-ring. Install the mounting bolt and nuts. Tighten bolt and nuts to 28 N·m (20 ft. lbs.).
(3) Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 15 N·m (11 ft. lbs.) in the sequence shown (Fig. 108).
(4) Raise the engine and remove the blocks of wood.
(5) Lower engine and install both the left and right side engine mount through bolts (Fig. 107). Tighten the nuts to 68 N·m (50 ft. lbs.).
(6) Remove jack and install oil filter.
(7) Install structural dust cover.
(8) Install exhaust pipe onto exhaust manifolds.
(9) Lower vehicle.
(10) Install intake manifold.
(11) Install throttle body resonator and air inlet hose.
(12) Install upper fan shroud.
(13) Fill cooling system.
(14) Fill engine oil.
(15) Start engine and check for leaks.

REMOVAL AND INSTALLATION (Continued)

OIL PAN 4X4 VEHICLE

REMOVAL

NOTE: 4X4 vehicles equipped with a 4.7L engine must have the front axle removed before the oil pan can be removed.

(1) Remove the front axle from vehicle. Refer to DIFFERENTIAL AND DRIVELINE.

(2) Remove the structural dust cover (Fig. 109). Refer to procedure in this section.

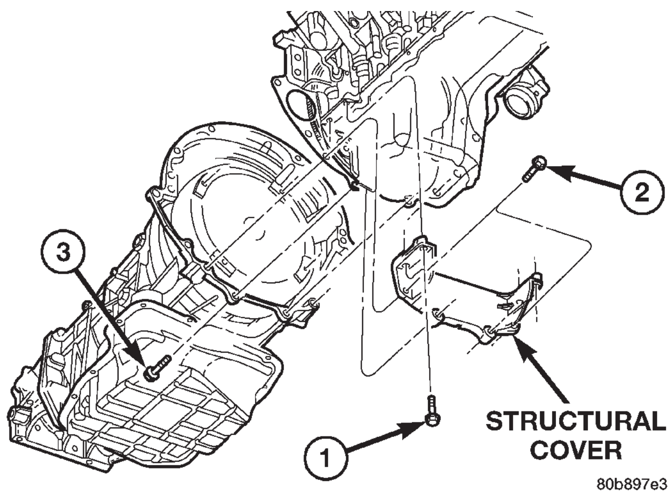


Fig. 109 Structural Dust Cover Removal / Installation

(3) Drain the engine oil and remove oil filter.

NOTE: Do not pry on oil pan or oil pan gasket. Gasket is mounted to engine and does not come out with oil pan.

(4) Remove the oil pan mounting bolts and oil pan (Fig. 110).

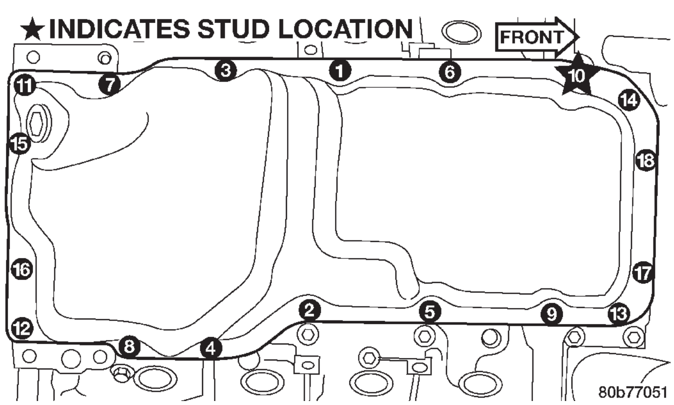


Fig. 110 Oil Pan Mounting Bolts and Oil Pan

(5) Unbolt oil pump pickup tube and remove tube and oil pan gasket from engine.

INSTALLATION

(1) Clean the oil pan gasket mating surface of the bedplate and oil pan.

(2) Position the oil pan gasket and pickup tube with new o-ring. Install the mounting bolt and nuts. Tighten bolt and nuts to 28 N·m (20 ft. lbs.).

(3) Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 15 N·m (11 ft. lbs.) in the sequence shown (Fig. 110).

(4) Install structural dust cover.

(5) Install oil filter.

(6) Install front axle. Refer to DIFFERENTIAL AND DRIVELINE.

(7) Lower vehicle.

(8) Fill engine oil.

(9) Start engine check for leaks.

PISTON AND CONNECTING ROD

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove the following components: (Refer to procedures in this section)
- Oil pan and gasket/windage tray.
- Cylinder head covers.
- Timing chain cover.
- Cylinder head(s).

(3) If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

(4) Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool (Fig. 111).

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

(5) Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

REMOVAL AND INSTALLATION (Continued)

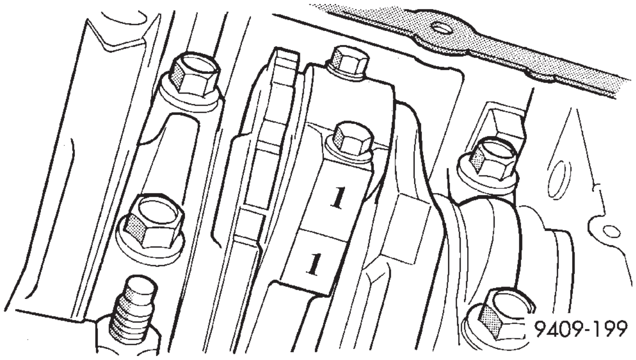


Fig. 111 Identify Connecting Rod to Cylinder Position—Typical

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

(6) Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.

(7) Carefully remove piston rings from piston(s), starting from the top ring down.

PISTON RINGS—INSTALLATION

(1) The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

NOTE: Piston rings are installed in the following order:

- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

(2) Install the oil ring expander.

(3) Install upper side rail (Fig. 112) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

(4) Install No. 2 intermediate piston ring using a piston ring installer (Fig. 113).

(5) Install No. 1 upper piston ring using a piston ring installer (Fig. 113).

(6) Position piston ring end gaps as shown in (Fig. 114). It is important that expander ring gap is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

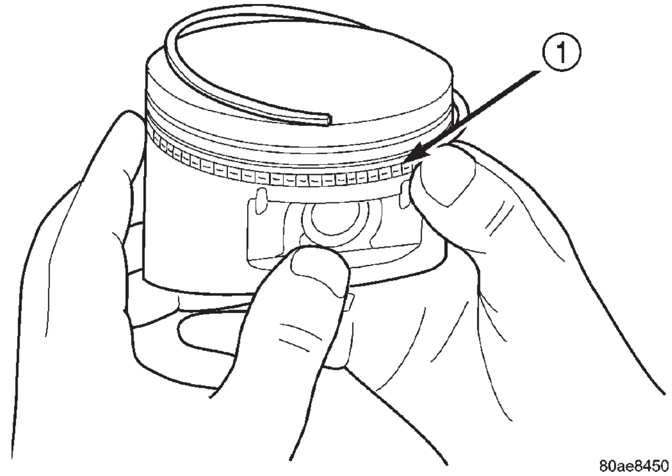


Fig. 112 Side Rail—Installation

1 – SIDE RAIL END

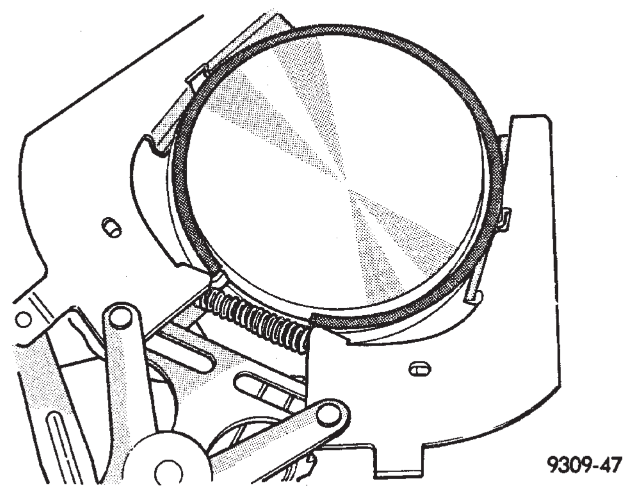


Fig. 113 Upper and Intermediate Rings—Installation

INSTALLATION

(1) Before installing piston and connecting rod assemblies in to the bore, ensure all rings are in position shown in (Fig. 114).

(2) Immerse the piston head and rings in clean engine oil. Position a ring compressor over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**

(3) Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.

(4) Install Special Tool 8507 Connecting Rod Guides into connecting rod bolt threads (Fig. 115).

REMOVAL AND INSTALLATION (Continued)

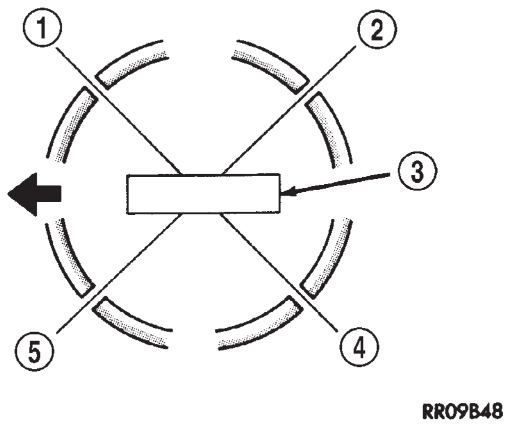


Fig. 114 Piston Ring End Gap Position

1 – SIDE RAIL UPPER
2 – NO. 1 RING GAP
3 – PISTON PIN
4 – SIDE RAIL LOWER
5 – NO. 2 RING GAP AND SPACER EXPANDER GAP

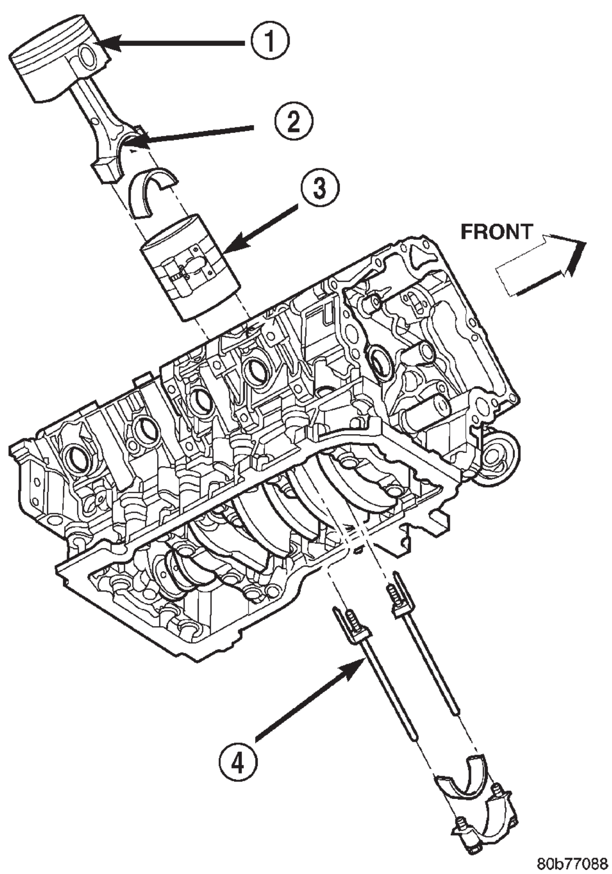


Fig. 115 Piston and Connecting Rod—Installation

1 – “F” TOWARD FRONT OF ENGINE
2 – OIL SLINGER SLOT
3 – RING COMPRESSOR
4 – SPECIAL TOOL 8507

(5) The pistons are marked on the piston pin bore surface with an raised “F” indicating installation position. This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine (Fig. 116).

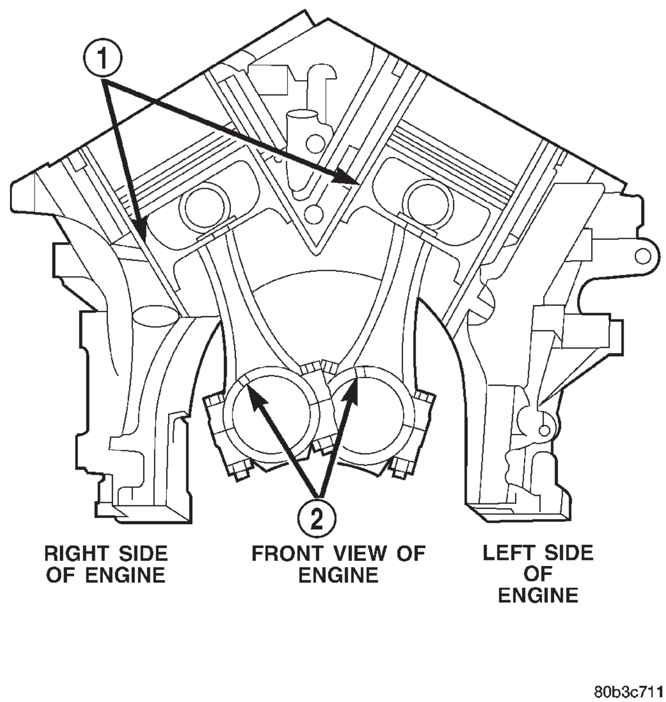


Fig. 116 Piston and Connecting Rod Positioning

1 – MAJOR THRUST SIDE OF PISTON
2 – OIL SLINGER SLOT

(6) Wipe cylinder bore clean and lubricate with engine oil.

(7) Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.

(8) Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

(9) Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N·m (20 ft. lbs.) plus 90°.

(10) Install the following components: (Refer to procedures in this section)

- Cylinder head(s).
- Timing chain and cover.
- Cylinder head covers.

REMOVAL AND INSTALLATION (Continued)

- Oil pan and gasket/windage tray.

(11) Fill crankcase with proper engine oil to correct level.

(12) Connect negative cable to battery.

CRANKSHAFT

REMOVAL

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

(1) Remove the engine. Refer to Engine Assembly in this section for procedure.

(2) Remove the engine oil pump. Refer to Oil Pump in this section for procedure.

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

(3) Remove oil pan bolts and oil pan.

(4) Remove the oil pump pickup tube and oil pan gasket /windage tray.

(5) Remove the bedplate mounting bolts. Note the location of the three stud bolts for installation.

(6) Remove the connecting rods from the crankshaft.

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause sever damage to the crankshaft.

NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are on both the left and right sides, only the left side is shown.

(7) Carefully pry on the pry points (Fig. 117) to loosen the bedplate then remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

(8) Remove the crankshaft.

(9) Remove the crankshaft tone wheel.

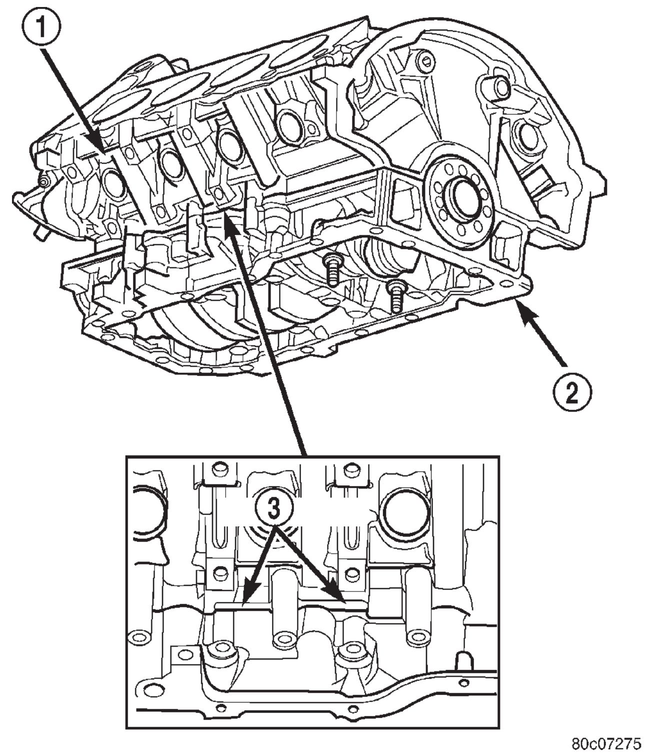


Fig. 117 Bedplate Pry Point Location

1 – CYLINDER BLOCK
2 – BEDPLATE
3 – PRY POINT

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

(1) If required, remove the main bearing halves from the cylinder block and bedplate.

(2) Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.

(3) Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.

(4) Inspect the crankshaft thrust washer for scoring, scratches or blueing. If either condition exist replace the thrust washer.

(5) Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: Main bearings are select fit. Refer to Crankshaft Main Bearings in this section for proper bearing selections.

(1) Lubricate upper main bearing halves with clean engine oil.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

NOTE: Apply sealant to the tone wheel retaining screws prior to installation.

(2) Install the crankshaft tone wheel. Torque the mounting screws to 22 N·m (21 ft. lbs.).

(3) Install the thrust washer (Fig. 118).

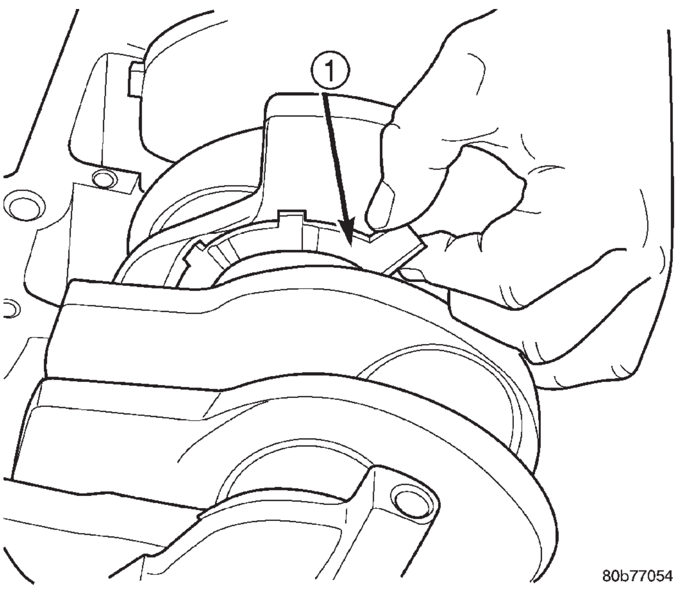


Fig. 118 Crankshaft Thrust Washer Installation

1 – CRANKSHAFT THRUST WASHER

(4) Position crankshaft in cylinder block.

CAUTION: The bedplate to cylinder block mateing surface must be coated with sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: The installation time to install the bedplate after the sealant has been applied is critical.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

(5) Apply a 2.5mm (0.100 inch) (Fig. 119) bead of Mopar® Gen II Silicone Rubber Adhesive sealant to the cylinder block-to-bedplate mating surface as shown (Fig. 120).

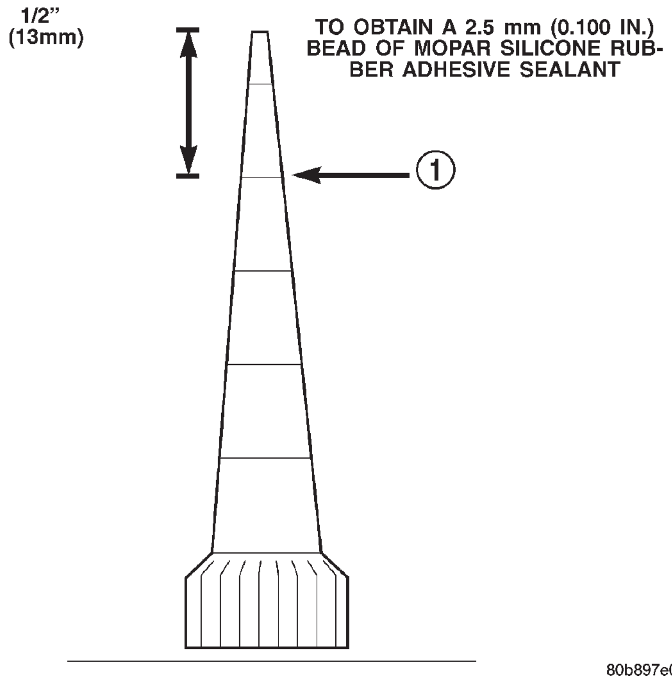


Fig. 119 Cutting Aplicator to Achieve 2.5mm (0.100 in.) Bead

1 – CUT HERE

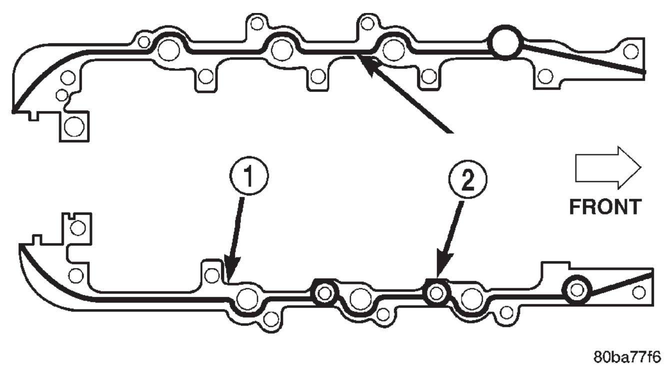


Fig. 120 Cylinder Block-to-Bedplate Sealent Bead Location

1 – CYLINDER BLOCK
2 – SEALANT BEAD LOCATION

(6) Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

REMOVAL AND INSTALLATION (Continued)

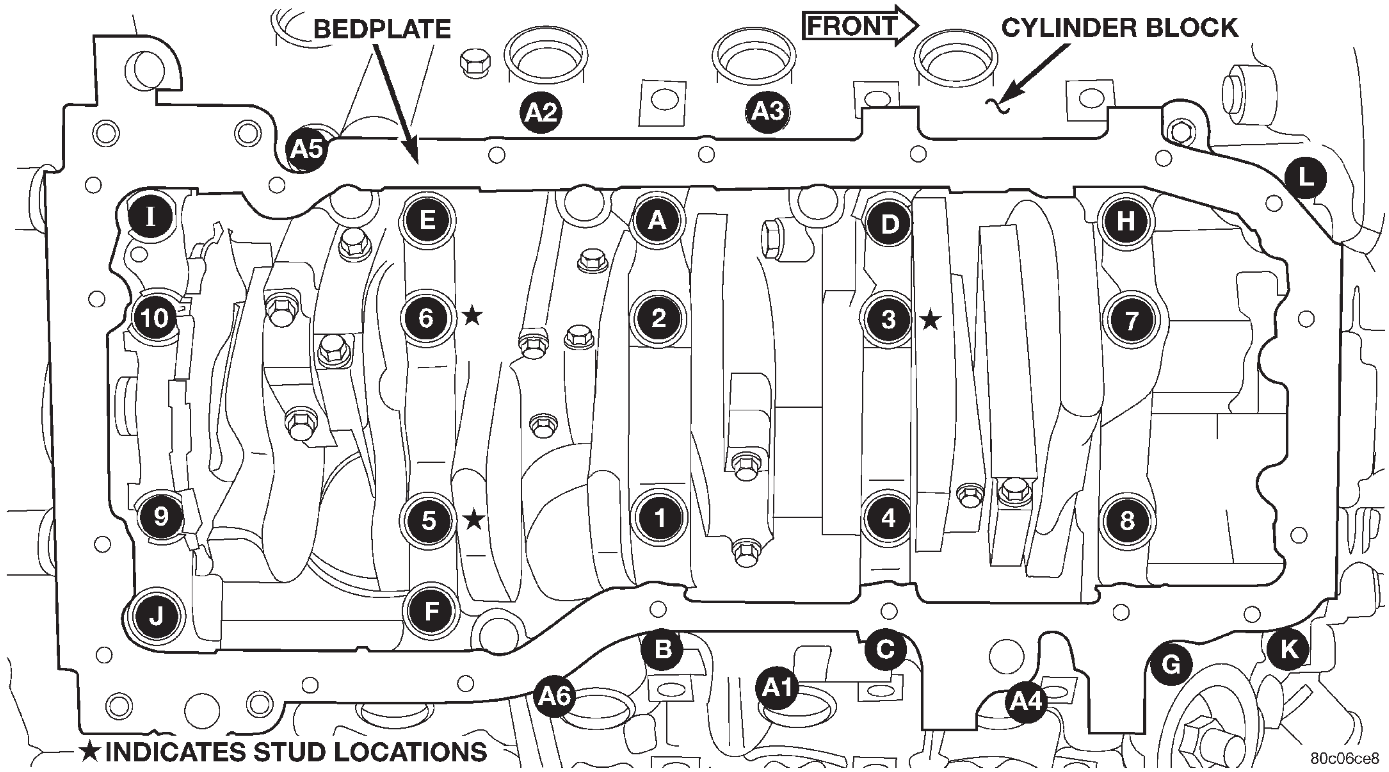


Fig. 121 Bedplate Tightening Sequence

(7) Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown (Fig. 121).

- Tighten bolts **A – L** to 54 N·m (40 ft. lbs.)
- Tighten bolts **1–10** to 2.8 N·m (25 in. lbs.)
- Turn bolts **1–10** an additional 90°.
- Tighten bolts **A1– A6** to 27 N·m (20 ft. lbs.)

(8) Measure crankshaft end play. Refer to Crankshaft Main Bearings in this section for procedure.

(9) Install the connecting rods and measure side clearance. Refer to Connecting Rod Bearings in this section for procedure.

(10) Position the oil pan gasket/windage tray, using a new o-ring, install the oil pickup tube. Torque the bolt to 28N·n (20 ft. lbs.) torque the nuts to 28N·m (20 ft. lbs.).

(11) Install the oil pan. Torque the retaining bolts to 15 N·m (11 ft. lbs.) in the sequence shown (Fig. 122).

(12) Install the engine.

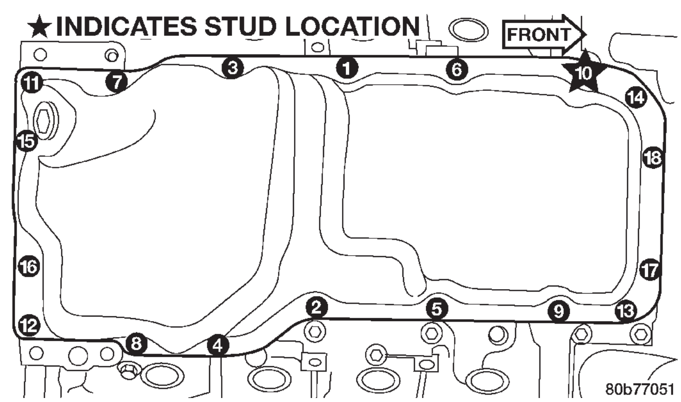


Fig. 122 Oil Pan Tightening Sequence

FLEXPLATE

REMOVAL

(1) Remove the transmission. Refer to Group 21, Transmission and Transfer Case for procedure.

(2) Remove the bolts and flexplate.

INSTALLATION

(1) Position the flexplate onto the crankshaft and install the bolts hand tight.

(2) Tighten the flexplate retaining bolts to 60 N·m (45 ft. lbs.) in the sequence shown (Fig. 123).

(3) Install the transmission.

OIL PUMP

REMOVAL

(1) Remove the oil pan and pick-up tube. Refer to the procedure in this section.

(2) Remove the timing chain cover. Refer to the procedure in this section.

REMOVAL AND INSTALLATION (Continued)

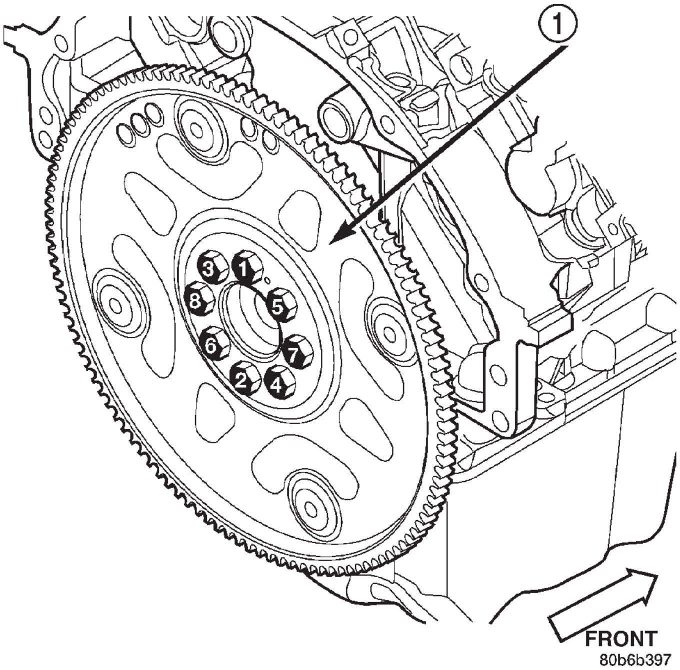


Fig. 123 Flexplate Tightening Sequence

1 – FLEXPLATE

(3) Remove the timing chains and tensioners. Refer to Timing Chain and Sprockets in this section.

(4) Remove the four bolts, primary timing chain tensioner and the oil pump.

INSTALLATION

(1) Position the oil pump onto the crankshaft and install two oil pump retaining bolts.

(2) Position the primary timing chain tensioner and install the two retaining bolts.

(3) Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown (Fig. 124).

(4) Install the secondary timing chain tensioners and timing chains.

(5) Install the timing chain cover.

(6) Install the pick-up tube and oil pan.

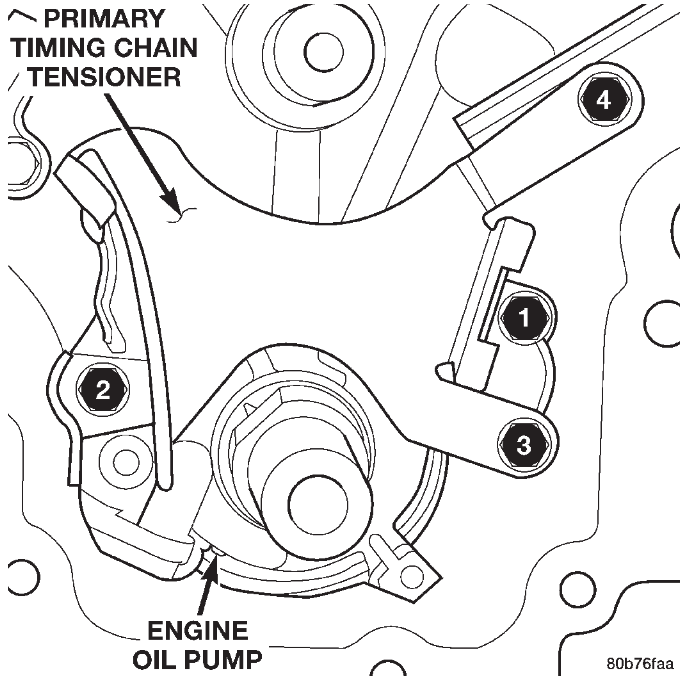


Fig. 124 Oil Pump and Primary Timing Chain Tightening Sequence

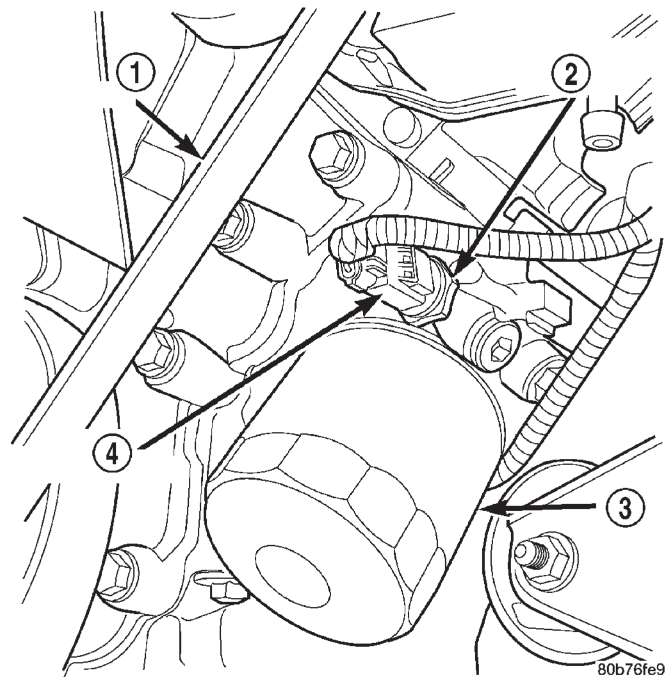


Fig. 125 Oil Pressure Sending Unit

1 – BELT
2 – OIL PRESSURE SENSOR
3 – OIL FILTER
4 – ELEC. CONNECTOR

ENGINE OIL PRESSURE SENDING UNIT

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise vehicle on hoist.

(3) Remove front splash shield.

(4) Disconnect oil pressure sender wire (Fig. 125).

(5) Remove the pressure sender (Fig. 125).

INSTALLATION

(1) Install oil pressure sender.

(2) Connect oil pressure sender wire.

(3) Install front splash shield.

(4) Lower vehicle.

(5) Connect the negative battery cable.

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT OIL SEAL—FRONT

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove accessory drive belt refer to Group 7, Cooling System for procedure.

(3) Remove A/C compressor mouning fasteners and set aside.

(4) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(5) Remove upper radiator hose.

(6) Using Special Tools 6958 Spanner with Adapter Pins 8346 loosen fan and viscous assembly from water pump (Fig. 126).

(7) Remove fan and viscous assembly.

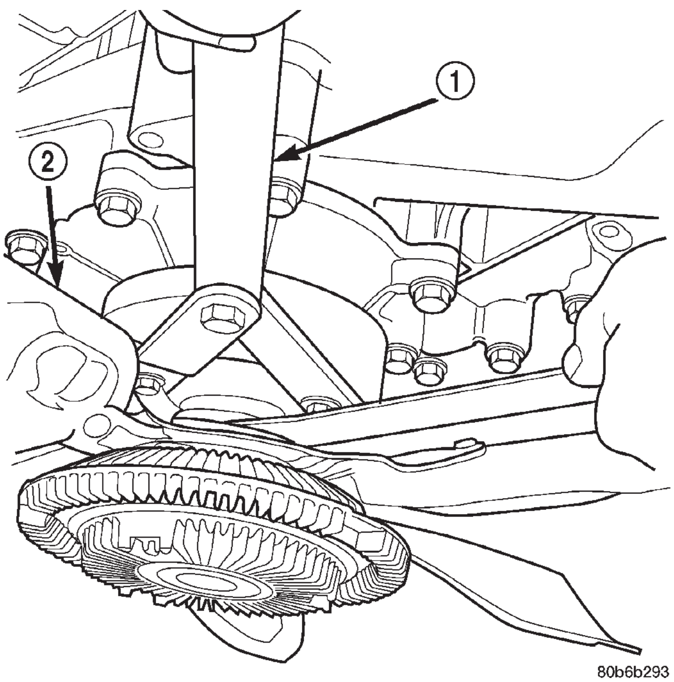


Fig. 126 Fan Assembly—Removal/Installation

1 – SPECIAL TOOL 6958 SPANNER WRENCH WITH ADAPTER PINS 8346
2 – FAN

(8) Disconnect electrical connector for fan mounted inside radiator shroud.

(9) Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

(10) Remove radiator shroud.

(11) Remove crankshaft damper bolt.

(12) Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (Fig. 127).

(13) Using Special Tool 8511, remove crankshaft front seal (Fig. 128).

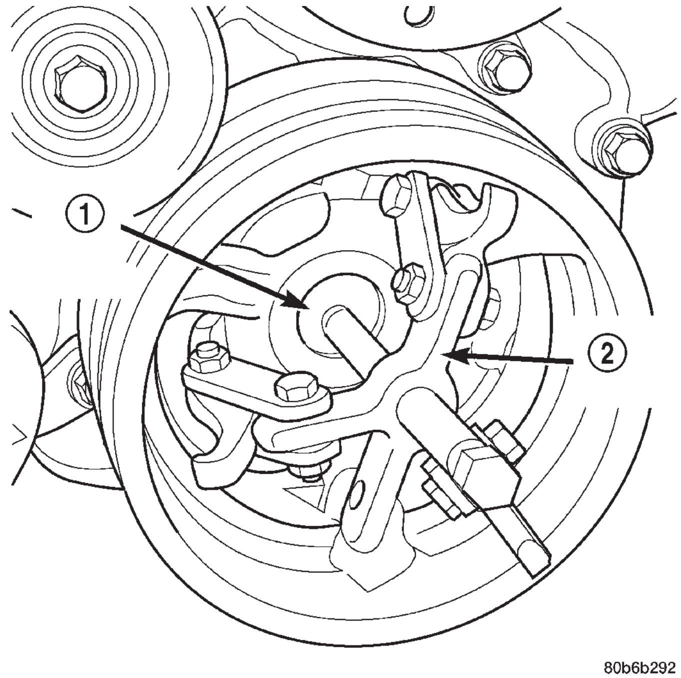


Fig. 127 Crankshaft Damper—Removal

1 – SPECIAL TOOL 8513 INSERT
2 – SPECIAL TOOL 1026

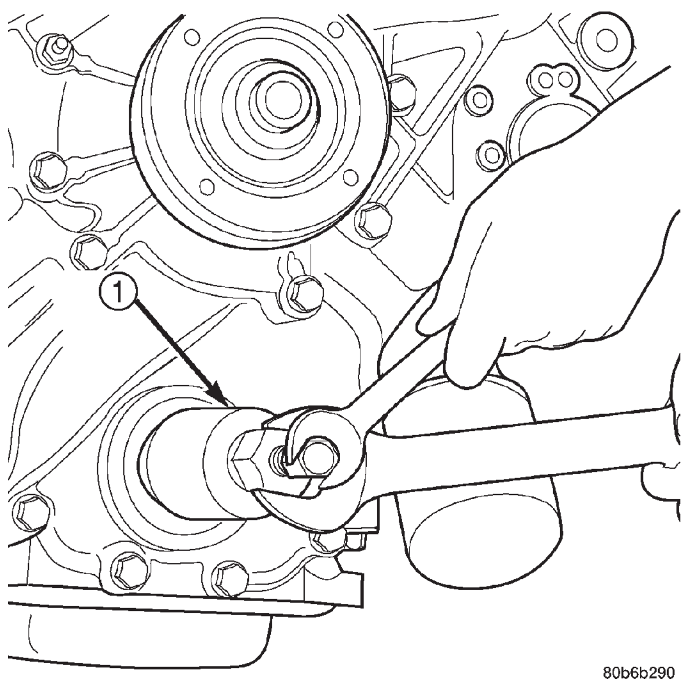


Fig. 128 Crankshaft Front Seal—Removal

1 – SPECIAL TOOL 8511

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

(1) Using Special Tool 8348 and 8512, install crankshaft front seal (Fig. 129).

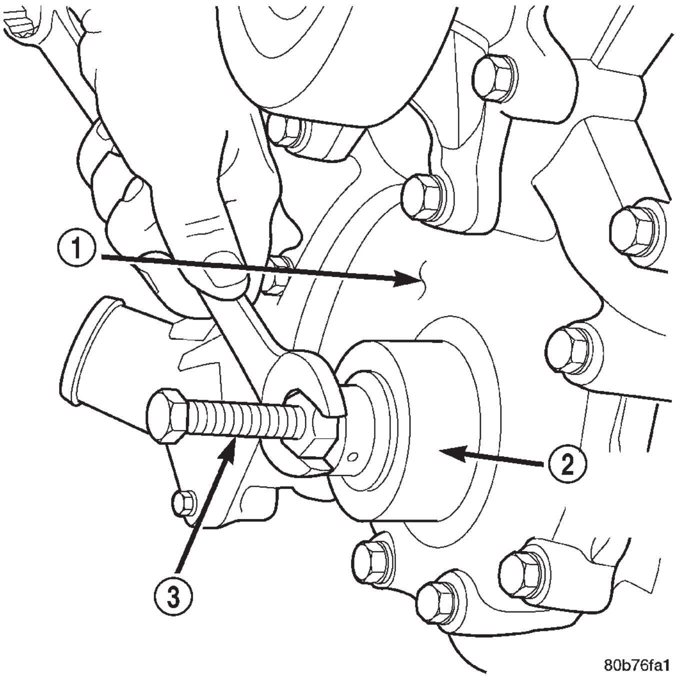


Fig. 129 Crankshaft Front Seal—Installation

1 – TIMING CHAIN COVER
2 – SPECIAL TOOL 8348
3 – SPECIAL TOOL 8512

CAUTION: Special Tool 8512, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.

(2) Assemble Special Tool 8512 as follows, The nut is threaded onto the shaft first. Then the roller bearing is placed onto the threaded rod (The hardened bearing surface of the bearing **MUST** face the nut). Then the hardened washer slides onto the threaded rod (Fig. 130). Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or (Loctite No. 771).

(3) Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

(4) Using Special Tool 8512 press damper onto crankshaft (Fig. 131).

(5) Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).

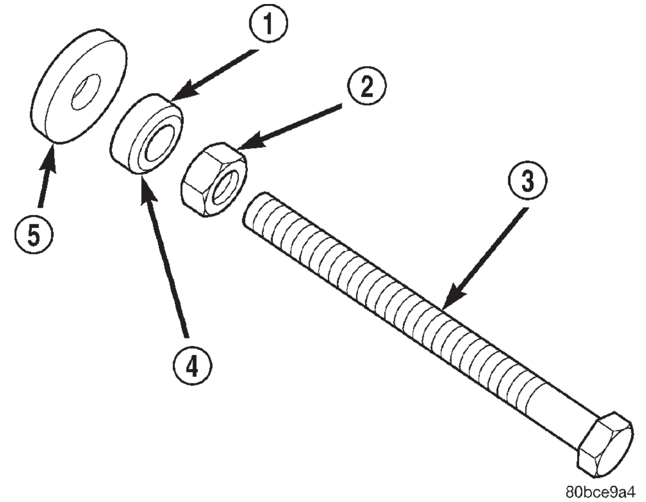


Fig. 130 Proper Assembly Method for Special Tool 8512

1 – BEARING
2 – NUT
3 – THREADED ROD
4 – BEARING HARDENED SURFACE (FACING NUT)
5 – HARDENED WASHER

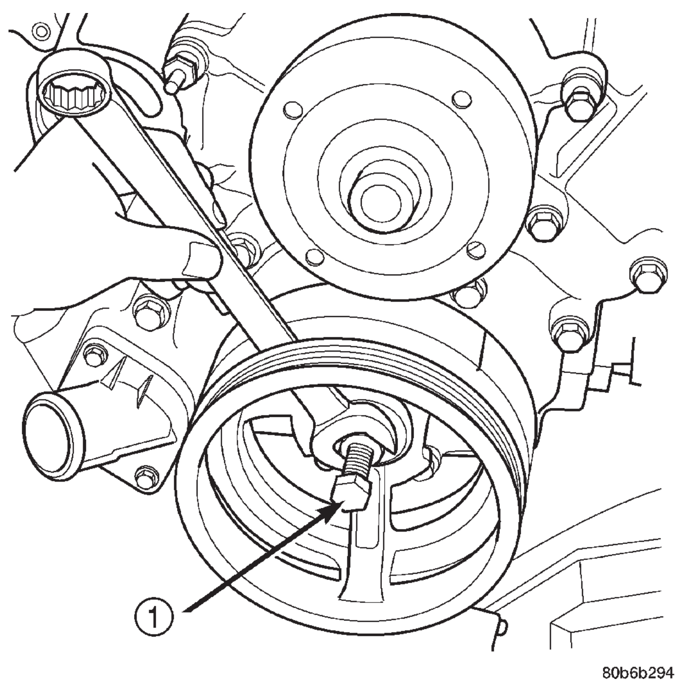


Fig. 131 Crankshaft Damper—Installation

1 – SPECIAL TOOL 8512

(6) Install radiator shroud and tighten fasteners to 11 N·m (95 in. lbs.).

(7) Connect electrical connector for shroud fan.

(8) Install fan and viscous assembly.

(9) Using Special Tools 6958 Spanner with Adapter Pins 8346 tighten fan and viscous assembly to water pump (Fig. 126).

REMOVAL AND INSTALLATION (Continued)

(10) Install upper radiator hose.

(11) Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).

(12) Install accessory drive belt refer to Group 7, Cooling System for procedure.

(13) Refill cooling system. Refer to Group 7, Cooling System for procedure.

(14) Connect negative cable to battery.

CRANKSHAFT OIL SEAL—REAR

REMOVAL

NOTE: This procedure can be preformed in vehicle.

(1) If being preformed in vehicle, remove the transmission. Refer to Group 21, Transmission and Transfer Case.

(2) Remove the flexplate. Refer to procedure in this section.

NOTE: The crankshaft oil seal CAN NOT be reused after removal.

NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.

(3) Using Special Tool 8506 (Fig. 132), remove the crankshaft rear oil seal.

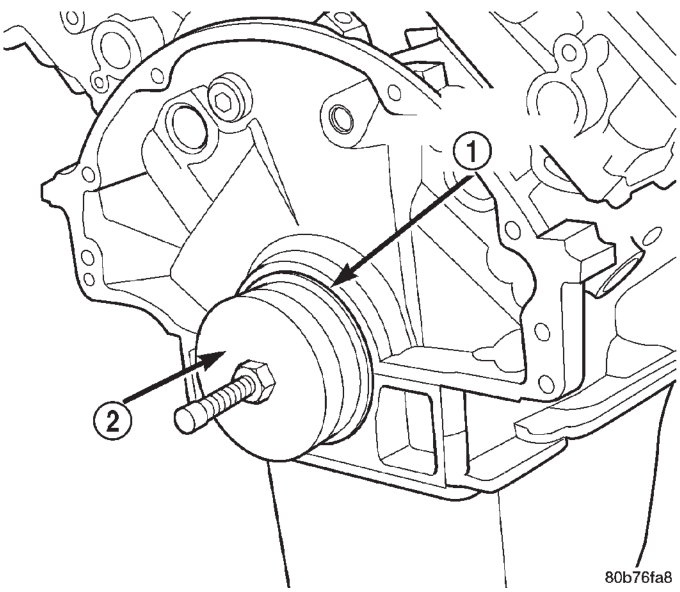


Fig. 132 Crankshaft Rear Oil Seal Removal

1 – REAR CRANKSHAFT SEAL
2 – SPECIAL TOOL 8506

INSTALLATION

(1) Position the magnetic seal guide Special Tool 8349–2 (Fig. 133) onto the crankshaft rear face. Then position the crankshaft rear oil seal onto the guide.

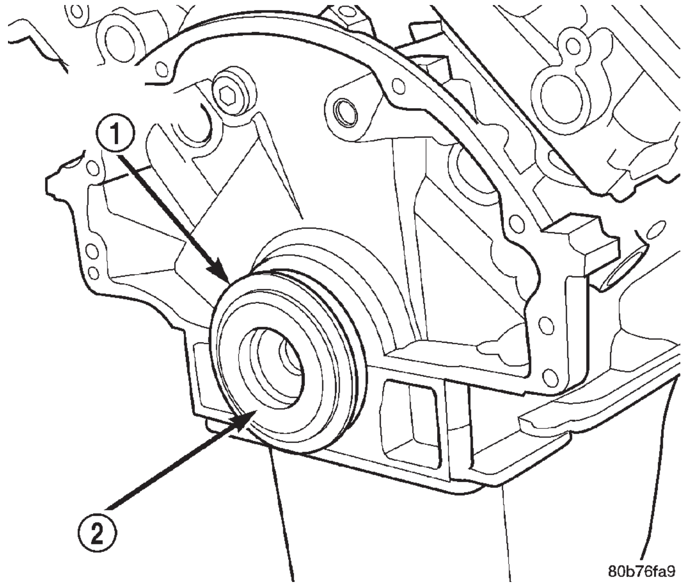


Fig. 133 Crankshaft Rear Oil Seal Guide Special Tool 8349–2 and Oil Seal

1 – REAR CRANKSHAFT SEAL
2 – SPECIAL TOOL 8349–2 GUIDE

(2) Using Special Tools 8349 Crankshaft Rear Oil Seal Installer and C-4171 Driver Handle (Fig. 134), with a hammer, tap the seal into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.

(3) Install the flexplate.

(4) If removed, install the transmission.

ENGINE CORE PLUGS

REMOVAL

(1) Drain the cooling system. Refer to Group 7, Cooling System for procedure.

(2) Using a blunt tool such as a drift or a screw driver and a hammer, strike the bottom edge of the cup plug (Fig. 135)

(3) Using a suitable pair of pliers, grasp the core plug and remove.

INSTALLATION

NOTE: Thoroughly clean core plug bore, remove all of the old sealer.

(1) Coat the edges of the engine core plug and the core plug bore with Mopar Gasket Maker, or equivalent.

REMOVAL AND INSTALLATION (Continued)

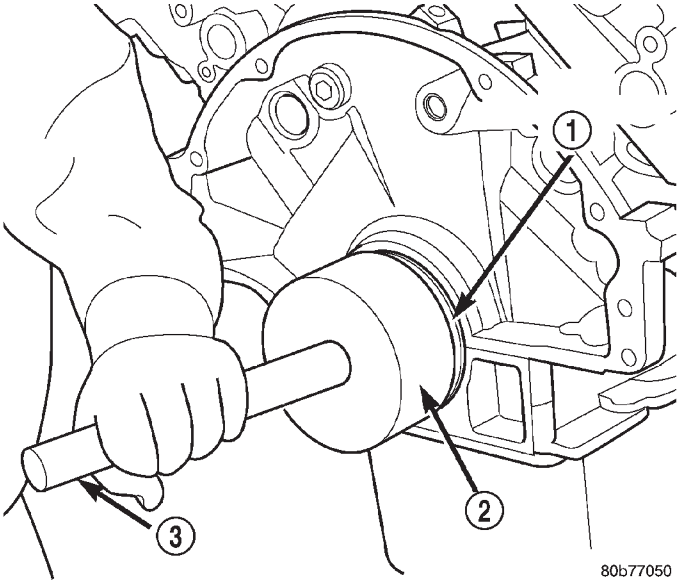


Fig. 134 Crankshaft Rear Oil Seal Installation

1 – REAR CRANKSHAFT SEAL
2 – SPECIAL TOOL 8349–1 INSTALLER
3 – SPECIAL TOOL C-4171 HANDLE

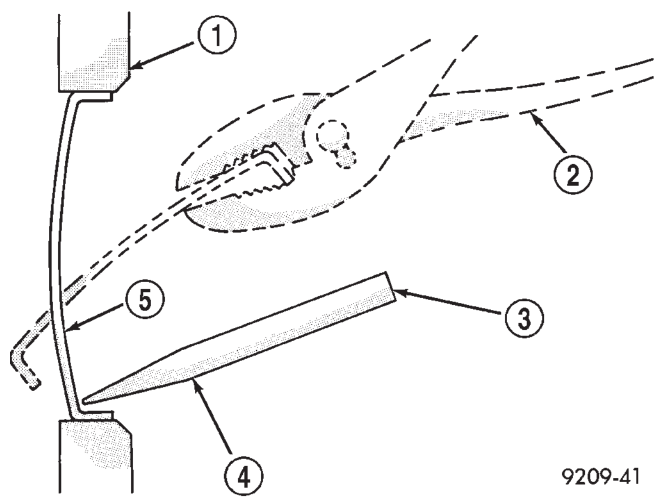


Fig. 135 Engine Core Plug Removal

1 – CYLINDER BLOCK
2 – REMOVE PLUG WITH PLIERS
3 – STRIKE HERE WITH HAMMER
4 – DRIFT PUNCH
5 – CUP PLUG

NOTE: It is not necessary to wait for the sealant to cure on the core plugs. The cooling system can be filled and the vehicle returned to service immediately.

(2) Using proper plug driver, drive core plug into the core plug bore. The sharp edge of the core plug should be at least 0.50 mm (0.020 in.) inside the lead in chamfer.

(3) Refill the cooling system.

DISASSEMBLY AND ASSEMBLY

OIL PUMP

DISASSEMBLE

(1) Remove oil pump cover screws and lift off cover plate.

(2) Remove pump inner and outer rotors.

NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

(3) If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

ASSEMBLE

(1) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

(2) Install inner and outer rotors

(3) Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).

(4) Prime oil pump before installation by filling rotor cavity with engine oil.

(5) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

CLEANING AND INSPECTION

INTAKE MANIFOLD

CLEANING

NOTE: There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.

Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

INSPECTION

(1) Inspect the intake sealing surface for cracks, nicks and distortion.

(2) Inspect the intake manifold vacuum hose fittings for looseness or blockage.

(3) Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

CLEANING AND INSPECTION (Continued)

EXHAUST MANIFOLD

CLEANING

(1) Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.

(2) Clean all gasket residue from the manifold mating surface.

INSPECTION

(1) Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.

(2) Using a straight edge and a feeler gauge, check the mating surface for warp and twist.

(3) Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

CYLINDER HEADS

CLEANING

CYLINDER HEAD GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components.

Never use the following to clean gasket surfaces:

- **never use a metal scraper.**
- **never use an abrasive pad or paper to clean the cylinder block.**
- **never use a high speed power tool or wire brush on any gasket sealing surface** (Fig. 136).

Only use the following for cleaning gasket surfaces:

- use Mopar® Brake and Parts Cleaner
- use only a plastic or wood scraper (Fig. 136)

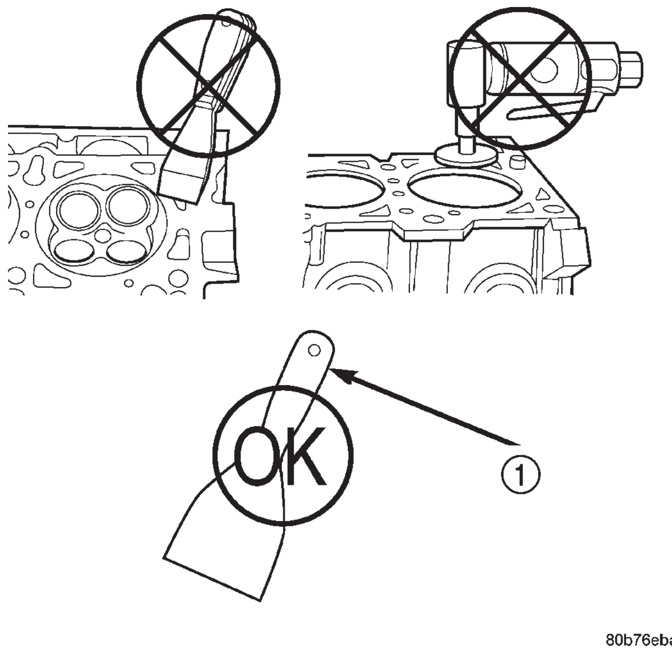


Fig. 136 Proper Tool Usage For Surface Preparation

1 – PLASTIC/WOOD SCRAPER

INSPECTION

(1) Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.

(2) Inspect the valve seats for damage. Service the valve seats as necessary.

(3) Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

PISTON AND CONNECTING ROD

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

(1) Using a suitable cleaning solvent clean the pistons in warm water and towel dry.

(2) Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the crankshaft connecting rod journal for excessive wear, taper and scoring.

Check the pistons for taper and elliptical shape before they are fitted into the cylinder bore.

Replace any piston and connecting rod not meeting the specifications.

OIL PAN

CLEANING

(1) Clean oil pan in solvent and wipe dry with a clean cloth.

(2) Clean the oil pan gasket surface. **DO NOT** use a grinder wheel or other abrasive tool to clean sealing surface.

(3) Clean oil screen and tube thoroughly in clean solvent.

INSPECTION

(1) Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.

CLEANING AND INSPECTION (Continued)

(2) Inspect the oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

OIL PUMP

CLEANING

(1) Wash all parts in a suitable solvent.

INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If the these components are disassembled andør removed from the pump the entire oil pump assembly must be replaced.

(1) Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.

(2) Lay a straight edge across the pump cover surface (Fig. 137). If a 0.025 mm (0.001 in.) feeler gauge can be inserted between the cover and the straight edge the oil pump assembly should be replaced.

(3) Measure the thickness of the outer rotor (Fig. 138). If the outer rotor thickness measures at 12.005 mm (0.400 in.) or less the oil pump assembly must be replaced.

(4) Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (0.400 in.) or less the oil pump assembly must be replaced.

(5) Measure the thickness of the inner rotor (Fig. 139). If the inner rotor thickness measures at 12.005 mm (0.400 in.) or less then the oil pump assembly must be replaced.

(6) Slide outer rotor into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body (Fig. 140). If the measurement is 0.47mm (0.0186 in.) or more the oil pump assembly must be replaced.

(7) Install the inner rotor in the into the oil pump body. Measure the clearance between the inner and outer rotors (Fig. 141). If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.

(8) Place a straight edge across the body of the oil pump (between the bolt holes), if a feeler gauge of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced (Fig. 142).

NOTE: 4.7 Oil pump is released as an assembly. There are no Chrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

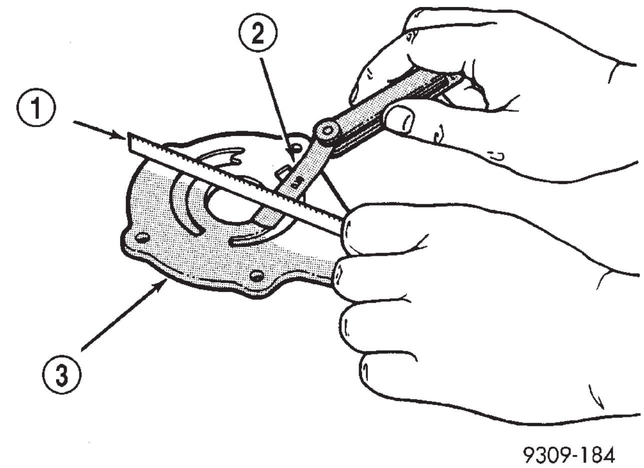


Fig. 137 Checking Oil Pump Cover Flatness

1 – STRAIGHT EDGE
2 – FEELER GAUGE
3 – OIL PUMP COVER

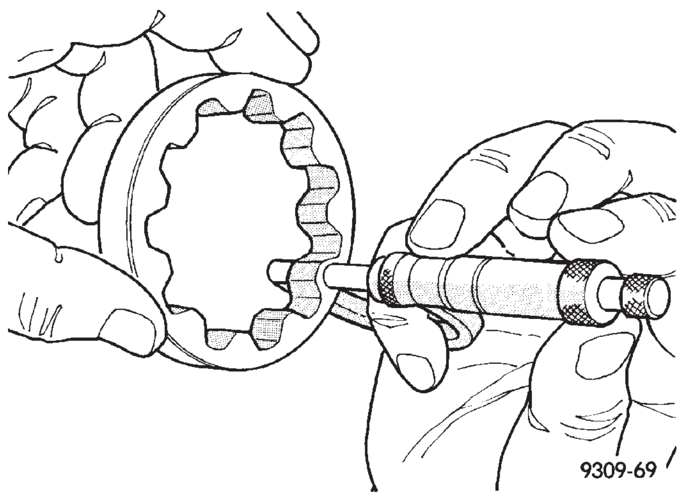


Fig. 138 Measuring Outer Rotor Thickness

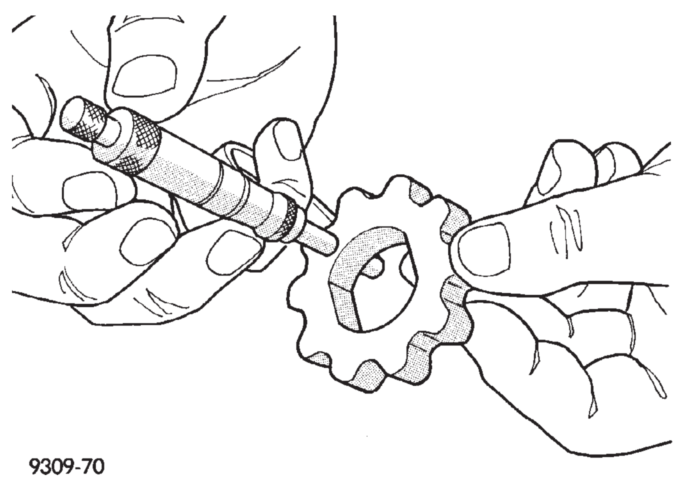


Fig. 139 Measuring Inner Rotor Thickness

CLEANING AND INSPECTION (Continued)

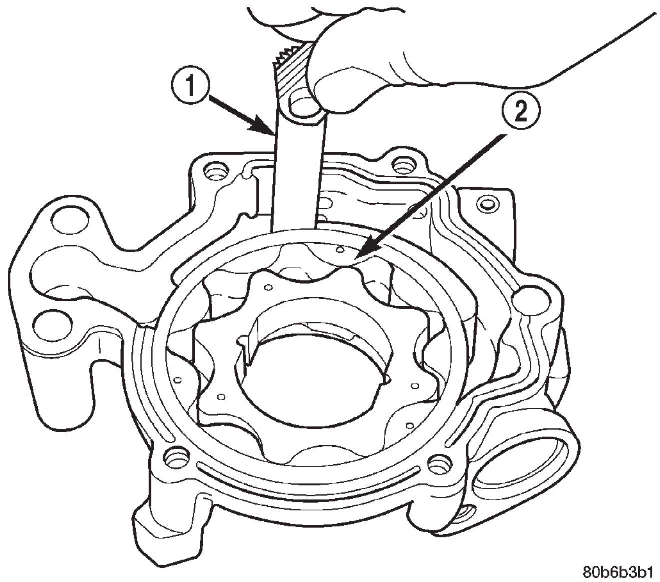


Fig. 140 Measuring Outer Rotor Clearance in Housing

1 – FEELER GAUGE
2 – OUTER ROTOR

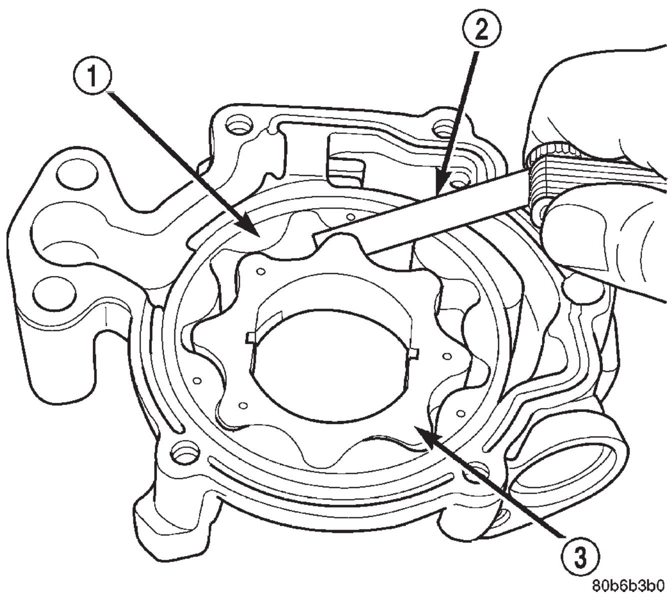


Fig. 141 Measuring Clearance Between Rotors

1 – OUTER ROTOR
2 – FEELER GAUGE
3 – INNER ROTOR

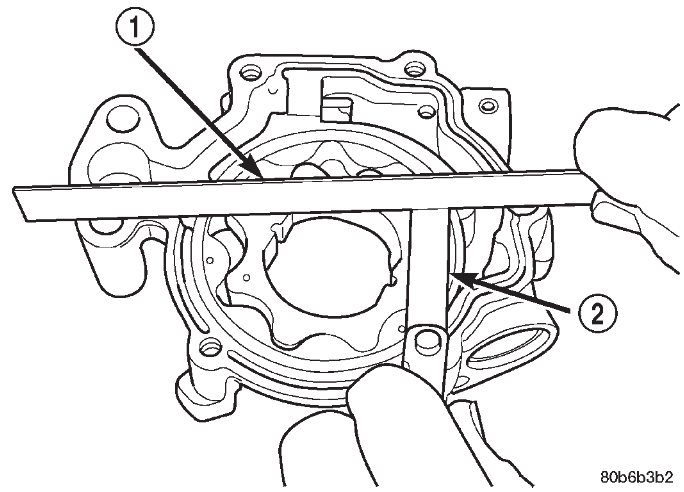


Fig. 142 Measuring Clearance Over Rotors

1 – STRAIGHT EDGE
2 – FEELER GAUGE

CYLINDER BLOCK

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the plugs to 34 N·m (25 ft. lbs.) torque.

INSPECTION

(1) It is mandatory to use a dial bore gauge to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer (Fig. 143).

(2) Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.

(3) Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.

CLEANING AND INSPECTION (Continued)

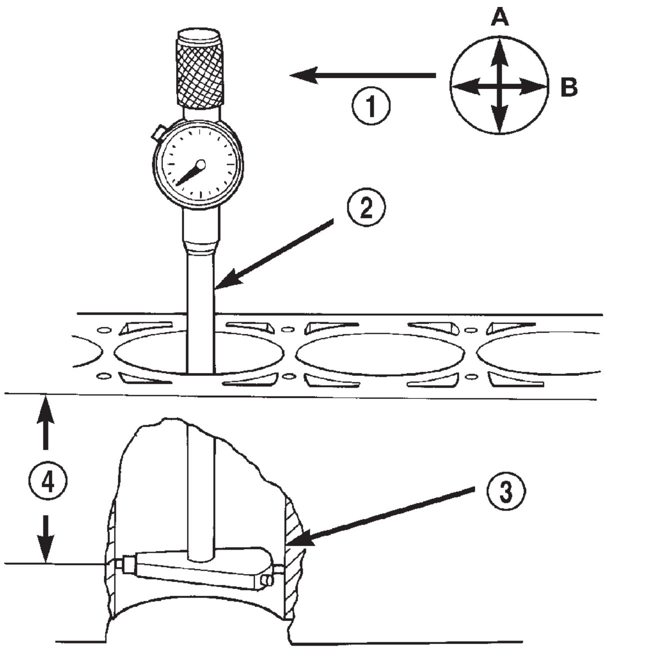


Fig. 143 Bore Gauge—Typical

1 – FRONT
2 – BORE GAUGE
3 – CYLINDER BORE
4 – 49.5 MM (1–15/16 in)

(4) Determine taper by subtracting the smaller diameter from the larger diameter.

(5) Rotate measuring device 90° and repeat steps above.

(6) Determine out-of-roundness by comparing the difference between each measurement.

(7) If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

SPECIFICATIONS

4.7L ENGINE

DESCRIPTION	SPECIFICATION
GENERAL SPECIFICATIONS	
Engine Type	90° SOHC V-8 16-Valve
Displacement	4.7 Liters / 4701cc (287 Cubic Inches)
Bore	93.0 mm (3.66 in.)
Stroke	86.5 mm (3.40 in.)
Compression Ratio	9.0:1
Horsepower	235 BHP @ 4800 RPM
Torque	295 LB-FT @ 3200 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2
CYLINDER BLOCK	
Cylinder Block	Cast Iron
Bore Diameter	93.010 ±.0075 mm (3.6619 ± 0.0003 in.)
Out of Round (MAX)	0.076 mm (0.003 in.)
Taper (MAX)	0.051 mm (0.002 in.)
PISTONS	
Material	Aluminum Alloy
Diameter	92.975 mm (3.6605 in.)
Weight	367.5 grams (12.96 oz)
Ring Groove Diameter	
No. 1	83.73 - 83.97 mm (3.296 - 3.269 in.)
No. 2	82.833 - 83.033 mm (3.261 - 3.310 in.)
No. 3	83.88 - 84.08 mm (3.302 - 3.310 in.)
PISTON PINS	
Type	Pressed Fit
Clearance In Piston	0.010 - 0.019 mm (0.0004 - 0.0008 in.)
Diameter	24.013 - 24.016 mm (0.9454 - 0.9456 in.)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
PISTON RINGS	
Ring Gap	
Top Compression Ring	0.37 - 0.63 mm
	(0.0146 - 0.0249 in.)
Second Compression Ring	0.37 - 0.63 mm
	(0.0146 - 0.0249 in.)
Oil Control (Steel Rails)	0.25 - 0.76 mm
	(0.0099 - 0.30 in.)
Side Clearance	
Top Compression Ring	.051 -.094 mm
	(0.0020 - 0.0037 in.)
Second Compression Ring	0.040 - 0.080 mm
	(0.0016 - 0.0031 in.)
Oil Ring (Steel Ring)	.019 -.229 mm
	(.0007 -.0091 in.)
Ring Width	
Top Compression Ring	1.472 - 1.490 mm
	(0.057 - 0.058 in.)
Second Compression Ring	1.472 - 1.490 mm
	(0.057 - 0.058 in.)
Oil Ring (Steel Rails)	0.445 - 0.470 mm
	(0.017 - 0.018 in.)
CONNECTING RODS	
Bearing Clearance	0.010 - 0.048 mm (0.0004 - 0.0019 in.)
Side Clearance	0.10 - 0.35 mm (0.004 - 0.0138 in.)
Piston Pin Bore Diameter (Interference Fit)	.022 -.045 mm (0.0009 - 0.0018 in.)
Bearing Bore Out of Round (MAX)	0.004 mm (0.0002 in.)
Total Weight (Less Bearing)	578 grams (20.388 ounces)

DESCRIPTION	SPECIFICATION
CRANKSHAFT	
Main BearingJournal	
Diameter	63.488 - 63.512 mm (2.4996 - 2.5005 in.)
Bearing Clearance	0.004 - 0.032 mm (0.0002 - 0.0013 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
End Play	0.052 - 0.282 mm (0.0021 - 0.0112 in.)
End Play (MAX)	0.282 mm (0.0112 in)
Connecting Rod Journal	
Diameter	50.992 - 51.008 mm (2.0076 - 2.0082 in.)
Bearing Clearance	0.010 - 0.048 mm (0.0004 -0.0019 in.)
Out of Round (MAX)	0.005 mm (0.0002 in.)
Taper (MAX)	0.008 mm (0.0004 in.)
CAMSHAFT	
Bore Diameter	26.02 - 26.04 mm
	(1.0245 - 1.0252 in.)
Bearing Journal Diameter	25.975 - 25.995 mm (1.0227 - 1.0235 in.)
Bearing Clearance	0.025 - 0.065 mm (0.001 - 0.0026 in.)
Bearing Clearance (MAX)	0.065 mm (0.0026 in.)
End Play	.075 -.200 mm (0.003 - 0.0079 in.)
End Play (MAX)	.200 mm (0.0079 in.)
VALVE TIMING	
Intake	
Opens (ATDC)	3.6°
Closes (ATDC)	247.1°
Duration	243.5°
Exhaust	
Opens (BTDC)	232.5°
Closes (ATDC)	21.2°
Duration	253.70°
Valve Overlap	17.6°

2000 AN Service Manual
Publication No. 81-370-0010
TSB 26-12-99 December, 1999

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
VALVES	
Face Angle	45° - 45.5°
Head Diameter	
Intake	48.52 - 48.78 mm
	(1.9103 - 1.9205 in.)
Exhaust	36.87 - 37.13 mm
	1.4516 - 1.4618 in.)
Length (Overall)	
Intake	113.45 - 114.21 mm
	(4.4666 - 4.4965)
Exhaust	114.92 - 115.68 mm
	(4.5244 - 4.5543 in.)
Stem Diameter	
Intake	6.931 - 6.957 mm
	(0.2729 - 0.2739 in.)
Exhaust	6.902 - 6.928 mm
	(0.2717 - 0.2728 in.)
Stem - to - Guide Clearance	
Intake	0.018 -0.069 mm
	(0.0008 - 0.0028 in.)
Exhaust	0.047 -0.098 mm
	(0.0019 - 0.0039 in.)
Max. Allowable Stem - to - Guide Clearance (Rocking Method)	
Intake	0.069 mm (0.0028 in.)
Exhaust	0.098 mm (0.0039 in.)
Valve Lift (Zero Lash)	
Intake	11.25 mm (0.443 in.)
Exhaust	10.90 mm (0.4292 in.)
VALVE SPRING	
Free Lenght (Approx)	
Intake and Exhaust	48.6 mm (1.9134 in.)
Spring Force (Valve Closed)	
Intake and Exhaust	315.5 - 352.5 N @ 40.89 mm

DESCRIPTION	SPECIFICATION
	(70.92722 - 79.24515 lbs. @ 1.6099 in.)
Spring Force (Valve Open)	
Intake and Exhaust	786.0 - 860.0 N @ 29.64 mm
	176.6998 - 193.3357 lbs. @ 1.167 in.)
Number of Coils	
Intake and Exhaust	6.69
Wire Diameter	
Intake and Exhaust	4.2799 - 4.3561 mm
	(0.1685 - 0.1715 in.)
Installed Height (Top of Valve Stem Seal to Bottom of Retainer) Nominal	
Early Build	
Intake	40.97 mm (1.613 in.)
Exhaust	40.81 mm (1.606 in.)
Late Build	
Intake	40.11 mm (1.5792 in.)
Exhaust	40.13 mm (1.58 in.)
CYLINDER HEAD	
Gasket Thickness (Compressed)	.7 mm (0.0276 in.)
Valve Seat Angle	44.5° - 45.0°
Valve Seat Runout (MAX)	0.051 mm (0.002 in.)
Valve Seat Width	
Intake	1.75 - 2.36 mm
	(0.0698 - 0.0928 in.)
Exhaust	1.71 - 2.32 mm
	(0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm (0.2747 - 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm (0.002 in.)

SPECIFICATIONS (Continued)

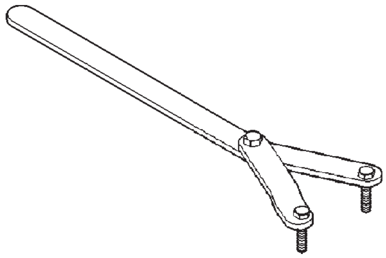
DESCRIPTION	SPECIFICATION
OIL PUMP	
Clearance Over Rotors (MAX)	0.035 -0.095 mm (0.0014 - 0.0038 in.)
Cover Out - of -Flat (MAX)	0.025 mm (0.001 in.)
Inner and Outer Rotor Thickness	12.08 mm (0.4756 in.)
Outer Rotor Clearance (MAX)	85.96 mm (3.3843 in.)
Outer Rotor Diameter (MIN)	85.925 mm (0.400 in.)
Tip Clearance Between Rotors (MAX)	0.150 mm (0.006 in.)
OIL PRESSURE	
At Curb Idle Speed (MIN)*	25 kPa (4 psi)
@ 3000 rpm	170 - 550 kPa (25 - 80 psi)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**	

TORQUE

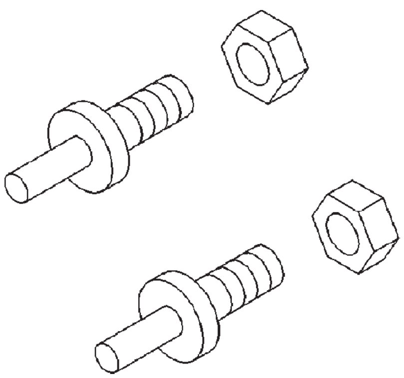
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft			
Non - Oiled Sprocket Bolt	122	90	—
Bearing Cap Bolts	11	—	100
Timing Chain Cover—Bolts	54	40	—
Connecting Rod Cap—Bolts	27	20	—
	PLUS 90° TURN		
Bed Plate—Bolts	Refer to Procedure		
Crankshaft Damper—Bolt	175	130	—
Cylinder Head—Bolts			
M11 Bolts	81	60	—
M8 Bolts	28	—	250
Cylinder Head Cover—Bolts	12	—	105
Exhaust Manifold—Bolts	25	18	—
Exhaust Manifold Heat Shield—Nuts	8	—	72
	Then loosen 45°		
Flexplate—Bolts	60	45	—
Engine Mount Bracket to Block—Bolts	61	45	—
Rear Mount to Transmission—Bolts	46	34	—
Generator Mounting—Bolts			
M10 Bolts	54	40	—
M8 Bolts	28	—	250
Intake Manifold—Bolts	12	—	105
	Refer to Procedure for Tightening Sequence		
Oil Pan—Bolts	15	—	130
Oil Pan—Drain Plug	34	25	—
Oil Pump—Bolts	28	—	250
Oil Pump Cover—Bolts	12	—	105
Oil Pickup Tube—Bolt and Nut	28	—	250
Oil Dipstick Tube—Bolt	28	—	250
Oil Fill Tube—Bolts	12	—	105
Timing Chain Guide—Bolts	28	—	250
Timing Chain Tensioner Arm—Special Pin Bolt	17	—	150
Hydraulic Tensioner—Bolts	28	—	250
Timing Chain Primary Tensioner—Bolts	28	—	250
Timing Drive Idler Sprocket—Bolt	34	25	—
Thermostat Housing—Bolts	12	—	105
Water Pump—Bolts	54	40	—

SPECIAL TOOLS

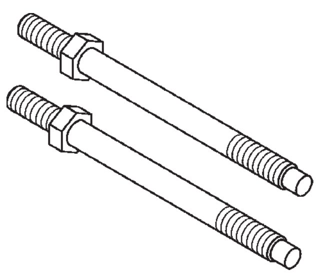
4.7L ENGINE



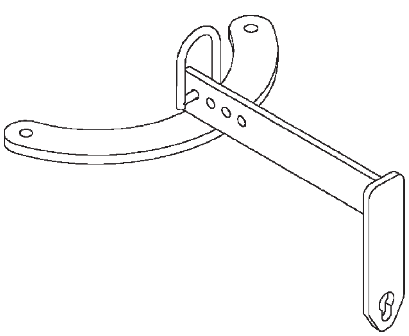
Spanner Wrench 6958



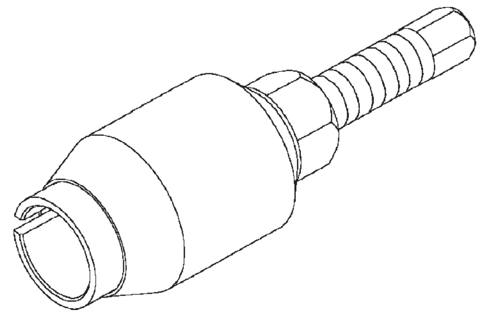
Adapter Pins 8346



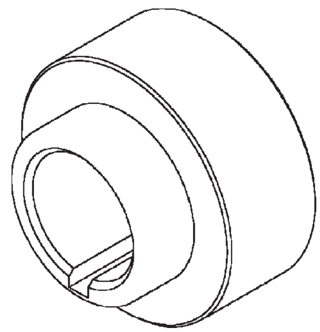
Engine Lifting Studs 8400



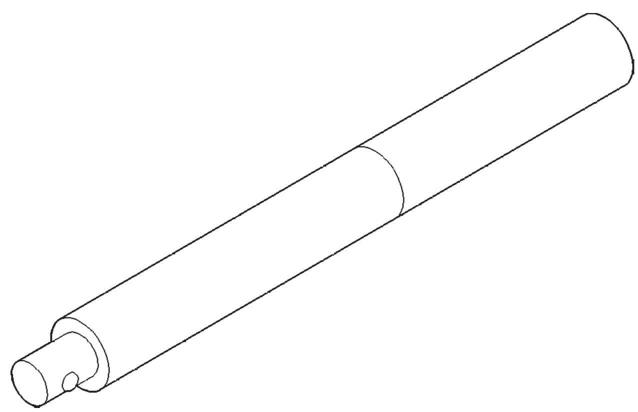
Engine Lift Fixture 8347



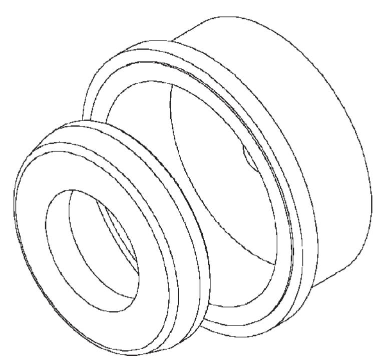
Front Crankshaft Seal Remover 8511



Front Crankshaft Seal Installer 8348

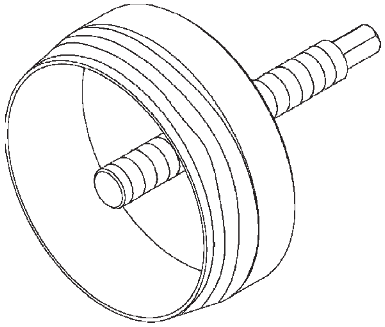


Handle C-4171

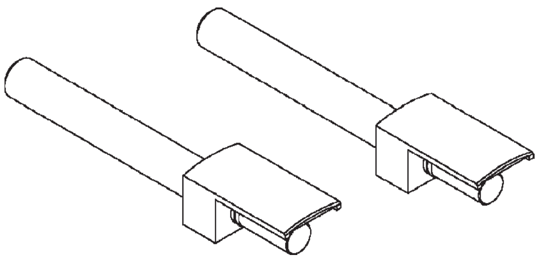


Rear Crankshaft Seal Installer 8349

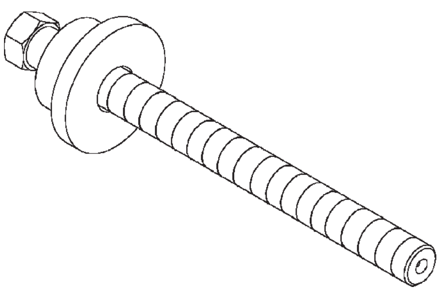
SPECIAL TOOLS (Continued)



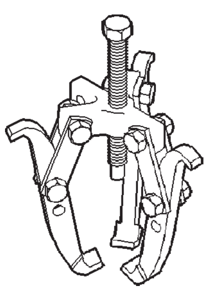
Rear Crankshaft Seal Remover 8506



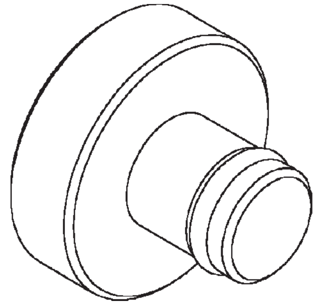
Connecting Rod Guides 8507



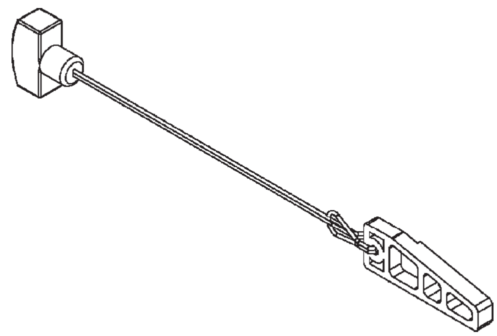
Crankshaft Damper Installer 8512



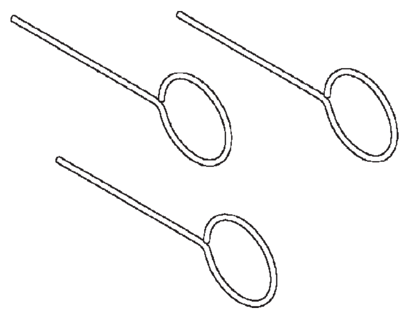
Puller 1026



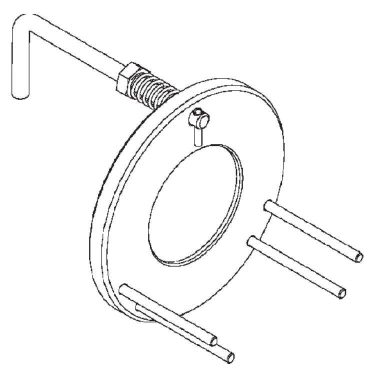
Crankshaft Damper Removal Insert 8513



Chain Tensioner Wedge 8350

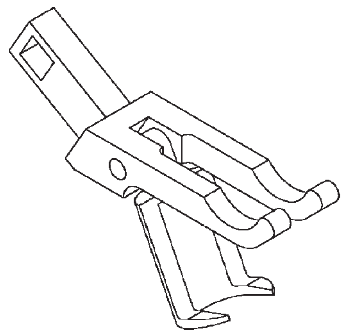


Chain Tensioner Pins 8514

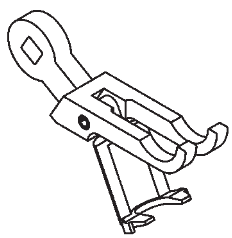


Secondary Chain Holder 8515

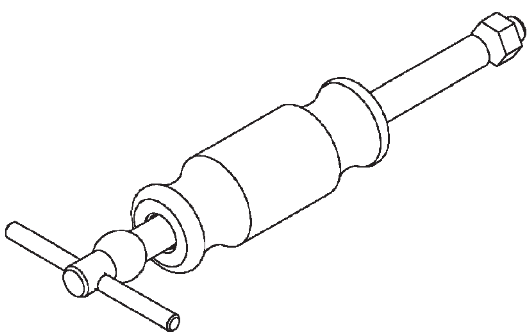
SPECIAL TOOLS (Continued)



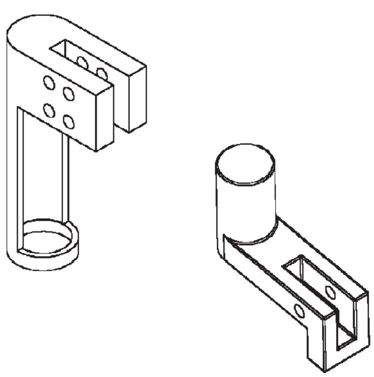
Remover, Rocker Arm 8516



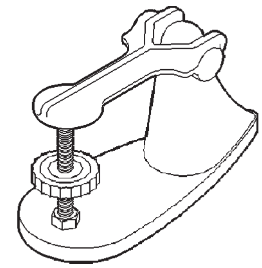
Valve Spring Compressor 8387



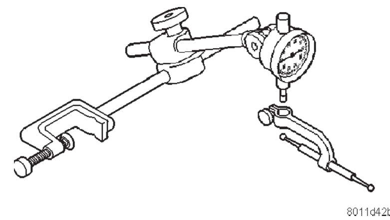
Idler Shaft Remover 8517



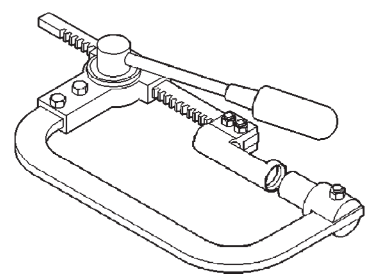
Valve Spring Compressor Adapters 8519



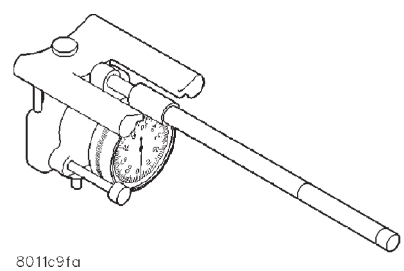
Valve Spring Tester C-647



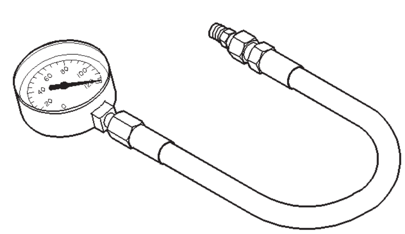
Dial Indicator C-3339



Valve Spring Compressor C-3422-B

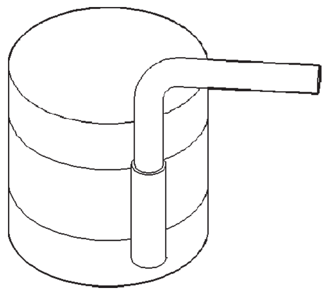


Bore Size Indicator C-119

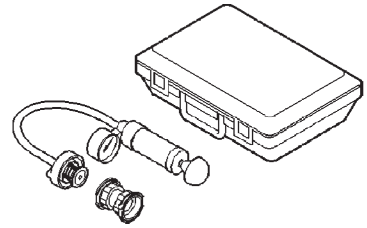


Oil Pressure Gauge C-3292

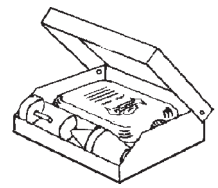
SPECIAL TOOLS (Continued)



Piston Ring Compressor C-385



Pressure Tester Kit 7700



Bloc–Chek–Kit C-3685–A

5.9L ENGINE

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
ENGINE	205
ENGINE LUBRICATION SYSTEM	205
EXHAUST MANIFOLD	208
INTAKE MANIFOLD	208
CYLINDER HEAD COVER GASKET	209
CYLINDER HEAD	209
VALVES AND VALVE SPRINGS	209
ENGINE OIL PAN	209
CRANKSHAFT OIL SEALS	209
PISTON AND CONNECTING ROD	210
CRANKSHAFT MAIN BEARINGS	210
CRANKSHAFT	210
DIAGNOSIS AND TESTING	
ENGINE DIAGNOSIS—INTRODUCTION	210
SERVICE DIAGNOSIS—GASOLINE ENGINES	211
INTAKE MANIFOLD LEAKAGE DIAGNOSIS	215
CYLINDER COMPRESSION PRESSURE TEST	215
CYLINDER HEAD GASKET FAILURE DIAGNOSIS	215
CYLINDER COMBUSTION PRESSURE LEAKAGE TEST	216
INSPECTION (ENGINE OIL LEAKS IN GENERAL)	216
REAR SEAL AREA LEAKS—INSPECTION	217
HYDRAULIC TAPPETS	217
ENGINE OIL PRESSURE	218
SERVICE PROCEDURES	
FORM-IN-PLACE GASKETS	218
ENGINE PERFORMANCE	219
ENGINE OIL	219
REPAIR DAMAGED OR WORN THREADS	221
CYLINDER BORE—HONING	221
HYDROSTATIC LOCK	222
VALVE TIMING	222
VALVE SERVICE	223
MEASURING TIMING CHAIN STRETCH	225
PISTONS—FITTING	225
PISTON RINGS—FITTING	226
CONNECTING ROD BEARINGS—FITTING	227
CRANKSHAFT MAIN BEARINGS—FITTING	227
REMOVAL AND INSTALLATION	
ENGINE FRONT MOUNTS	228
ENGINE REAR SUPPORT	230
ENGINE ASSEMBLY	231
INTAKE MANIFOLD	232
EXHAUST MANIFOLD	234
CYLINDER HEAD COVER	235
ROCKER ARMS AND PUSH RODS	235
VALVE SPRING AND STEM SEAL REPLACEMENT-IN VEHICLE	236
CYLINDER HEAD	236
VALVES AND VALVE SPRINGS	237
HYDRAULIC TAPPETS	237
VIBRATION DAMPER	238
TIMING CHAIN COVER	238
TIMING CHAIN	240
CAMSHAFT	240
CAMSHAFT BEARINGS	242
DISTRIBUTOR DRIVE SHAFT BUSHING	242
CRANKSHAFT MAIN BEARINGS	243
OIL PAN	244
PISTON AND CONNECTING ROD ASSEMBLY	245
CRANKSHAFT	246
OIL PUMP	247
CRANKSHAFT OIL SEAL—FRONT	247
CRANKSHAFT OIL SEALS—REAR	248
ENGINE CORE OIL AND CAMSHAFT PLUGS	250
DISASSEMBLY AND ASSEMBLY	
OIL PUMP	250
CLEANING AND INSPECTION	
CYLINDER HEAD COVER	251
CYLINDER HEAD ASSEMBLY	251
PISTON AND CONNECTING ROD ASSEMBLY	252
OIL PAN	252
OIL PUMP	252
CYLINDER BLOCK	254
INTAKE MANIFOLD	254
EXHAUST MANIFOLD	254
SPECIFICATIONS	
5.9L ENGINE SPECIFICATIONS	255
TORQUE	258
SPECIAL TOOLS	
5.9L ENGINE	259

DESCRIPTION AND OPERATION

ENGINE

DESCRIPTION

The 5.9 Liter (360 CID) eight-cylinder engine is a V-Type lightweight, single cam, overhead valve engine with hydraulic roller tappets. This engine is designed for unleaded fuel.

The engine lubrication system consists of a rotor type oil pump and a full flow oil filter.

The cylinders are numbered from front to rear; 1, 3, 5, 7 on the left bank and 2, 4, 6, 8 on the right bank. The firing order is 1-8-4-3-6-5-7-2 (Fig. 1).

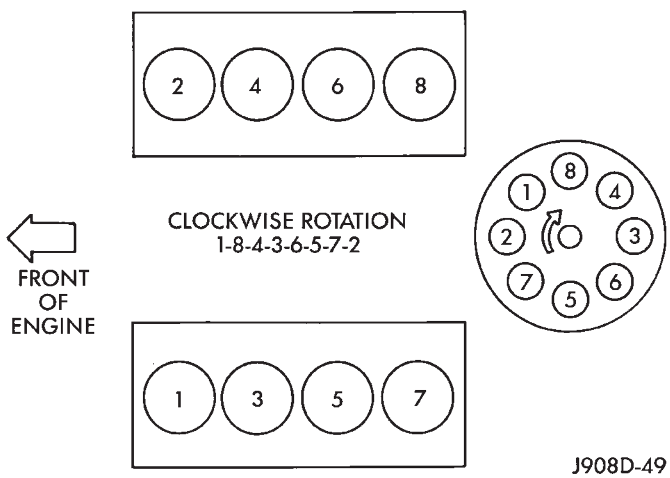


Fig. 1 Firing Order

The engine serial number is stamped into a machined pad located on the left, front corner of the cylinder block. When component part replacement is necessary, use the engine type and serial number for reference (Fig. 2).

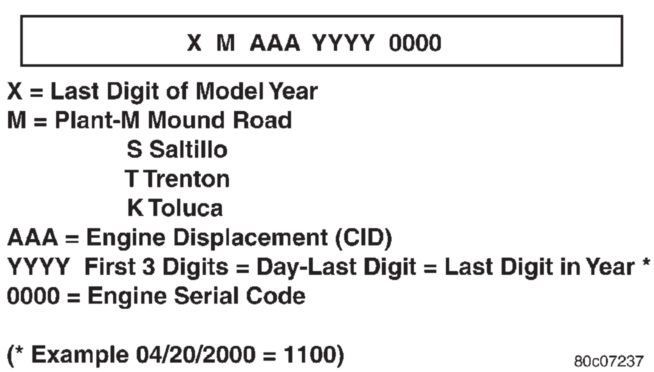


Fig. 2 Engine Identification Number

ENGINE LUBRICATION SYSTEM

DESCRIPTION

A gear-type positive displacement pump (Fig. 3) is mounted at the underside of the rear main bearing cap. The pump uses a pick-up tube and screen assembly to gather engine oil from the oil pan.

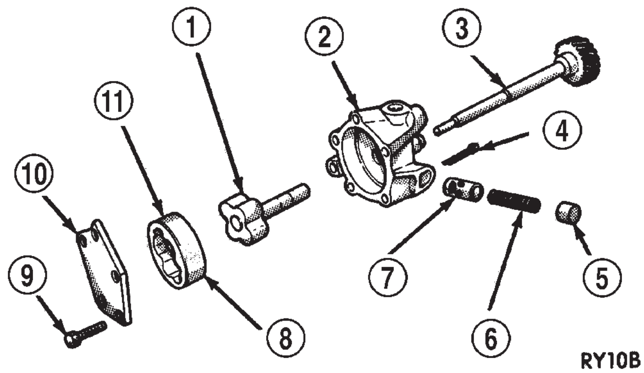


Fig. 3 Positive Displacement Oil Pump—Typical

1 – INNER ROTOR AND SHAFT
2 – BODY
3 – DISTRIBUTOR DRIVESHAFT (REFERENCE)
4 – COTTER PIN
5 – RETAINER CAP
6 – SPRING
7 – RELIEF VALVE
8 – LARGE CHAMFERED EDGE
9 – BOLT
10 – COVER
11 – OUTER ROTOR

OPERATION

The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and pump body, then forced through the outlet to the block. An oil gallery in the block channels the oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery that channels the oil up to the main gallery, which extends the entire length on the right side of the block. The oil then goes down to the No. 1 main bearing, back up to the left side of the block, and into the oil gallery on the left side of the engine.

DESCRIPTION AND OPERATION (Continued)

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals to the connecting rod journals. Each connecting rod bearing has half a hole in it, oil passes through the hole when the rods rotate and the hole lines up, oil is then thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls, and piston pins.

The hydraulic valve tappets receive oil directly from the main oil gallery. The camshaft bearings receive oil from the main bearing galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the timing chain. Oil drains back to the oil pan under the No. 1 main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets, which pass oil through hollow push rods to a hole in the corresponding rocker arm. Oil from the rocker arm lubricates the valve train components. The oil then passes down through the push rod guide holes and the oil drain-back passages in the cylinder head, past the valve tappet area, and then returns to the oil pan.

DESCRIPTION AND OPERATION (Continued)

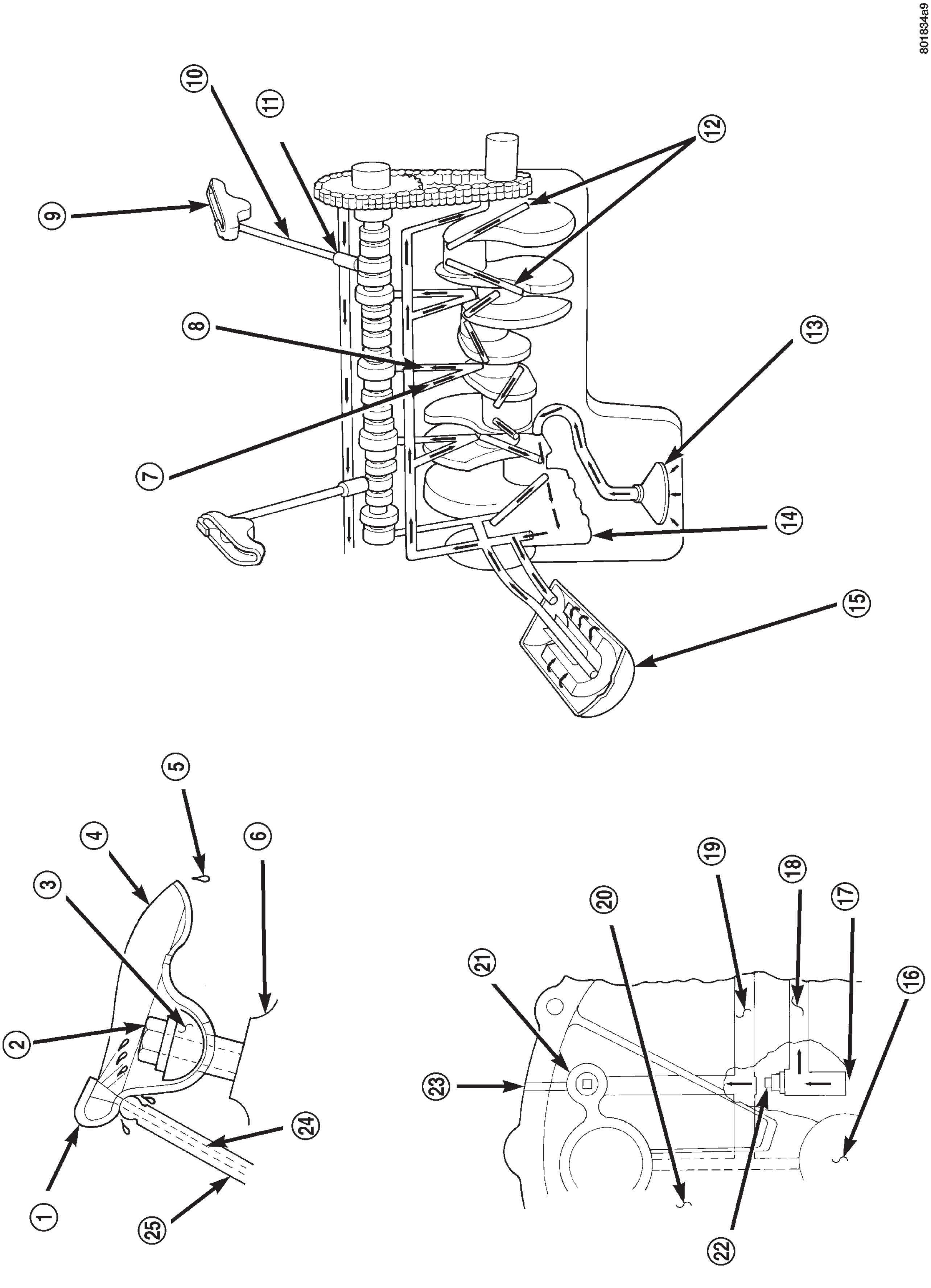


Fig. 4 Oil Lubrication System

DESCRIPTION AND OPERATION (Continued)

1 – OIL DEFLECTOR TAB
2 – BOLT
3 – ROCKER ARM PIVOT
4 – ROCKER ARM
5 – DRIP OILING FOR VALVE TIP
6 – CYLINDER HEAD BOSS
7 – TO MAIN BEARINGS
8 – TO CAMSHAFT BEARINGS
9 – ROCKER ARM
10 – HOLLOW PUSH ROD
11 – TAPPET
12 – TO CONNECTING ROD BEARINGS
13 – OIL INTAKE
14 – OIL PUMP
15 – OIL FILTER
16 – CRANKSHAFT
17 – FROM OIL PUMP
18 – OIL TO FILTER
19 – OIL FROM FILTER TO SYSTEM
20 – PASSAGE TO CAMSHAFT REAR BEARING
21 – RIGHT OIL GALLERY
22 – PLUG
23 – OIL PASSAGE FOR OIL PRESSURE INDICATOR LIGHT
24 – OIL SUPPLY VIA HOLLOW PUSH ROD SUPPLY IS FROM OIL GALLERY METERED THROUGH HYDRAULIC TAPPET
25 – OIL SUPPLY FROM HOLLOW PUSH ROD

EXHAUST MANIFOLD

DESCRIPTION

The exhaust manifolds (Fig. 5) are constructed of cast iron and are LOG type with balanced flow. One exhaust manifold is attached to each cylinder head.

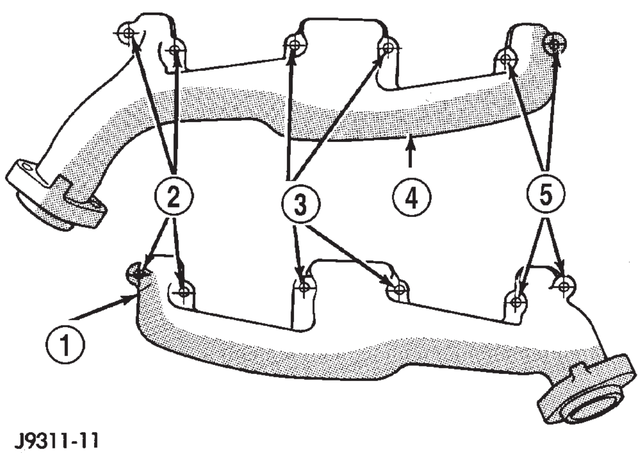


Fig. 5 Exhaust Manifolds—V-8 Gas Engines Typical

1 – EXHAUST MANIFOLD (LEFT)
2 – BOLTS & WASHERS
3 – NUTS & WASHERS
4 – EXHAUST MANIFOLD (RIGHT)
5 – BOLTS & WASHERS

OPERATION

The exhaust manifolds collect the engine exhaust exiting the combustion chambers, then channels the exhaust gases to the exhaust pipes attached to the manifolds.

INTAKE MANIFOLD

DESCRIPTION

The aluminum intake manifold (Fig. 6) is a single plane design with equal length runners and uses a separate plenum, therefore the manifold does have a plenum gasket. It also uses separate flange gaskets and front and rear cross-over gaskets. Extreme care must be used when sealing the gaskets to ensure that excess sealant does not enter the intake runners causing a restriction. Whenever the intake manifold is removed inspect the plenum pan for evidence of excess oil buildup, this condition indicates that the plenum pan gasket is leaking.

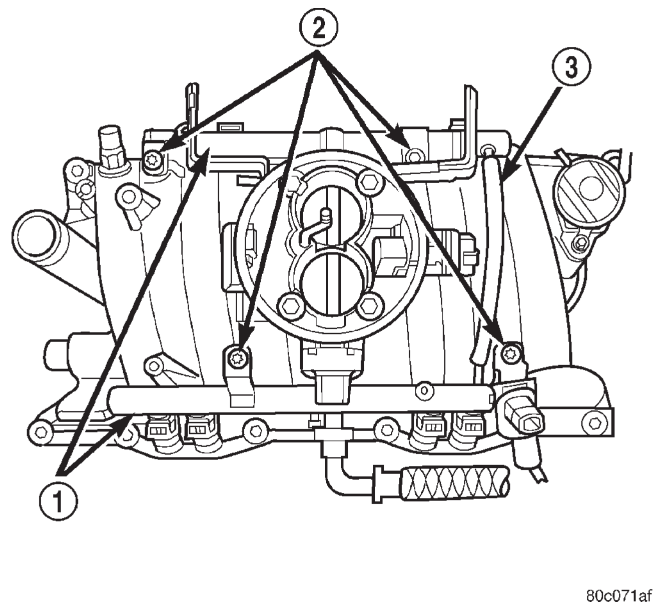


Fig. 6 Intake Manifold and Throttle Body—V-8 Gas Engines Typical

1 – FUEL RAIL ASSEMBLY
2 – FUEL RAIL MOUNTING BOLTS
3 – FUEL RAIL CONNECTING HOSES

OPERATION

The intake manifold, meters and delivers air to the combustion chambers allowing the fuel delivered by the fuel injectors to ignite, thus producing power.

DESCRIPTION AND OPERATION (Continued)

CYLINDER HEAD COVER GASKET

DESCRIPTION

The cylinder head cover gasket is a steel-backed silicone gasket, designed for long life usage (Fig. 7).

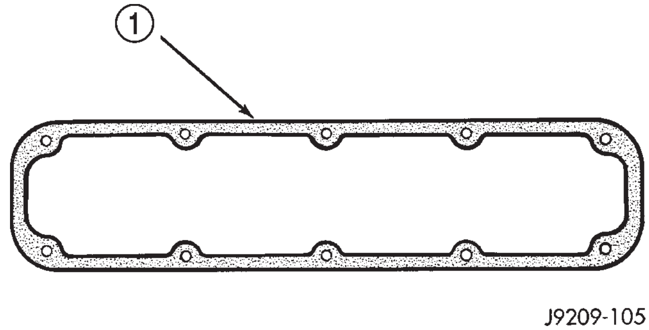


Fig. 7 Cylinder Head Cover Gasket V-8 Gas Engines

1 – CYLINDER HEAD COVER GASKET

OPERATION

The steel-backed silicone gasket is designed to seal the cylinder head cover for long periods of time through extensive heat and cold, without failure. The gasket is designed to be reusable.

CYLINDER HEAD

DESCRIPTION

The cast iron cylinder heads (Fig. 8) are mounted to the cylinder block using ten bolts. The spark plugs are located in the peak of the wedge between the valves.

OPERATION

The cylinder head closes the combustion chamber allowing the pistons to compress the air fuel mixture to the correct ratio for ignition. The valves located in the cylinder head open and close to either allow clean air into the combustion chamber or to allow the exhaust gases out, depending on the stroke of the engine.

VALVES AND VALVE SPRINGS

DESCRIPTION

Both the intake and exhaust valves are made of steel. The intake valve is 48.768 mm (1.92 inches) in diameter and the exhaust valve is 41.148 mm (1.62 inches) in diameter and has a 2.032 mm (0.080 inch) wafer interia welded to the tip for durability. These valves are not splayed.

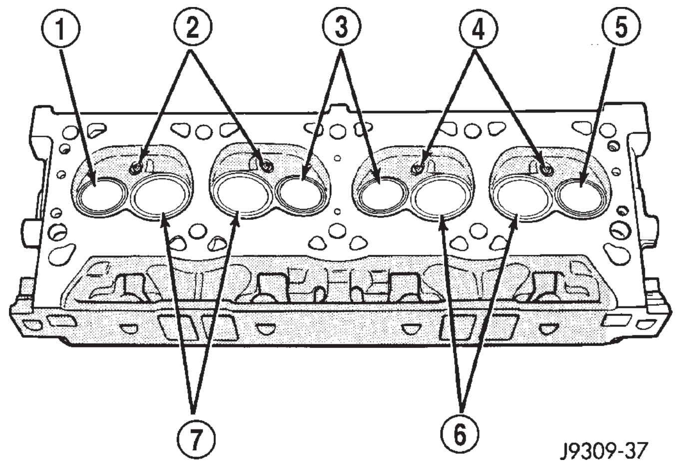


Fig. 8 Cylinder Head Assembly—V-8 Gas Engines

1 – EXHAUST VALVE
2 – SPARK PLUGS
3 – EXHAUST VALVES
4 – SPARK PLUGS
5 – EXHAUST VALVE
6 – INTAKE VALVES
7 – INTAKE VALVES

ENGINE OIL PAN

DESCRIPTION

The stamped steel engine oil pan is located at the bottom of the engine, and contains a drain plug for draining the engine oil.

OPERATION

The oil pan holds the engine oil and seals and protects the engine lower components from contaminates.

CRANKSHAFT OIL SEALS

DESCRIPTION

The crankshaft rear seal is a two piece viton seal. The crankshaft front seal is a one piece viton seal with a steel housing. The front seal is located in the engine front cover. One part of the two piece rear seal is located in a slot in the number five (5) crankshaft main bore, the second part of the two piece seal is located in the number five (5) main bearing cap.

OPERATION

The crankshaft seals prevent oil from leaking from around the crankshaft, either from the rear of the engine or from the engine front cover.

DESCRIPTION AND OPERATION (Continued)

PISTON AND CONNECTING ROD

DESCRIPTION

The pistons are made of aluminum and have three ring grooves, the top two grooves are for the compression rings and the bottom groove is for the oil control ring. The connecting rods are forged steel and are coined prior to heat treat. The piston pins are press fit.

CRANKSHAFT MAIN BEARINGS

DESCRIPTION

Main bearings are located in the cylinder block. One half of the main bearing is located in the crankshaft main bore the other half of the matching bearing is located in the main bearing cap (Fig. 9). there are five main bearings. Number three main bearing is flanged, this flange controls crankshaft thrust.

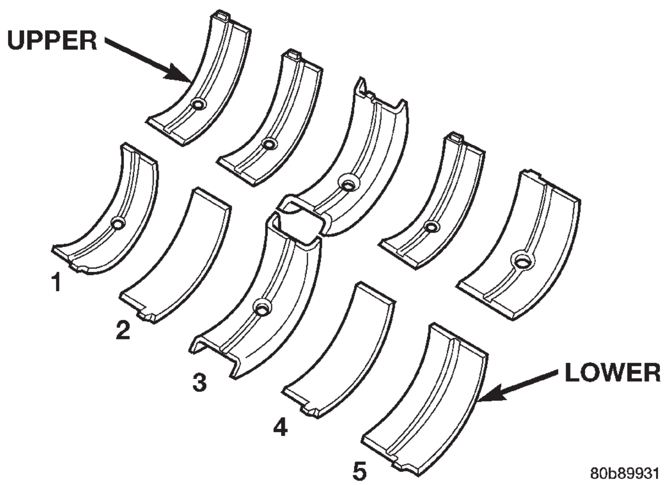


Fig. 9 Main Bearing Orientation

OPERATION

The main bearings encircle the crankshaft main bearing journals, this aligns the crankshaft to the centerline of the engine and allows the crankshaft to turn without wobbling or shaking therefore eliminating vibration. The main bearings are available in standard and undersizes.

CRANKSHAFT

DESCRIPTION

The crankshaft is of a cast nodular steel splayed type design, with five main bearing journals.The crankshaft is located at the bottom of the engine block and is held in place with five main bearing caps. The number 3 counterweight is the location for journal size identification.

Undersize Journal	Identification Stamp
0.025 mm (0.001 inch) (Rod)	R1-R2-R3 or R4
0.025 mm (0.001 inch) (Main)	M1-M2-M3-M4 or M5

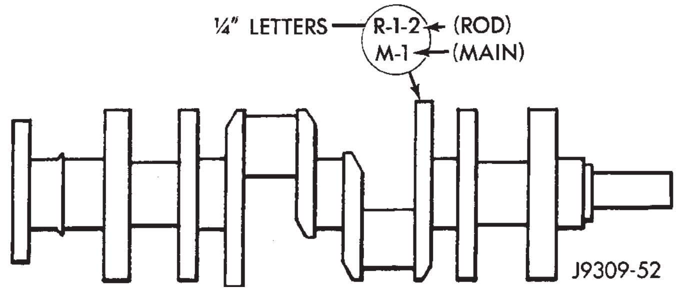


Fig. 10 Crankshaft with Journal Size Identification

OPERATION

The crankshaft transfers force generated by combustion within the cylinder bores to the flywheel or flexplate.

DIAGNOSIS AND TESTING

ENGINE DIAGNOSIS—INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Service Diagnosis—Mechanical Chart and the Service Diagnosis—Performance Chart, for possible causes and corrections of malfunctions. Refer to FUEL SYSTEM for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Lash Adjuster (Tappet) Noise Diagnosis
- Engine Oil Leak Inspection

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—GASOLINE ENGINES

PERFORMANCE DIAGNOSIS CHART—GASOLINE ENGINES

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK	1. Weak or dead battery	1. Charge/Replace Battery. Refer to Group 8A, Battery, for correct procedures. Check charging system. Refer to Group 8C, Charging Systems, for correct procedures.
	2. Corroded or loose battery connections	2. Clean/tighten suspect battery/ starter connections
	3. Faulty starter or related circuit(s)	3. Check starting system. Refer to Group 8B, Starting Systems, for correct diagnostics/procedures
	4. Seized accessory drive component	4. Remove accessory drive belt and attempt to start engine. If engine starts, repair/replace seized component.
	5. Engine internal mechanical failure or hydro-static lock	5. Refer to Group 9, Engine, for correct diagnostics/procedures
ENGINE CRANKS BUT WILL NOT START	1. No spark	1. Check for spark. Refer to Group 8D, Ignition System, for correct procedures.
	2. No fuel	2. Perform fuel pressure test, and if necessary, inspect fuel injector(s) and driver circuits. Refer to Group 14, Fuel System, for correct procedures.
	3. Low or no engine compression	3. Perform cylinder compression pressure test. Refer to Group 9, Engine, for correct procedures.
ENGINE LOSS OF POWER	1. Worn or burned distributor rotor	1. Install new distributor rotor
	2. Worn distributor shaft	2. Remove and repair distributor (Refer to group 8D, Ignition System
	3. Worn or incorrect gapped spark plugs	3. Clean plugs and set gap. (Refer to group 8D, Ignition System)
	4. Dirt or water in fuel system	4. Clean system and replace fuel filter
	5. Faulty fuel pump	5. Install new fuel pump
	6. Incorrect valve timing	6. Correct valve timing
	7. Blown cylinder head gasket	7. Install new cylinder head gasket
	8. Low compression	8. Test cylinder compression
	9. Burned, warped, or pitted valves	9. Install/Reface valves as necessary
	10. Plugged or restricted exhaust system	10. Install new parts as necessary
	11. Faulty ignition cables	11. Replace any cracked or shorted cables

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	12. Faulty ignition coil	12. Test and replace, as necessary. (Refer to Group 8D, ignition system)
ENGINE STALLS OR ROUGH IDLE	1. Carbon build-up on throttle plate	1. Remove throttle body and de-carbon. (Refer to Group 14 for correct procedures)
	2. Engine idle speed too low	2. Check Idle Air Control circuit. (Refer to Group 14, Fuel System)
	3. Worn or incorrectly gapped spark plugs	3. Replace or clean and re-gap spark plugs (Refer to group 8D, Ignition System)
	4. Worn or burned distributor rotor	4. Install new distributor rotor
	5. Spark plug cables defective or crossed	5. Check for correct firing order or replace spark plug cables. (Refer to Group 8D, Ignition System for correct procedures.)
	6. Faulty coil	6. Test and replace, if necessary (Refer to group 8D, Ignition System)
	7. Intake manifold vacuum leak	7. Inspect intake manifold gasket and vacuum hoses. Replace if necessary.
	8. EGR valve leaking or stuck open	8. Test and replace, if necessary (Refer to group 25, Emission Control Systems)
ENGINE MISSES ON ACCELERATION	1. Worn or incorrectly gapped spark plugs	1. Replace spark plugs or clean and set gap. (Refer to group 8D, Ignition System)
	2. Spark plug cables defective or crossed	2. Replace or rewire secondary ignition cables. Refer to Group 8D, Ignition System
	3. Dirt in fuel system	3. Clean fuel system
	4. Burned, warped or pitted valves	4. Install new valves
	5. Faulty coil	5. Test and replace as necessary (refer to group 8D, Ignition System)

DIAGNOSIS AND TESTING (Continued)

MECHANICAL DIAGNOSIS CHART—GASOLINE ENGINES

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES/LIFTERS	1. High or low oil level in crankcase	1. Check for correct oil level. Adjust oil level by draining or adding as needed
	2. Thin or diluted oil	2. Change oil (Refer to Engine Oil Service in this group)
	3. Low oil pressure	3. Check engine oil level. If ok, Perform oil pressure test. Refer to this group for engine oil pressure test/specifications
	4. Dirt in tappets/lash adjusters	4. Clean/replace hydraulic tappets/lash adjusters
	5. Bent push rod(s)	5. Install new push rods
	6. Worn rocker arms	6. Inspect oil supply to rocker arms and replace worn arms as needed
	7. Worn tappets/lash adjusters	7. Install new hydraulic tappets/lash adjusters
	8. Worn valve guides	8. Inspect all valve guides and replace as necessary
	9. Excessive runout of valve seats or valve faces	9. Grind valves and seats
CONNECTING ROD NOISE	1. Insufficient oil supply	1. Check engine oil level. (Refer to group 0, Lubrication and Maintenance)
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. Refer to this group for engine oil pressure test/specifications
	3. Thin or diluted oil	3. Change oil to correct viscosity. Refer to this group for correct procedure/engine oil specifications
	4. Excessive connecting rod bearing clearance	Measure bearings for correct clearance with plasti-gage. Repair as necessary
	5. Connecting rod journal out of round	5. Replace crankshaft or grind journals
	6. Misaligned connecting rods	6. Replace bent connecting rods
MAIN BEARING NOISE	1. Insufficient oil supply	1. Check engine oil level. (Refer to group 0, Lubrication and Maintenance)
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. Refer to this group for engine oil pressure test/specifications
	3. Thin or diluted oil	3. Change oil to correct viscosity. Refer to this group for correct procedure/engine oil specifications

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Excessive main bearing clearance	4. Measure bearings for correct clearance. Repair as necessary
	5. Excessive end play	5. Check crankshaft thrust bearing for excessive wear on flanges
	6. Crankshaft main journal out of round or worn	6. Grind journals or replace crankshaft
	7. Loose flywheel or torque converter	7. Inspect crankshaft, flexplate/ flywheel and bolts for damage. Tighten to correct torque
LOW OIL PRESSURE	1. Low oil level	1. Check oil level and fill if necessary
	2. Faulty oil pressure sending unit	2. Install new sending unit
	3. Clogged oil filter	3. Install new oil filter
	4. Worn oil pump	4. Replace worn gears or oil pump assy
	5. Thin or diluted oil	5. Change oil to correct viscosity. Refer to this group for correct procedure/engine oil specifications
	6. Excessive bearing clearance	6. Measure bearings for correct clearance
	7. Oil pump relief valve stuck	7. Remove valve to inspect, clean and reinstall
	8. Oil pump suction tube loose, broken, bent or clogged	8. Inspect suction tube and clean or replace if necessary
	9. Oil pump cover warped or cracked	9. Install new oil pump
OIL LEAKS	1. Misaligned or deteriorated gaskets	1. Replace gasket
	2. Loose fastener, broken or porous metal part	2. Tighten, repair or replace the part
	3. Front or rear crankshaft oil seal leaking	3. Replace seal
	4. Leaking oil gallery plug or cup plug	4. Remove and reseal threaded plug. Replace cup style plug
	5. Leaking intake manifold cross-over gaskets	5. Replace gaskets
EXCESSIVE OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. PCV System malfunction	1. Refer to group 25, Emission Control System for correct operation
	2. Intake manifold plenum pan gasket failure	2. Replace plenum pan gasket
	3. Defective valve stem seal(s)	3. Replace seals

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	4. Worn or broken piston rings	4. Hone cylinder bores. Install new rings
	5. Scuffed pistons/cylinder walls	5. Hone cylinder bores and replace pistons as required
	6. Carbon in oil control ring groove	6. Remove rings and de-carbon piston
	7. Worn valve guides	6. Repair as necessary
	8. Piston rings fitted too tightly in grooves	8. Remove rings and check ring end gap and side clearance. Replace if necessary

INTAKE MANIFOLD LEAKAGE DIAGNOSIS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS, OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

(1) Start the engine.
(2) Spray a small stream of water at the suspected leak area.
(3) If a change in RPMs, the area of the suspected leak has been found.
(4) Repair as required.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise, the indicated compression pressures may not be valid for diagnosis purposes.

(1) Clean the spark plug recesses with compressed air.
(2) Remove the spark plugs.
(3) Secure the throttle in the wide-open position.
(4) Disconnect the ignition coil.
(5) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
(6) Record the compression pressure on the third revolution. Continue the test for the remaining cylinders.

Refer to Engine Specifications for the correct engine compression pressures.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

- Possible indications of the cylinder head gasket leaking between adjacent cylinders are:
- Loss of engine power
- Engine misfiring
- Poor fuel economy
- Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:
- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test in this section. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

DIAGNOSIS AND TESTING (Continued)

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating)
- Leaks between adjacent cylinders or into water jacket
- Any causes for combustion/compression pressure loss

WARNING: DO NOT REMOVE THE RADIATOR CAP WITH THE SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM HOT COOLANT CAN OCCUR.

Check the coolant level and fill as required. DO NOT install the radiator cap.

Start and operate the engine until it attains normal operating temperature, then turn OFF the engine.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.

Perform the test procedure on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe or oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to the Cylinder Combustion Pressure Leakage Test Diagnosis chart.

INSPECTION (ENGINE OIL LEAKS IN GENERAL)

Begin with a through visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil-soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to be sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light source.

(3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

(4) If dye is not observed, drive the vehicle at various speeds for approximately 24km (15 miles), and repeat previous step.

(5) If the oil leak source is not positively identified at this time, proceed with the air leak detection test method as follows:

(6) Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.

(7) Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.

(8) Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

(9) Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

DIAGNOSIS AND TESTING (Continued)

(10) If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

(11) If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose. Proceed to next step.

(12) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

REAR SEAL AREA LEAKS—INSPECTION

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

(1) Disconnect the battery.

(2) Raise the vehicle.

(3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Group 9, Engines, for proper repair procedures of these items.

(4) If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. Refer to the service Diagnosis—Mechanical, under the Oil Leak row, for components inspections on possible causes and corrections.

(7) After the oil leak root cause and appropriate corrective action have been identified, Refer to Group 9, Engines—Crankshaft Rear Oil Seals, for proper replacement procedures.

HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, check the oil pressure. If vehicle has no oil pressure gauge, install a reliable gauge at the pressure sending-unit. The pressure should be between 207-552 kPa (30-80 psi) at 3,000 RPM.

Check the oil level after the engine reaches normal operating temperature. Allow 5 minutes to stabilize oil level, check dipstick. The oil level in the pan should never be above the FULL mark or below the ADD OIL mark on dipstick. Either of these two conditions could be responsible for noisy tappets.

OIL LEVEL

HIGH

If oil level is above the FULL mark, it is possible for the connecting rods to dip into the oil. With the engine running, this condition could create foam in the oil pan. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

LOW

Low oil level may allow oil pump to take in air. When air is fed to the tappets, they lose length, which allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected, operate the engine at fast idle. Run engine for a sufficient time to allow all of the air inside the tappets to be bled out.

TAPPET NOISE DIAGNOSIS

(1) To determine source of tappet noise, operate engine at idle with cylinder head covers removed.

(2) Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

DIAGNOSIS AND TESTING (Continued)

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

(3) Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger, or by the plunger partially sticking in the tappet body cylinder. The tappet should be replaced. A heavy click is caused by a tappet check valve not seating, or by foreign particles wedged between the plunger and the tappet body. This will cause the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.

(4) The valve train generates a noise very much like a light tappet noise during normal operation. Care must be taken to ensure that tappets are making the noise. If more than one tappet seems to be noisy, it's probably not the tappets.

LEAK-DOWN TEST

After cleaning and inspection, test each tappet for specified leak-down rate tolerance to ensure zero-lash operation (Fig. 11).

Swing the weighted arm of the hydraulic valve tappet tester away from the ram of the Universal Leak-Down Tester.

(1) Place a 7.925-7.950 mm (0.312-0.313 inch) diameter ball bearing on the plunger cap of the tappet.

(2) Lift the ram and position the tappet (with the ball bearing) inside the tester cup.

(3) Lower the ram, then adjust the nose of the ram until it contacts the ball bearing. DO NOT tighten the hex nut on the ram.

(4) Fill the tester cup with hydraulic valve tappet test oil until the tappet is completely submerged.

(5) Swing the weighted arm onto the push rod and pump the tappet plunger up and down to remove air. When the air bubbles cease, swing the weighted arm away and allow the plunger to rise to the normal position.

(6) Adjust the nose of the ram to align the pointer with the SET mark on the scale of the tester and tighten the hex nut.

(7) Slowly swing the weighted arm onto the push rod.

(8) Rotate the cup by turning the handle at the base of the tester clockwise one revolution every 2 seconds.

(9) Observe the leak-down time interval from the instant the pointer aligns with the START mark on the scale until the pointer aligns with the 0.125 mark. A normally functioning tappet will require 20-110 seconds to leak-down. Discard tappets with leak-down time interval not within this specification.

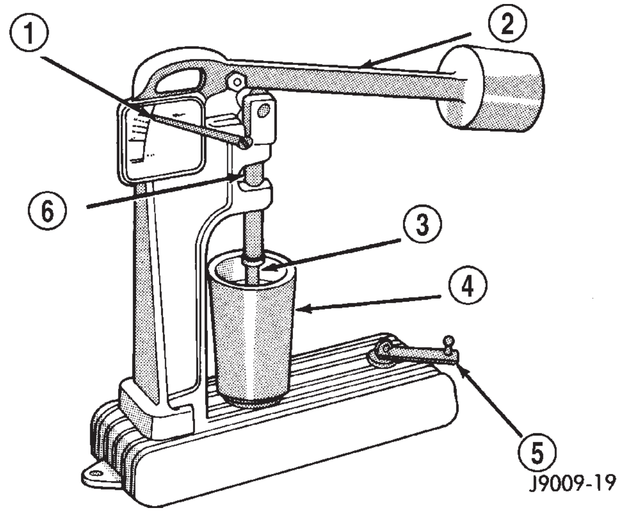


Fig. 11 Leak-Down Tester

1 – POINTER
2 – WEIGHTED ARM
3 – RAM
4 – CUP
5 – HANDLE
6 – PUSH ROD

ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit.

(2) Install Oil Pressure Line and Gauge Tool C-3292. Start engine and record pressure. Refer to Oil Pressure in Engine Specifications for the proper pressures.

SERVICE PROCEDURES

FORM-IN-PLACE GASKETS

There are several places where form-in-place gaskets are used on the engine. **DO NOT use form-in-place gasket material unless specified.** Care must be taken when applying form-in-place gaskets. Bead size, continuity and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over. A continuous bead of the proper width is essential to obtain a leak-free joint.

Two types of form-in-place gasket materials are used in the engine area (Mopar Silicone Rubber Adhesive Sealant and Mopar Gasket Maker). Each have different properties and cannot be used interchangeably.

SERVICE PROCEDURES (Continued)

MOPAR SILICONE RUBBER ADHESIVE SEALANT

Mopar Silicone Rubber Adhesive Sealant, normally black in color, is available in 3 ounce tubes. Moisture in the air causes the sealant material to cure. This material is normally used on flexible metal flanges. It has a shelf life of a year and will not properly cure if over aged. Always inspect the package for the expiration date before use.

MOPAR GASKET MAKER

Mopar Gasket Maker, normally red in color, is available in 6 cc tubes. This anaerobic type gasket material cures in the absence of air when squeezed between smooth machined metallic surfaces. It will not cure if left in the uncovered tube. DO NOT use on flexible metal flanges.

SURFACE PREPARATION

Parts assembled with form-in-place gaskets may be disassembled without unusual effort. In some instances, it may be necessary to lightly tap the part with a mallet or other suitable tool to break the seal between the mating surfaces. A flat gasket scraper may also be lightly tapped into the joint but care must be taken not to damage the mating surfaces.

Scrape or wire brush all gasket surfaces to remove all loose material. Inspect stamped parts to ensure gasket rails are flat. Flatten rails with a hammer on a flat plate, if required. Gasket surfaces must be free of oil and dirt. Make sure the old gasket material is removed from blind attaching holes.

GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care.

Mopar Silicone Rubber Adhesive Sealant should be applied in a continuous bead approximately 3 mm (0.12 inch) in diameter. All mounting holes must be circled. For corner sealing, a 3 or 6 mm (1/8 or 1/4 inch) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

Mopar Gasket Maker should be applied sparingly to one gasket surface. The sealant diameter should be 1.00 mm (0.04 inch) or less. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing the material off location.

ENGINE PERFORMANCE

It is important that the vehicle is operating to its optimum performance level to maintain fuel economy and the lowest emission levels. If vehicle is not operating to these standards, refer to Engine Diagnosis outlined in this section. The following procedures can assist in achieving the proper engine diagnosis.

(1) Test cranking amperage draw. Refer to Electrical Group 8B, Cold Cranking Test.

(2) Check intake manifold bolt torque; Refer to Group 11, Exhaust System and Intake Manifold.

(3) Perform cylinder compression test. Refer to Cylinder Compression Pressure Test in the Engine Diagnosis area of this section.

(4) Clean or replace spark plugs as necessary and adjust gap as specified in Electrical Group 8D. Tighten to specifications.

(5) Test resistance of spark plug cables. Refer to Electrical Group 8D, Spark Plug Cables.

(6) Inspect the primary wires. Test coil output voltage and primary resistance. Replace parts as necessary. Refer to Electrical Group 8D, for specifications.

(7) Test fuel pump for pressure. Refer to Group 14, Fuel System Specifications.

(8) The air filter elements should be replaced as specified in Lubrication and Maintenance, Group 0.

(9) Inspect crankcase ventilation system as out lined in Group 0, Lubrication and Maintenance. For emission controls see Group 25, Emission Controls for service procedures.

(10) Road test vehicle as a final test.

ENGINE OIL

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY.

ENGINE OIL SPECIFICATION

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine failure can result.

SERVICE PROCEDURES (Continued)

API SERVICE GRADE CERTIFIED

In gasoline engines, use an engine oil that is API Service Grade Certified (Fig. 12). Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans. MOPAR only provides engine oil that conforms to this certification.

Fig. 12 Engine Oil Container Standard Notations

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 10W-30 specifies a multiple viscosity engine oil. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. When choosing an engine oil, consider the range of temperatures the vehicle will be operated in before the next oil change. Select an engine oil that is best suited to your area's particular ambient temperature range and variation (Fig. 13).

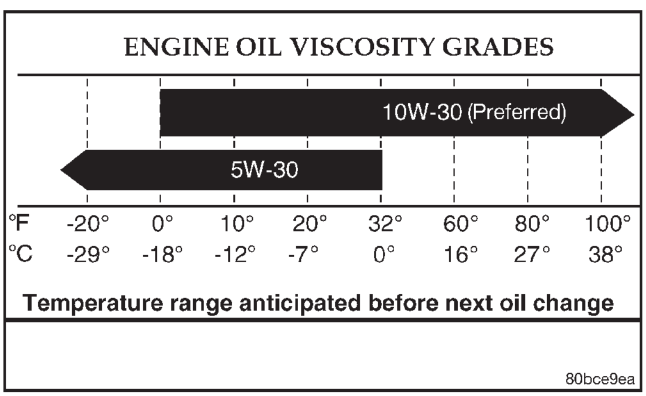


Fig. 13 Temperature/Engine Oil Viscosity Recommendation

ENERGY CONSERVING OIL

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

OIL LEVEL INDICATOR (DIPSTICK)

The engine oil level indicator is located at the right front of the engine, left of the generator on 5.9L engines (Fig. 14).

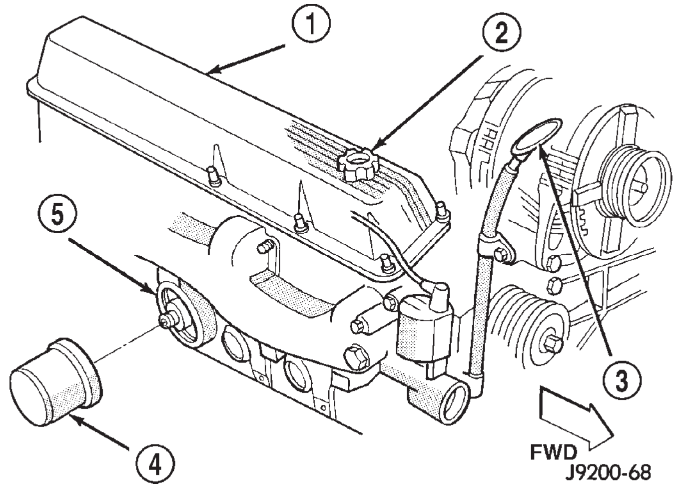


Fig. 14 Engine Oil Dipstick Location—5.9L Engines

1 – CYLINDER HEAD COVER
2 – ENGINE OIL FILL-HOLE CAP
3 – DIPSTICK
4 – ENGINE OIL FILTER
5 – FILTER BOSS

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, oil foaming and oil pressure loss can result.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

(5) Remove dipstick, with handle held above the tip, take oil level reading.

(6) Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in the Maintenance Schedule. This information can be found in your owner's manual.

TO CHANGE ENGINE OIL

Run engine until achieving normal operating temperature.

SERVICE PROCEDURES (Continued)

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE OIL FILTER CHANGE

FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar or equivalent oil filter be used.

OIL FILTER REMOVAL

(1) Position a drain pan under the oil filter.

(2) Using a suitable oil filter wrench loosen filter.

(3) Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss (Fig. 15).

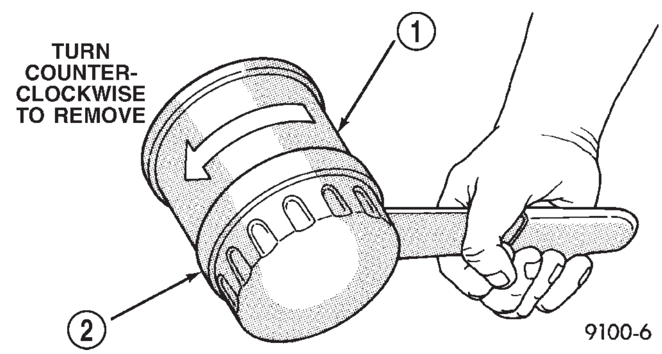


Fig. 15 Oil Filter Removal—Typical

1 – ENGINE OIL FILTER
2 – OIL FILTER WRENCH

(4) When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(5) With a wiping cloth, clean the gasket sealing surface (Fig. 16) of oil and grime.

OIL FILTER INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil or chassis grease.

(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 16) hand tighten filter one full turn, do not over tighten.

(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

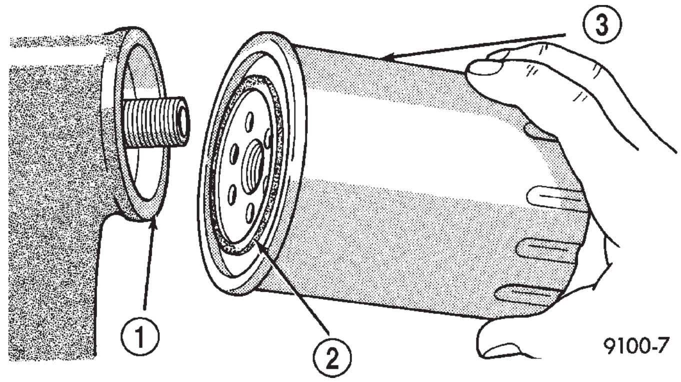


Fig. 16 Oil Filter Sealing Surface—Typical

1 – SEALING SURFACE
2 – RUBBER GASKET
3 – OIL FILTER

REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

CYLINDER BORE—HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

(1) Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

SERVICE PROCEDURES (Continued)

(2) Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.

CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

(3) Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings (Fig. 17).

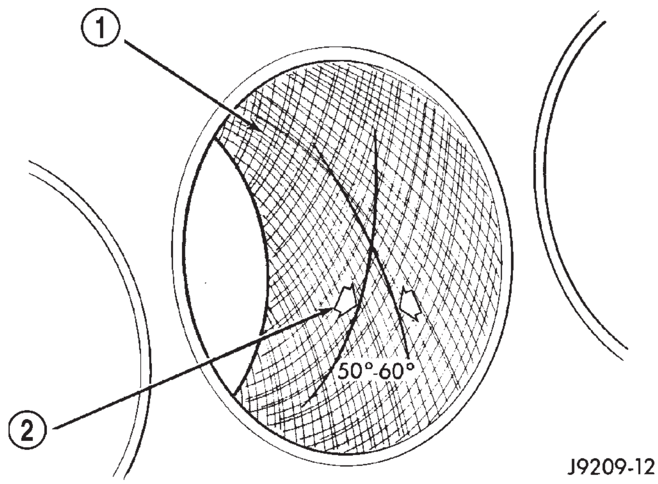


Fig. 17 Cylinder Bore Crosshatch Pattern

1 – CROSSHATCH PATTERN
2 – INTERSECT ANGLE

(4) A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.

(5) After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

HYDROSTATIC LOCK

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Perform the Fuel Pressure Release Procedure (refer to Group 14, Fuel System).

(2) Disconnect the battery negative cable.

(3) Inspect air cleaner, induction system and intake manifold to ensure system is dry and clear of foreign material.

(4) Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the plugs from the engine.

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

(5) With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.

(6) Identify the fluid in the cylinders (i.e. coolant, fuel, oil, etc.).

(7) Make sure all fluid has been removed from the cylinders.

(8) Repair engine or components as necessary to prevent this problem from occurring again.

(9) Squirt engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.

(10) Install new spark plugs.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil.

(15) Connect the negative cable to the battery.

(16) Start the engine and check for any leaks.

VALVE TIMING

(1) Turn crankshaft until the No.6 exhaust valve is closing and No.6 intake valve is opening.

(2) Insert a 6.350 mm (1/4 inch) spacer between rocker arm pad and stem tip of No.1 intake valve. Allow spring load to bleed tappet down giving in effect a solid tappet.

(3) Install a dial indicator so plunger contacts valve spring retainer as nearly perpendicular as possible. Zero the indicator.

(4) Rotate the crankshaft clockwise (normal running direction) until the valve has lifted 0.863 mm (0.034 inch). The timing of the crankshaft should now read from 10° before top dead center to 2° after top dead center. Remove spacer.

CAUTION: DO NOT turn crankshaft any further clockwise as valve spring might bottom and result in serious damage.

If reading is not within specified limits:

- Check sprocket index marks.
- Inspect timing chain for wear.
- Check accuracy of DC mark on timing indicator.

SERVICE PROCEDURES (Continued)

VALVE SERVICE

VALVE CLEANING

Clean valves thoroughly. Discard burned, warped and cracked valves.

Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

VALVE INSPECTION

Measure valve stems for wear. If wear exceeds 0.051 mm (0.002 inch), replace the valve.

VALVE GUIDES

Measure valve stem guide clearance as follows:

(1) Install Valve Guide Sleeve Tool C-3973 over valve stem and install valve (Fig. 18). The special sleeve places the valve at the correct height for checking with a dial indicator.

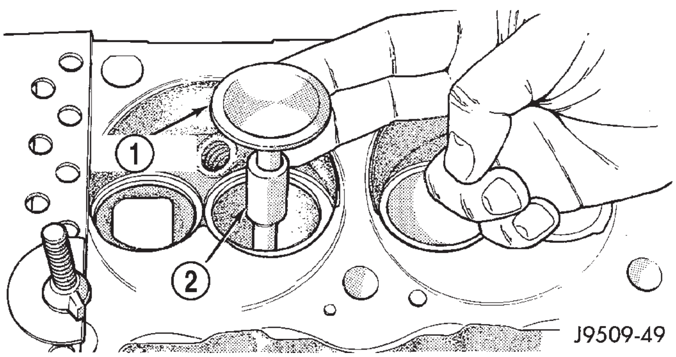


Fig. 18 Positioning Valve with Tool C-3973

1 – VALVE
2 – SPACER TOOL

(2) Attach Dial Indicator Tool C-3339 to cylinder head and set it at right angle of valve stem being measured (Fig. 19).

(3) Move valve to and from the indicator. The total dial indicator reading should not exceed 0.432 mm (0.017 inch). Ream the guides for valves with oversize stems if dial indicator reading is excessive or if the stems are scuffed or scored.

Service valves with oversize stems are available as shown below.

Slowly turn reamer by hand and clean guide thoroughly before installing new valve. **Ream the valve guides from standard to 0.381 mm (0.015 inch). Use a 2 step procedure so the valve guides are reamed true in relation to the valve seat:**

- Step 1—Ream to 0.0763 mm (0.003 inch).
- Step 2—Ream to 0.381 mm (0.015 inch).

REFACING VALVES AND VALVE SEATS

The intake and exhaust valves have a 43-1/4° to 43-3/4° face angle and a 44-1/4° to 44-3/4° seat angle (Fig. 20).

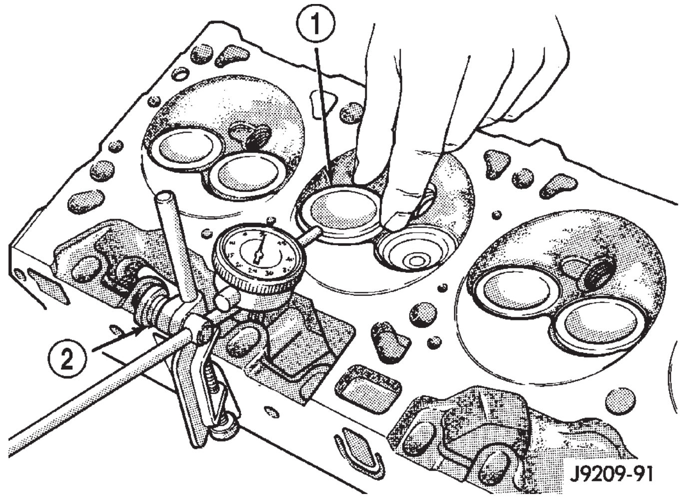


Fig. 19 Measuring Valve Guide Wear

1 – VALVE
2 – SPECIAL TOOL C-3339

REAMER SIZES

REAMER O/S	VALVE GUIDE SIZE
0.076 mm (0.003 in.)	8.026 - 8.052 mm (0.316 - 0.317 in.)
0.381 mm (0.015 in.)	8.331 - 8.357 mm (0.328 - 0.329 in.)

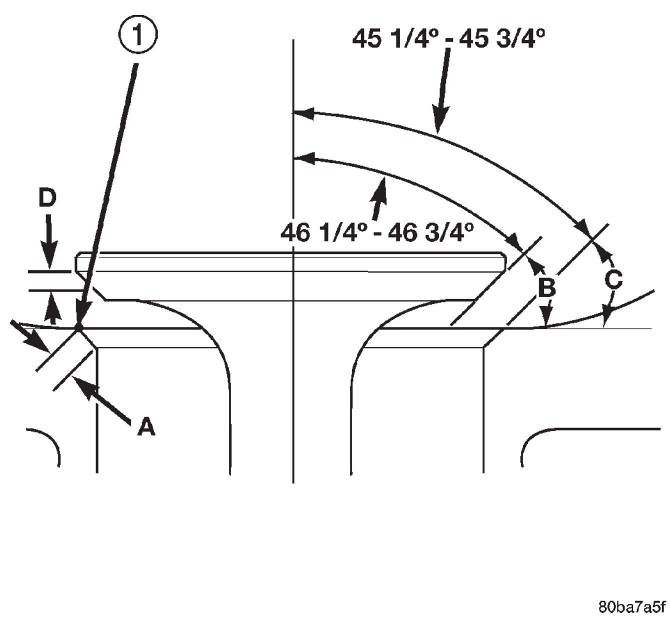


Fig. 20 Valve Face and Seat Angles

1 – CONTACT POINT

SERVICE PROCEDURES (Continued)

VALVE FACE AND VALVE SEAT ANGLE CHART

ITEM	DESCRIPTION	SPECIFICATION
A	SEAT WIDTH– INTAKE	1.016 - 1.524 mm (0.040 - 0.060 in.)
	SEAT WIDTH– EXHAUST	1.524 - 2.032 mm (0.060 - 0.080 in.)
B	FACE ANGLE (INT. and EXT.)	43¼° - 43¾°
C	SEAT ANGLE (INT. and EXT.)	44¼° - 44¾°
D	CONTACT SURFACE	—

VALVES

Inspect the remaining margin after the valves are refaced (Fig. 21). Valves with less than 1.190 mm (0.047 inch) margin should be discarded.

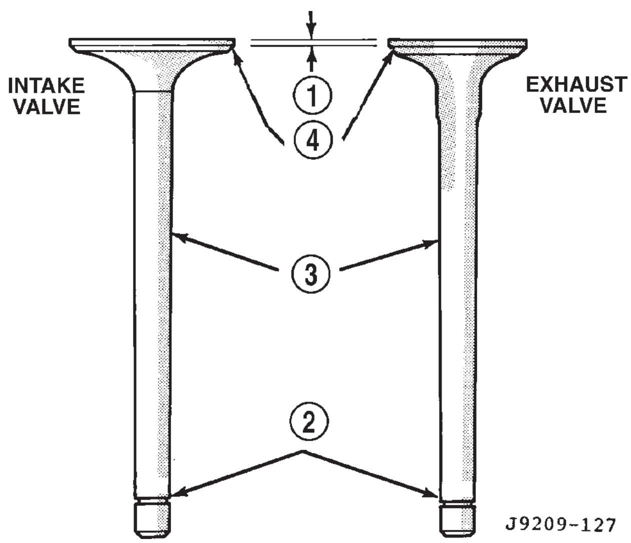


Fig. 21 Intake and Exhaust Valves

1 – MARGIN
2 – VALVE SPRING RETAINER LOCK GROOVE
3 – STEM
4 – FACE

VALVE SEATS

CAUTION: DO NOT un-shroud valves during valve seat refacing (Fig. 22).

(1) When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

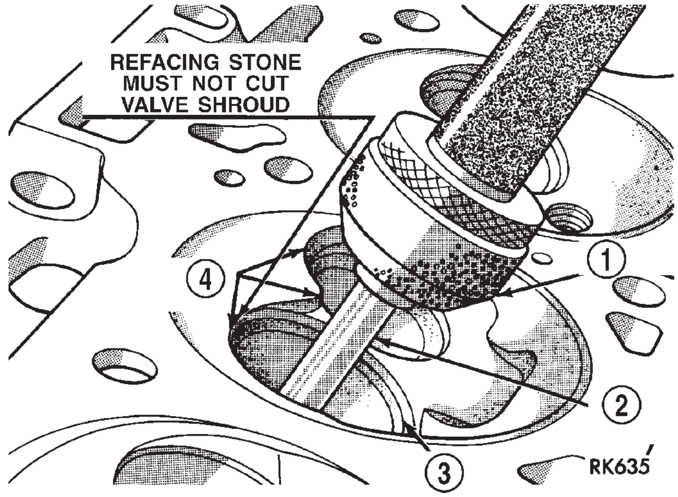


Fig. 22 Refacing Valve Seats

1 – STONE
2 – PILOT
3 – VALVE SEAT
4 – SHROUD

(2) Measure the concentricity of valve seat using a dial indicator. Total runout should not exceed 0.051 mm (0.002 inch) total indicator reading.

(3) Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to the top edge of valve face, lower valve seat with a 15° stone. If the blue is transferred to bottom edge of valve face raise valve seat with a 60° stone.

(4) When seat is properly positioned the width of intake seats should be 1.016-1.524 mm (0.040-0.060 inch). The width of the exhaust seats should be 1.524-2.032 mm (0.060-0.080 inch).

VALVE SPRING INSPECTION

Whenever valves have been removed for inspection, reconditioning or replacement, valve springs should be tested. As an example the compression length of the spring to be tested is 1-5/16 inch. Turn table of Universal Valve Spring Tester Tool until surface is in line with the 1-5/16 inch mark on the threaded stud. Be sure the zero mark is to the front (Fig. 23). Place spring over stud on the table and lift compressing lever to set tone device. Pull on torque wrench until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by 2. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to specifications to obtain specified height and allowable tensions. Discard the springs that do not meet specifications.

SERVICE PROCEDURES (Continued)

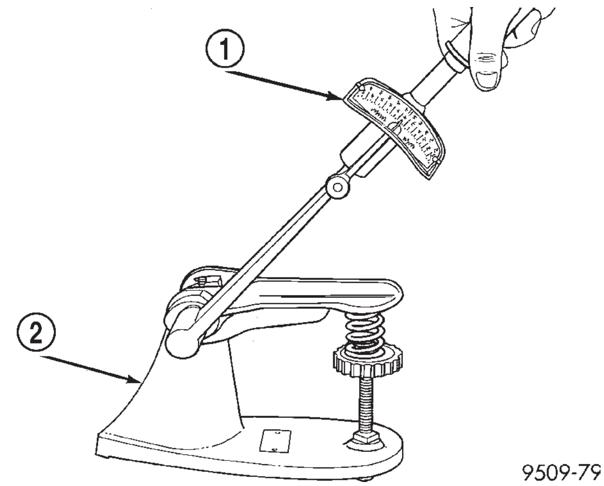


Fig. 23 Testing Valve Spring for Compressed Length

1 – TORQUE WRENCH
2 – VALVE SPRING TESTER

MEASURING TIMING CHAIN STRETCH

NOTE: To access timing chain Refer to Timing Chain Cover in Removal and Installation Section.

(1) Place a scale next to the timing chain so that any movement of the chain may be measured.

(2) Place a torque wrench and socket over camshaft sprocket attaching bolt. Apply torque in the direction of crankshaft rotation to take up slack; 41 N·m (30 ft. lbs.) torque with cylinder head installed or 20 N·m (15 ft. lbs.) torque with cylinder head removed. With a torque applied to the camshaft sprocket bolt, crankshaft should not be permitted to move. It may be necessary to block the crankshaft to prevent rotation.

(3) Hold a scale with dimensional reading even with the edge of a chain link. With cylinder heads installed, apply 14 N·m (30 ft. lbs.) torque in the reverse direction. With the cylinder heads removed, apply 20 N·m (15 ft. lbs.) torque in the reverse direction. Note the amount of chain movement (Fig. 24).

(4) Install a new timing chain, if its movement exceeds 3.175 mm (1/8 inch).

(5) If chain is not satisfactory, remove camshaft sprocket attaching bolt and remove timing chain with crankshaft and camshaft sprockets.

(6) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(7) Place timing chain around both sprockets.

(8) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

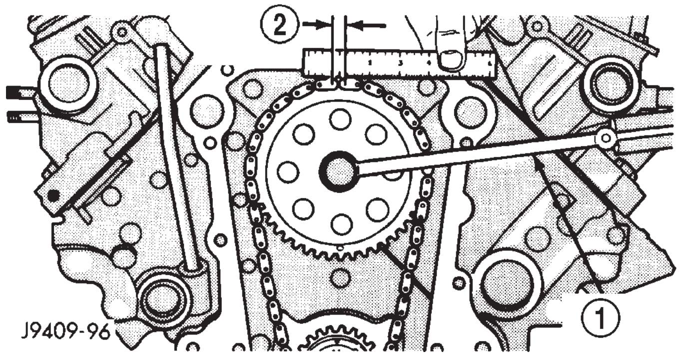


Fig. 24 Measuring Timing Chain Wear and Stretch

1 – TORQUE WRENCH
2 – 3.175 MM (0.125 IN.)

(9) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(10) Slide both sprockets evenly over their respective shafts and use a straightedge to check alignment of timing marks (Fig. 25).

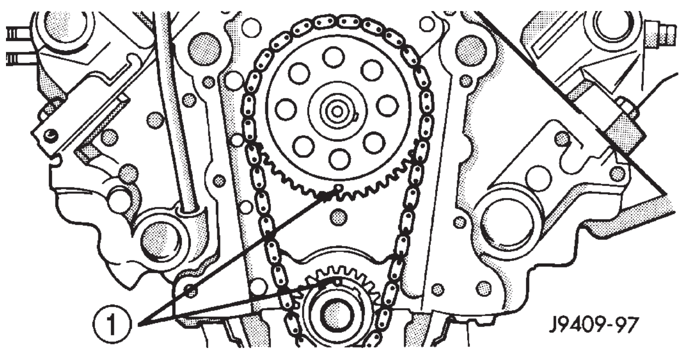


Fig. 25 Alignment of Timing Marks

1 – TIMING MARKS

(11) Install the camshaft bolt. Tighten the bolt to 47 N·m (35 ft. lbs.) torque.

(12) Check camshaft end play. The end play should be 0.051-0.152 mm (0.002-0.006 inch) with a new thrust plate and up to 0.254 mm (0.010 inch) with a used thrust plate. If not within these limits install a new thrust plate.

PISTONS—FITTING

Piston and cylinder wall must be clean and dry. Specified clearance between the piston and the cylinder wall is 0.013-0.038 mm (0.0005-0.0015 inch) at 21°C (70°F).

Piston diameter should be measured at the top of skirt, 90° to piston pin axis. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line.

Pistons and cylinder bores should be measured at normal room temperature, 21°C (70°F).

SERVICE PROCEDURES (Continued)

Check the pistons for taper and elliptical shape before they are fitted into the cylinder bore (Fig. 26).

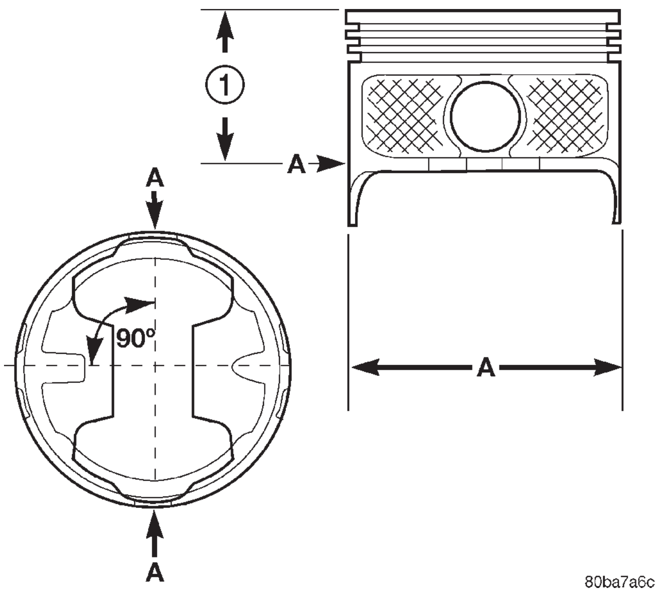


Fig. 26 Piston Measurements

1 – 49.53 mm (1.95 IN.)

PISTON RINGS—FITTING

(1) Measurement of end gaps:

(a) Measure piston ring gap 2 inches from bottom of cylinder bore. An inverted piston can be used to push the rings down to ensure positioning rings squarely in the cylinder bore before measuring.

(b) Insert feeler gauge in the gap. The top compression ring gap should be between 0.254-0.508 mm (0.010-0.020 inch). The second compression ring gap should be between 0.508-0.762 mm (0.020-0.030 inch). The oil ring gap should be 0.254-1.270 mm (0.010-0.050 inch).

(c) Rings with insufficient end gap may be properly filed to the correct dimension. Rings with excess gaps should not be used.

(2) Install rings and confirm ring side clearance:

(a) Install oil rings being careful not to nick or scratch the piston. Install the oil control rings according to instructions in the package. It is not necessary to use a tool to install the upper and lower rails. Insert oil rail spacer first, then side rails.

(b) Install the second compression rings using Installation Tool C-4184. The compression rings must be installed with the identification mark face up (toward top of piston) and chamfer facing down. An identification mark on the ring is a drill point, a stamped letter "O", an oval depression or the word TOP (Fig. 27) (Fig. 29).

PISTON MEASUREMENT CHART

PISTON SIZE	A DIA = PISTON DIAMETER		BORE DIAMETER	
	MIN. mm (in.)	MAX. mm (in.)	MIN. mm (in.)	MAX. mm (in.)
A	—	—	—	—
B	101.580 (3.9992)	101.592 (3.9997)	101.605 (4.0002)	101.618 (4.0007)
C	101.592 (3.9997)	101.605 (4.0002)	101.618 (4.0007)	101.630 (4.0012)
D	101.605 (4.0002)	101.618 (4.0007)	101.630 (4.0012)	101.643 (4.0017)
E	—	—	—	—

DESCRIPTION	SPECIFICATION
PISTON PIN BORE	25.007 - 25.015 mm (.9845 -.9848 in.)
RING GROOVE HEIGHT	
OIL RAIL	4.033 - 4.058 mm (.1588 -.1598 in.)
COMPRESSION RAIL	1.529 - 1.554 mm (.0602 -.0612 in.)
TOTAL FINISHED WEIGHT	470.8 ± 2 grams (16.607 ±.0706 ounces)

(c) Using a ring installer, install the top compression ring with the chamfer facing up (Fig. 28) (Fig. 29). An identification mark on the ring is a drill point, a stamped letter "O", an oval depression or the word TOP facing up.

(d) Measure side clearance between piston ring and ring land. Clearance should be 0.074-0.097 mm (0.0029-0.0038 inch) for the compression rings. The steel rail oil ring should be free in groove, but should not exceed 0.246 mm (0.0097 inch) side clearance.

(e) Pistons with insufficient or excessive side clearance should be replaced.

SERVICE PROCEDURES (Continued)

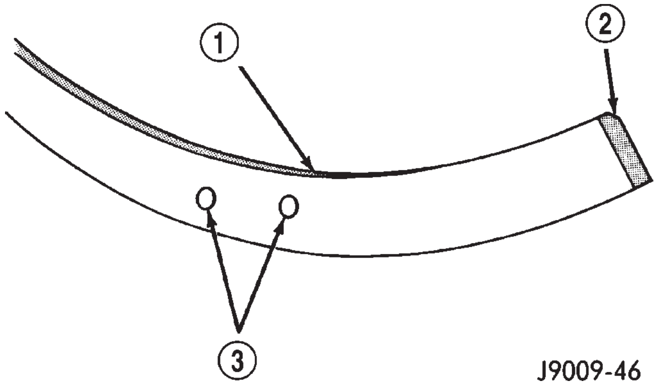


Fig. 27 Second Compression Ring Identification (Typical)

1 – SECOND COMPRESSION RING (BLACK CAST IRON)
2 – CHAMFER
3 – TWO DOTS

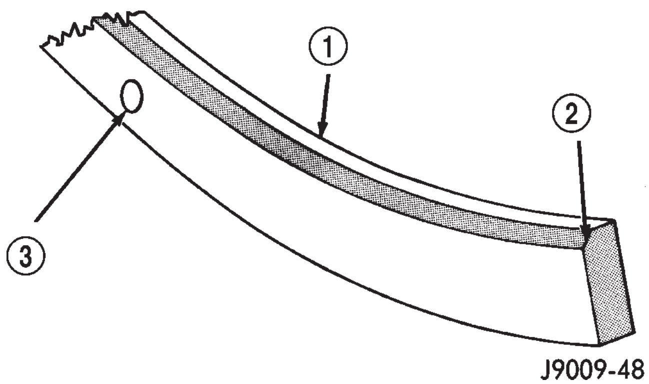


Fig. 28 Top Compression Ring Identification (Typical)

1 – TOP COMPRESSION RING (GRAY IN COLOR)
2 – CHAMFER
3 – ONE DOT

CONNECTING ROD BEARINGS—FITTING

Fit all rods on a bank until completed. DO NOT alternate from one bank to another, because connecting rods and pistons are not interchangeable from one bank to another.

The bearing caps are not interchangeable and should be marked at removal to ensure correct assembly.

Each bearing cap has a small V-groove across the parting face. When installing the lower bearing shell, make certain that the V-groove in the shell is in line with the V-groove in the cap. This provides lubrication of the cylinder wall in the opposite bank.

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

Limits of taper or out-of-round on any crankshaft journals should be held to 0.025 mm (0.001 inch).

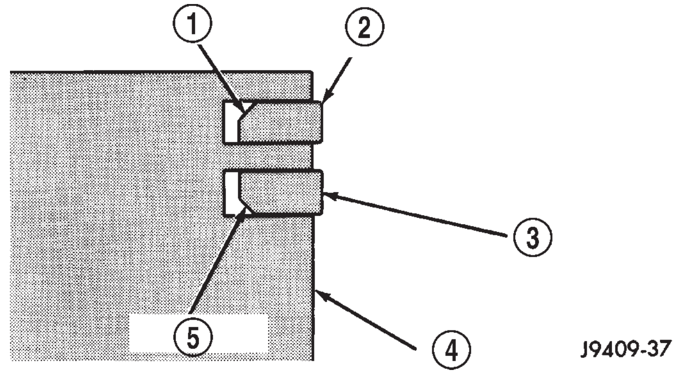


Fig. 29 Compression Ring Chamfer Location (Typical)

1 – CHAMFER
2 – TOP COMPRESSION RING
3 – SECOND COMPRESSION RING
4 – PISTON
5 – CHAMFER

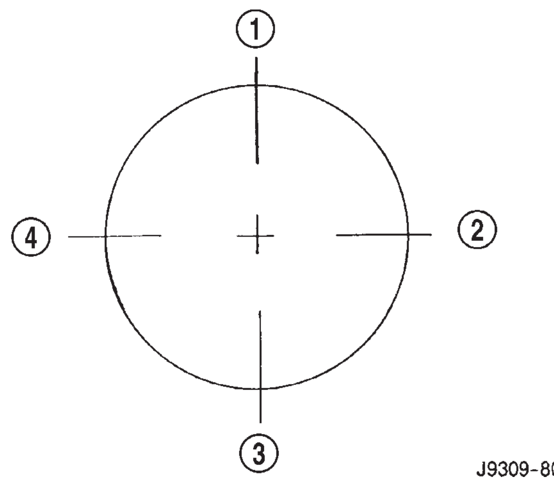


Fig. 30 Proper Ring Installation

1 – OIL RING SPACER GAP
2 – SECOND COMPRESSION RING GAP OIL RING RAIL GAP (TOP)
3 – OIL RING RAIL GAP (BOTTOM)
4 – TOP COMPRESSION RING GAP

Bearings are available in 0.025 mm (0.001 inch), 0.051 mm (0.002 inch), 0.076 mm (0.003 inch), 0.254 mm (0.010 inch) and 0.305 mm (0.012 inch) undersize. **Install the bearings in pairs. DO NOT use a new bearing half with an old bearing half. DO NOT file the rods or bearing caps.**

CRANKSHAFT MAIN BEARINGS—FITTING

Bearing caps are not interchangeable and should be marked at removal to ensure correct assembly. Upper and lower bearing halves are NOT interchangeable. Lower main bearing halves of No.2 and 4 are interchangeable.

SERVICE PROCEDURES (Continued)

Upper and lower No.3 bearing halves are flanged to carry the crankshaft thrust loads. They are NOT interchangeable with any other bearing halves in the engine (Fig. 31). Bearing shells are available in standard and the following undersizes: 0.25 mm (0.001 inch), 0.051 mm (0.002 inch), 0.076 mm (0.003 inch), 0.254 mm (0.010 inch) and 0.305 mm (0.012 inch). Never install an undersize bearing that will reduce clearance below specifications.

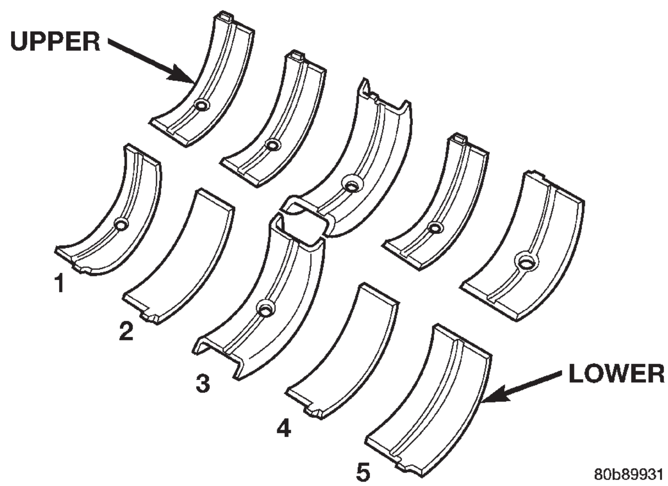


Fig. 31 Main Bearing Identification

REMOVAL AND INSTALLATION

ENGINE FRONT MOUNTS

REMOVAL—2WD

(1) Disconnect the negative cable from the battery.

(2) Raise hood and position fan to assure clearance for radiator top tank and hose.

CAUTION: DO NOT lift the engine by the intake manifold.

(3) Install engine lifting fixture.

(4) Raise vehicle on hoist.

(5) Remove the insulator through bolt (Fig. 32) (Fig. 33).

(6) Raise engine with lifting fixture SLIGHTLY. Remove insulator retaining bolts and remove the insulator assembly.

(7) Remove insulator heat shield and transfer to new insulator.

INSTALLATION—2WD

(1) With the engine raised SLIGHTLY, position insulator assembly onto the engine block and install bolts (Fig. 32) (Fig. 33). Tighten the bolts to 41 N·m (30 ft. lbs.) torque.

(2) Lower engine with lifting fixture while guiding insulator assembly into the engine insulator bracket (Fig. 34).

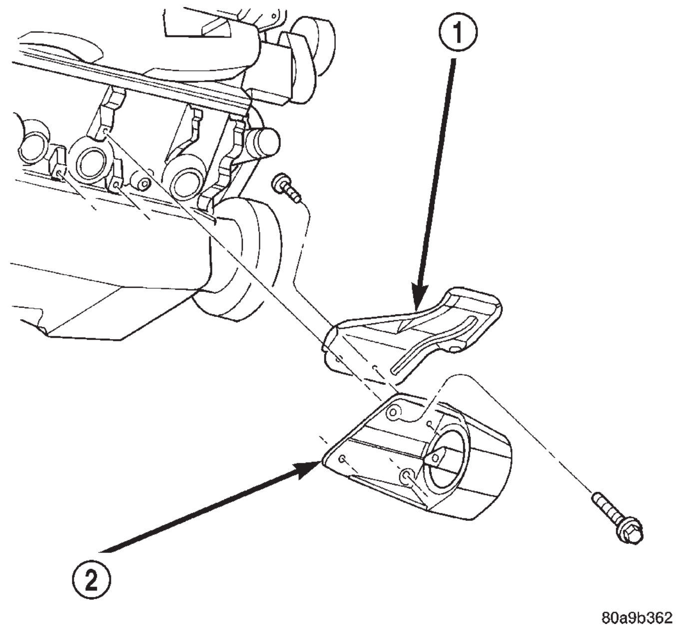


Fig. 32 Engine Right Front Insulator Mount—2WD Vehicles

1 – HEAT SHIELD
2 – INSULATOR

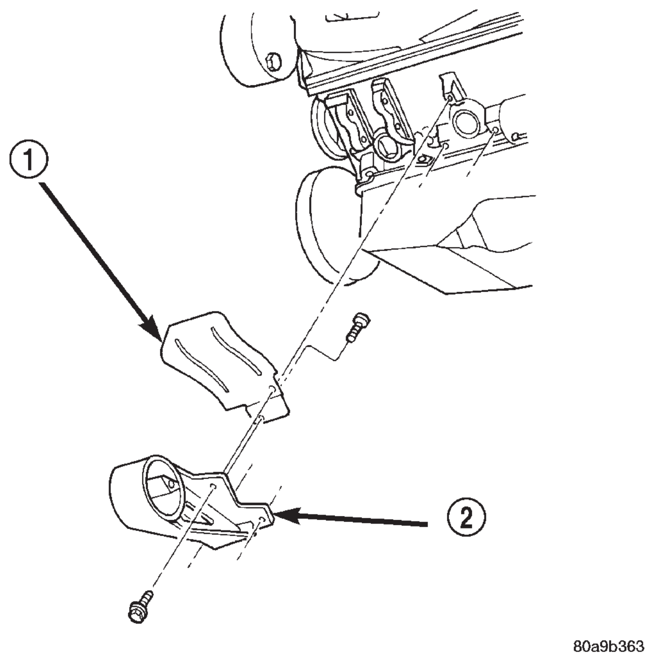


Fig. 33 Engine Left Front Insulator Mount—2WD Vehicles

1 – HEAT SHIELD
2 – INSULATOR

(3) Install insulator to bracket thru-bolt. Tighten the thru-bolt nut to 68 N·m (50 ft. lbs.) torque.

(4) Remove lifting fixture.

(5) Connect the negative cable to the battery.

REMOVAL AND INSTALLATION (Continued)

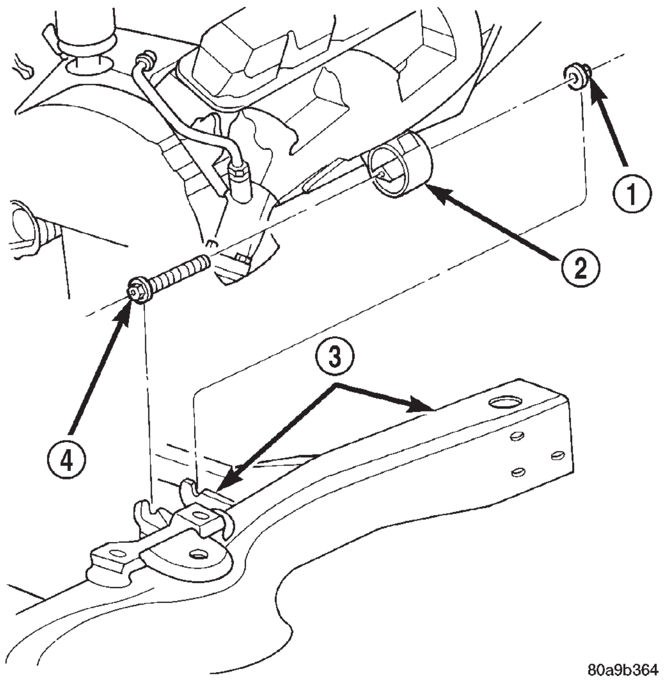


Fig. 34 Engine Mount Insulator at Frame

1 – NUT
2 – INSULATOR
3 – FRAME
4 – THROUGH BOLT

REMOVAL—4WD

On 4WD vehicles the engine front support brackets attach directly to engine block and the axle housing. The brackets provide a solid interconnection for these units (Fig. 35) (Fig. 36). Engine must be supported during any service procedures involving the front support assemblies.

(1) Disconnect the negative cable from the battery.

(2) Raise vehicle on hoist.

(3) Install engine lifting (support) fixture.

(4) Remove front axle. (Refer to Group 3, Differential and Driveline in this publication.)

(5) **Left mount insulator only.** Remove starter wires and starter motor assembly.

(6) Remove insulator to frame through bolt (Fig. 37).

(7) Raise engine slightly.

(8) Remove upper insulator to support bracket stud nut and insulator to support through bolt.

(9) Remove engine mount insulator. (Fig. 35) (Fig. 36).

(10) If engine support bracket is to be removed/replaced, remove support bracket to transmission bell housing bolt(s) and three (3) support bracket to engine block bolts. Remove support bracket (Fig. 35) (Fig. 36).

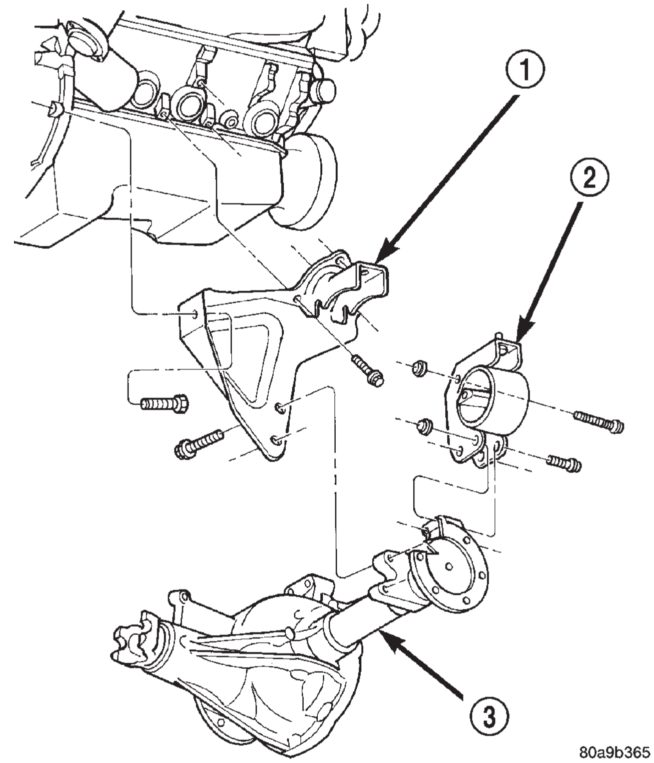


Fig. 35 Right Engine Mount Insulator and Support Bracket—4WD Vehicles

1 – ENGINE SUPPORT BRACKET
2 – INSULATOR
3 – FRONT AXLE

INSTALLATION—4WD

(1) If engine support brackets were removed, install them and their fasteners (Fig. 35) (Fig. 36). Tighten support bracket to block bolts to 41 N·m (30 ft. lbs.). Tighten support bracket to transmission bell-housing bolt(s) to 88 N·m (65 ft. lbs.).

(2) Install Engine mount insulator and tighten insulator to support bracket nut to 41 N·m (30 ft. lbs.). Tighten insulator to support bracket through bolt nut to 102 N·m (75 ft. lbs.).

(3) Lower engine and install insulator to frame through bolt and nut (Fig. 37). Tighten nut to 95 N·m (70 ft. lbs.).

(4) Install starter motor and mounting bolts. Tighten bolts to 68 N·m (50 ft. lbs.).

(5) Connect starter wires.

(6) Remove engine lifting (support) fixture.

(7) Install front axle assembly. (Refer to Group 3, Differential and Driveline)

(8) Lower the vehicle.

(9) Connect the negative cable to the battery.

REMOVAL AND INSTALLATION (Continued)

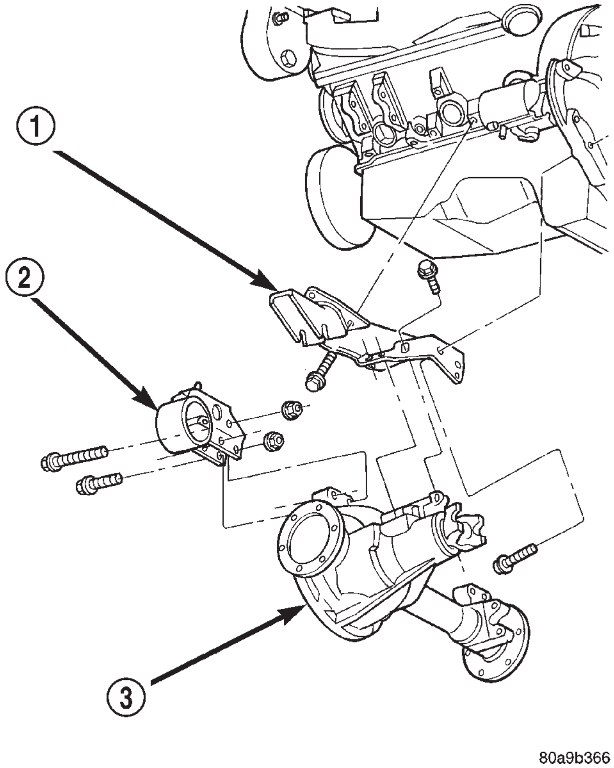


Fig. 36 Left Engine Mount Insulator and Support Bracket—4WD Vehicles

1 – ENGINE SUPPORT BRACKET
2 – INSULATOR
3 – FRONT AXLE

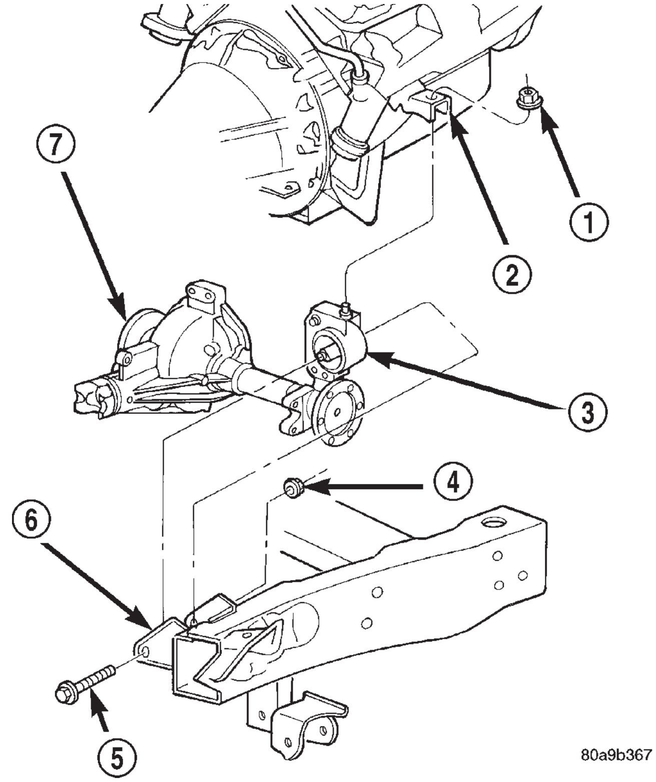


Fig. 37 Engine Mount Insulator at Frame—4WD Vehicles

1 – NUT
2 – ENGINE SUPPORT BRACKET
3 – INSULATOR
4 – NUT
5 – THROUGH BOLT
6 – FRAME
7 – FRONT AXLE

ENGINE REAR SUPPORT

REMOVAL—2WD

(1) Disconnect the negative cable from the battery.
(2) Raise the vehicle on a hoist.
(3) Support the transmission with a jack.
(4) Remove engine support bracket and insulator thru-bolt (Fig. 38).
(5) Raise the transmission and engine slightly.
(6) Remove stud nuts attaching insulator to cross-member (Fig. 38). Remove insulator.

INSTALLATION—2WD

(1) If the engine support bracket was removed, position the bracket to the transmission extension (Fig. 38). Tighten the bolts to 68 N·m (50 ft. lbs.) torque.
(2) Install the insulator onto crossmember. Tighten the stud nuts to 41 N·m (30 ft. lbs) torque.
(3) Lower the transmission and engine while aligning the engine support bracket to the insulator.
(4) Install thru-bolt in bracket and insulator. Tighten thru-bolt nut to 68 N·m (50 ft. lbs.) torque.
(5) Remove transmission jack.
(6) Lower the vehicle.
(7) Connect the negative cable to the battery.

REMOVAL—4WD

(1) Disconnect the negative cable from the battery.
(2) Raise the vehicle on a hoist.
(3) Support the transmission with a transmission jack.
(4) Remove stud nuts holding the insulator to the crossmember (Fig. 39).
(5) Raise rear of transmission SLIGHTLY.
(6) Remove bolts holding the insulator to the insulator bracket (Fig. 39). Remove the insulator.

INSTALLATION—4WD

(1) If the insulator bracket was removed, install the bracket to the transmission (Fig. 39). Tighten the bolts to 28 N·m (250 in. lbs.) torque.
(2) Install the bolts holding insulator to insulator bracket. Tighten the bolts to 28 N·m (250 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

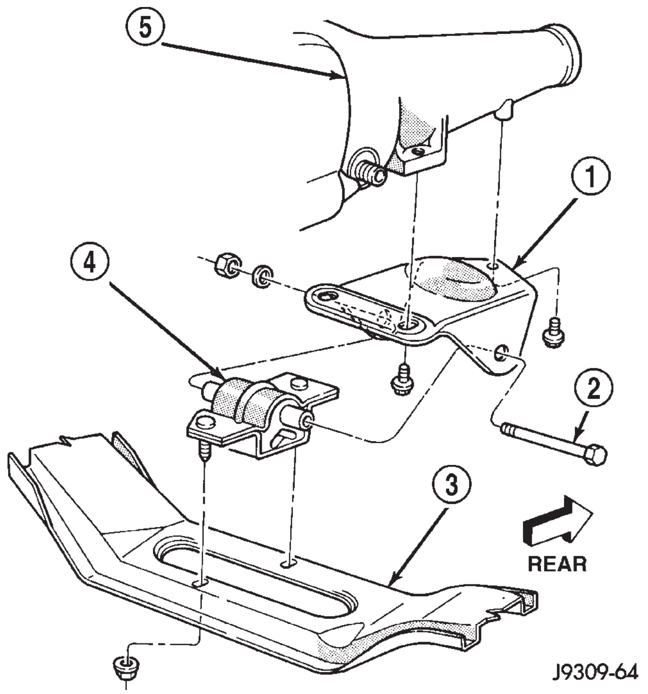


Fig. 38 Rear Insulator—2WD Vehicles

1 – ENGINE SUPPORT BRACKET
2 – THROUGH BOLT
3 – CROSSMEMBER
4 – INSULATOR
5 – TRANSMISSION EXTENSION

(3) Lower rear of transmission while aligning the insulator studs into the mounting support bracket. Install stud nuts and tighten to 28 N·m (250 in. lbs.) torque.

(4) Remove the transmission jack.

(5) Lower the vehicle.

(6) Connect the negative cable to the battery.

ENGINE ASSEMBLY

REMOVAL

(1) Scribe hood hinge outlines on hood. Remove the hood.

(2) Remove the battery.

(3) Drain cooling system. Refer to COOLING SYSTEM.

(4) Remove the air cleaner assembly and air inlet hose.

(5) Disconnect the radiator and heater hoses.

(6) Set fan shroud aside.

(7) Remove the vacuum lines.

(8) Remove the distributor cap and wiring.

(9) Disconnect the accelerator linkage.

(10) Remove throttle body.

(11) Perform the Fuel System Pressure release procedure. Refer to FUEL SYSTEM.

(12) Disconnect the fuel lines.

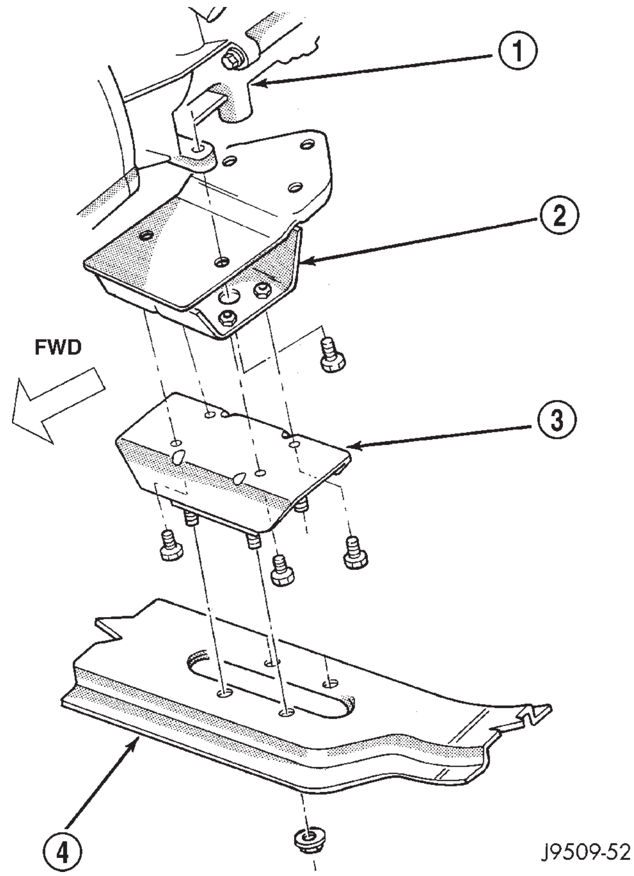


Fig. 39 Rear Insulator—4WD Vehicles

1 – AUTOMATIC TRANSMISSION
2 – INSULATOR BRACKET
3 – INSULATOR
4 – CROSSMEMBER

(13) Disconnect the starter wires.

(14) Disconnect the oil pressure wire.

(15) Discharge the air conditioning system, if equipped. Refer to HEATING and AIR CONDITIONING.

(16) Disconnect the air conditioning hoses.

(17) Disconnect the power steering hoses, if equipped.

(18) Remove starter motor. Refer to STARTING SYSTEMS.

(19) Remove the generator.

(20) Raise and support the vehicle on a hoist.

(21) Disconnect exhaust pipe at manifold.

(22) Remove Transmission. Refer to TRANSMISSIONS.

CAUTION: DO NOT lift the engine by the intake manifold.

(23) Install an engine lifting fixture.

(24) **2WD VEHICLES** —Remove engine front mount bolts.

REMOVAL AND INSTALLATION (Continued)

(25) **4WD VEHICLES** —The engine and front driving axle (engine/axle/transmission) are connected through insulators and support brackets. Separate the engine as follows:

- **LEFT SIDE** —Remove 2 bolts attaching (engine/pinion nose/transmission) bracket to transmission bell housing. Remove 2 bracket to pinion nose adaptor bolts. Separate engine from insulator by removing upper nut washer assembly and bolt from engine support bracket.
- **RIGHT SIDE** —Remove 2 bracket to axle (disconnect housing) bolts and a bracket to bell housing bolt. Separate engine from insulator by removing upper nut washer assembly and bolt from engine support bracket.

(26) Lower the vehicle.

(27) Install engine assembly on engine repair stand.

INSTALLATION

(1) Remove engine from the repair stand and position in the engine compartment.

(2) Install an engine support fixture.

(3) Raise and support the vehicle on a hoist.

(4) Install the engine front mounts.

(5) Refer to Group, 21 Transmissions for transmission installation

(6) Install the inspection plate.

(7) Remove transmission support.

(8) Install exhaust pipe to manifold.

(9) Lower the vehicle.

(10) Remove engine lifting fixture.

(11) Install the generator.

(12) Install starter motor.

(13) Connect power steering hoses, if equipped.

(14) Connect air conditioning hoses.

(15) Evacuate and charge the air conditioning system, if equipped.

(16) Using a new gasket, install throttle body. Tighten the throttle body bolts to 23 N·m (200 in. lbs.) torque.

(17) Connect the accelerator linkage.

(18) Connect the starter wires.

(19) Connect the oil pressure wire.

(20) Install the distributor cap and wiring.

(21) Connect the vacuum lines.

(22) Connect the fuel lines.

(23) Install the radiator. Connect the radiator hoses and heater hoses.

(24) Install fan shroud in position.

(25) Fill cooling system.

(26) Install the air cleaner assembly and air inlet hose.

(27) Install the battery.

(28) Warm engine and adjust.

(29) Install hood and line up with the scribe marks.

(30) Road test vehicle.

INTAKE MANIFOLD

REMOVAL

(1) Disconnect the battery negative cable.

(2) Drain the cooling system. Refer to COOLING SYSTEM.

(3) Remove the A/C compressor. Refer to HEATING and AIR CONDITIONING.

(4) Remove the generator. Refer to CHARGING SYSTEM.

(5) Remove the accessory drive bracket.

(6) Remove the air cleaner assembly and air inlet hose.

(7) Perform the fuel pressure release procedure. Refer to FUEL SYSTEM.

(8) Disconnect the fuel supply line from the fuel rail. Refer to FUEL SYSTEM.

(9) Disconnect the accelerator linkage and, if so equipped, the speed control and transmission kickdown cables.

(10) Remove the distributor cap and wires.

(11) Disconnect the coil wires.

(12) Disconnect the coolant temperature sending unit wire.

(13) Disconnect the heater hoses and bypass hose.

(14) Remove the closed crankcase ventilation and evaporation control systems.

(15) Remove intake manifold bolts.

(16) Lift the intake manifold and throttle body out of the engine compartment as an assembly.

(17) Remove and discard the flange side gaskets and the front and rear cross-over gaskets.

(18) Remove the throttle body bolts and lift the throttle body off the intake manifold (Fig. 40). Discard the throttle body gasket.

INSTALLATION

(1) If the plenum pan was removed, position pan gasket and pan.

(2) Install plenum pan retaining bolts. (Fig. 41).

(3) Tighten plenum pan mounting bolts as follows:

- Step 1. Tighten bolts to 5.4 N·m (24 in. lbs.)
- Step 2. Tighten bolts to 9.5 N·m (84 in. lbs.)
- Step 3. Check all bolts are at 9.5 N·m (84 in. lbs.)

(4) Using a new gasket, install the throttle body onto the intake manifold. Tighten the bolts to 23 N·m (200 in. lbs.) torque.

(5) Apply a bead of Mopar Silicone Rubber Adhesive Sealant, or equivalent, to the four corner joints. The sealant bead height should be slightly higher than the cross-over gaskets, approximately 5 mm (0.2

REMOVAL AND INSTALLATION (Continued)

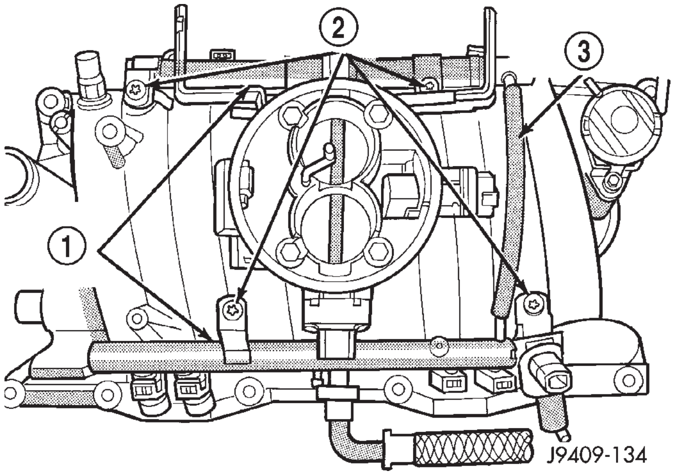


Fig. 40 Throttle Body Assembly

1 – FUEL RAIL ASSEMBLY
2 – FUEL RAIL MOUNTING BOLTS
3 – FUEL RAIL CONNECTING HOSES

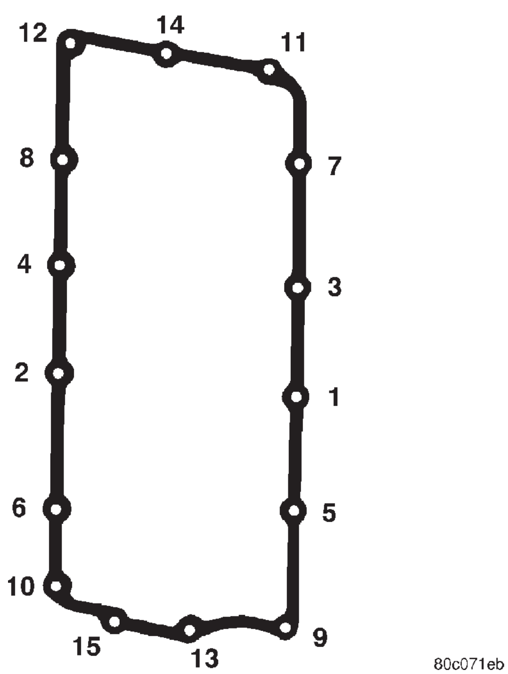


Fig. 41 Plenum Pan Bolt Tightening Sequence

in). An excessive amount of sealant is not required to ensure a leak proof seal, and an excessive amount of sealant may reduce the effectiveness of the flange gasket.

(6) Install the front and rear cross-over gaskets onto the engine (Fig. 42).

(7) Install the flange gaskets. Ensure that the vertical port alignment tab is resting on the deck face of the block. Also the horizontal alignment tabs must be in position with the mating cylinder head gasket tabs (Fig. 43). The words MANIFOLD SIDE should be visible on the center of each flange gasket.

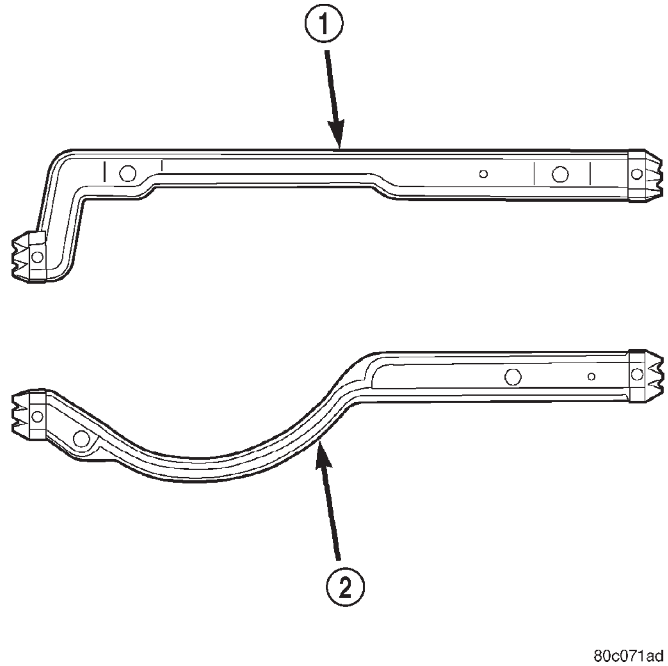


Fig. 42 Cross-Over Gaskets

1 – FRONT CROSS-OVER GASKET
2 – REAR CROSS-OVER GASKET

(8) Carefully lower intake manifold into position on the cylinder block and cylinder heads. long studs at the front and rear of the manifold will help to align the intake manifold. After intake manifold is in place, inspect to make sure seals are in place. Remove alignment studs if used.

(9) The following torque sequence duplicates the expected results of the automated assembly system (Fig. 44).

- Step 1—Tighten bolts 1 thru 4, in sequence, to 8 N·m (72 in. lbs.) torque. Tighten in alternating steps 1.4 N·m (12 in. lbs.) torque at a time.
- Step 2—Tighten bolts 5 thru 12, in sequence, to 8 N·m (72 in. lbs.) torque.
- Step 3—Check that all bolts are tightened to 8 N·m (72 in. lbs.) torque.
- Step 4—Tighten all bolts, in sequence, to 16 N·m (12 ft. lbs.) torque.
- Step 5—Check that all bolts are tightened to 16 N·m (12 ft. lbs.) torque.

(10) Install closed crankcase ventilation and evaporation control systems.

(11) Install the coil wires.

(12) Connect the coolant temperature sending unit wire.

(13) Connect the heater hoses and bypass hose.

(14) Install distributor cap and wires.

(15) Connect the accelerator linkage and, if so equipped, the speed control and transmission kick-down cables.

REMOVAL AND INSTALLATION (Continued)

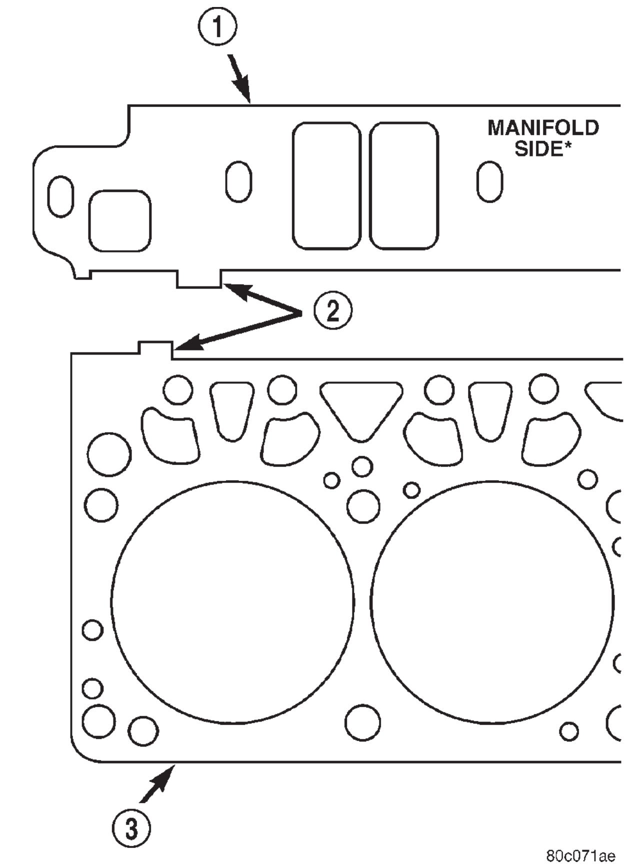


Fig. 43 Intake Manifold Flange Gasket Alignment

1 – FLANGE GASKET
2 – ALIGNMENT TABS
3 – CYLINDER HEAD GASKET

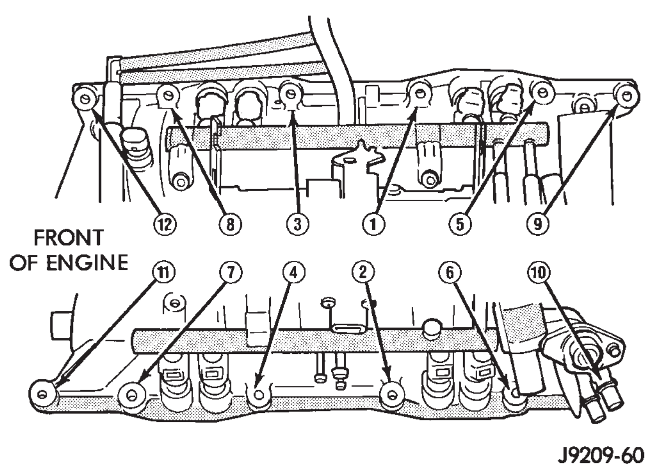


Fig. 44 Intake Manifold Bolt Tightening Sequence—5.9L Engine

(16) Install the fuel supply line to the fuel rail.
(17) Install the accessory drive bracket and A/C compressor.
(18) Install the generator and accessory drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque.
(19) Install the air cleaner assembly and air inlet hose.
(20) Fill cooling system.
(21) Connect the battery negative cable.

EXHAUST MANIFOLD

REMOVAL

(1) Disconnect the battery negative cable.
(2) Raise the vehicle.
(3) Remove the exhaust pipe to manifold nuts.
(4) Lower the vehicle.
(5) Remove three nuts, heat shield and washers from the right side exhaust manifold, if necessary (Fig. 45).
(6) Remove two nuts, heat shield and washers from the left side exhaust manifold, if necessary (Fig. 46).
(7) Remove bolts, nuts and washers attaching manifold to cylinder head.
(8) Remove manifold from the cylinder head.

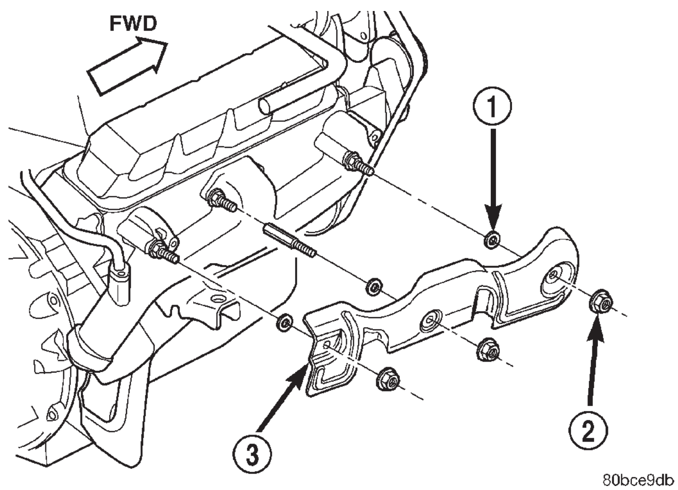


Fig. 45 Exhaust Manifold Heat Shield—Right Side

1 – WASHER
2 – NUT AND WASHER
3 – EXHAUST MANIFOLD HEAT SHIELD

INSTALLATION

CAUTION: If the studs came out with the nuts when removing the exhaust manifold, install new studs.

(1) Position the exhaust manifolds on the two studs located on the cylinder head. Install conical washers and nuts on these studs (Fig. 47).
(2) Install new bolt and washer assemblies in the remaining holes (Fig. 47). Start at the center arm and work outward. Tighten the bolts and nuts to 24 N·m (18 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

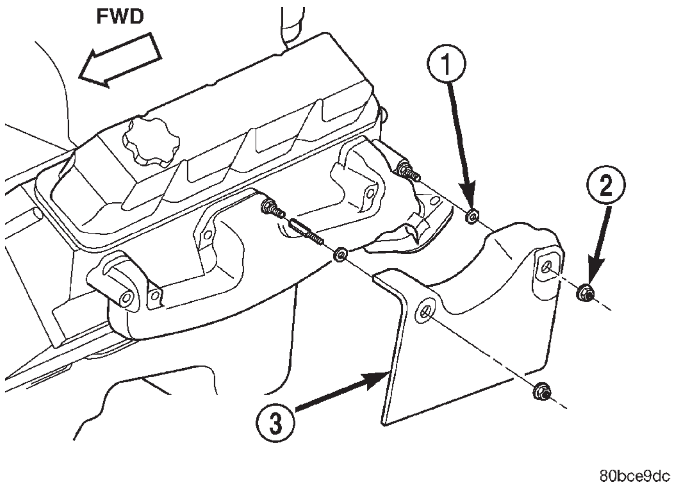


Fig. 46 Exhaust Manifold Heat Shield—Left Side

1 – WASHER
2 – NUT AND WASHER
3 – EXHAUST MANIFOLD HEAT SHIELD

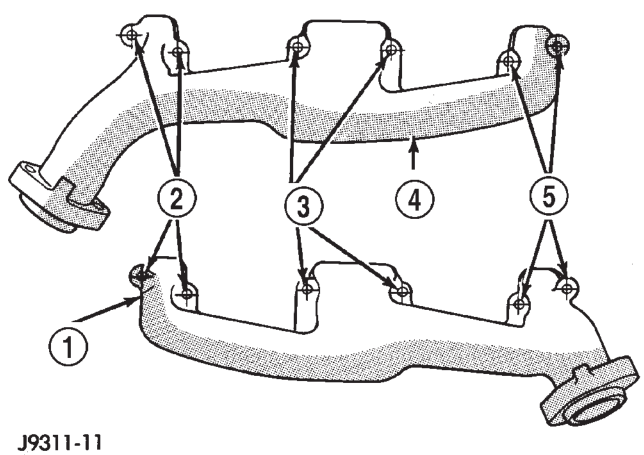


Fig. 47 Exhaust Manifold Installation—5.9L Engine

1 – EXHAUST MANIFOLD (LEFT)
2 – BOLTS & WASHERS
3 – NUTS & WASHERS
4 – EXHAUST MANIFOLD (RIGHT)
5 – BOLTS & WASHERS

(3) Position three washers, heat shield and nuts on the right side exhaust manifold. Tighten nuts to 24 N·m (18 ft. lbs.).

(4) Position two washers, heat shield and nuts on the left side exhaust manifold. Tighten nuts to 24 N·m (18 ft. lbs.).

(5) Raise the vehicle.

(6) Assemble the exhaust pipe to the exhaust manifold and secure with bolts, nuts and washers. Tighten these nuts to 27 N·m (20 ft. lbs.) torque.

(7) Lower the vehicle.

(8) Connect the battery negative cable.

CYLINDER HEAD COVER

A steel backed silicon gasket is used with the cylinder head cover (Fig. 48). This gasket can be used again.

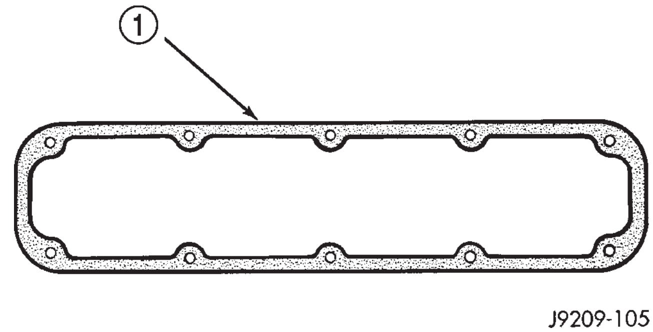


Fig. 48 Cylinder Head Cover Gasket

1 – CYLINDER HEAD COVER GASKET

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Disconnect closed ventilation system and evaporation control system from cylinder head cover.

(3) Remove the air inlet hose.

(4) Remove cylinder head cover and gasket. The gasket may be used again.

INSTALLATION

(1) The cylinder head cover gasket can be used again. Install the gasket onto the head rail.

(2) Position the cylinder head cover onto the gasket. Tighten the bolts to 11 N·m (95 in. lbs.) torque.

(3) Install closed crankcase ventilation system and evaporation control system.

(4) Install the air inlet hose.

(5) Connect the negative cable to the battery.

ROCKER ARMS AND PUSH RODS

REMOVAL

(1) Remove cylinder head cover and gasket. Refer to Cylinder Head Cover in this section for correct procedure.

(2) Remove the rocker arm bolts and pivots (Fig. 49). Place them on a bench in the same order as removed.

(3) Remove the push rods and place them on a bench in the same order as removed.

INSTALLATION

(1) Rotate the crankshaft until the “V8” mark lines up with the TDC mark on the timing chain case cover. This mark is located 147° ATDC from the No.1 firing position.

(2) Install the push rods in the same order as removed.

REMOVAL AND INSTALLATION (Continued)

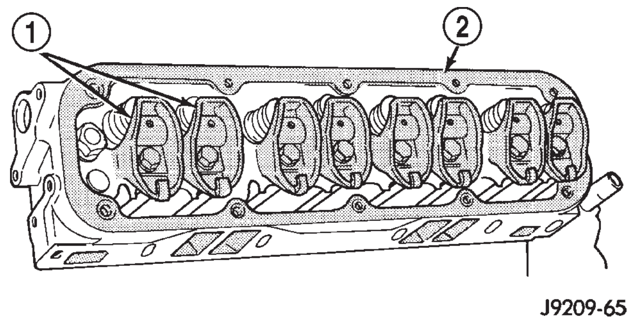


Fig. 49 Rocker Arms

1 – ROCKER ARMS
2 – CYLINDER HEAD

(3) Install rocker arm and pivot assemblies in the same order as removed. Tighten the rocker arm bolts to 28 N·m (21 ft. lbs.) torque.

CAUTION: DO NOT rotate or crank the engine during or immediately after rocker arm installation. Allow the hydraulic roller tappets adequate time to bleed down (about 5 minutes).

(4) Install cylinder head cover.

VALVE SPRING AND STEM SEAL REPLACEMENT-IN VEHICLE

(1) Remove the air cleaner.
(2) Remove cylinder head covers and spark plugs.
(3) Remove coil wire from distributor and secure to good ground to prevent engine from starting.
(4) Using suitable socket and flex handle at crankshaft retaining bolt, turn engine so the No.1 piston is at TDC on the compression stroke.
(5) Remove rocker arms.
(6) With air hose attached to an adapter installed in No.1 spark plug hole, apply 620-689 kPa (90-100 psi) air pressure.
(7) Using Valve Spring Compressor Tool MD-998772A with adaptor 6716A, compress valve spring and remove retainer valve locks and valve spring.
(8) Install seals on the exhaust valve stem and position down against valve guides.
(9) The intake valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as a guide. DO NOT force seal against top of guide. When installing the valve retainer locks, compress the spring only enough to install the locks.
(10) Follow the same procedure on the remaining 7 cylinders using the firing sequence 1-8-4-3-6-5-7-2. Make sure piston in cylinder is at TDC on the valve spring that is being removed.
(11) Remove adapter from the No.1 spark plug hole and install spark plugs.
(12) Install rocker arms.
(13) Install covers and coil wire to distributor.
(14) Install air cleaner.
(15) Road test vehicle.

CYLINDER HEAD

REMOVAL

(1) Disconnect the battery negative cable.
(2) Drain cooling system Refer to COOLING SYSTEM.
(3) Remove the intake manifold-to-generator bracket support rod. Remove the generator.
(4) Remove closed crankcase ventilation system.
(5) Disconnect the evaporation control system.
(6) Remove the air cleaner assembly and air inlet hose.
(7) Perform fuel system pressure release procedure. Refer to FUEL SYSTEM.
(8) Disconnect the fuel supply line.
(9) Disconnect accelerator linkage and if so equipped, the speed control and transmission kickdown cables.
(10) Remove distributor cap and wires.
(11) Disconnect the coil wires.
(12) Disconnect heat indicator sending unit wire.
(13) Disconnect heater hoses and bypass hose.
(14) Remove cylinder head covers and gaskets.
(15) Remove intake manifold and throttle body as an assembly. Discard the flange side gaskets and the front and rear cross-over gaskets.
(16) Remove exhaust manifolds.
(17) Remove rocker arm assemblies and push rods. Identify to ensure installation in original locations.
(18) Remove the head bolts from each cylinder head and remove cylinder heads. Discard the cylinder head gasket.
(19) Remove spark plugs.

INSTALLATION

(1) Position the new cylinder head gaskets onto the cylinder block.
(2) Position the cylinder heads onto head gaskets and cylinder block.
(3) Starting at top center, tighten all cylinder head bolts, in sequence, to 68 N·m (50 ft. lbs.) torque (Fig. 50). Repeat procedure, tighten all cylinder head bolts to 143 N·m (105 ft. lbs.) torque. Repeat procedure to confirm that all bolts are at 143 N·m (105 ft. lbs.) torque.

CAUTION: When tightening the rocker arm bolts, make sure the piston in that cylinder is NOT at TDC. Contact between the valves and piston could occur.

REMOVAL AND INSTALLATION (Continued)

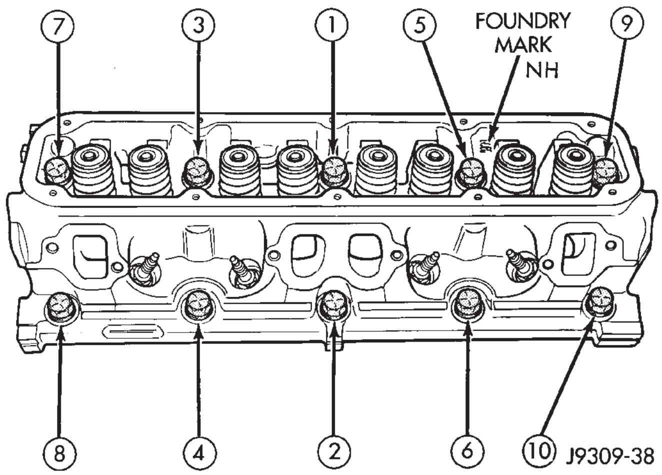


Fig. 50 Cylinder Head Bolt Tightening Sequence

(4) Install push rods and rocker arm assemblies in their original position. Tighten the bolts to 28 N·m (21 ft. lbs.) torque.

(5) Install the intake manifold and throttle body assembly.

(6) Install exhaust manifolds. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

(7) Adjust spark plugs to specifications. Refer to IGNITION SYSTEM. Install the plugs and tighten to 41 N·m (30 ft. lbs.) torque.

(8) Install coil wires.

(9) Connect heat indicator sending unit wire.

(10) Connect the heater hoses and bypass hose.

(11) Install distributor cap and wires.

(12) Connect the accelerator linkage and if so equipped, the speed control and transmission kick-down cables.

(13) Install the fuel supply line.

(14) Install the generator and drive belt. Tighten generator mounting bolt to 41 N·m (30 ft. lbs.) torque.

(15) Install the intake manifold-to-generator bracket support rod. Tighten the bolts.

(16) Place the cylinder head cover gaskets in position and install cylinder head covers. Tighten the bolts to 11 N·m (95 in. lbs.) torque.

(17) Install closed crankcase ventilation system.

(18) Connect the evaporation control system.

(19) Install the air cleaner assembly and air inlet hose.

(20) Install the heat shields. Tighten the bolts to 41 N·m (30 ft. lbs.) torque.

(21) Fill cooling system.

(22) Connect the battery negative cable.

VALVES AND VALVE SPRINGS

REMOVAL

(1) Remove the cylinder head.

(2) Compress valve springs using Valve Spring Compressor Tool MD- 998772A.

(3) Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.

(4) Before removing valves, remove any burrs from valve stem lock grooves to prevent damage to the valve guides. Identify valves to ensure installation in original location.

INSTALLATION

(1) Coat valve stems with lubrication oil and insert them in cylinder head.

(2) If valves or seats are reground, check valve stem height. If valve is too long, replace cylinder head.

(3) Install new seals on all valve guides. Install valve springs and valve retainers.

(4) Compress valve springs with Valve Spring Compressor Tool MD-998772A, install locks and release tool. If valves and/or seats are ground, measure the installed height of springs. Make sure the measurement is taken from bottom of spring seat in cylinder head to the bottom surface of spring retainer. If spacers are installed, measure from the top of spacer. If height is greater than 42.86 mm (1-11/16 inches), install a 1.587 mm (1/16 inch) spacer in head counterbore. This should bring spring height back to normal 41.27 to 42.86 mm (1-5/8 to 1-11/16 inch).

HYDRAULIC TAPPETS

REMOVAL

(1) Remove the air cleaner assembly and air inlet hose.

(2) Remove cylinder head cover, rocker assembly and push rods. Identify push rods to ensure installation in original location.

(3) Remove intake manifold, yoke retainer and aligning yokes.

(4) Slide Hydraulic Tappet Remover/Installer Tool C-4129-A through opening in cylinder head and seat tool firmly in the head of tappet.

(5) Pull tappet out of bore with a twisting motion. If all tappets are to be removed, identify tappets to ensure installation in original location.

INSTALLATION

(1) If the tappet or bore in cylinder block is scored, scuffed, or shows signs of sticking, ream the bore to next oversize. Replace with oversize tappet.

(2) Lubricate tappets.

(3) Install tappets and push rods in their original positions. Ensure that the oil feed hole in the side of the tappet body faces up (away from the crankshaft).

REMOVAL AND INSTALLATION (Continued)

(4) Install aligning yokes with ARROW toward camshaft.

(5) Install yoke retainer. Tighten the bolts to 23 N·m (200 in. lbs.) torque. Install intake manifold.

(6) Install push rods in original positions.

(7) Install rocker arm.

(8) Install cylinder head cover.

(9) Install air cleaner assembly and air inlet hose.

(10) Start and operate engine. Warm up to normal operating temperature.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

VIBRATION DAMPER

REMOVAL

(1) Disconnect the battery negative cable.

(2) Remove the cooling system fan.

(3) Remove the cooling fan shroud.

(4) Remove the accessory drive belt. Refer to COOLING SYSTEM.

(5) Remove vibration damper bolt and washer from end of crankshaft.

(6) Position Special Tool 8513 Insert into the crankshaft nose.

(7) Install Special Tool 1026 Three Jaw Puller onto the vibration damper (Fig. 51).

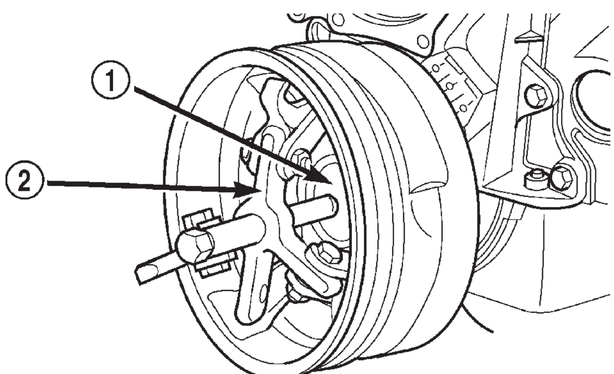


Fig. 51 Vibration Damper Removal

1 – SPECIAL TOOL 8513 INSERT
2 – SPECIAL TOOL 1026

(8) Pull vibration damper off of the crankshaft.

INSTALLATION

CAUTION: Thoroughly remove any contaminants from the crankshaft nose and the vibration damper bore. Failure to do so can cause sever damage to the crankshaft.

(1) Position the vibration damper onto the crankshaft.

(2) Place installing tool, part of Puller Tool Set C-3688 in position and press the vibration damper onto the crankshaft (Fig. 52).

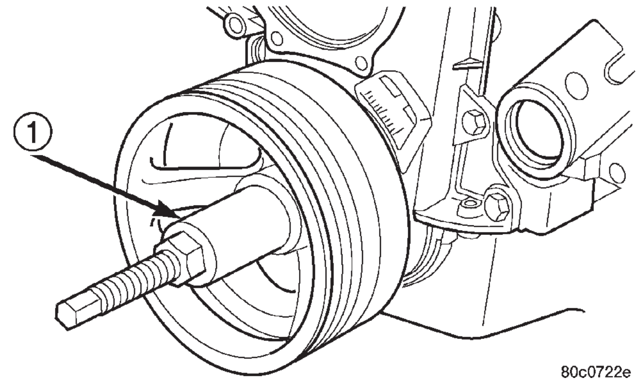


Fig. 52 Vibration Damper Installation

1 – SPECIAL TOOL C-3688

(3) Install the crankshaft bolt and washer. Tighten the bolt to 244 N·m (180 ft. lbs.) torque.

(4) Install the accessory drive belt.

(5) Position the fan shroud and install the bolts. Tighten the retainer bolts to 11 N·m (95 in. lbs.) torque.

(6) Install the cooling fan.

(7) Connect the battery negative cable.

TIMING CHAIN COVER

(1) Disconnect the negative cable from the battery.

(2) Drain cooling system (refer to Group 7, Cooling System).

(3) Remove the serpentine belt (refer to Group 7, Cooling System).

(4) Remove water pump (refer to Group 7, Cooling System).

(5) Remove power steering pump (refer to Group 19, Steering).

(6) Remove vibration damper.

(7) Remove fuel lines (refer to Group 14, Fuel System).

(8) Loosen oil pan bolts and remove the front bolt at each side.

(9) Remove the cover bolts.

(10) Remove chain case cover and gasket using extreme caution to avoid damaging oil pan gasket.

(11) Place a suitable tool behind the lips of the oil seal to pry the oil seal outward. Be careful not to damage the crankshaft seal surface of cover (Fig. 53).

INSTALLATION

(1) Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs.

REMOVAL AND INSTALLATION (Continued)

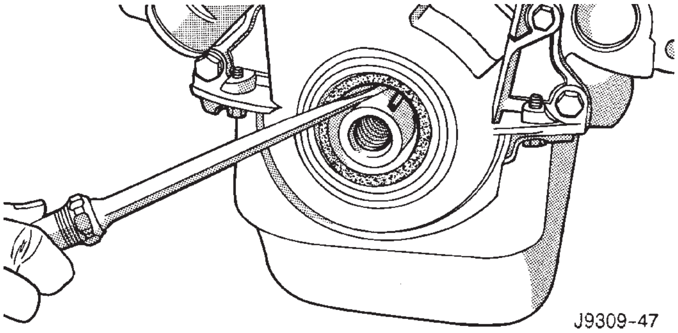


Fig. 53 Removal of Front Crankshaft Oil Seal

(2) The water pump mounting surface must be cleaned.

(3) Using a new cover gasket, carefully install chain case cover to avoid damaging oil pan gasket. Use a small amount of Mopar Silicone Rubber Adhesive Sealant, or equivalent, at the joint between timing chain cover gasket and the oil pan gasket. Finger tighten the timing chain cover bolts at this time.

(4) Place the smaller diameter of the oil seal over Front Oil Seal Installation Tool 6635 (Fig. 54). Seat the oil seal in the groove of the tool.

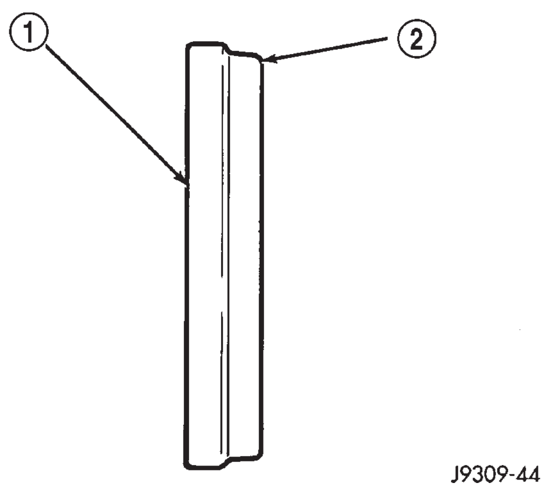


Fig. 54 Placing Oil Seal on Installation Tool 6635

1 – CRANKSHAFT FRONT OIL SEAL
2 – INSTALL THIS END INTO SPECIAL TOOL 6635

(5) Position the seal and tool onto the crankshaft (Fig. 55).

(6) Tighten the 4 lower chain case cover bolts to 13N·m (10 ft.lbs.) to prevent the cover from tipping during seal installation.

(7) Using the vibration damper bolt, tighten the bolt to draw the seal into position on the crankshaft (Fig. 56).

(8) Loosen the 4 bolts tightened in step 4 to allow realignment of front cover assembly.

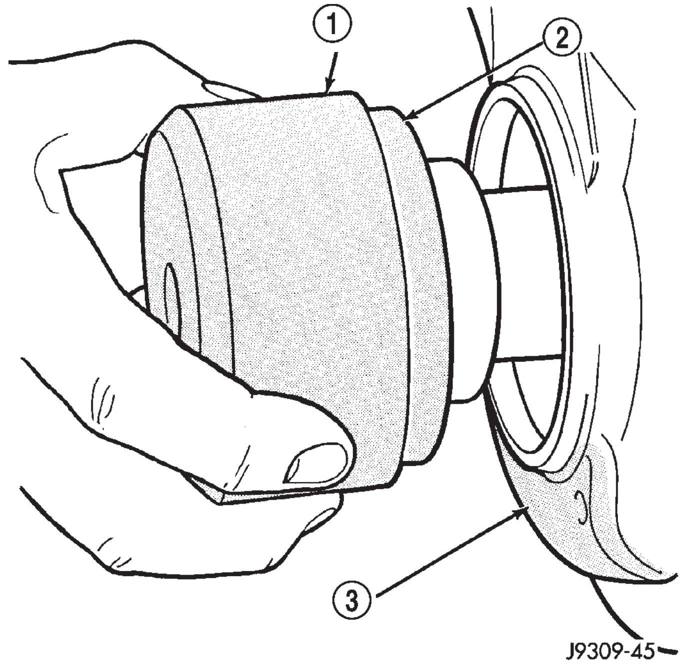


Fig. 55 Position Tool and Seal onto Crankshaft

1 – SPECIAL TOOL 6635
2 – OIL SEAL
3 – TIMING CHAIN COVER

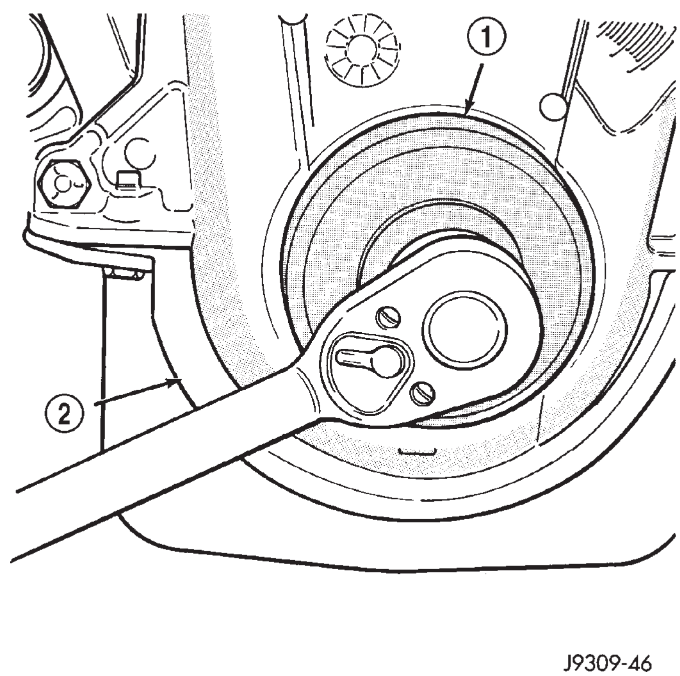


Fig. 56 Installing Oil Seal

1 – SPECIAL TOOL 6635
2 – TIMING CHAIN COVER

(9) Tighten chain case cover bolts to 41 N·m (30 ft. lbs.) torque. Tighten oil pan bolts to 24 N·m (215 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

(10) Remove the vibration damper bolt and seal installation tool.

(11) Install vibration damper.

(12) Install water pump and housing assembly using new gaskets (refer to Group 7, Cooling System). Tighten bolts to 41 N·m (30 ft. lbs.) torque.

(13) Install power steering pump (refer to Group 19, Steering).

(14) Install the serpentine belt (refer to Group 7, Cooling System).

(15) Install the cooling system fan. Tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(16) Position the fan shroud and install the bolts. Tighten the bolts to 11 N·m (95 in. lbs.) torque.

(17) Fill cooling system (refer to Group 7, Cooling System for the proper procedure).

(18) Connect the negative cable to the battery.

TIMING CHAIN

REMOVAL

(1) Disconnect battery negative cable.

(2) Remove Timing Chain Cover. Refer to Timing Chain Cover in this section for correct procedure.

(3) Re-install the vibration damper bolt finger tight. Using a suitable socket and breaker bar, rotate the crankshaft to align timing marks as shown in (Fig. 57).

(4) Remove camshaft sprocket attaching bolt and remove timing chain with crankshaft and camshaft sprockets.

INSTALLATION

(1) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(2) Place timing chain around both sprockets.

(3) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(4) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(5) Slide both sprockets evenly over their respective shafts and use a straightedge to check alignment of timing marks (Fig. 57).

(6) Install the camshaft bolt. Tighten the bolt to 68 N·m (50 ft. lbs.) torque.

(7) Check camshaft end play. The end play should be 0.051-0.152 mm (0.002-0.006 inch) with a new thrust plate and up to 0.254 mm (0.010 inch) with a used thrust plate. If not within these limits install a new thrust plate.

(8) Install the timing chain cover.

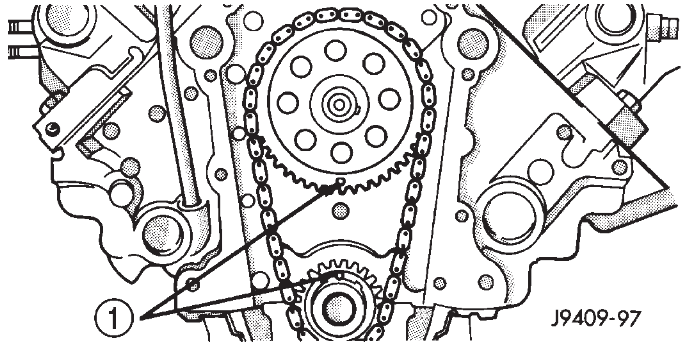


Fig. 57 Alignment of Timing Marks

1 – TIMING MARKS

CAMSHAFT

NOTE: The camshaft has an integral oil pump and distributor drive gear (Fig. 58).

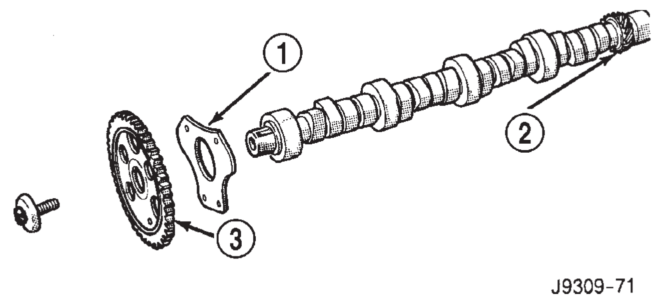


Fig. 58 Camshaft and Sprocket Assembly

1 – THRUST PLATE
2 – OIL PUMP AND DISTRIBUTOR DRIVE GEAR INTEGRAL WITH CAMSHAFT
3 – CAMSHAFT SPROCKET

REMOVAL

(1) Remove the radiator. Refer to Group 7, Cooling for the correct procedures.

(2) Remove the A/C Condenser (if equipped).

(3) Remove the engine cover.

(4) Remove intake manifold. Refer to Intake Manifold in this section for the correct procedure.

(5) Remove cylinder head covers.

(6) Remove timing case cover and timing chain.

(7) Remove rocker arms.

(8) Remove push rods and tappets. Identify each part so it can be installed in its original location.

(9) Remove distributor and lift out the oil pump and distributor drive shaft.

(10) Remove camshaft thrust plate, note location of oil tab (Fig. 59).

(11) Install a long bolt into front of camshaft to aid in removal of the camshaft. Remove camshaft, being careful not to damage cam bearings with the cam lobes.

REMOVAL AND INSTALLATION (Continued)

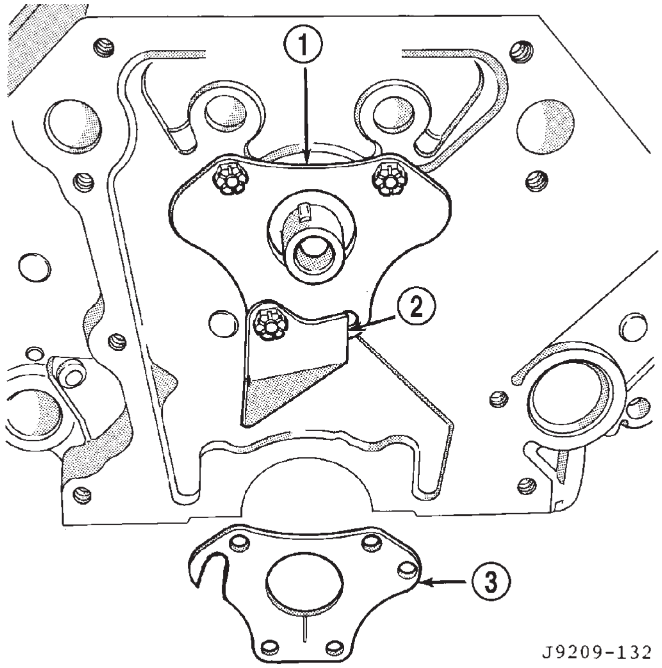


Fig. 59 Timing Chain Oil Tab Installation

1 – THRUST PLATE FRONT SIDE
2 – CHAIN OIL TAB
3 – THRUST PLATE REAR SIDE

INSTALLATION

(1) Lubricate camshaft lobes and camshaft bearing journals and insert the camshaft to within 51 mm (2 inches) of its final position in cylinder block.

(2) Install Camshaft Gear Installer Tool C-3509 with tongue back of distributor drive gear (Fig. 60).

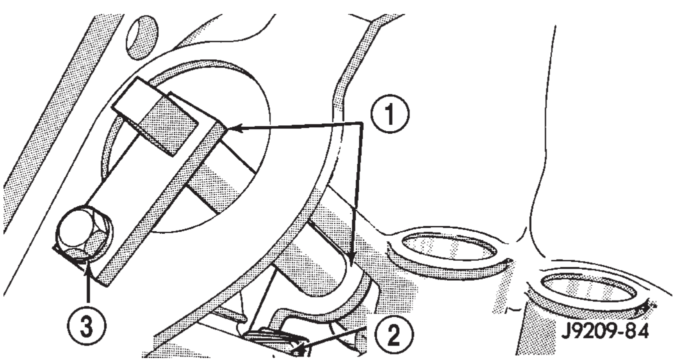


Fig. 60 Camshaft Holding Tool C-3509 (Installed Position)

1 – SPECIAL TOOL C-3509
2 – DRIVE GEAR
3 – DISTRIBUTOR LOCK BOLT

(3) Hold tool in position with a distributor lock-plate bolt. This tool will restrict camshaft from being pushed in too far and prevent knocking out the welch plug in rear of cylinder block. **Tool should remain installed until the camshaft and crankshaft sprockets and timing chain have been installed.**

(4) Install camshaft thrust plate and chain oil tab. **Make sure tang enters lower right hole in thrust plate.** Tighten bolts to 24 N·m (210 in. lbs.) torque. Top edge of tab should be flat against thrust plate in order to catch oil for chain lubrication.

(5) Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.

(6) Place timing chain around both sprockets.

(7) Turn crankshaft and camshaft to line up with keyway location in crankshaft sprocket and in camshaft sprocket.

(8) Lift sprockets and chain (keep sprockets tight against the chain in position as described).

(9) Slide both sprockets evenly over their respective shafts and use a straightedge to check alignment of timing marks (Fig. 61).

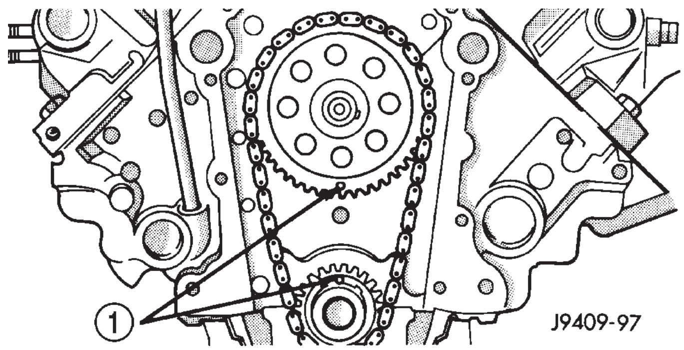


Fig. 61 Alignment of Timing Marks

1 – TIMING MARKS

(10) Install the camshaft bolt/cup washer. Tighten bolt to 68 N·m (50 ft. lbs.) torque.

(11) Measure camshaft end play. Refer to Specifications for proper clearance. If not within limits install a new thrust plate.

(12) Each tappet reused must be installed in the same position from which it was removed. **When camshaft is replaced, all of the tappets must be replaced.**

(13) Install distributor and distributor drive shaft.

(14) Install push rods and tappets.

(15) Install rocker arms.

(16) Install timing case cover.

(17) Install cylinder head covers.

(18) Install intake manifold.

(19) Install the engine cover.

(20) Install the A/C Condenser (if equipped).

(21) Install the radiator. Refer to Group 7, Cooling for the correct procedures.

(22) Refill cooling system. Refer to Group 7, Cooling for the correct procedures.

(23) Start engine check for leaks.

REMOVAL AND INSTALLATION (Continued)

CAMSHAFT BEARINGS

REMOVAL

NOTE: This procedure requires that the engine is removed from the vehicle.

(1) With engine completely disassembled, drive out rear cam bearing core plug.

(2) Install proper size adapters and horseshoe washers (part of Camshaft Bearing Remover/Installer Tool C-3132-A) at back of each bearing shell. Drive out bearing shells (Fig. 62).

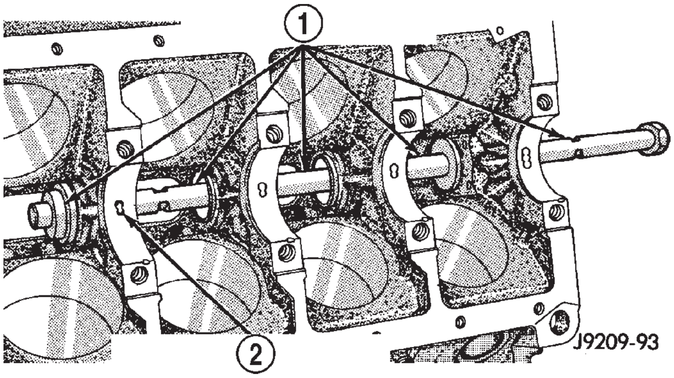


Fig. 62 Camshaft Bearings Removal/Installation with Tool C-3132-A

1 – SPECIAL TOOL C-3132–A
2 – MAIN BEARING OIL HOLE

INSTALLATION

(1) Install new camshaft bearings with Camshaft Bearing Remover/Installer Tool C-3132-A by sliding the new camshaft bearing shell over proper adapter.

(2) Position rear bearing in the tool. Install horseshoe lock and by reversing removal procedure, carefully drive bearing shell into place.

(3) Install remaining bearings in the same manner. Bearings must be carefully aligned to bring oil holes into full register with oil passages from the main bearing. If the camshaft bearing shell oil holes are not in exact alignment, remove and install them correctly. Install a new core hole plug at the rear of camshaft. **Be sure this plug does not leak.**

DISTRIBUTOR DRIVE SHAFT BUSHING

REMOVAL

(1) Remove distributor, refer to Group 8D, Ignition Systems for the proper procedure.

(2) Remove the intake manifold. Refer to Intake Manifold in this section for correct procedure.

(3) Insert Distributor Drive Shaft Bushing Puller Tool C-3052 into old bushing and thread down until a tight fit is obtained (Fig. 63).

(4) Hold puller screw and tighten puller nut until bushing is removed.

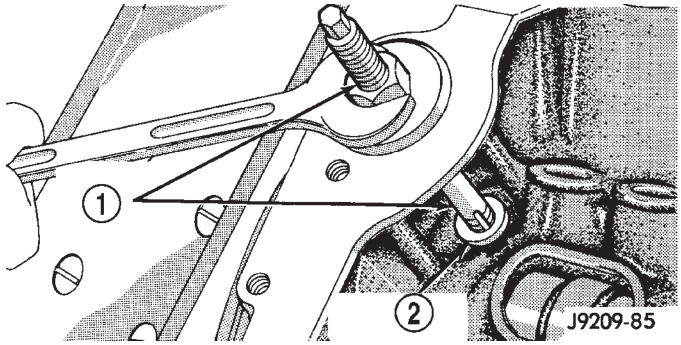


Fig. 63 Distributor Driveshaft Bushing Removal

1 – SPECIAL TOOL C-3052
2 – BUSHING

INSTALLATION

(1) Slide new bushing over burnishing end of Distributor Drive Shaft Bushing Driver/Burnisher Tool C-3053. Insert the tool and bushing into the bore.

(2) Drive bushing and tool into position, using a hammer (Fig. 64).

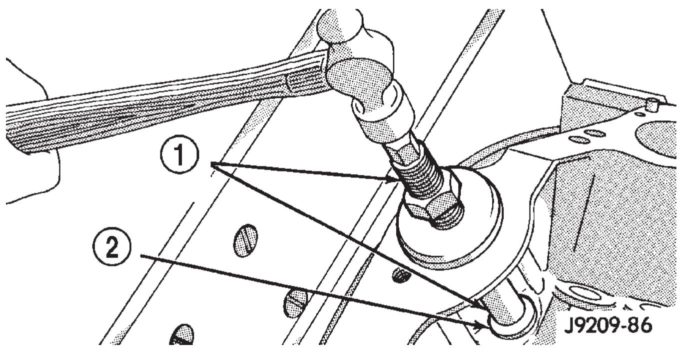


Fig. 64 Distributor Driveshaft Bushing Installation

1 – SPECIAL TOOL C-3053
2 – BUSHING

(3) As the burnisher is pulled through the bushing, the bushing is expanded tight in the block and burnished to correct size (Fig. 65). **DO NOT ream this bushing.**

CAUTION: This procedure MUST be followed when installing a new bushing or seizure to shaft may occur.

(4) Install the intake manifold.

DISTRIBUTOR INSTALLATION

NOTE: Before installing the distributor, the oil pump drive shaft must be aligned to number one cylinder.

REMOVAL AND INSTALLATION (Continued)

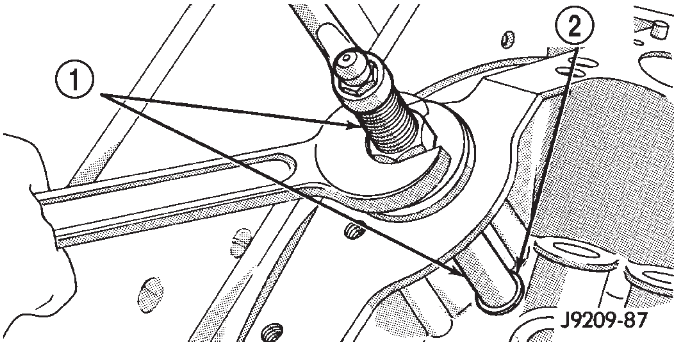


Fig. 65 Burnishing Distributor Driveshaft Bushing

1 – SPECIAL TOOL C-3053
2 – BUSHING

(1) Rotate crankshaft until No.1 cylinder is at top dead center on the firing stroke.

(2) When in this position, the timing mark of vibration damper should be under "0" on the timing indicator.

(3) Install the shaft so that after the gear spirals into place, it will index with the oil pump shaft. The slot on top of oil pump shaft should be aligned towards the left front intake manifold attaching bolt hole (Fig. 66).

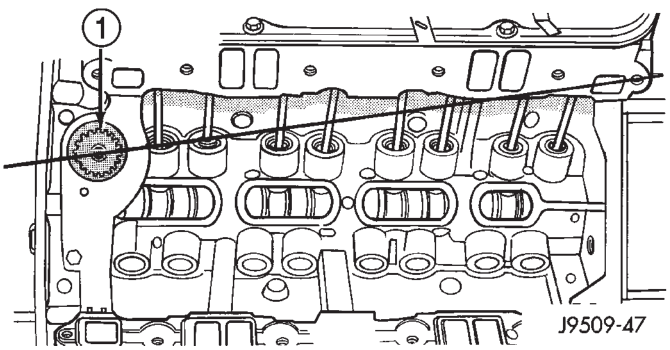


Fig. 66 Position of Oil Pump Shaft Slot

1 – DISTRIBUTOR DRIVE

(4) Install distributor, refer to Group 8D, Ignition Systems for the proper procedure.

After the distributor has been installed, its rotational position must be set using the **SET SYNC** mode of the DRB scan tool. Refer to Checking Distributor Position following the Distributor Installation section in Group 8D, Ignition system.

Do not attempt to adjust ignition timing by rotating the distributor. It has no effect on ignition timing. Adjusting distributor position will effect fuel synchronization only.

CRANKSHAFT MAIN BEARINGS

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Identify bearing caps before removal. Remove bearing caps one at a time.

(4) Remove upper half of bearing by inserting Crankshaft Main Bearing Remover/Installer Tool C-3059 into the oil hole of crankshaft (Fig. 67).

(5) Slowly rotate crankshaft clockwise, forcing out upper half of bearing shell.

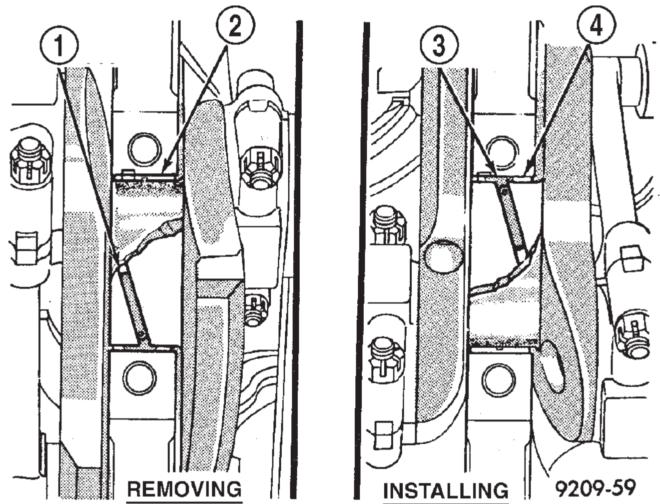


Fig. 67 Upper Main Bearing Removal and Installation with Tool C-3059

1 – SPECIAL TOOL C-3059
2 – BEARING
3 – SPECIAL TOOL C-3059
4 – BEARING

INSTALLATION

Only one main bearing should be selectively fitted while all other main bearing caps are properly tightened. All bearing capbolts removed during service procedures are to be cleaned and oiled before installation.

When installing a new upper bearing shell, slightly chamfer the sharp edges from the plain side.

(1) Start bearing in place, and insert Crankshaft Main Bearing Remover/Installer Tool C-3059 into oil hole of crankshaft (Fig. 67).

(2) Slowly rotate crankshaft counterclockwise sliding the bearing into position. Remove Tool C-3059.

(3) Install the bearing caps. Clean and oil the bolts. Tighten the capbolts to 115 N·m (85 ft. lbs.) torque.

(4) Install the oil pump.

(5) Install the oil pan.

(6) Start engine check for leaks.

2000 AN Service Manual
Publication No. 81-370-0010
TSB 26-12-99 December, 1999

REMOVAL AND INSTALLATION (Continued)

OIL PAN

REMOVAL

2WD

(1) Disconnect the negative cable from the battery.
(2) Remove air cleaner assembly.
(3) Remove engine oil dipstick.
(4) Disconnect distributor cap and position away from cowl.
(5) Remove the fan shroud. Refer to COOLING SYSTEM.
(6) Disconnect throttle valve cable from throttle body and mounting bracket (Fig. 67A).

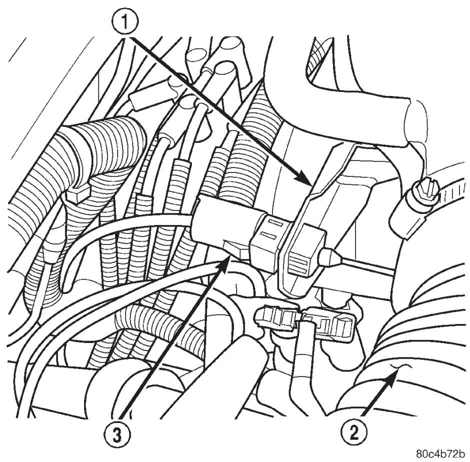


Fig. 67A Throttle Valve Cable Removal/Installation

1 – TRANSMISSION THROTTLE VALVE CABLE BRACKET
2 – AIR INLET DUCT
3 – TRANSMISSION THROTTLE VALVE CABLE

(7) Raise vehicle.
(8) Drain engine oil.
(9) Remove exhaust pipe from exhaust manifolds.
(10) Remove engine mount insulator through bolts.
(11) Raise engine by way of oil pan using a block of wood between the jack and oil pan.
(12) When engine is high enough, place mount through bolts in the engine mount attaching points on the frame brackets.
(13) Lower engine so bottom of engine mounts rest on the replacement bolts placed in the engine mount frame brackets.
(14) Remove transmission to engine braces.
(15) Remove starter. Refer to STARTING SYSTEMS.
(16) Remove transmission torque converter inspection cover.
(17) Disconnect rear support cushion from crossmember.
(18) Raise rear of transmission away from crossmember.
(19) Remove oil pan and one-piece gasket.

4WD

(1) Disconnect the negative cable from the battery.
(2) Remove engine oil dipstick.
(3) Raise vehicle.
(4) Drain engine oil.
(5) Remove front driving axle. Refer to DIFFERENTIAL and DRIVELINE.
(6) Remove both engine mount support brackets.
(7) Remove transmission torque converter inspection cover.
(8) Remove oil pan and one-piece gasket.

INSTALLATION

2WD

(1) Fabricate 4 alignment dowels from 5/16 x 1 1/2 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 68).

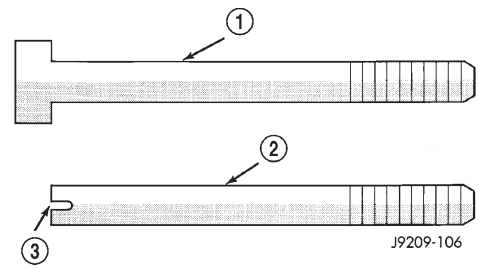


Fig. 68 Fabrication of Alignment Dowels

1 – 1 1/2” x 5/16” BOLT
2 – DOWEL
3 – SLOT

(2) Install the dowels in the cylinder block (Fig. 69).

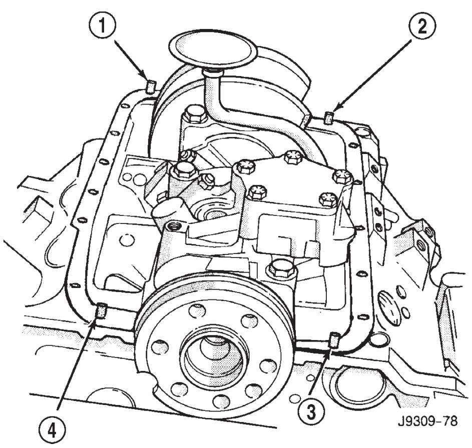


Fig. 69 Position of Dowels in Cylinder Block

1 – DOWEL
2 – DOWEL
3 – DOWEL
4 – DOWEL

(3) Apply small amount of Mopar Silicone Rubber Adhesive Sealant, or equivalent in the corner of the cap and the cylinder block.
(4) Slide the one-piece gasket over the dowels and onto the block.
(5) Position the oil pan over the dowels and onto the gasket.
(6) Install the oil pan bolts. Tighten the bolts to 24 N·m (215 in. lbs.) torque.
(7) Remove the dowels. Install the remaining oil pan bolts. Tighten these bolts to 24 N·m (215 in. lbs.) torque.

2000 AN Service Manual
Publication No. 81-370-0010
TSB 26-12-99 December, 1999

REMOVAL AND INSTALLATION (Continued)

(8) Install the drain plug. Tighten drain plug to 34 N·m (25 ft. lbs.) torque.
(9) Lower transmission onto crossmember.
(10) Install rear support cushion mounting bolts. Tighten bolts to 28 N·m (250 in. lbs.).
(11) Raise engine by way of oil pan with a wood block placed between jack and oil pan.
(12) Remove through bolts from frame brackets and lower engine. Install mount insulator through bolts and tighten to 95 N·m (70 ft. lbs.).
(13) Install starter.
(14) Install transmission torque converter inspection cover.
(15) Install engine to transmission braces.
(16) Install exhaust pipe.
(17) Lower vehicle.
(18) Position throttle valve cable into bracket, then attach to throttle body (Fig. 67A).
(19) Connect the distributor cap.
(20) Install dipstick.
(21) Install fan shroud.
(22) Install air cleaner assembly.
(23) Connect the negative cable to the battery.
(24) Fill crankcase with oil to proper level.

4WD

(1) Fabricate 4 alignment dowels from 1 1/2 x 5/16 inch bolts. Cut the head off the bolts and cut a slot into the top of the dowel. This will allow easier installation and removal with a screwdriver (Fig. 68).
(2) Install the dowels in the cylinder block (Fig. 69).
(3) Apply small amount of Mopar Silicone Rubber Adhesive Sealant, or equivalent in the corner of the cap and the cylinder block.
(4) Slide the one-piece gasket over the dowels and onto the block.
(5) Position the oil pan over the dowels and onto the gasket.
(6) Install the oil pan bolts. Tighten the bolts to 24 N·m (215 in. lbs.) torque.
(7) Remove the dowels. Install the remaining oil pan bolts. Tighten these bolts to 24 N·m (215 in. lbs.) torque.
(8) Install the drain plug. Tighten drain plug to 34 N·m (25 ft. lbs.) torque.
(9) Install transmission inspection cover.
(10) Install engine mount support brackets and insulators.
(11) Install front drive axle. Refer to DIFFERENTIAL and DRIVELINE.
(12) Lower vehicle
(13) Connect the distributor cap.
(14) Install dipstick.
(15) Connect the negative cable to the battery.
(16) Fill crankcase with oil to proper level.

PISTON AND CONNECTING ROD ASSEMBLY

REMOVAL

(1) Remove the engine from the vehicle.
(2) Remove the cylinder head.
(3) Remove the oil pan.
(4) Remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. Be sure to keep tops of pistons covered during this operation.
(5) Be sure the connecting rod and connecting rod cap are identified with the cylinder number. Remove connecting rod cap. Install connecting rod bolt guide set on connecting rod bolts.
(6) Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies, rotate crankshaft to center the connecting rod in the cylinder bore and at BDC. **Be careful not to nick crankshaft journals.**
(7) After removal, install bearing cap on the mating rod.

INSTALLATION

(1) Be sure that compression ring gaps are staggered so that neither is in-line with oil ring rail gap.
(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located properly (Fig. 70).

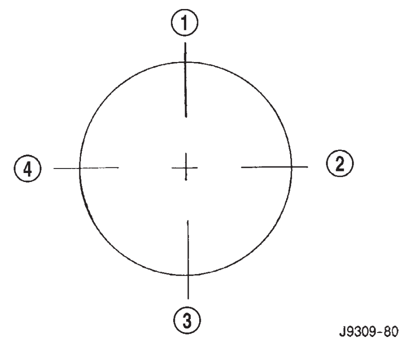


Fig. 70 Proper Ring Installation

1 – OIL RING SPACER GAP
2 – SECOND COMPRESSION RING GAP OIL RING RAIL GAP (TOP)
3 – OIL RING RAIL GAP (BOTTOM)
4 – TOP COMPRESSION RING GAP

(3) Immerse the piston head and rings in clean engine oil. Slide Piston Ring Compressor Tool C-385 over the piston and tighten with the special wrench (part of Tool C-385). **Be sure position of rings does not change during this operation.**
(4) Install connecting rod bolt protectors on rod bolts, the long protector should be installed on the numbered side of the connecting rod.
(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Be sure connecting rod and cylinder bore number are the same. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.
(6) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on crankshaft journal.
(7) The notch or groove on top of piston must be pointing toward front of engine. The larger chamfer of the connecting rod bore must be installed toward crankshaft journal fillet.
(8) Install rod caps. Be sure connecting rod, connecting rod cap and cylinder bore number are the same. Install nuts on cleaned and oiled rod bolts and tighten nuts to 61 N·m (45 ft. lbs.) torque.
(9) Install the oil pan.
(10) Install the cylinder head.
(11) Install the engine into the vehicle.

REMOVAL AND INSTALLATION (Continued)

CRANKSHAFT

A crankshaft which has undersize journals will be stamped with 1/4 inch letters on the milled flat on the No.3 crankshaft counterweight (Fig. 71).

FOR EXAMPLE: R2 stamped on the No.3 crankshaft counterweight indicates that the No.2 rod journal is 0.025 mm (0.001 in) undersize. M4 indicates that the No.4 main journal is 0.025 mm (0.001 in) undersize. R3 M2 indicates that the No.3 rod journal and the No.2 main journal are 0.025 mm (0.001 in) undersize.

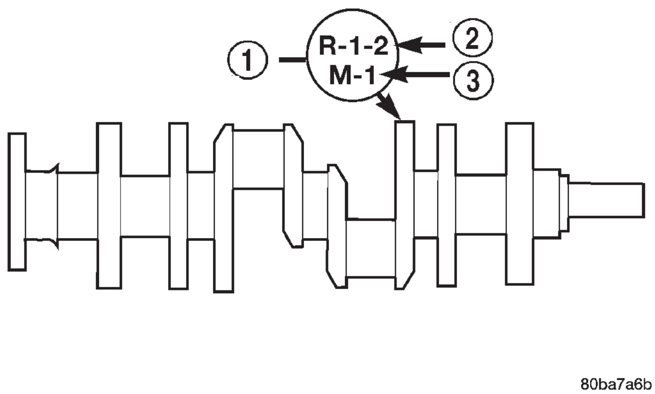


Fig. 71 Location of Crankshaft Identification

1 – 1/4" LETTERS
2 – (ROD)
3 – (MAIN)

CRANKSHAFT IDENTIFICATION MARK LOCATION CHART

UNDERSIZE JOURNAL	IDENTIFICATION STAMP
0.025 mm (0.001 in.) (ROD)	R1-R2-R3 or R4
0.025 mm (0.001 in.) (MAIN)	M1-M2-M3-M4 or M5

When a crankshaft is replaced, all main and connecting rod bearings should be replaced with new bearings. Therefore, selective fitting of the bearings is not required when a crankshaft and bearings are replaced.

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the vibration damper.

(4) Remove the timing chain cover.

(5) Identify bearing caps before removal. Remove bearing caps and bearings one at a time.

(6) Lift the crankshaft out of the block.

(7) Remove and discard the crankshaft rear oil seals.

(8) Remove and discard the front crankshaft oil seal.

INSPECTION OF JOURNALS

The crankshaft connecting rod and main journals should be checked for excessive wear, taper and scoring. The maximum taper or out-of-round on any crankshaft journal is 0.025 mm (0.001 inch).

Journal grinding should not exceed 0.305 mm (0.012 inch) under the standard journal diameter. DO NOT grind thrust faces of No.3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all oil passages.

CAUTION: After any journal grind, it is important that the final paper or cloth polish be in the same direction as the engine rotates.

CLEANING

Clean Loctite 518 residue and sealant from the cylinder block and rear cap mating surface. Do this before applying the Loctite drop and the installation of rear cap.

INSTALLATION

(1) Lightly oil the new upper seal lips with engine oil.

(2) Install the new upper rear bearing oil seal with the white paint facing towards the rear of the engine.

(3) Position the crankshaft into the cylinder block.

(4) Lightly oil the new lower seal lips with engine oil.

(5) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(6) Apply 5 mm (0.20 in) drop of Loctite 518, or equivalent, on each side of the rear main bearing cap (Fig. 72). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

(7) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(8) Clean and oil all cap bolts. Install all main bearing caps. Install all cap bolts and alternately tighten to 115 N·m (85 ft. lbs.) torque.

(9) Install oil pump.

Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 73). Apply enough sealant until a small amount is squeezed out.

REMOVAL AND INSTALLATION (Continued)

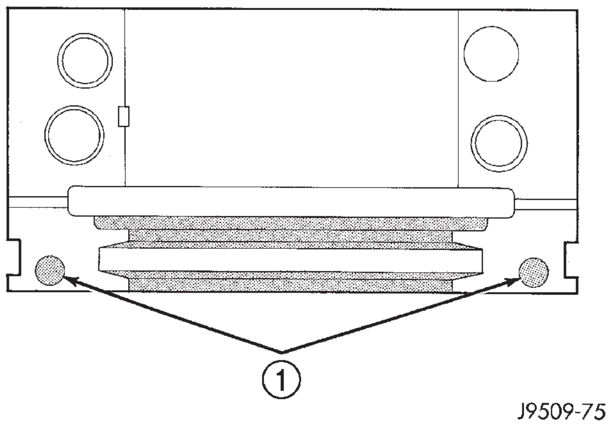


Fig. 72 Sealant Application to Bearing Cap

1 – .25 DROP OF LOCTITE 515 ON BOTH SIDES OF REAR MAIN CAP

Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(10) Install new front crankshaft oil seal.

(11) Immediately install the oil pan.

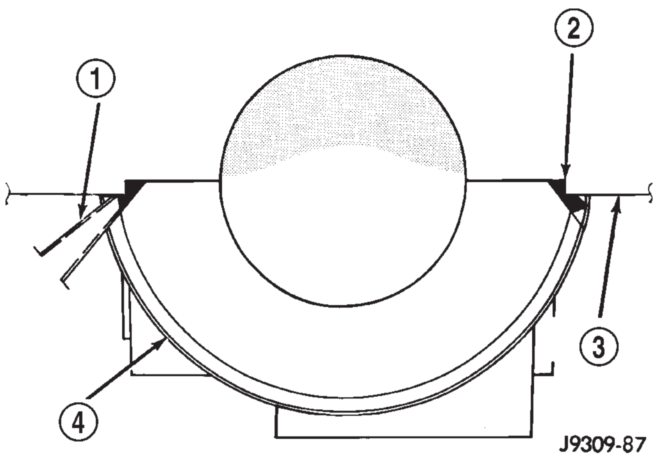


Fig. 73 Apply Sealant to Bearing Cap to Block Joint

1 – MOPAR SILICONE RUBBER ADHESIVE SEALANT NOZZLE TIP
2 – SEALANT APPLIED
3 – CYLINDER BLOCK
4 – REAR MAIN BEARING CAP

OIL PUMP

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from rear main bearing cap.

INSTALLATION

(1) Install oil pump. During installation slowly rotate pump body to ensure driveshaft-to-pump rotor shaft engagement.

(2) Hold the oil pump base flush against mating surface on No.5 main bearing cap. Finger tighten pump attaching bolts. Tighten attaching bolts to 41 N·m (30 ft. lbs.) torque.

(3) Install the oil pan.

CRANKSHAFT OIL SEAL—FRONT

The oil seal can be replaced without removing the timing chain cover provided the cover is not misaligned.

(1) Disconnect the negative cable from the battery.

(2) Remove vibration damper.

(3) If front seal is suspected of leaking, check front oil seal alignment to crankshaft. The seal installation/alignment tool 6635, should fit with minimum interference. If tool does not fit, the cover must be removed and installed properly.

(4) Place a suitable tool behind the lips of the oil seal to pry the oil seal outward. Be careful not to damage the crankshaft seal bore of cover.

(5) Place the smaller diameter of the oil seal over Front Oil Seal Installation Tool 6635 (Fig. 74). Seat the oil seal in the groove of the tool.

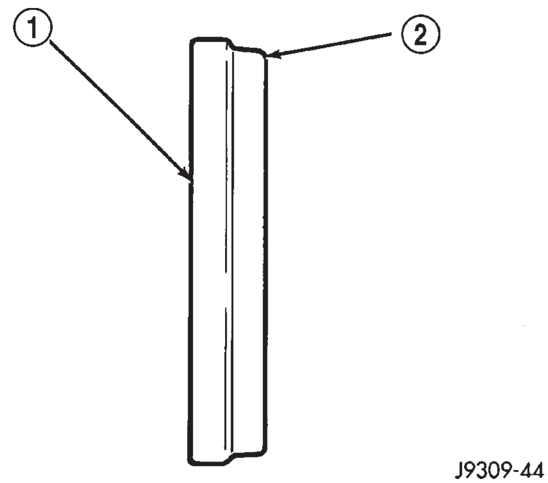


Fig. 74 Placing Oil Seal on Installation Tool 6635

1 – CRANKSHAFT FRONT OIL SEAL
2 – INSTALL THIS END INTO SPECIAL TOOL 6635

(6) Position the seal and tool onto the crankshaft (Fig. 75).

(7) Using the vibration damper bolt, tighten the bolt to draw the seal into position on the crankshaft (Fig. 76).

(8) Remove the vibration damper bolt and seal installation tool.

(9) Inspect the seal flange on the vibration damper.

(10) Install the vibration damper.

(11) Connect the negative cable to the battery.

REMOVAL AND INSTALLATION (Continued)

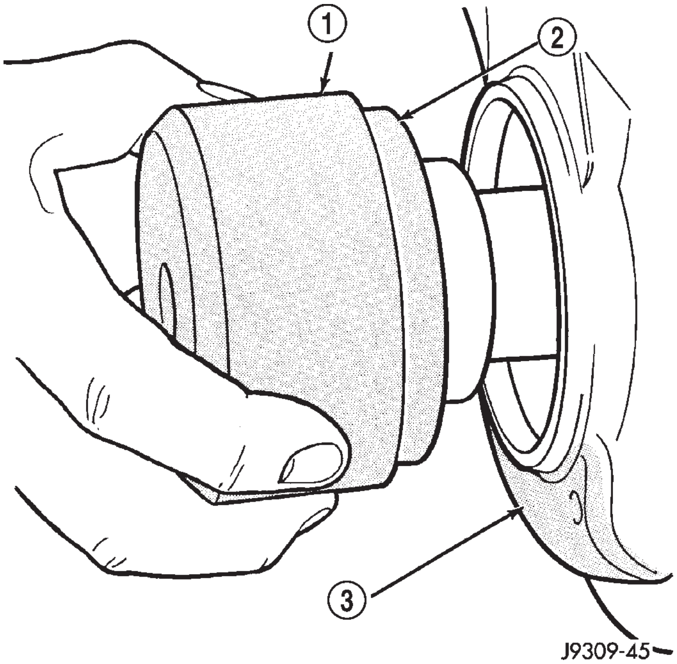


Fig. 75 Position Tool and Seal onto Crankshaft

1 – SPECIAL TOOL 6635
2 – OIL SEAL
3 – TIMING CHAIN COVER

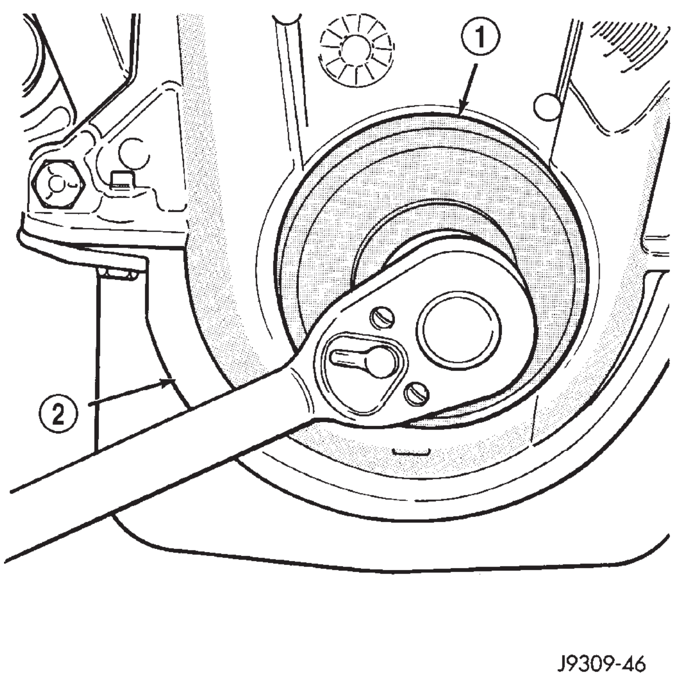


Fig. 76 Installing Oil Seal

1 – SPECIAL TOOL 6635
2 – TIMING CHAIN COVER

CRANKSHAFT OIL SEALS—REAR

The service seal is a 2 piece, viton seal. The upper seal half can be installed with crankshaft removed from engine or with crankshaft installed. When a new upper seal is installed, install a new lower seal. The lower seal half can only be installed with the rear main bearing cap removed.

UPPER SEAL —CRANKSHAFT REMOVED

REMOVAL

(1) Remove the crankshaft. Discard the old upper seal.

INSTALLATION

(1) Clean the cylinder block rear cap mating surface. Make sure the seal groove is free of debris.

(2) Lightly oil the new upper seal lips with engine oil.

(3) Install the new upper rear bearing oil seal with the white paint facing towards the rear of the engine.

(4) Position the crankshaft into the cylinder block.

(5) Lightly oil the new lower seal lips with engine oil.

(6) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(7) Apply 5 mm (0.20 in) drop of Mopar® Gasket Maker, or equivalent, on each side of the rear main bearing cap (Fig. 77). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

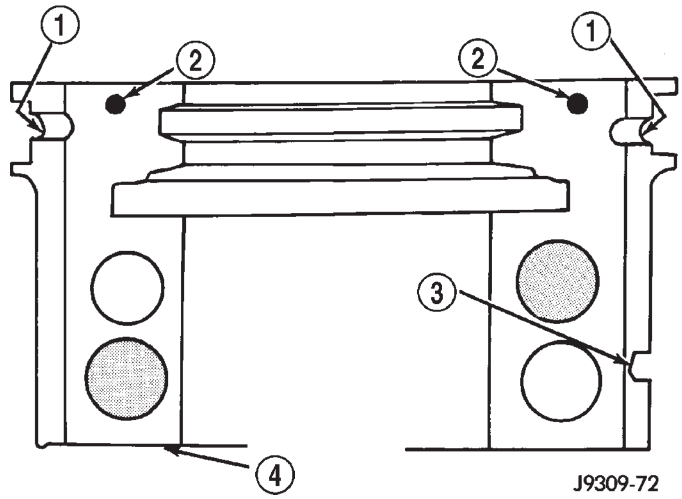


Fig. 77 Sealant Application to Bearing Cap

1 – MOPAR SILICONE RUBBER ADHESIVE SEALANT SLOTS
2 – LOCTITE 518 (OR EQUIVALENT)
3 – CAP ALIGNMENT SLOT
4 – REAR MAIN BEARING CAP

(8) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

REMOVAL AND INSTALLATION (Continued)

(9) Clean and oil all cap bolts. Install all main bearing caps. Install all cap bolts and alternately tighten to 115 N·m (85 ft. lbs.) torque.

(10) Install oil pump.

(11) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 78). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(12) Install new front crankshaft oil seal.

(13) Immediately install the oil pan.

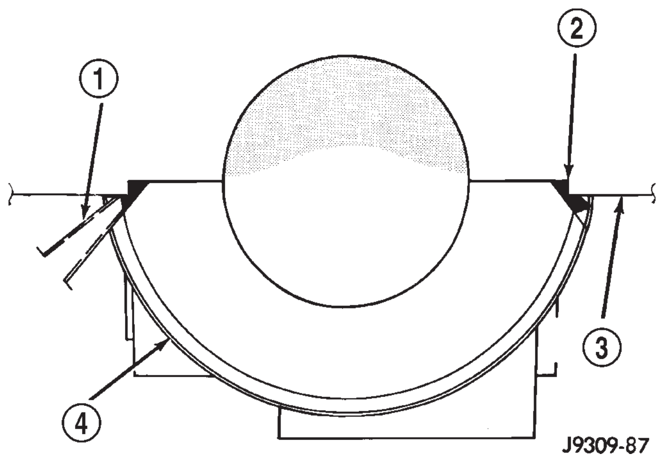


Fig. 78 Apply Sealant to Bearing Cap to Block Joint

1 – MOPAR SILICONE RUBBER ADHESIVE SEALANT NOZZLE TIP
2 – SEALANT APPLIED
3 – CYLINDER BLOCK
4 – REAR MAIN BEARING CAP

UPPER SEAL —CRANKSHAFT INSTALLED

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the rear main bearing cap. Remove and discard the old lower oil seal.

(4) Carefully remove and discard the old upper oil seal.

INSTALLATION

(1) Clean the cylinder block mating surfaces before oil seal installation. Check for burr at the oil hole on the cylinder block mating surface to rear cap.

(2) Lightly oil the new upper seal lips with engine oil. To allow ease of installation of the seal, loosen at least the 2 main bearing caps forward of the rear bearing cap.

(3) Rotate the new upper seal into the cylinder block being careful not to shave or cut the outer surface of the seal. To assure proper installation, use the installation tool provided with the kit. Install the new seal with the white paint facing towards the rear of the engine.

(4) Install the new lower rear bearing oil seal into the bearing cap with the white paint facing towards the rear of the engine.

(5) Apply 5 mm (0.20 in) drop of Mopar® Gasket Maker, or equivalent, on each side of the rear main bearing cap (Fig. 77). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application. Be sure the white paint faces toward the rear of the engine.

(6) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(7) Install the rear main bearing cap with cleaned and oiled cap bolts. Alternately tighten ALL cap bolts to 115 N·m (85 ft. lbs.) torque.

(8) Install oil pump.

(9) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 78). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(10) Immediately install the oil pan.

LOWER SEAL

REMOVAL

(1) Remove the oil pan.

(2) Remove the oil pump from the rear main bearing cap.

(3) Remove the rear main bearing cap and discard the old lower seal.

INSTALLATION

(1) Clean the rear main cap mating surfaces including the oil pan gasket groove.

(2) Carefully install a new upper seal (refer to Upper Seal Replacement - Crankshaft Installed procedure above).

(3) Lightly oil the new lower seal lips with engine oil.

(4) Install a new lower seal in bearing cap with the white paint facing the rear of engine.

(5) Apply 5 mm (0.20 in) drop of Mopar® Gasket Maker, or equivalent, on each side of the rear main bearing cap (Fig. 77). DO NOT over apply sealant or allow the sealant to contact the rubber seal. Assemble bearing cap to cylinder block immediately after sealant application.

REMOVAL AND INSTALLATION (Continued)

(6) To align the bearing cap, use cap slot, alignment dowel and cap bolts. DO NOT remove excess material after assembly. DO NOT strike rear cap more than 2 times for proper engagement.

(7) Install the rear main bearing cap with cleaned and oiled cap bolts. Alternately tighten the cap bolts to 115 N·m (85 ft. lbs.) torque.

(8) Install oil pump.

(9) Apply Mopar® Silicone Rubber Adhesive Sealant, or equivalent, at bearing cap to block joint to provide cap to block and oil pan sealing (Fig. 78). Apply enough sealant until a small amount is squeezed out. Withdraw nozzle and wipe excess sealant off the oil pan seal groove.

(10) Immediately install the oil pan.

ENGINE CORE OIL AND CAMSHAFT PLUGS

Engine core plugs have been pressed into the oil galleries behind the camshaft thrust plate (Fig. 79). This will reduce internal leakage and help maintain higher oil pressure at idle.

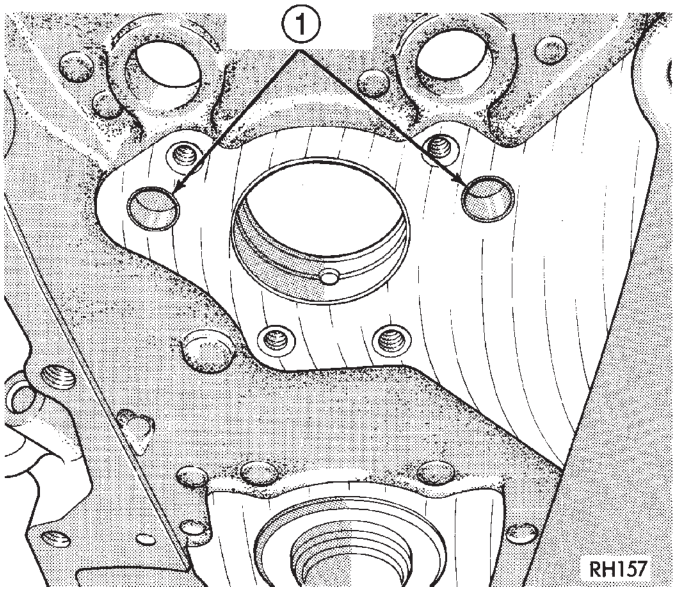


Fig. 79 Location of Cup Plugs in Oil Galleries

1 – CUP PLUGS

REMOVAL

(1) Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup plug (Fig. 80).

(2) With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 80).

INSTALLATION

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer.

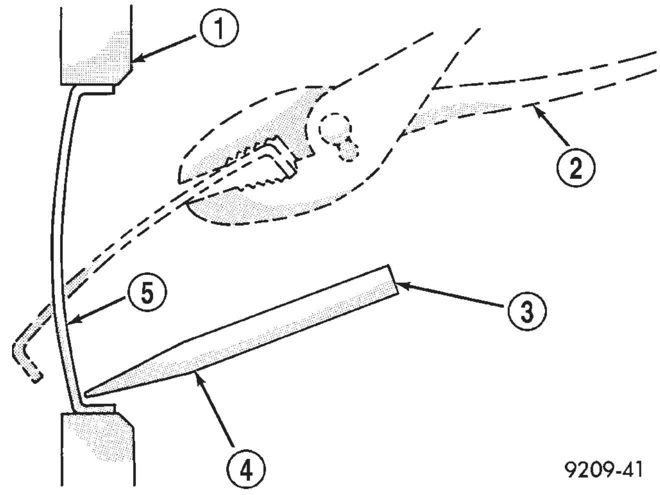


Fig. 80 Core Hole Plug Removal

1 – CYLINDER BLOCK
2 – REMOVE PLUG WITH PLIERS
3 – STRIKE HERE WITH HAMMER
4 – DRIFT PUNCH
5 – CUP PLUG

Be certain the new plug is cleaned of all oil or grease.

(1) Coat edges of plug and core hole with Mopar® Gasket Maker, or equivalent.

CAUTION: DO NOT drive cup plug into the casting, as restricted coolant flow can result and cause serious engine problems.

(2) Using proper plug drive, drive cup plug into hole. The sharp edge of the plug should be at least 0.50 mm (0.020 in.) inside the lead-in chamfer.

(3) It is not necessary to wait for curing of the sealant. The cooling system can be filled and the vehicle placed in service immediately.

DISASSEMBLY AND ASSEMBLY

OIL PUMP

DISASSEMBLE

(1) Remove the relief valve as follows:

(a) Remove cotter pin. Drill a 3.175 mm (1/8 inch) hole into the relief valve retainer cap and insert a self-threading sheet metal screw.

(b) Clamp screw into a vise and while supporting oil pump, remove cap by tapping pump body using a soft hammer. Discard retainer cap and remove spring and relief valve (Fig. 81).

DISASSEMBLY AND ASSEMBLY (Continued)

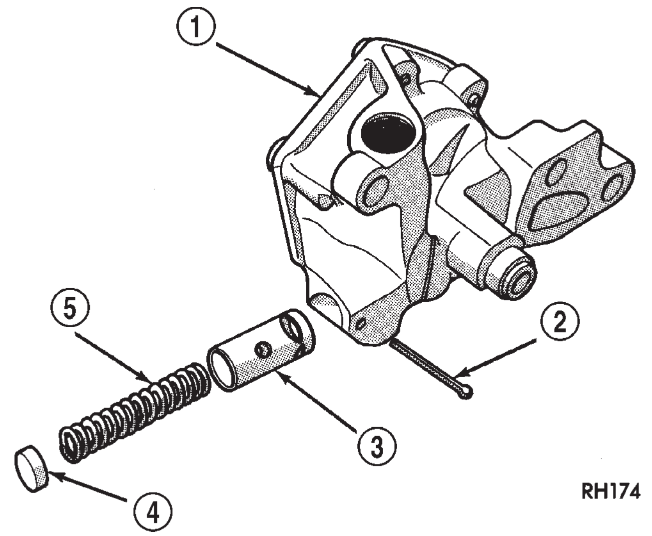


Fig. 81 Oil Pressure Relief Valve

1 – OIL PUMP ASSEMBLY
2 – COTTER PIN
3 – RELIEF VALVE
4 – RETAINER CAP
5 – SPRING

(2) Remove oil pump cover (Fig. 82).

(3) Remove pump outer rotor and inner rotor with shaft (Fig. 82).

(4) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

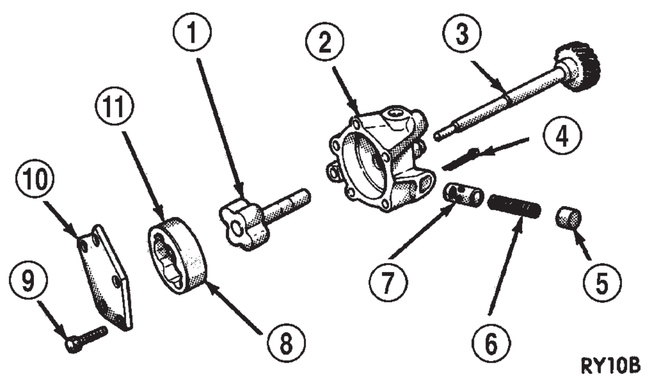


Fig. 82 Oil Pump

1 – INNER ROTOR AND SHAFT
2 – BODY
3 – DISTRIBUTOR DRIVESHAFT (REFERENCE)
4 – COTTER PIN
5 – RETAINER CAP
6 – SPRING
7 – RELIEF VALVE
8 – LARGE CHAMFERED EDGE
9 – BOLT
10 – COVER
11 – OUTER ROTOR

ASSEMBLE

(1) Install pump rotors and shaft, using new parts as required.

(2) Position the oil pump cover onto the pump body. Tighten cover bolts to 11 N·m (95 in. lbs.) torque.

(3) Install the relief valve and spring. Insert the cotter pin.

(4) Tap on a new retainer cap.

(5) Prime oil pump before installation by filling rotor cavity with engine oil.

CLEANING AND INSPECTION

CYLINDER HEAD COVER

CLEANING

Clean cylinder head cover gasket surface.

Clean head rail, if necessary.

INSPECTION

Inspect cover for distortion and straighten, if necessary.

Check the gasket for use in head cover installation. If damaged, use a new gasket.

CYLINDER HEAD ASSEMBLY

CLEANING

Clean all surfaces of cylinder block and cylinder heads.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

INSPECTION

Inspect all surfaces with a straightedge if there is any reason to suspect leakage. If out-of-flatness exceeds 0.00075 mm/mm (0.00075 inch/inch) times the span length in inches in any direction, either replace head or lightly machine the head surface.

FOR EXAMPLE: A 305 mm (12 inch) span is 0.102 mm (0.004 inch) out-of-flat. The allowable out-of-flat is 305 X 0.00075 (12 X 0.00075) equals 0.23 mm (0.009 inch). This amount of out-of-flat is acceptable.

The cylinder head surface finish should be 1.78-3.00 microns (70-125 microinches).

CLEANING AND INSPECTION (Continued)

PISTON AND CONNECTING ROD ASSEMBLY

INSPECTION

Check the crankshaft connecting rod journal for excessive wear, taper and scoring.

Check the cylinder block bore for out-of-round, taper, scoring and scuffing.

Check the pistons for taper and elliptical shape before they are fitted into the cylinder bore (Fig. 83).

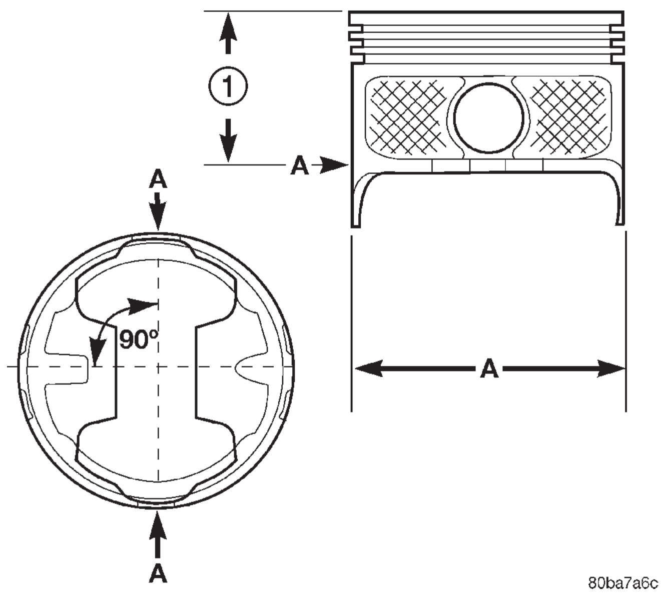


Fig. 83 Piston Measurements

1 – 49.53 mm (1.95 IN.)

OIL PAN

CLEANING

Clean the block and pan gasket surfaces.

Trim or remove excess sealant film in the rear main cap oil pan gasket groove. **DO NOT remove the sealant inside the rear main cap slots.**

If present, trim excess sealant from inside the engine.

Clean oil pan in solvent and wipe dry with a clean cloth.

Clean oil screen and pipe thoroughly in clean solvent. Inspect condition of screen.

INSPECTION

Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.

Inspect oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

PISTON MEASUREMENT CHART

PISTON SIZE	A DIA = PISTON DIAMETER		BORE DIAMETER	
	MIN. mm (in.)	MAX. mm (in.)	MIN. mm (in.)	MAX. mm (in.)
A	—	—	—	—
B	101.580 (3.9992)	101.592 (3.9997)	101.605 (4.0002)	101.618 (4.0007)
C	101.592 (3.9997)	101.605 (4.0002)	101.618 (4.0007)	101.630 (4.0012)
D	101.605 (4.0002)	101.618 (4.0007)	101.630 (4.0012)	101.643 (4.0017)
E	—	—	—	—

DESCRIPTION	SPECIFICATION
PISTON PIN BORE	25.007 - 25.015 mm (.9845 -.9848 in.)
RING GROOVE HEIGHT	
OIL RAIL	4.033 - 4.058 mm (.1588 -.1598 in.)
COMPRESSION RAIL	1.529 - 1.554 mm (.0602 -.0612 in.)
TOTAL FINISHED WEIGHT	470.8 ± 2 grams (16.607 ±.0706 ounces)

OIL PUMP

INSPECTION

Mating surface of the oil pump cover should be smooth. Replace pump assembly if cover is scratched or grooved.

Lay a straightedge across the pump cover surface (Fig. 84). If a 0.038 mm (0.0015 inch) feeler gauge can be inserted between cover and straightedge, pump assembly should be replaced.

Measure thickness and diameter of OUTER rotor. If outer rotor thickness measures 20.9 mm (0.825 inch) or less or if the diameter is 62.7 mm (2.469 inches) or less, replace outer rotor (Fig. 85).

CLEANING AND INSPECTION (Continued)

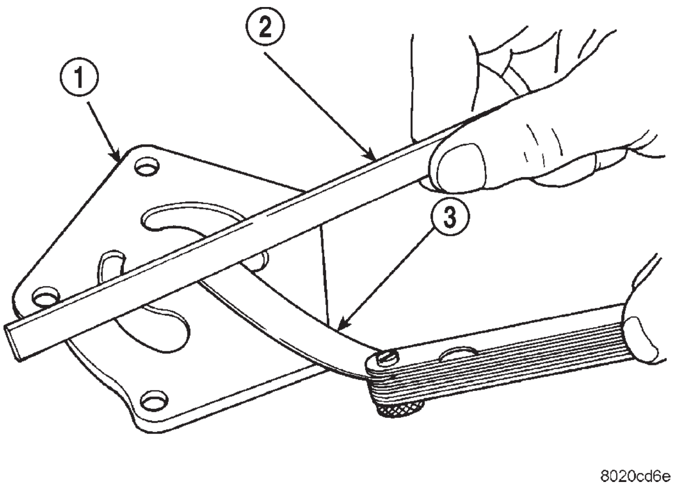


Fig. 84 Checking Oil Pump Cover Flatness

1 – COVER
2 – STRAIGHT EDGE
3 – FEELER GAUGE

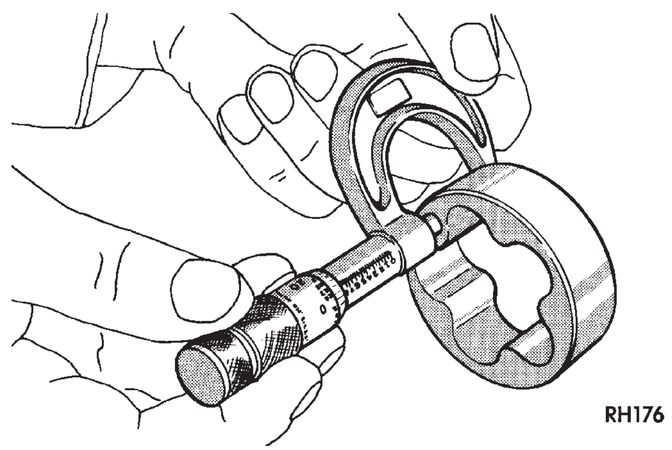


Fig. 85 Measuring Outer Rotor Thickness

If inner rotor measures 20.9 mm (0.825 inch) or less, replace inner rotor and shaft assembly (Fig. 86).

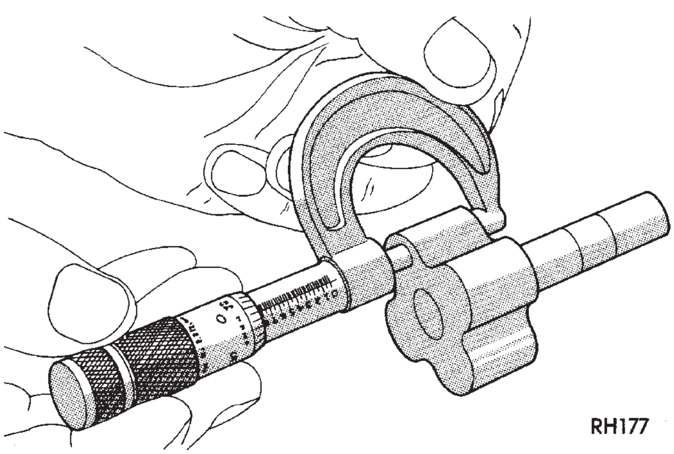


Fig. 86 Measuring Inner Rotor Thickness

Slide outer rotor into pump body. Press rotor to the side with your fingers and measure clearance between rotor and pump body (Fig. 87). If clearance is 0.356 mm (0.014 inch) or more, replace oil pump assembly.

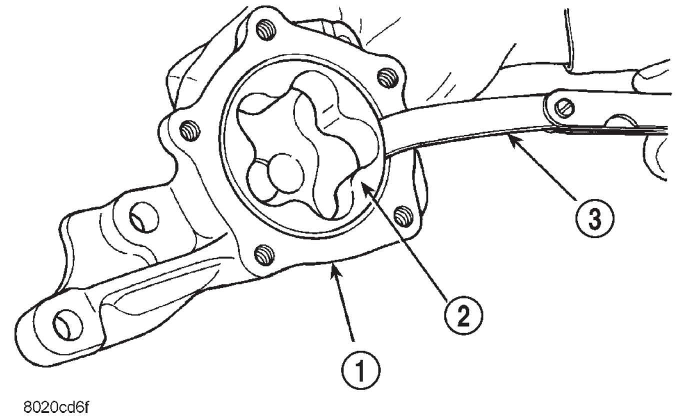


Fig. 87 Measuring Outer Rotor Clearance in Housing

1 – PUMP BODY
2 – OUTER ROTOR
3 – FEELER GAUGE

Install inner rotor and shaft into pump body. If clearance between inner and outer rotors is 0.203 mm (0.008 inch) or more, replace shaft and both rotors (Fig. 88).

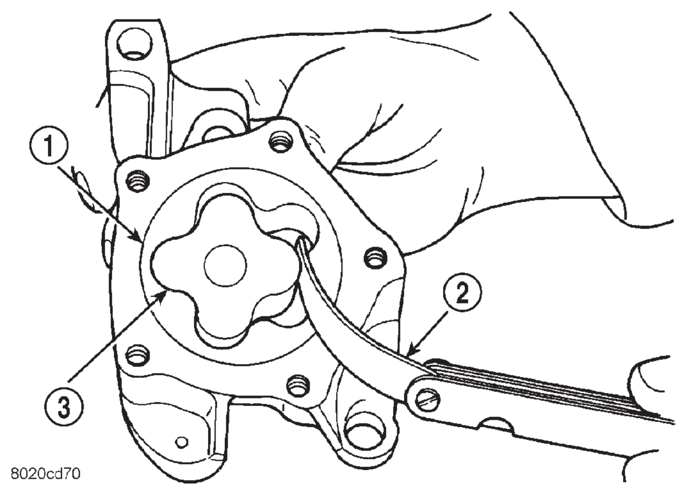


Fig. 88 Measuring Clearance Between Rotors

1 – OUTER ROTOR
2 – FEELER GAUGE
3 – INNER ROTOR

Place a straightedge across the face of the pump, between bolt holes. If a feeler gauge of 0.102 mm (0.004 inch) or more can be inserted between rotors and the straightedge, replace pump assembly (Fig. 89).

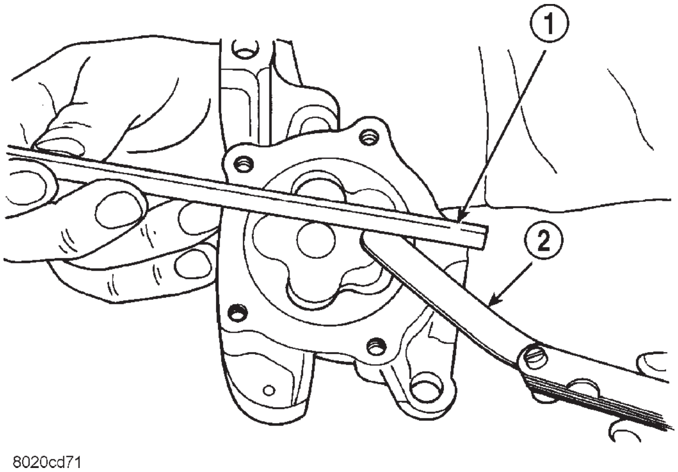


Fig. 89 Measuring Clearance Over Rotors

1 – STRAIGHT EDGE
2 – FEELER GAUGE

Inspect oil pressure relief valve plunger for scoring and free operation in its bore. Small marks may be removed with 400-grit wet or dry sandpaper.

The relief valve spring has a free length of approximately 49.5 mm (1.95 inches). The spring should test between 19.5 and 20.5 pounds when compressed to 34 mm (1-11/32 inches). Replace spring that fails to meet these specifications (Fig. 90).

If oil pressure was low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

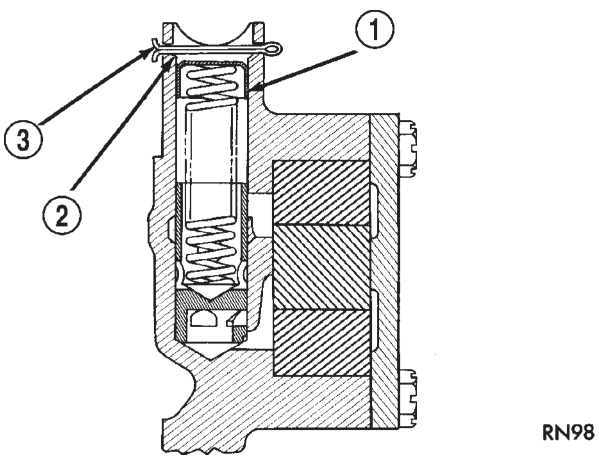


Fig. 90 Proper Installation of Retainer Cap

1 – RETAINER CAP
2 – CHAMFER
3 – COTTER KEY

CYLINDER BLOCK

CLEANING

Clean cylinder block thoroughly and check all core hole plugs for evidence of leaking.

INSPECTION

Examine block for cracks or fractures.

The cylinder walls should be checked for out-of-round and taper with Cylinder Bore Indicator Tool C-119. The cylinder block should be bored and honed with new pistons and rings fitted if:

- The cylinder bores show more than 0.127 mm (0.005 inch) out-of-round.
- The cylinder bores show a taper of more than 0.254 mm (0.010 inch).
- The cylinder walls are badly scuffed or scored.

Boring and honing operation should be closely coordinated with the fitting of pistons and rings so specified clearances may be maintained.

Refer to Standard Service Procedures in the beginning of this Group for the proper honing of cylinder bores.

INTAKE MANIFOLD

CLEANING

Clean manifold in solvent and blow dry with compressed air.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

The plenum pan rail must be clean and dry (free of all foreign material).

INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straightedge.

EXHAUST MANIFOLD

CLEANING

Clean mating surfaces on cylinder head and manifold, wash with solvent and blow dry with compressed air.

INSPECTION

Inspect manifold for cracks, Inspect mating surfaces of manifold for flatness with a straight edge. Seal surfaces must be flat within 0.1 mm (0.004 inch) overall.

SPECIFICATIONS

5.9L ENGINE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Engine Type	90° V-8 OHV
Bore and Stroke	101.6 x 90.9 mm (4.00 x 3.58 in.)
Displacement	5.9L (360 c.i.)
Compression Ratio	9.1:1
Firing Order	1–8–4–3–6–5–7–2
Lubrication	Pressure Feed – Full Flow Filtration
Cooling System	Liquid Cooled – Forced Circulation
Cylinder Block	Cast Iron
Cylinder Head	Cast Iron
Crankshaft	Nodular Iron
Camshaft	Nodular Cast Iron
Combustion Chambers	Wedge - High Swirl Valve Shrouding
Pistons	Aluminum Alloy w/strut
Connecting Rods	Forged Steel
Cylinder Compression Pressure (Min.)	689.5 kPa (100 psi)

DESCRIPTION	SPECIFICATION
CAMSHAFT	
Bearing Diameter	
No. 1	50.800 – 50.825 mm (2.000 – 2.001 in.)
No. 2	50.394 – 50.419 mm (1.984 – 1.985 in.)
No. 3	50.013 – 50.038 mm (1.969 – 1.970 in.)
No. 4	49.606 – 49.632 mm (1.953 – 1.954 in.)
No. 5	39.688 – 39.713 mm (1.5625 – 1.5635 in.)
Bearing Journal Diameter	
No. 1	50.749 – 50.775 mm (1.998 – 1.999 in.)
No. 2	50.343 – 50.368 mm (1.982 – 1.983 in.)
No. 3	49.962 – 49.987 mm (1.967 – 1.968 in.)
No. 4	49.555 – 49.581 mm (1.951 – 1.952 in.)
No. 5	39.637 – 39.662 mm (1.5605 – 1.5615 in.)
Bearing to Journal Clearance	
Standard	0.0254 – 0.0762 mm (0.001 – 0.003 in.)
Service Limit	0.127 mm (0.005 in.)
Camshaft End Play	0.051 – 0.254 mm (0.002 – 0.010 in.)
CONNECTING RODS	
Piston Pin Bore Diameter	24.966 - 24.978 mm (0.9829 - 0.9834 in.)
Side Clearance	0.152 - 0.356 mm (0.006 - 0.014 in.)
CRANKSHAFT	
Rod Journal	
Diameter	53.950 – 53.975 mm (2.124 – 2.125 in.)
Out of Round (Max.)	0.0254 mm (0.001 in.)
Taper (Max.)	0.0254 mm (0.001 in.)
Bearing Clearance	0.013 – 0.056 mm (0.0005 – 0.0022 in.)
Service Limit	0.0762 mm (0.003 in.)
Main Bearing Journal	
Diameter	71.361 – 71.387 mm (2.8095 – 2.8105 in.)
Out of Round (Max.)	0.127 mm (0.001 in.)
Taper (Max.)	0.0254 mm (0.001 in.)
Bearing Clearance	
#1 Journal	0.013 – 0.038 mm (0.0005 – 0.0015 in.)
Service Limit	

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
#1 Journal	0.0381 mm (0.0015 in.)
Bearing Clearance	
#2-5 Journals	0.013 – 0.051 mm
	(0.0005 – 0.002 in.)
Service Limit	
#2-5 Journals	0.064 mm (0.0025 in.)
End Play	0.051 – 0.178 mm
	(0.002 – 0.007 in.)
Service Limit	0.254 mm (0.010 in.)
CYLINDER BLOCK	
Cylinder Bore	
Diameter	101.60 – 101.65 mm
	(4.000 – 4.002 in.)
Out of Round (Max.)	0.025 mm (0.001 in.)
Taper (Max.)	0.025 mm (0.001 in.)
Lifter Bore	
Diameter	22.99 – 23.01 mm
	(0.9051 – 0.9059 in.)
Distributor Drive Bushing—	
(Press Fit)	
Bushing to Bore Interference	0.0127 – 0.3556 mm
	(0.0005 – 0.0140 in.)
Shaft to Bushing Clearance	0.0178 – 0.0686 mm
	(0.0007 – 0.0027 in.)
CYLINDER HEAD AND VALVES	
Valve Seat	
Angle	44.25° – 44.75°
Runout (Max.)	0.0762 mm (0.003 in.)
Width (Finish) – Intake	1.016 – 1.524 mm
	(0.040 – 0.060 in.)
Width (Finish) – Exhaust	1.524 – 2.032 mm
	(0.060 – 0.080 in.)
Valves	
Face Angle	43.25° – 43.75°
Head Diameter – Intake	47.752 mm (1.88 in.)
Head Diameter – Exhaust	41.072 mm (1.617 in.)

DESCRIPTION	SPECIFICATION
Length (Overall) – Intake	126.21 – 126.85 mm
	(4.969 – 4.994 in.)
Length (Overall) – Exhaust	126.44 – 127.30 mm
	(4.978 – 5.012 in.)
Lift (@ zero lash) – Intake	10.414 mm (0.410 in.)
Lift (@ zero lash) – Exhaust	10.592 mm (0.417 in.)
Stem Diameter – Intake	9.449 – 9.474 mm
	(0.372 – 0.373 in.)
Stem Diameter – Exhaust	9.423 – 9.449 mm
	(0.371 – 0.372 in.)
Guide Bore	9.500 – 9.525 mm
	(0.374 – 0.375 in.)
Stem to Guide Clearance—	
Intake	0.0254 – 0.0762 mm
	(0.001 – 0..003 in.)
Stem to Guide Clearance—	
Exhaust	0.0508 – 0.1016 mm
	(0.002 – 0.004 in.)
Service Limit	0.4318 mm (0.017 in.)
Valve Springs	
Free Length	49.962 mm (1.967 in.)
Spring Tension – (valve closed)	378 N @ 41.66 mm
	(85 lbs. @ 1.64 in.)
Spring Tension – (valve open)	890 N @ 30.89 mm
	(200 lbs. @ 1.212 in.)
Number of Coils	6.8
Installed Height	41.66 mm (1.64 in.)
HYDRAULIC TAPPETS	
Body Diameter	22.949 – 22.962 mm
	(0.9035 – 0.9040 in.)
Clearance (to bore)	0.0279 – 0.0610 mm
	(0.0011 – 0.0024 in.)
Dry Lash	1.524 – 5.334 mm
	(0.060 – 0.210 in.)
Push Rod Length	175.64 – 176.15 mm

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
	(6.915 – 6.935 in.)
OIL PRESSURE	
Curb Idle (Min.*)	41.4 kPa (6 psi)
3000 rpm	207 – 552 kPa (30 – 80 psi)
Oil Pressure Bypass Valve—	
Setting	62 – 103 kPa (9 – 15 psi)
Switch Actuating Pressure	34.5 – 48.3 kPa (5 – 7 psi)
*** If oil pressure is zero at curb idle, DO NOT RUN ENGINE.**	
OIL PUMP	
Clearance over Rotors (Max.)	0.1016 mm (0.004 in.)
Cover Out of Flat (Max.)	0.0381 mm (0.0015 in.)
Inner Rotor Thickness (Min.)	20.955 mm (0.825 in.)
Outer Rotor Clearance (Max.)	0.3556 mm (0.014 in.)
Outer Rotor Diameter (Min.)	62.7126 mm (2.469 in.)
Outer Rotor Thickness (Min.)	20.955 mm (0.825 in.)
Tip Clearance between Rotors—	
(Max.)	0.2032 mm (0.008 in.)
PISTONS	
Clearance at Top of Skirt	0.013 – 0.038 mm
	(0.0005 – 0.0015 in.)
Land Clearance (Diam.)	0.508 – 0.660 mm
	(0.020 – 0.026 in.)
Piston Length	81.03 mm (3.19 in.)
Piston Ring Groove Depth—	
#1&2	4.761 – 4.912 mm
	(0.187 – 0.193 in.)
Piston Ring Groove Depth—	
#3	3.996 – 4.177 mm
	(0.157 – 0.164 in.)
Weight	582 – 586 grams

DESCRIPTION	SPECIFICATION
	(20.53 – 20.67 oz.)
PISTON PINS	
Clearance in Piston	0.006 – 0.019 mm
	(0.00023 – 0.00074 in.)
Diameter	25.007 – 25.015 mm
	(0.9845 – 0.9848 in.)
End Play	NONE
Length	67.8 – 68.3 mm
	(2.67 – 2.69 in.)
PISTON RINGS	
Ring Gap	
Compression Ring (Top)	0.30 – 0.55 mm
	(0.012 – 0.022 in.)
Compression Ring (2nd)	0.55 – 0.80 mm
	(0.022 – 0.031 in.)
Oil Control (Steel Rails)	0.381 – 1.397 mm
	(0.015 – 0.055 in.)
Ring Side Clearance	
Compression Rings	0.040 – 0.085 mm
	(0.0016 – 0.0033 in.)
Oil Ring (Steel Rails)	0.05 – 0.21 mm
	(0.002 – 0.008 in.)
Ring Width	
Compression rings	1.530 – 1.555 mm
	(0.060 – 0.061 in.)
Oil Ring (Steel Rails) – Max.	0.447 –0.473 mm
	(0.018 – 0.019 in.)
VALVE TIMING	
Exhaust Valve	
Closes (ATDC)	33°
Opens (BBDC)	56°
Duration	269°
Intake Valve	
Closes (ATDC)	62°
Opens (BBDC)	7°
Duration	249°
Valve Overlap	41°

SPECIFICATIONS (Continued)

ITEM	U/S (O/S)	IDENTIFICATION	IDENTIFICATION LOCATION
Crankshaft Journals	0.0254 mm (0.001 in.) U/S	R or M M-2-3 ect. (indicating No. 2 and 3 main bearing journal) and/or R-1-4 ect. (indicating No. 1 and 4 connecting rod journal)	Milled flat on No. 8 crankshaft counterweight.
Hydraulic Tappets	0.2032 mm (0.008 in.) (O/S)	♦	Diamond-shaped stamp top pad - front of engine and flat ground on outside surface of each O/S tappet bore.
Valve Stems	0.127 mm (0.005 in.) (O/S)	X	Milled pad adjacent to two tapped holes (3/8 in.) on each end of cylinder head.

TORQUE

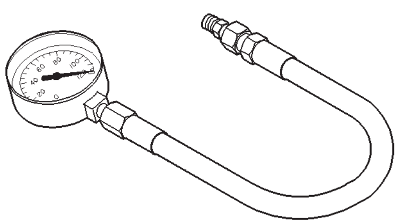
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Sprocket—Bolt	68	50	—
Camshaft Thrust Plate—Bolts	24	—	210
Timing Chain Case Cover—Bolts	41	30	—
Connecting Rod Cap—Bolts	61	45	—
Main Bearing Cap—Bolts	115	85	—
Crankshaft Pulley—Bolts	24	—	210
Cylinder Head—Bolts			
Step 1	68	50	—
Step 2	143	105	—
Cylinder Head Cover—Bolts	11	—	95
Engine Support Bracket to Block—	41	30	—
Bolts (4WD)			
Exhaust Manifold to Cylinder Head— Bolts/Nuts	34	25	—
Flywheel—Bolts	75	55	—
Front Insulator—Through bolt/nut	95	70	—
Front Insulator to Support Bracket			
—Stud Nut (4WD)	41	30	—
—Through Bolt/Nut (4WD)	102	75	—
Front Insulator to Block—Bolts (2WD)	95	70	—
Generator—Mounting Bolt	41	30	—
Intake Manifold—Bolts	Refer to Procedure		
Oil Pan—Bolts	24	—	215
Oil Pan—Drain Plug	34	25	—
Oil Pump—Attaching Bolts	41	30	—
Oil Pump Cover—Bolts	11	—	95
Rear Insulator to Bracket— Through-Bolt (2WD)	68	50	—
Rear Insulator to Crossmember Support Bracket—Nut (2WD)	41	30	—
Rear Insulator to Crossmember— Nuts (4WD)	68	50	—
Rear Insulator to Transmission— Bolts (4WD)	68	50	—
Rear Insulator Bracket—Bolts (4WD Automatic)	68	50	—
Rear Support Bracket to Crossmember Flange—Nuts	41	30	—
Rear Support Plate to Transfer Case—Bolts	41	30	—
Rocker Arm—Bolts	28	21	—
Spark Plugs	41	30	—
Starter Motor—Mounting Bolts	68	50	—
Thermostat Housing—Bolts	25	—	225

SPECIFICATIONS (Continued)

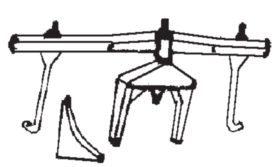
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Throttle Body—Bolts	23	—	200
Torque Converter Drive Plate—Bolts	31	—	270
Transfer Case to Insulator Mounting Plate—Nuts	204	105	—
Transmission Support Bracket— Bolts (2WD)	68	50	—
Vibration Damper—Bolt	244	180	—
Water Pump to Timing Chain Case Cover—Bolts	41	30	—

SPECIAL TOOLS

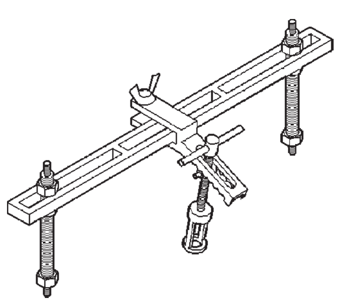
5.9L ENGINE



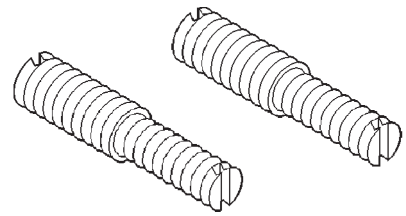
Oil Pressure Gauge C-3292



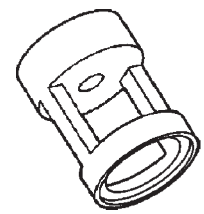
Engine Support Fixture C-3487–A



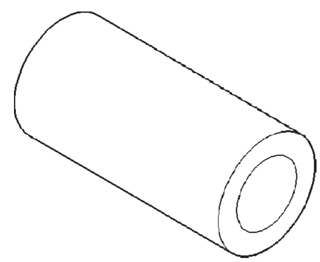
Valve Spring Compressor MD-998772–A



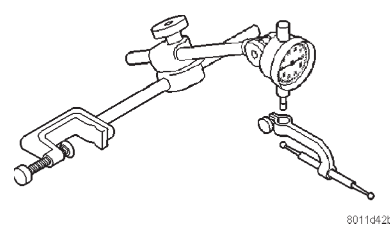
Adapter 6633



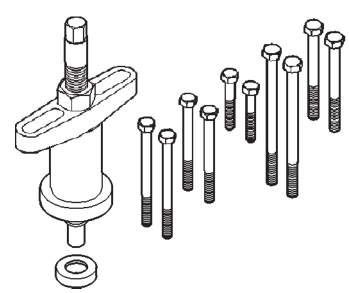
Adapter 6716A



Valve Guide Sleeve C-3973

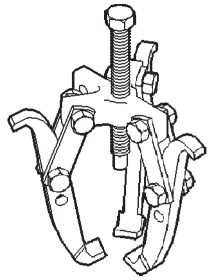


Dial Indicator C-3339

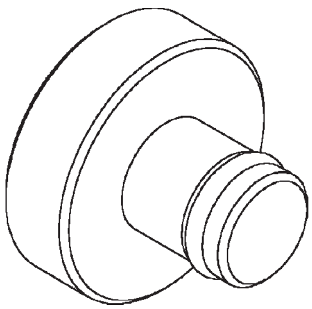


Puller C-3688

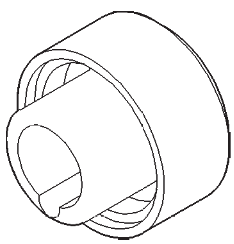
SPECIAL TOOLS (Continued)



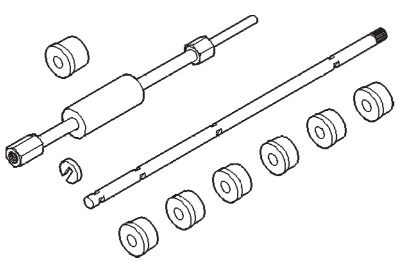
Puller 1026



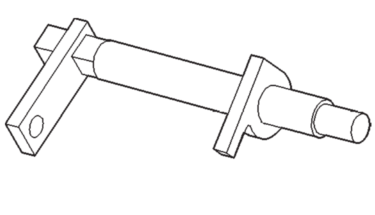
Crankshaft Damper Removal Insert 8513



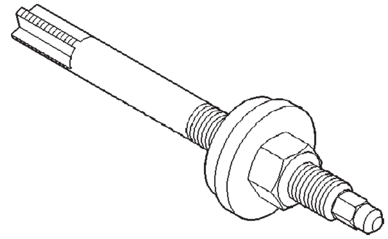
Front Oil Seal Installer 6635



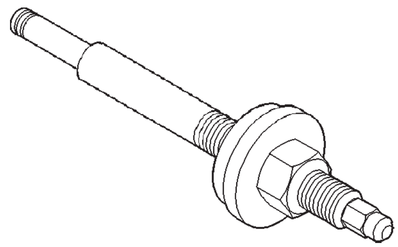
Cam Bearing Remover/Installer C-3132–A



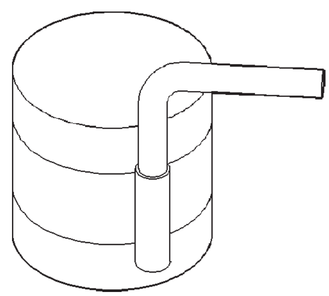
Camshaft Holder C-3509



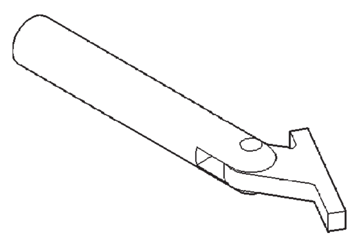
Distributor Bushing Puller C-3052



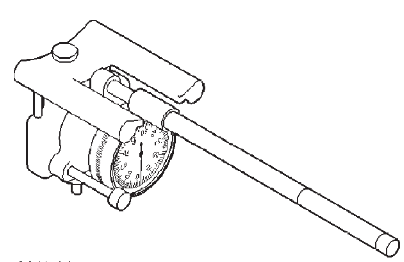
Distributor Bushing Driver/Burnisher C-3053



Piston Ring Compressor C-385

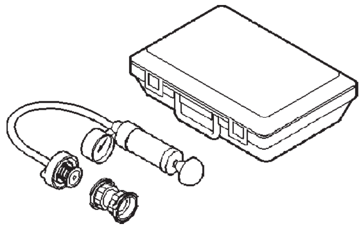


Crankshaft Main Bearing Remover C-3059

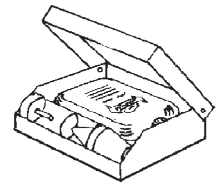


Cylinder Bore Gauge C-119

SPECIAL TOOLS (Continued)



Pressure Tester Kit 7700



Bloc–Chek–Kit C-3685–A

EXHAUST SYSTEM

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
EXHAUST SYSTEM 1
CATALYTIC CONVERTER 1
MUFFLER 1
TAILPIPE 1
EXHAUST HEAT SHIELDS 1
DIAGNOSIS AND TESTING
EXHAUST SYSTEM DIAGNOSIS 3
REMOVAL AND INSTALLATION
EXHAUST PIPE 3
CATALYTIC CONVERTER 5
EXTENSION PIPE 6
MUFFLER 6
TAILPIPE 7
HEAT SHIELDS 7
CLEANING AND INSPECTION
EXHAUST PIPE 10
CATALYTIC CONVERTER 10
SPECIFICATIONS
TORQUE SPECIFICATIONS 10

DESCRIPTION AND OPERATION

EXHAUST SYSTEM

DESCRIPTION

CAUTION: Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

The gasoline engine exhaust system consists of engine exhaust manifolds, exhaust pipes, catalytic converter(s), extension pipe (if needed), exhaust heat shields, muffler and exhaust tailpipe.

The exhaust system must be properly aligned to prevent stress, leakage and body contact. Minimum clearance between any exhaust component and the body or frame is 25.4 mm (1.0 in.). If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

CATALYTIC CONVERTER

DESCRIPTION

California emissions vehicles equipped with 2.5L or 4.7L engines, incorporate mini catalytic converters into the exhaust system. These catalytic converters are made of stainless steel designed to operate at extremely high temperatures.

OPERATION

The catalytic converter captures and burns any unburned fuel mixture exiting the combustion chambers during the exhaust stroke of the engine. This process aids in reducing emissions output.

MUFFLER

DESCRIPTION

All engines use a stainless steel muffler to control exhaust noise levels and exhaust back pressure.

TAILPIPE

DESCRIPTION

The tailpipe is made of stainless steel and attaches to the muffler.

OPERATION

The tailpipe channels the exhaust out of the muffler and out from under the vehicle to control noise and prevent exhaust gas fumes from entering the passenger compartment.

EXHAUST HEAT SHIELDS

DESCRIPTION

There are two types of heat shields used. One is stamped steel the other is molded foil sheets. The shields attach to the vehicle around the exhaust system to prevent heat from the exhaust system from entering the passenger area and other areas where the heat can cause damage to other components.

DESCRIPTION AND OPERATION (Continued)

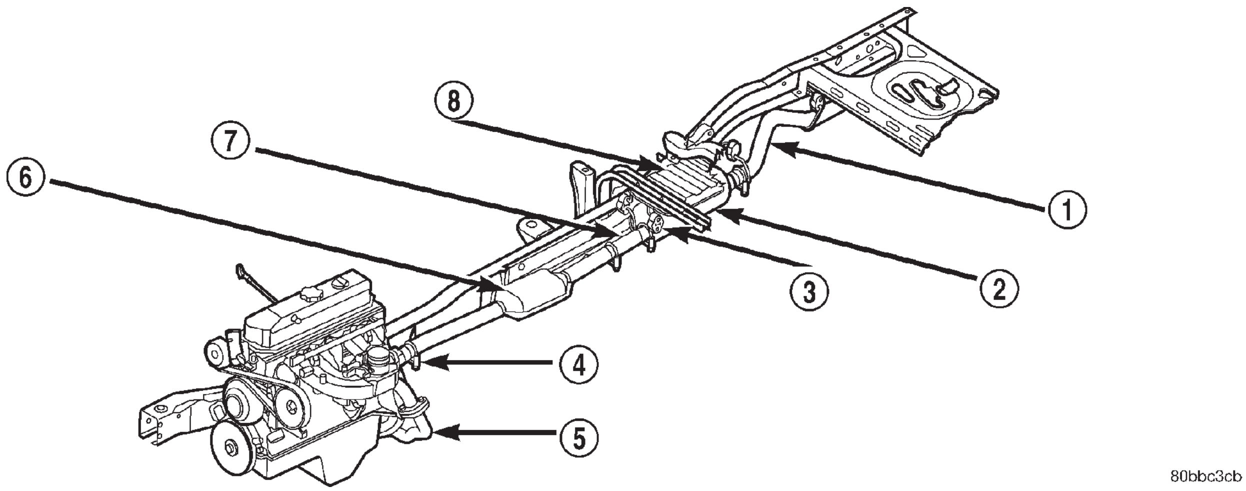


Fig. 1 Exhaust System 2.5L Engines—Typical

1 – TAILPIPE
2 – MUFFLER
3 – MUFFLER HANGER BRACKET AND ISOLATOR
4 – CLAMP
5 – EXHAUST PIPE
6 – CATALYTIC CONVERTER
7 – EXTENSION PIPE
8 – MUFFLER HEAT SHIELD

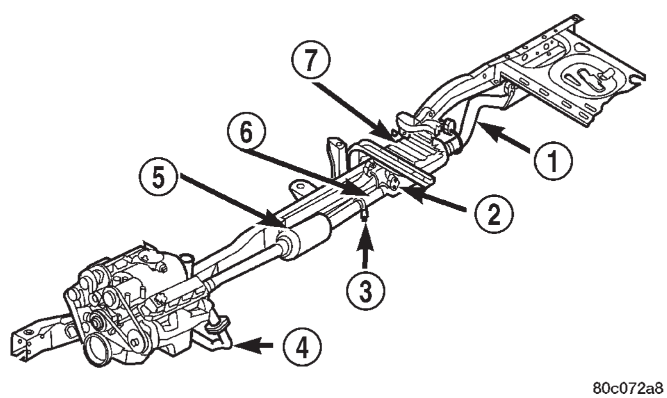


Fig. 2 Exhaust System 3.9L, 4.7L and 5.9L Engines—Typical

1 – TAILPIPE
2 – MUFFLER HANGER BRACKET AND ISOLATOR
3 – CLAMP
4 – EXHAUST PIPE
5 – CATALYTIC CONVERTER
6 – EXTENSION PIPE
7 – MUFFLER HEAT SHIELD

DIAGNOSIS AND TESTING

EXHAUST SYSTEM DIAGNOSIS

EXHAUST SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE	1. Leaks at pipe joints.	1. Tighten clamps to specified torque at leaking joints.
	2. Burned or blown out muffler.	2. Replace muffler assembly. Check exhaust system.
	3. Burned or rusted-out exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten connection attaching nuts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten exhaust manifold to cylinder head stud nuts or bolts.
	7. Restriction in muffler or tailpipe.	7. Remove restriction, if possible. Replace muffler or tailpipe, as necessary.
	8. Exhaust system contacting body or chassis.	8. Re-align exhaust system to clear surrounding components.
LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten/replace clamps at leaking joints.
	2. Damaged or improperly installed gaskets (4.0L only).	2. Replace gaskets as necessary (4.0L only).

REMOVAL AND INSTALLATION

EXHAUST PIPE

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.

(3) Disconnect the oxygen sensor(s).

(4) Remove the exhaust manifold-to-exhaust pipe nuts (Fig. 3) (Fig. 4) (Fig. 5) (Fig. 6).

(5) Remove exhaust pipe to converter exhaust clamp.

(6) Disconnect the exhaust pipe from the catalytic converter front flange.

(7) Remove the exhaust pipe.

REMOVAL AND INSTALLATION (Continued)

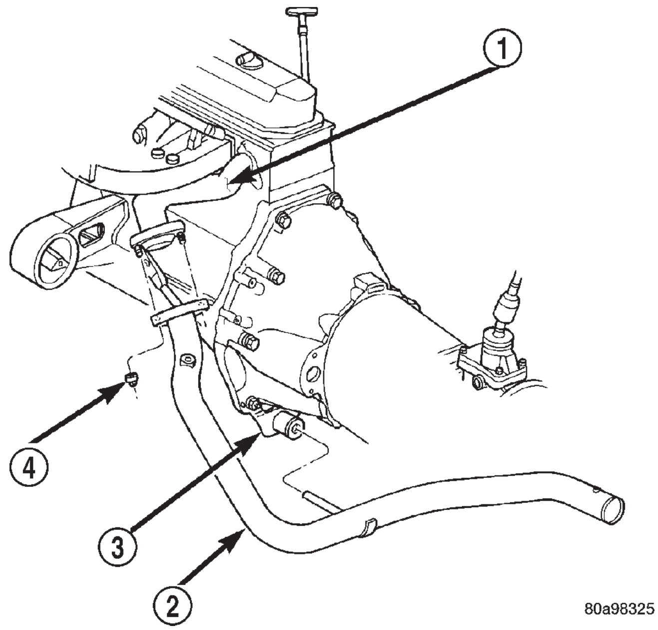


Fig. 3 Exhaust Pipe to Manifold Connection—(2.5L)

1 – EXHAUST MANIFOLD
2 – EXHAUST PIPE
3 – SUPPORT BRACKET
4 – NUT

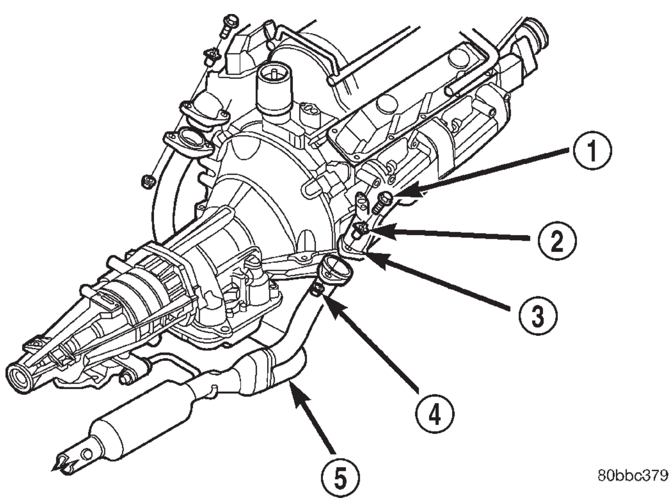


Fig. 4 Exhaust Pipe to Manifold Connection—(3.9L/5.9L)

1 – BOLT
2 – RETAINER
3 – EXHAUST MANIFOLD
4 – NUT
5 – EXHAUST PIPE

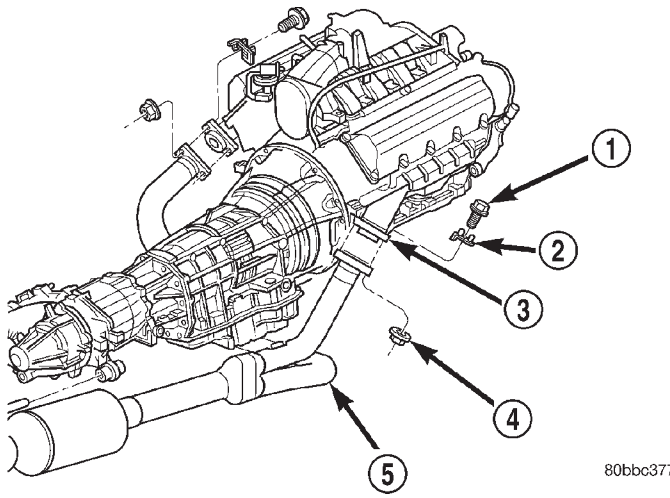


Fig. 5 Exhaust Pipe(s) to Manifold Connection—(4.7L Federal Models)

1 – BOLT
2 – RETAINER
3 – EXHAUST MANIFOLD
4 – NUT
5 – EXHAUST PIPE

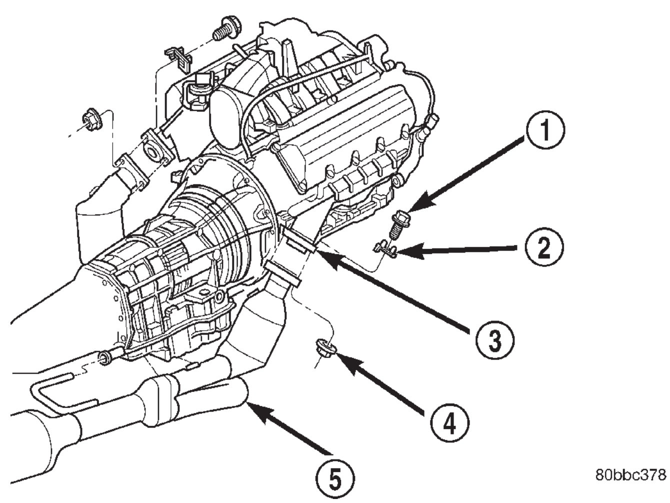


Fig. 6 Exhaust Pipe(s) to Manifold Connection—(4.7L California Models)

1 – BOLT
2 – RETAINER
3 – EXHAUST MANIFOLD
4 – NUT
5 – EXHAUST PIPE

REMOVAL AND INSTALLATION (Continued)

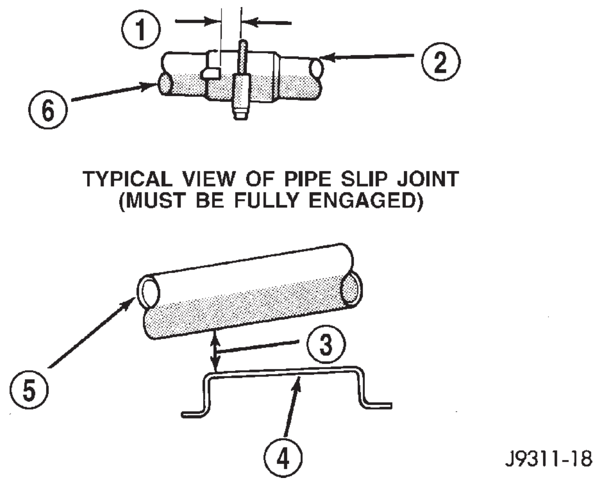


Fig. 7 Exhaust Pipe-to-Catalytic Converter Flange Alignment—Typical

1 – 7.874–17.526 mm (0.31–0.69 in.)
2 – CATALYTIC CONVERTER FLANGE
3 – 20 mm (0.79”) MIN.
4 – CROSSMEMBER
5 – EXHAUST PIPE
6 – EXHAUST PIPE

INSTALLATION

(1) Connect the exhaust pipe(s) to the exhaust manifold. Tighten the nuts to 26 N·m (19 ft. lbs.) torque.

(2) Align and connect the exhaust pipe to the catalytic converter flange (Fig. 7). Install exhaust clamp and tighten clamp nuts to 41 N·m (33 ft. lbs.) torque.

(3) Connect oxygen sensor connector(s).

(4) Lower the vehicle.

(5) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

CATALYTIC CONVERTER

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

REMOVAL

NOTE: The mini catalytic converters used on the 4.7L engine is an integeral part of the exhaust pipe. To replace the mini catalytic converters, the entire exhaust pipe assembly must be replaced. Refer to Exhaust Pipe in this section.

(1) Raise and support the vehicle.

(2) Saturate the bolts and nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.

(3) Remove the clamp holding the catalytic converter flange to the exhaust pipe(s) (Fig. 8) (Fig. 9).

(4) Remove the clamp holding the catalytic converter flange to the muffler or extension pipe.

(5) Remove the transmission mount. Refer to ENGINE.

(6) Remove the crossmember. Refer to FRAME.

(7) Remove the catalytic converter. You may have to loosen up other sections of the exhaust system.

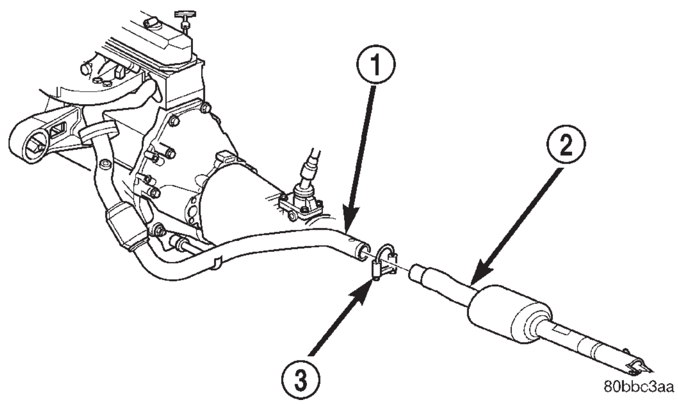


Fig. 8 Catalytic Converter—2.5L Engine

1 – EXHAUST PIPE
2 – CATALYTIC CONVERTER AND PIPE
3 – CLAMP

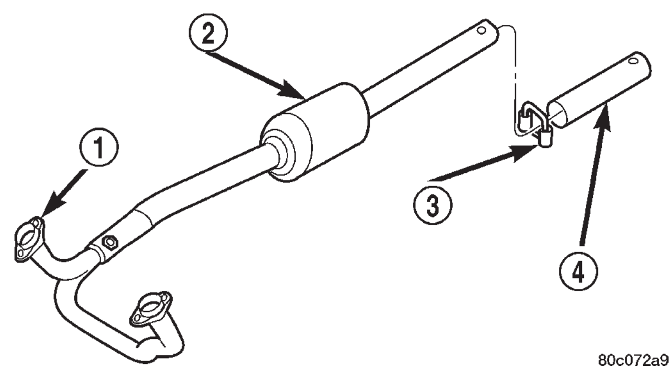


Fig. 9 Catalytic Converter—3.9L/5.9L Engine

1 – EXHAUST PIPE
2 – CATALYTIC CONVERTER
3 – CLAMP
4 – EXTENSION PIPE TO MUFFLER

INSTALLATION

(1) Align and connect the catalytic converter flange to the exhaust pipe (Fig. 7).

(2) Install the catalytic converter flange into the muffler or extension pipe (Fig. 10).

(3) If other sections of the exhaust system where loosened in removal, refer to that section for the tightening procedures.

REMOVAL AND INSTALLATION (Continued)

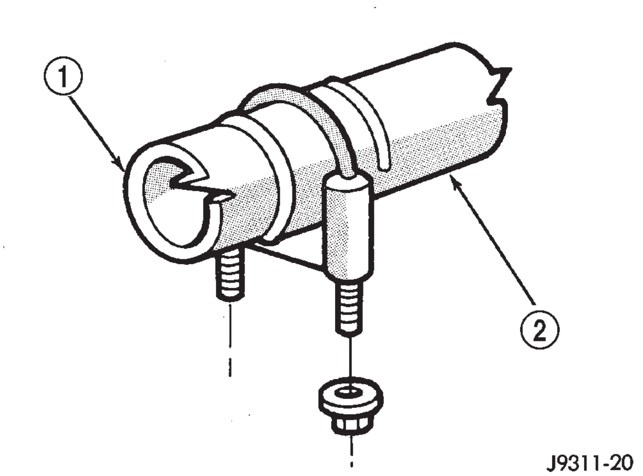


Fig. 10 Extension Pipe/Muffler to Catalytic Converter Flange

1 – CATALYTIC CONVERTER FLANGE
2 – EXTENSION PIPE

(4) At the catalytic converter flange connections, install the clamp and nuts. Tighten the clamp nuts to 41 N·m (30 ft. lbs.) torque.

(5) Install the crossmember.

(6) Install the transmission mount.

(7) Lower the vehicle.

(8) Start the engine and inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

EXTENSION PIPE

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the clamp nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.

(3) Remove the front and rear clamp nuts.

(4) It may be necessary to loosen other sections of the exhaust system to remove the extension pipe.

INSTALLATION

(1) Position the extension pipe in the muffler and the catalytic converter flange.

(2) If other sections of the exhaust system where loosened in removal, refer to the section for tightening procedures.

(3) Install the clamps and nuts (Fig. 10). Tighten the nuts to 47 N·m (35 ft. lbs.) torque.

(4) Lower the vehicle.

(5) Start the engine, inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

MUFFLER

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the clamp nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.

(3) Remove the muffler clamp nuts from the front hanger and the rear muffler to tailpipe connection (Fig. 11).

(4) Disconnect the muffler from the tailpipe. The tailpipe should be supported when the muffler is disconnected.

(5) Remove the muffler from the extension pipe or catalytic converter flange.

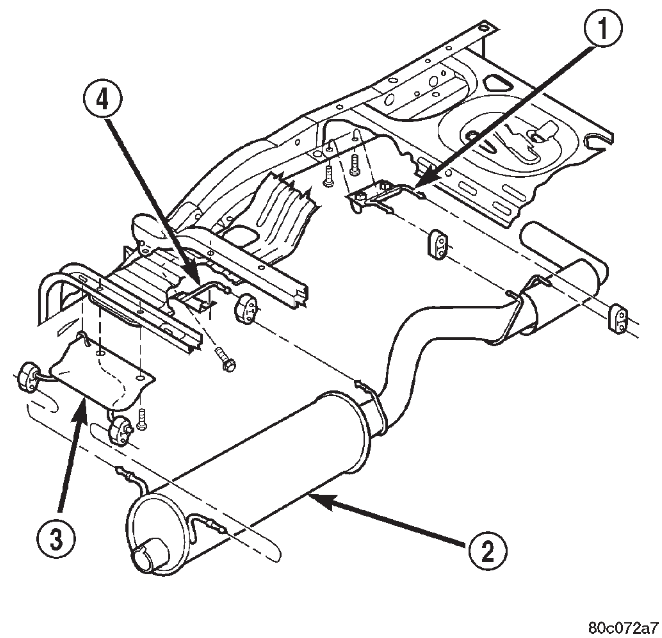


Fig. 11 Muffler and Tailpipe Assembly

1 – TAILPIPE HANGER
2 – MUFFLER AND TAILPIPE
3 – FRONT MUFFLER HANGER
4 – REAR MUFFLER HANGER

INSTALLATION

(1) If the 3.9L/5.9L upper front muffler support was removed (Fig. 11), install the bolts into the frame. Tighten the bolts to 23 N·m (200 in. lbs.)

torque. The insulators slip over the ends of the upper and lower muffler hangers.

(2) Install the muffler into the extension pipe or catalytic converter flange. Install the clamp and tighten the nuts finger tight.

(3) Install the tailpipe into the rear of the muffler.

(4) Tighten the clamp nuts on the front and rear muffler hangers to 41 N·m (30 ft. lbs.) torque.

(5) Lower the vehicle.

(6) Start the engine, inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

TAILPIPE

CAUTION: When servicing or replacing exhaust system components, disconnect the oxygen sensor connector(s). Allowing the exhaust to hang by the oxygen sensor wires will damage the harness and/or sensor.

REMOVAL

(1) Raise and support the vehicle.

(2) Saturate the clamp nuts with Mopar® Rust Penetrant. Allow 5 minutes for penetration.

(3) Remove muffler to tailpipe exhaust clamp.

(4) Remove the tailpipe from the front and rear insulators (Fig. 12) (Fig. 13).

(5) Remove the tailpipe.

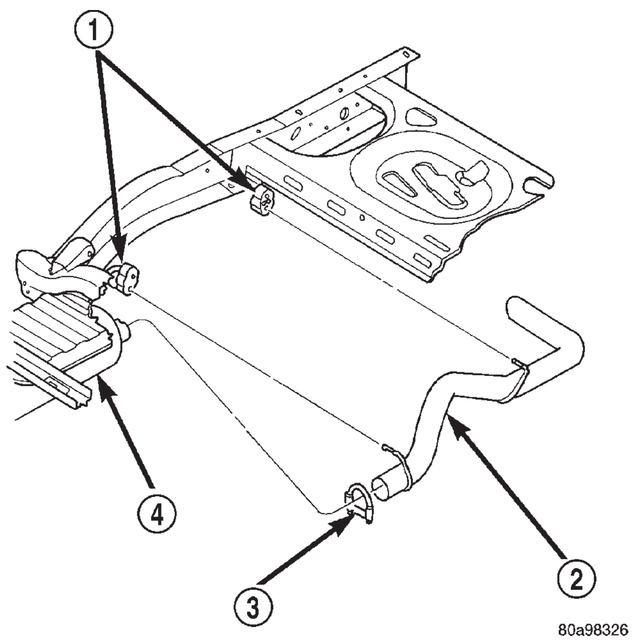


Fig. 12 Tailpipe and Hangers—2.5L/3.9L/4.7L

1 – INSULATORS
2 – TAILPIPE
3 – CLAMP
4 – MUFFLER

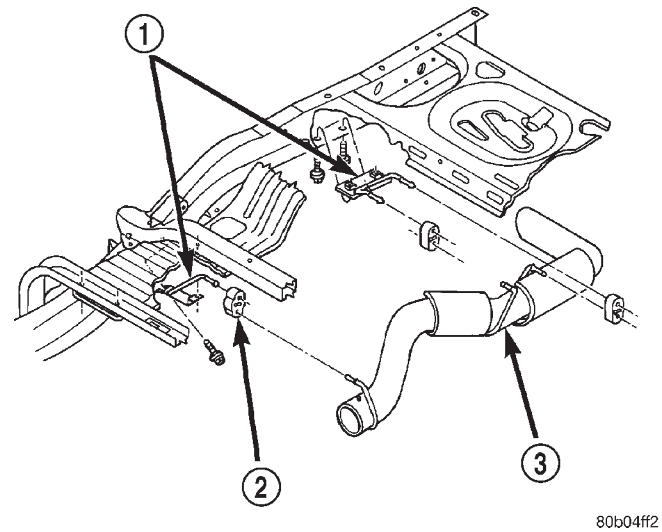


Fig. 13 Tailpipe and Hangers—5.9L R/T

1 – HANGER BRACKETS
2 – ISOLATOR
3 – TAILPIPE

INSTALLATION

(1) Position the tailpipe into the muffler. Install the nuts onto the clamp bolt finger tight.

(2) Install the tailpipe into the insulators.

(3) Position tailpipe and tighten the muffler rear clamp nuts to 47 N·m (35 ft. lbs.) torque.

(4) Lower the vehicle.

(5) Start the engine, inspect for exhaust leaks and exhaust system contact with the body panels. Adjust the alignment, if needed.

HEAT SHIELDS

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the screws and/or nuts holding the heat shields to the frame and/or floor pan.

(3) When removing muffler heat shield, the muffler front support bracket must be removed first.

(4) Slide the shields out around the exhaust system.

INSTALLATION

(1) Position the heat shields to the floor pan or the frame and install the screws and/or nuts.

(2) Tighten the nuts and/or screws to specification. Refer to Specifications in this section for correct torque values.

(3) Lower the vehicle.

REMOVAL AND INSTALLATION (Continued)

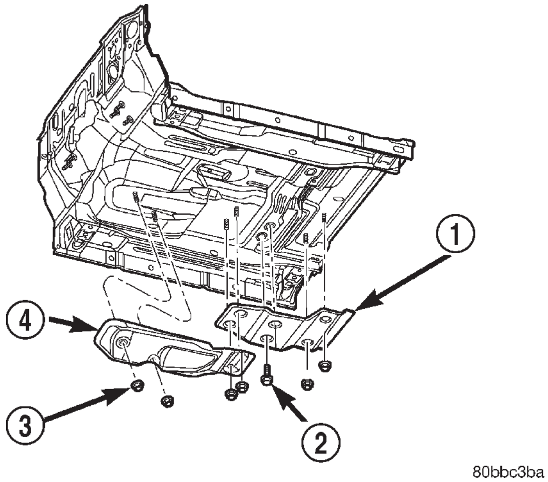


Fig. 14 Floor Pan Heat Shields—Standard Cab

1 – FLOOR PAN HEAT SHIELD
2 – SCREW AND WASHER SELF TAPPING
3 – NUT AND WASHER
4 – FLOOR PAN HEAT SHIELD

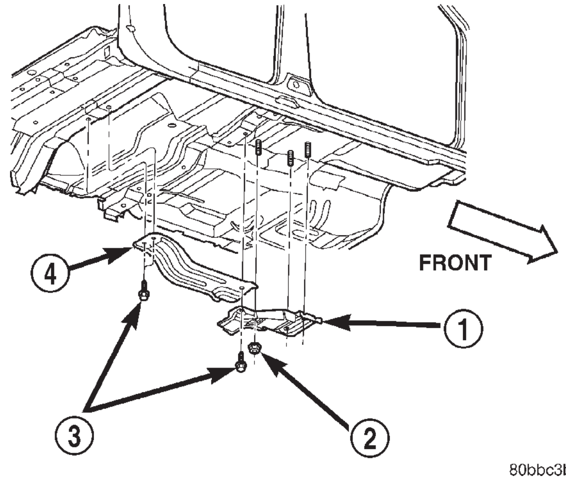


Fig. 16 Floor Pan Heat Shields, Front and Middle Shields—4 Door Cab

1 – FLOOR PAN (FRONT) HEAT SHIELD
2 – NUT AND WASHER
3 – SELF TAPPING SCREW
4 – FLOOR PAN (MIDDLE) HEAT SHIELD

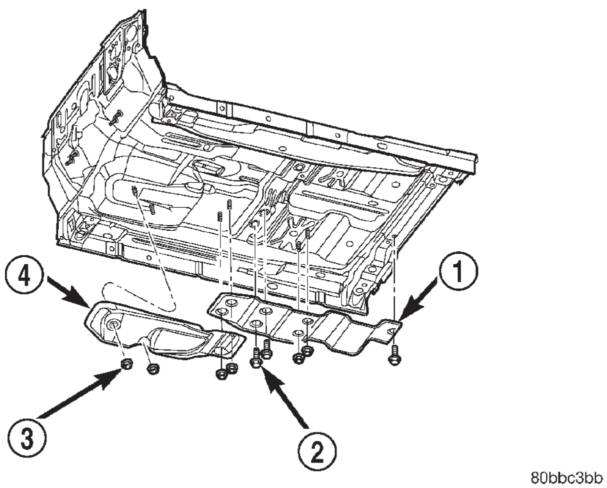


Fig. 15 Floor Pan Heat Shields—Extended Cab

1 – FLOOR PAN AND CATALYTIC CONVERTER HEAT SHIELD
2 – SCREW AND WASHER SELF TAPPING
3 – NUT AND WASHER
4 – FLOOR PAN HEAT SHIELD

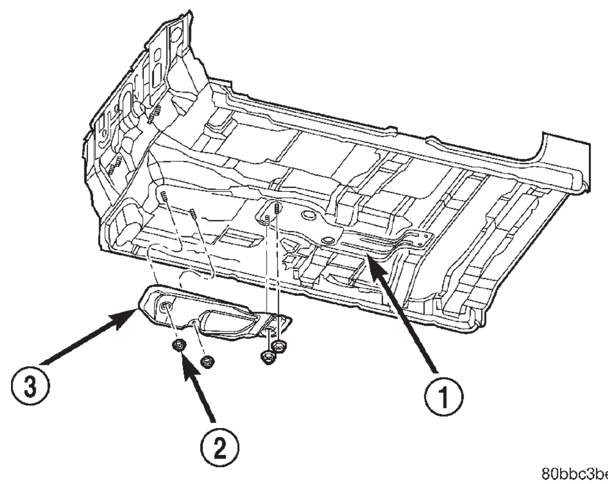


Fig. 17 Floor Pan Heat Shields Front Floor Pan Shield—4 Door Cab

1 – FLOOR PAN (MIDDLE) HEAT SHIELD
2 – NUT AND WASHER
3 – FLOOR PAN (FRONT) HEAT SHIELD

REMOVAL AND INSTALLATION (Continued)

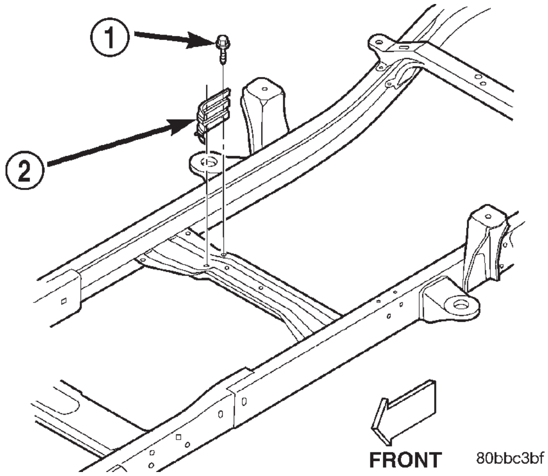


Fig. 18 Center Bearing Heat Shield—Standard Cab and Extended Cab

1 – SCREW AND WASHER SELF TAPPING
2 – CENTER BEARING HEAT SHIELD

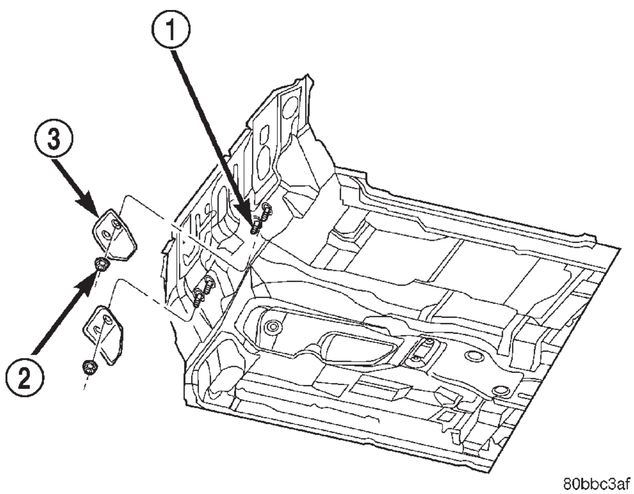


Fig. 19 Dash/Floor Pan Heat Shields

1 – SCREWS
2 – NUT AND WASHER
3 – FRONT FLOOR/DASH HEAT SHIELD

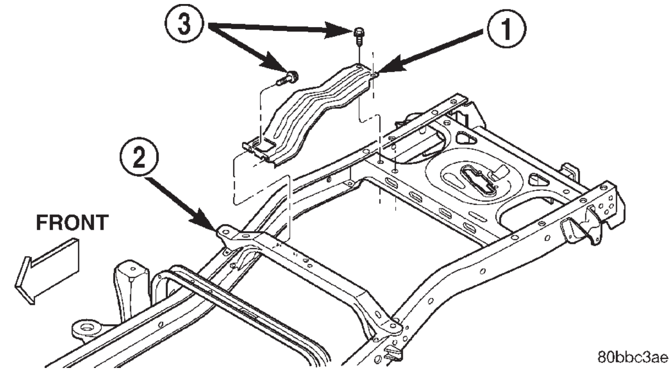


Fig. 20 Tailpipe Heat Shield

1 – TAILPIPE HEAT SHIELD
2 – FUEL TANK CROSSMEMBER
3 – SCREW AND WASHER

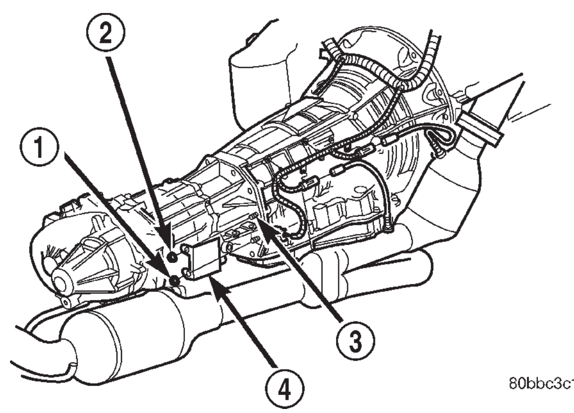


Fig. 21 Electrical Connector Heat Shield—45RFE Transmission

1 – BOLT RETAINER
2 – LOCKNUT
3 – STUDS
4 – HEAT SHIELD

REMOVAL AND INSTALLATION (Continued)

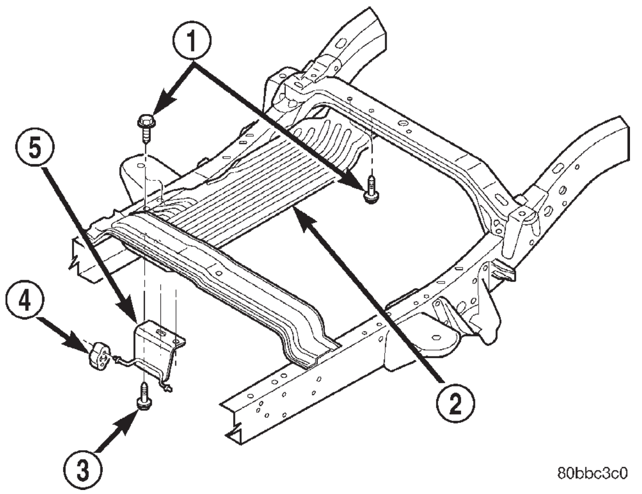


Fig. 22 Muffler Heat Shield—4 Door Cab

1 – SCREW SELF TAPPING
2 – MUFFLER HEAT SHIELD
3 – SCREW SELF TAPPING
4 – ISOLATOR
5 – HANGER BRACKET

CLEANING AND INSPECTION

EXHAUST PIPE

CLEANING

Clean ends of pipes to assure mating of all parts.

INSPECTION

Discard rusted clamps, broken or worn supports and attaching parts. Replace a component with original equipment parts, or equivalent. This will assure proper alignment with other parts in the system and provide acceptable exhaust noise levels.

CATALYTIC CONVERTER

CLEANING

Clean ends of pipes and muffler to assure a good seal at mating surfaces.

INSPECTION

Look at the stainless steel body of the converter, inspect for bulging or other distortion that could be a result of overheating. If the converter has a heat shield attached make sure it is not bent or loose.

If you suspect internal damage to the catalyst, tapping the bottom of the catalyst with a rubber mallet may indicate a damaged core.

SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
EGR Tube—Bolts	23	17	—
Exhaust Clamps—Nuts	41	30	—
Exhaust Pipe to Manifold—Nuts	26	19	—
Heat Shield—Nuts			
Floor Pan/Dash Panel	6	—	55
Floor Pan (All Except 4 Door Cab)	7	—	60
Floor Pan (4 Door Cab)	5	—	45
Electrical Connector (45RFE Trans.)	20	—	175
Heat Shield—Screws			
Floor Pan	22	16	—
Muffler	22	16	—
Tail Pipe	22	16	—
Center Bearing	22	16	—
Muffler Hanger—Screws	22	16	—
Tail Pipe Hanger—Screws	22	16	—

FRAME AND BUMPERS

TABLE OF CONTENTS

	page
BUMPERS	1
FRAME	4

BUMPERS

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
BUMPERS	1
REMOVAL AND INSTALLATION	
FRONT BUMPER	1
FRONT BUMPER FASCIA	1
REAR BUMPER	2
VALANCE PANEL	3

DESCRIPTION AND OPERATION

BUMPERS

DESCRIPTION

Bumpers are used at the front and rear of the vehicle. Bumpers are incorporated into the design of the front and rear fascias. They are mounted to the frame with brackets and may contain some lamp elements.

OPERATION

Bumpers are designed to protect the exterior sheetmetal in low impact situations. The bumpers are attached to the frame and provide mounting points for some optional accessories such as fog lights and tow hooks.

REMOVAL AND INSTALLATION

FRONT BUMPER

REMOVAL

(1) Open hood.
(2) Support front bumper on a suitable lifting device.
(3) Disengage wire connectors from fog lamps, if equipped.
(4) Disengage push-in fasteners attaching air deflector to bottom of bumper fascia.
(5) Pull the front wheelhouse liner back at the bumper and remove bolts attaching outer bumper brackets to frame rail (Fig. 1).
(6) Remove the bolts attaching the bumper to the inner bumper bracket.
(7) Separate front bumper with outer bracket attached from vehicle.

INSTALLATION

When the front bumper is installed, there should be a 19 mm gap between the bumper and front fender.
(1) Place the bumper on a suitable lifting device and position the bumper at the vehicle.
(2) Install the bolts attaching front bumper to inner bumper bracket. Tighten to 94 N·m (70 ft. lbs.) torque.
(3) Install the bolts attaching outer bumper brackets to the frame rail. Tighten to 94 N·m (70 ft. lbs.) torque. Ensure front wheelhouse liners are positioned correctly behind bumper.
(4) Engage wire connectors to fog lamps, if equipped.
(5) Install push-in fasteners attaching air deflector to front bumper fascia.
(6) Remove lifting device.
(7) Close hood.

FRONT BUMPER FASCIA

REMOVAL

(1) Remove the front bumper.

REMOVAL AND INSTALLATION (Continued)

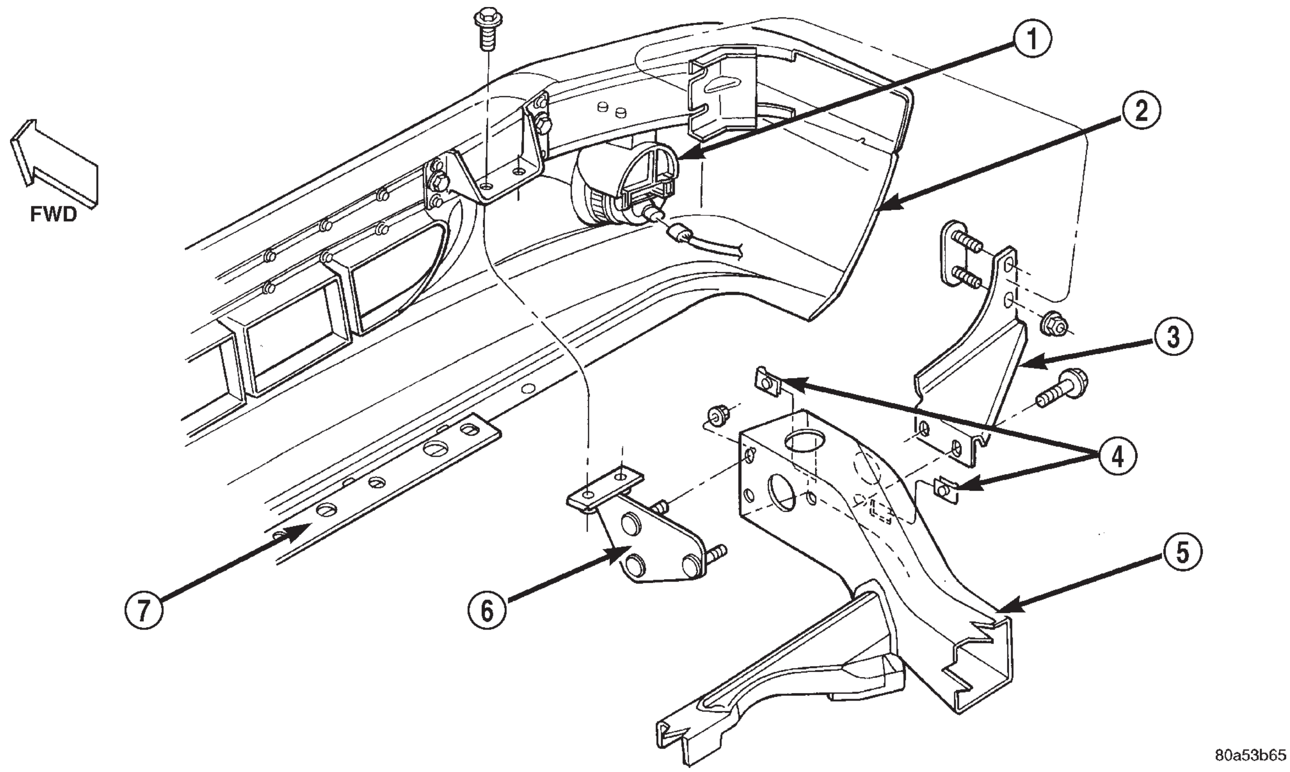


Fig. 1 Front Bumper

1 – FOG LAMP
2 – FRONT BUMPER
3 – OUTER BUMPER BRACKET
4 – U-NUT
5 – FRAME
6 – INNER BUMPER BRACKET
7 – FASCIA BRACKET

(2) Remove the bolts attaching the fascia to the bumper.

(3) Separate fascia from bumper.

INSTALLATION

(1) Position fascia on bumper.

(2) Install the bolts attaching the fascia to the bumper.

(3) Install the front bumper.

REAR BUMPER

REMOVAL

(1) Support rear bumper on a suitable lifting device.

(2) Remove bolts attaching inner bumper brackets to frame rails (Fig. 2).

(3) Disengage license plate lamp wire connector from body wire harness, if equipped.

(4) Separate rear bumper from vehicle.

INSTALLATION

(1) Place bumper on a suitable lifting device and raise into position.

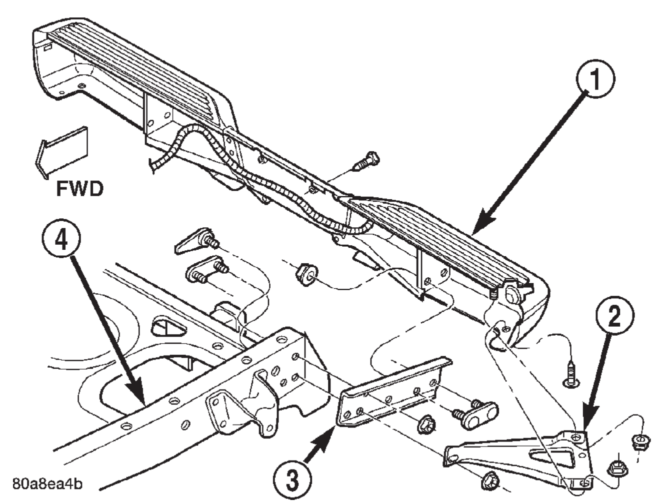


Fig. 2 Rear Bumper

1 – REAR BUMPER
2 – OUTER BRACKET
3 – INNER BRACKET
4 – FRAME

REMOVAL AND INSTALLATION (Continued)

(2) Engage license plate lamp wire connector from body wire harness, if equipped.

(3) Install bolts attaching inner bumper brackets to frame rails. Tighten to 94 N·m (70 ft. lbs.) torque.

(4) Remove lifting device.

VALANCE PANEL

REMOVAL

(1) Remove nuts attaching valance panel to bracket (Fig. 3).

(2) Disengage license plate lamp harness connector.

(3) Separate valance panel from cargo box.

INSTALLATION

(1) Position valance panel on cargo box.

(2) Engage license plate lamp harness connector.

(3) Install nuts attaching valance panel to bracket.

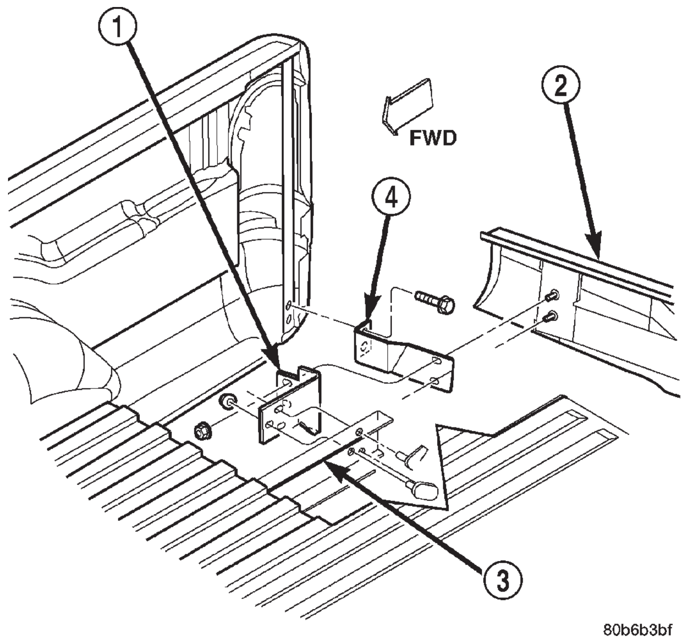


Fig. 3 Valance Panel

1 – BRACKET
2 – VALANCE PANEL
3 – FRAME
4 – BRACKET

FRAME

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
FRAME 4
SERVICE PROCEDURES
FRAME SERVICE 7
REMOVAL AND INSTALLATION
FRONT AXLE SKID PLATE. 8
TRANSFER CASE SKID PLATE 9
FUEL TANK SKID PLATE—4WD VEHICLES 9
SPARE TIRE WINCH 10
TRAILER HITCH. 10
SPECIFICATIONS
FRAME DIMENSIONS 11
TORQUE SPECIFICATIONS. 16

DESCRIPTION AND OPERATION

FRAME

DESCRIPTION

Dakota trucks have a ladder-type frame with Box-section front rails, dropped center section and open-channel side rails in the rear (Fig. 1) and (Fig. 2).

Cross members attached to the frame side rails with rivets, welds or bolts form a ladder-type construction. Additionally, the Dakota Quad Cab uses a mass dampener located between the frame rails, immediately forward of the rear bumper. This damper is used to address NVH issues. The cab is isolated from the frame with rubber load cushions (Fig. 3) and (Fig. 4) with through-bolts. The cargo box or bed is attached to the frame with bolts (Fig. 5). Refer to Group 23, Body for cargo box service procedures.

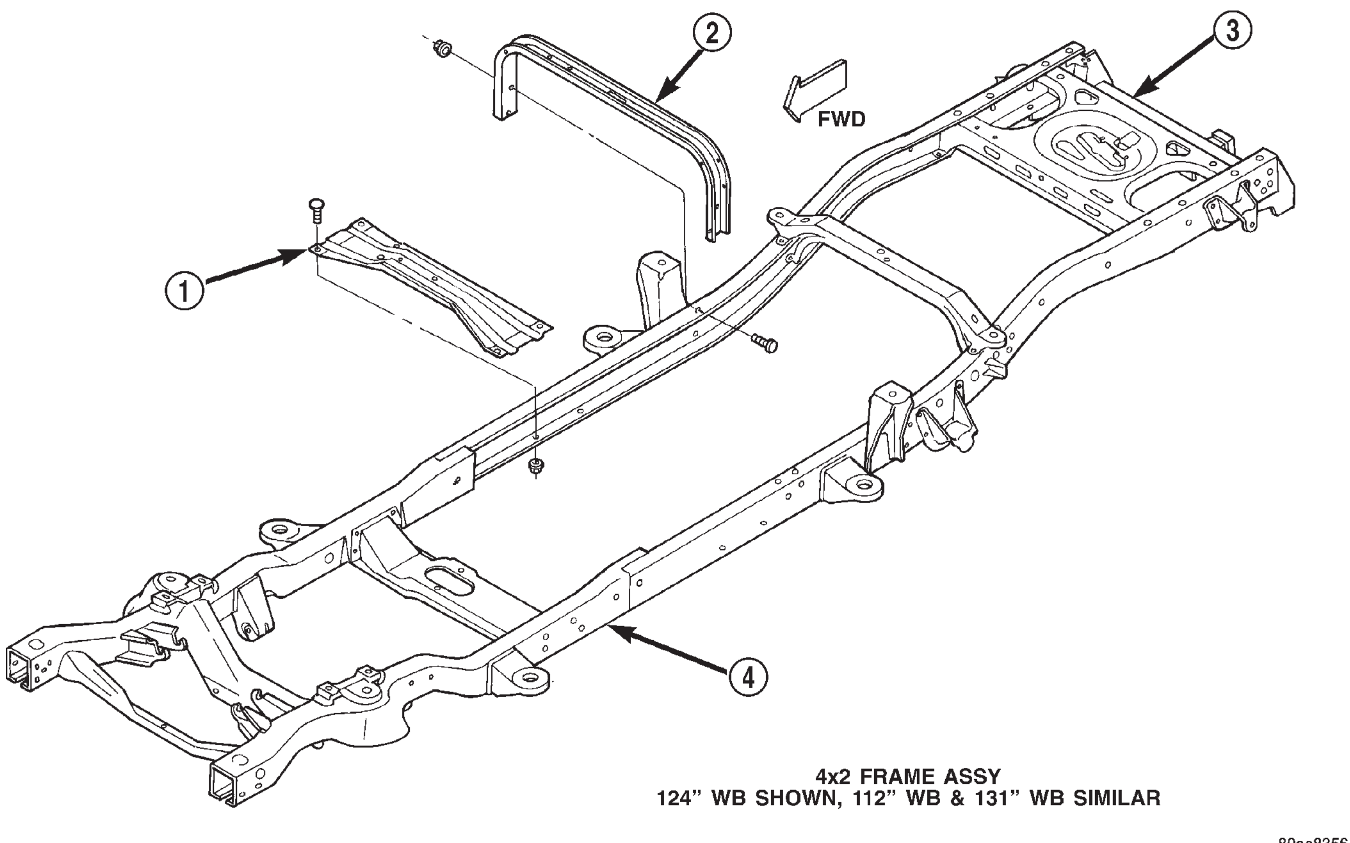


Fig. 1 4X2 Frame

1 – CENTER BEARING CROSSMEMBER
2 – FUEL TANK CROSSMEMBER
3 – TRAILER HITCH
4 – FRAME

DESCRIPTION AND OPERATION (Continued)

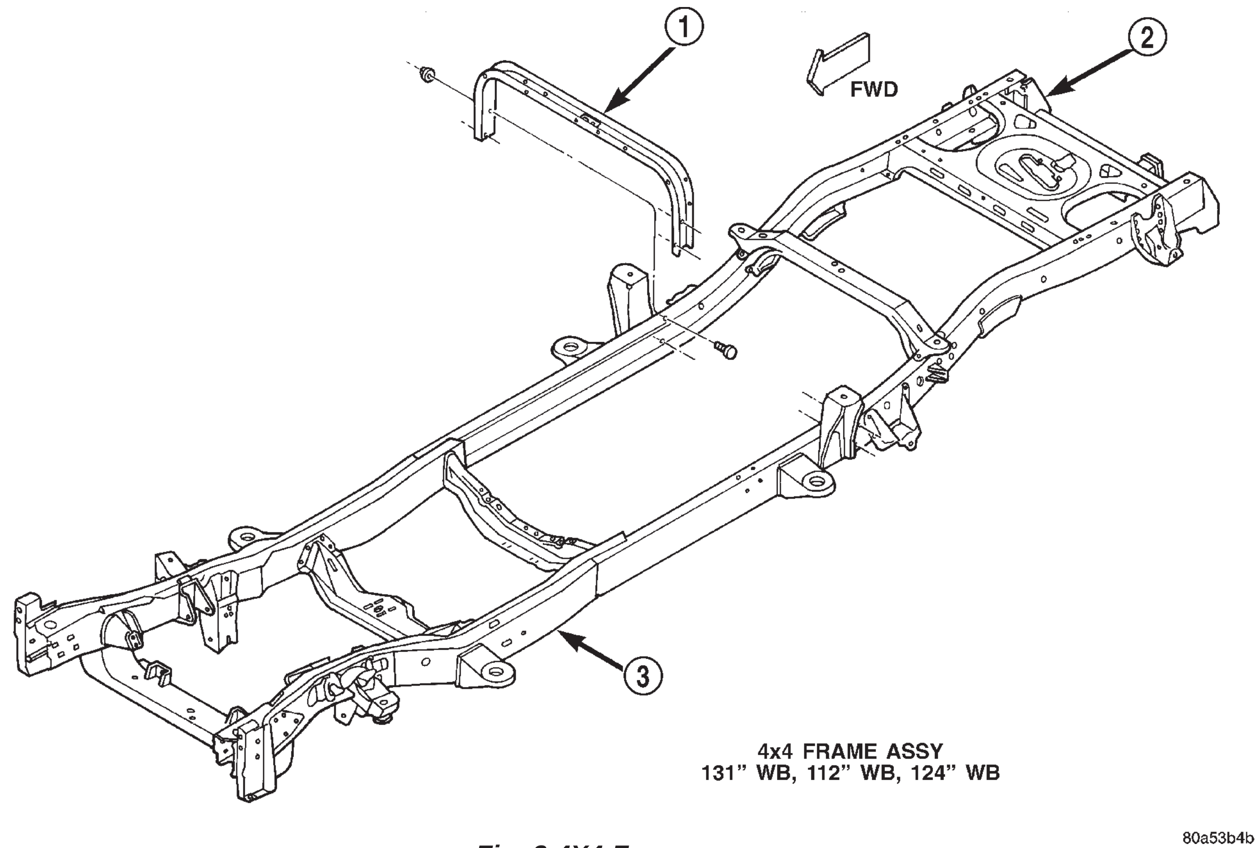


Fig. 2 4X4 Frame

1 – FUEL TANK CROSSMEMBER
2 – TRAILER HITCH
3 – FRAME

DESCRIPTION AND OPERATION (Continued)

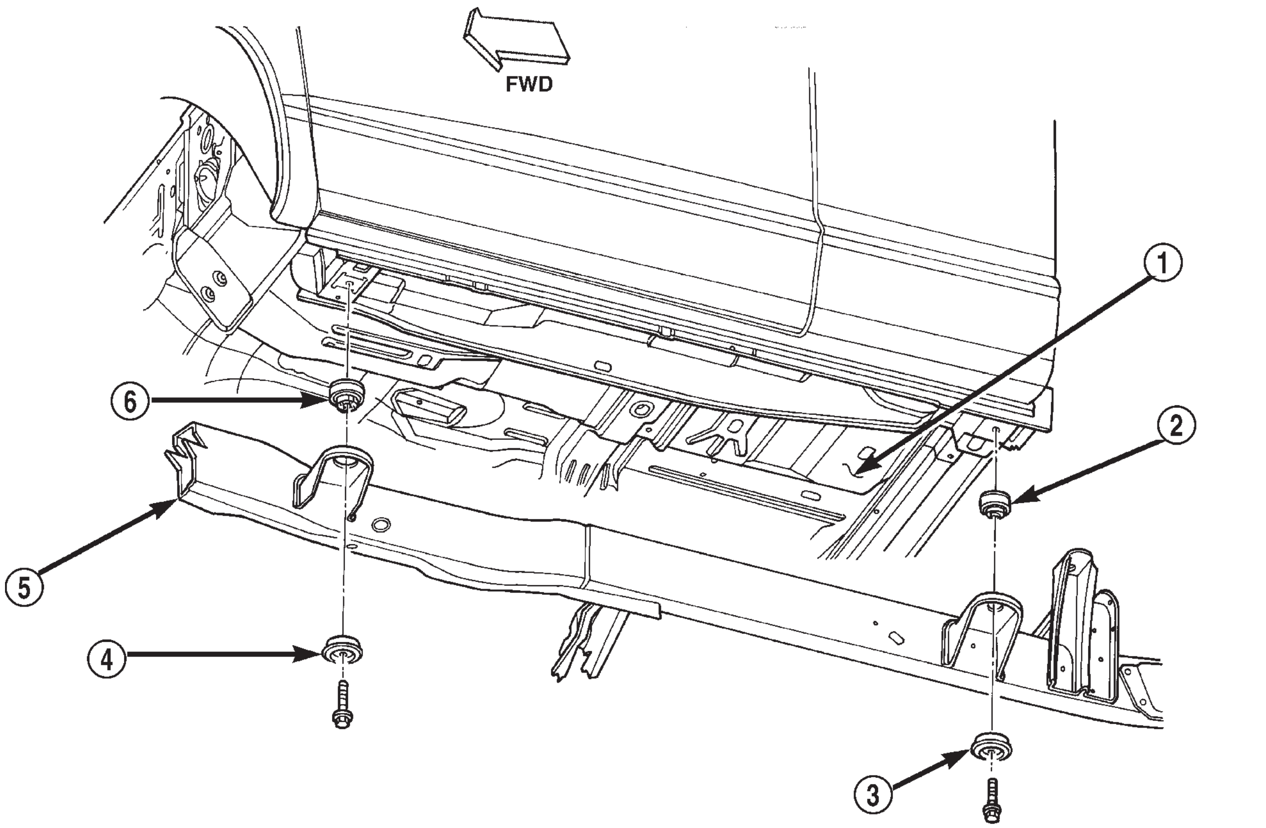


Fig. 3 Cab Mounts

1 – FLOOR PAN
2 – REAR CAB ISOLATOR
3 – UNDER CAB ISOLATOR
4 – UNDER CAB ISOLATOR
5 – FRAME
6 – FRONT CAB ISOLATOR

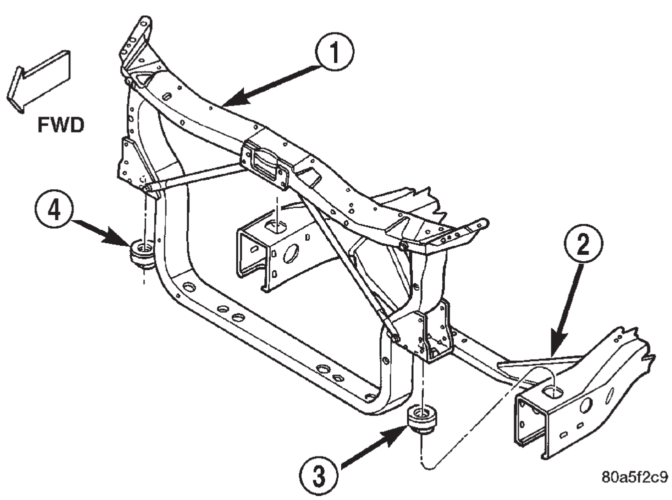


Fig. 4 Radiator Closure Panel

1 – RADIATOR CLOSURE PANEL
2 – FRAME
3 – ISOLATOR
4 – ISOLATOR

DESCRIPTION AND OPERATION (Continued)

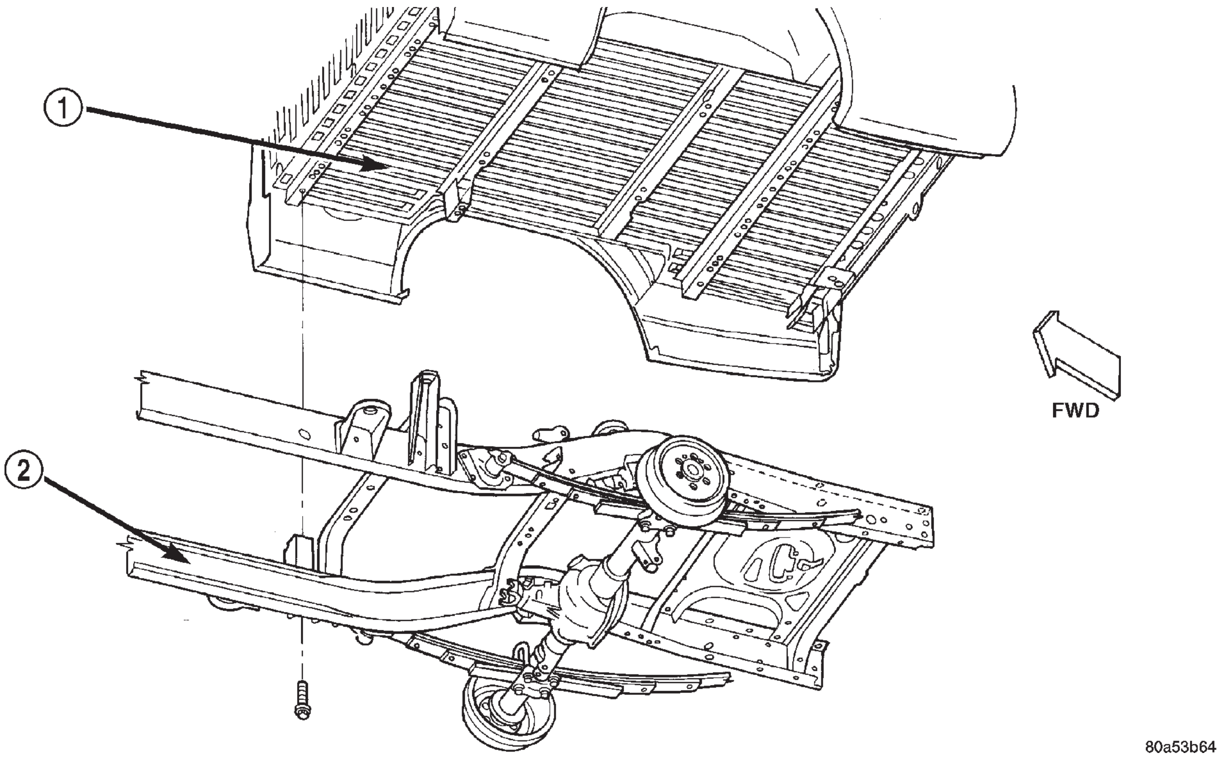


Fig. 5 Cargo Box

1 – CARGO BOX
2 – FRAME RAIL

OPERATION

The frame is designed to absorb and dissipate flexing and twisting due to acceleration, braking, cornering and road surface variances without bending when subjected to normal driving conditions. The frame is the mounting platform for the following systems and components:

- Front and rear suspension systems.
- Engine, transmission, and transfer case.
- Steering gear and linkage.
- Exhaust system and heat shields.
- Fuel cell and fuel line tubing.
- Front end sheet metal and radiator closure panel.
- Skid plate.
- Passenger cab.
- Cargo box or bed.
- Spare tire winch.
- Front and rear bumper systems.

SERVICE PROCEDURES

FRAME SERVICE

SAFETY PRECAUTIONS AND WARNINGS

WARNING: USE EYE PROTECTION WHEN GRINDING OR WELDING METAL, SERIOUS EYE INJURY CAN RESULT. BEFORE PROCEEDING WITH FRAME REPAIR INVOLVING GRINDING OR WELDING, VERIFY THAT VEHICLE FUEL SYSTEM IS NOT LEAKING OR IN CONTACT WITH REPAIR AREA, PERSONAL INJURY CAN RESULT. DO NOT ALLOW OPEN FLAME TO CONTACT PLASTIC BODY PANELS. FIRE OR EXPLOSION CAN RESULT. WHEN WELDED FRAME COMPONENTS ARE REPLACED, 100% PENETRATION WELD MUST BE ACHIEVED DURING INSTALLATION. IF NOT, DANGEROUS OPERATING CONDITIONS CAN RESULT. STAND CLEAR OF CABLES OR CHAINS ON PULLING EQUIPMENT DURING FRAME STRAIGHTENING OPERATIONS, PERSONAL INJURY CAN RESULT. DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT SUPPORTED ON SAFETY STANDS, PERSONAL INJURY CAN RESULT.

SERVICE PROCEDURES (Continued)

CAUTION: Do not reuse damaged fasteners, quality of repair would be suspect. Do not drill holes in top or bottom frame rail flanges, frame rail failure can result. Do Not use softer than Grade 5 bolts to replace production fasteners, loosening or failure can result. When using heat to straighten frame components do not exceed 566°C (1050°F), metal fatigue can result. Welding the joints around riveted cross members and frame side rails can weaken frame.

FRAME STRAIGHTENING

When necessary, a conventional frame that is bent or twisted can be straightened by application of heat. The temperature must not exceed 566°C (1050°F). The metal will have a dull red glow at the desired temperature. Excessive heat will decrease the strength of the metal and result in a weakened frame.

Welding the joints around riveted cross members and frame side rails is not recommended.

A straightening repair process should be limited to frame members that are not severely damaged. The replacement bolts, nuts and rivets that are used to join the frame members should conform to the same specifications as the original bolts, nuts and rivets.

FRAME REPAIRS

DRILLING HOLES

Do not drill holes in frame side rail top and bottom flanges, metal fatigue can result causing frame failure. Holes drilled in the side of the frame rail must be at least 38 mm (1.5 in.) from the top and bottom flanges.

Additional drill holes should be located away from existing holes.

WELDING

Use MIG, TIG or arc welding equipment to repair welded frame components.

Frame components that have been damaged should be inspected for cracks before returning the vehicle to use. If cracks are found in accessible frame components perform the following procedures.

(1) Drill a hole at each end of the crack with a 3 mm (O.125 in.) diameter drill bit.

(2) Using a suitable die grinder with 3 inch cut off wheel, V-groove the crack to allow 100% weld penetration.

(3) Weld the crack.

(4) If necessary when a side rail is repaired, grind the weld smooth and install a reinforcement channel (Fig. 6) over the repaired area.

NOTE: If a reinforcement channel is required, the top and bottom flanges should be 0.250 inches narrower than the side rail flanges. Weld only in the areas indicated (Fig. 6).

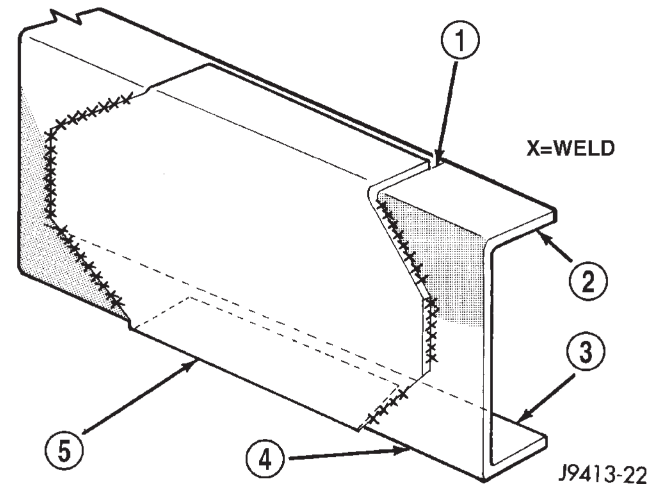


Fig. 6 Frame Reinforcement

1 – .250 IN FROM EDGE
2 – TOP FLANGE
3 – BOTTOM FLANGE
4 – FRAME RAIL
5 – FRAME REPAIR REINFORCEMENT

FRAME FASTENERS

Bolts, nuts and rivets can be used to repair frames or to install a reinforcement section on the frame. Bolts can be used in place of rivets. When replacing rivets with bolts, install the next larger size diameter bolt to assure proper fit. If necessary, ream the hole out just enough to sufficiently receive the bolt.

Conical-type washers are preferred over the split-ring type lock washers. Normally, grade-5 bolts are adequate for frame repair. **Grade-3 bolts or softer should not be used.** Tightening bolts/nuts with the correct torque, refer to the Introduction Group at the front of this manual for tightening information.

REMOVAL AND INSTALLATION

FRONT AXLE SKID PLATE

REMOVAL

(1) Position a support under the skid plate.

(2) Remove the bolts that attach the skid plate to the front crossmember (Fig. 7).

(3) Remove the bolts that attach the skid plate to the skid plate crossmember (Fig. 8).

(4) Separate the crossmember from the vehicle.

REMOVAL AND INSTALLATION (Continued)

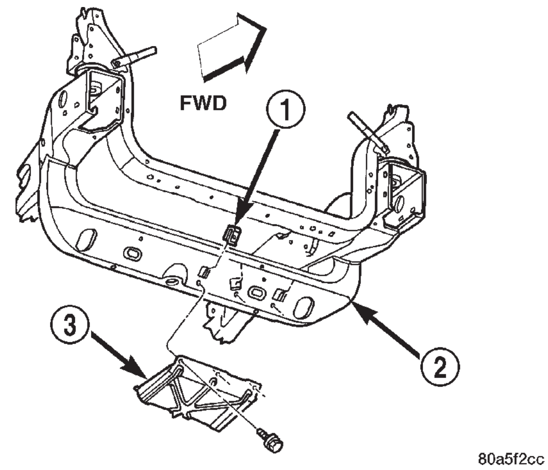


Fig. 7 Front Axle Skid Plate

1 – U-NUT
2 – FRAME
3 – SKID PLATE

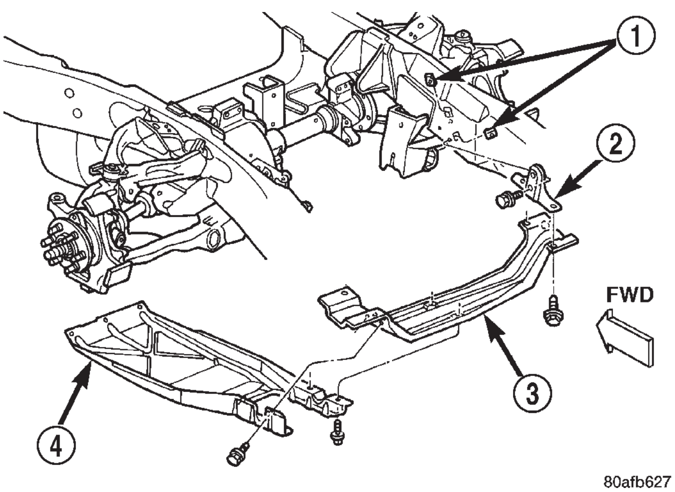


Fig. 8 Front Axle Skid Plate

1 – U-NUT
2 – BRACKET
3 – SKID PLATE CROSSMEMBER
4 – SKID PLATE

INSTALLATION

(1) Position and support the skid plate at the front crossmember.

(2) Install the bolts that attach the skid plate to the transmission crossmember. Tighten to 23 N·m (17 ft. lbs.) torque.

(3) Install the bolts that attach the skid plate to the front crossmember. Tighten to 23 N·m (17 ft. lbs.) torque.

(4) Remove the support from under the skid plate.

TRANSFER CASE SKID PLATE

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove bolts attaching skid plate to crossmembers (Fig. 9).

(3) Separate skid plate from vehicle.

INSTALLATION

(1) Position skid plate on vehicle.

(2) Install bolts attaching skid plate to crossmembers. Tighten to 23 N·m (17 ft. lbs.) torque.

(3) Remove safety stands and lower vehicle.

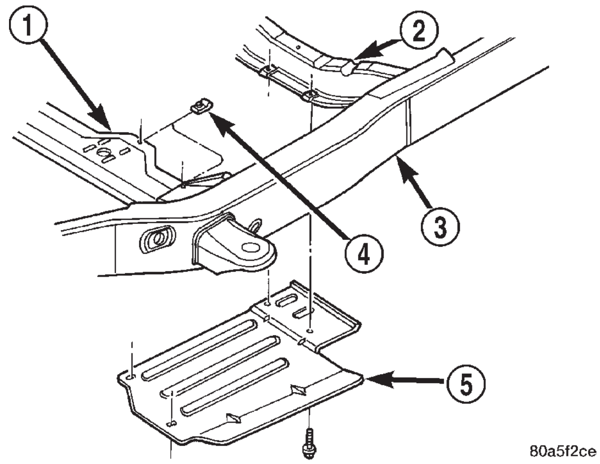


Fig. 9 Transfer Case Skid Plate

1 – TRANSMISSION CROSSMEMBER
2 – TORSION BAR CROSSMEMBER
3 – FRAME
4 – U-NUT
5 – TRANSFER CASE SKID PLATE

FUEL TANK SKID PLATE—4WD VEHICLES

REMOVAL

(1) Position a support under the skid plate.

(2) Remove the nuts that attach the skid plate to the fuel tank crossmember and the frame crossmember (Fig. 10).

(3) Remove the screws that attach the skid plate to the support bracket and the frame side rail.

(4) Remove the support and the skid plate from the vehicle.

INSTALLATION

(1) Position and support the skid plate under the fuel tank.

(2) Install the nuts to attach the skid plate to the fuel tank crossmember and the frame crossmember. Tighten the nuts with 41 N·m (30 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

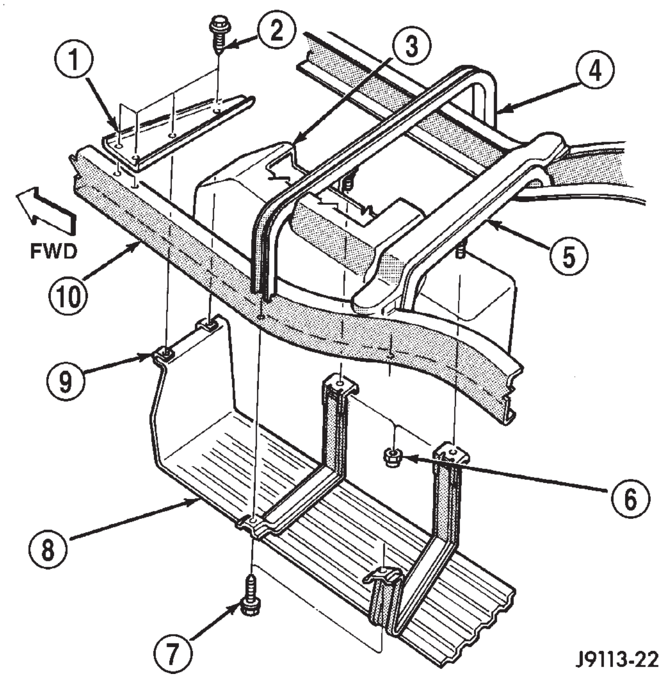


Fig. 10 Fuel Tank Skid Plate—4WD Vehicles

1 – SKID PLATE SUPPORT BRACKET
2 – SCREW
3 – FUEL TANK
4 – FUEL TANK CROSSMEMBER
5 – FRAME CROSSMEMBER
6 – LOCK NUT
7 – SCREW
8 – SKID PLATE
9 – U-NUT
10 – FRAME RAIL

(3) Install the screws to attach the skid plate to the frame side rail and the support bracket. Tighten the screws with 23 N·m (200 in. lbs.) torque.

(4) Remove the support from under the skid plate.

SPARE TIRE WINCH

REMOVAL

(1) Remove spare tire.

(2) Remove bolts attaching spare tire winch to crossmember (Fig. 11).

(3) Disengage clip attaching extension tube to spare tire winch (Fig. 12).

(4) Separate spare tire winch from vehicle.

INSTALLATION

(1) Position extension tube on spare tire winch and engage clip.

(2) Position spare tire winch on vehicle.

(3) Install bolts attaching spare tire winch to spare tire bracket.

(4) Install spare tire.

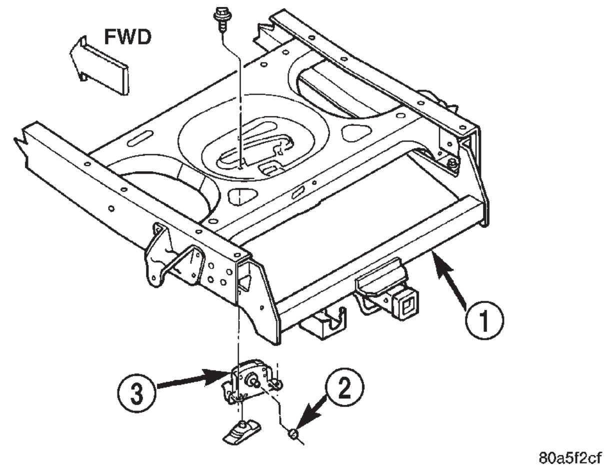


Fig. 11 Spare Tire Winch

1 – TRAILER HITCH
2 – CAP
3 – SPARE TIRE WINCH

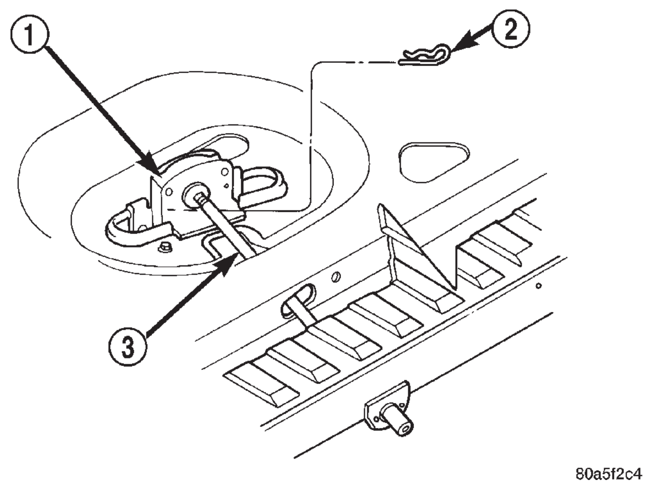


Fig. 12 Extension Tube

1 – WINCH
2 – PIN
3 – WINCH ACTUATOR EXTENSION TUBE

TRAILER HITCH

REMOVAL

(1) Support trailer hitch on a suitable lifting device.

(2) Remove fasteners attaching trailer wiring connector to trailer hitch, if equipped.

(3) Remove bolts attaching trailer hitch to frame rails (Fig. 13).

(4) Separate trailer hitch from vehicle.

INSTALLATION

(1) Position trailer hitch on vehicle.

REMOVAL AND INSTALLATION (Continued)

(2) Install the bolts attaching trailer hitch to frame rails and remove lifting device. Tighten to 108 N·m (80 ft. lbs.) torque.

(3) Install fasteners attaching trailer wiring connector to trailer hitch, if equipped.

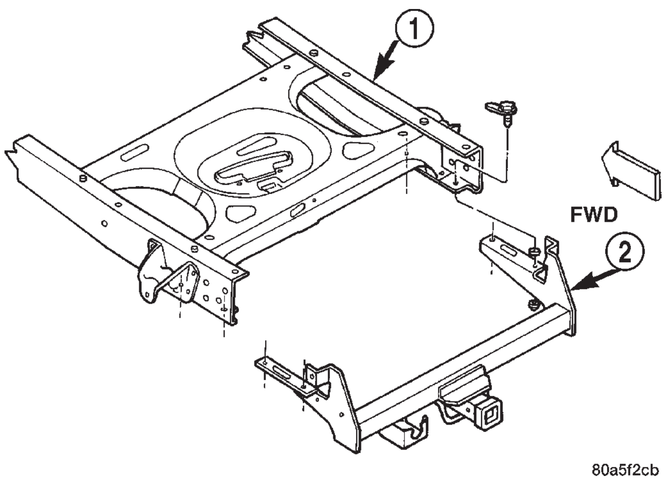


Fig. 13 Trailer Hitch

1 – FRAME
2 – TRAILER HITCH

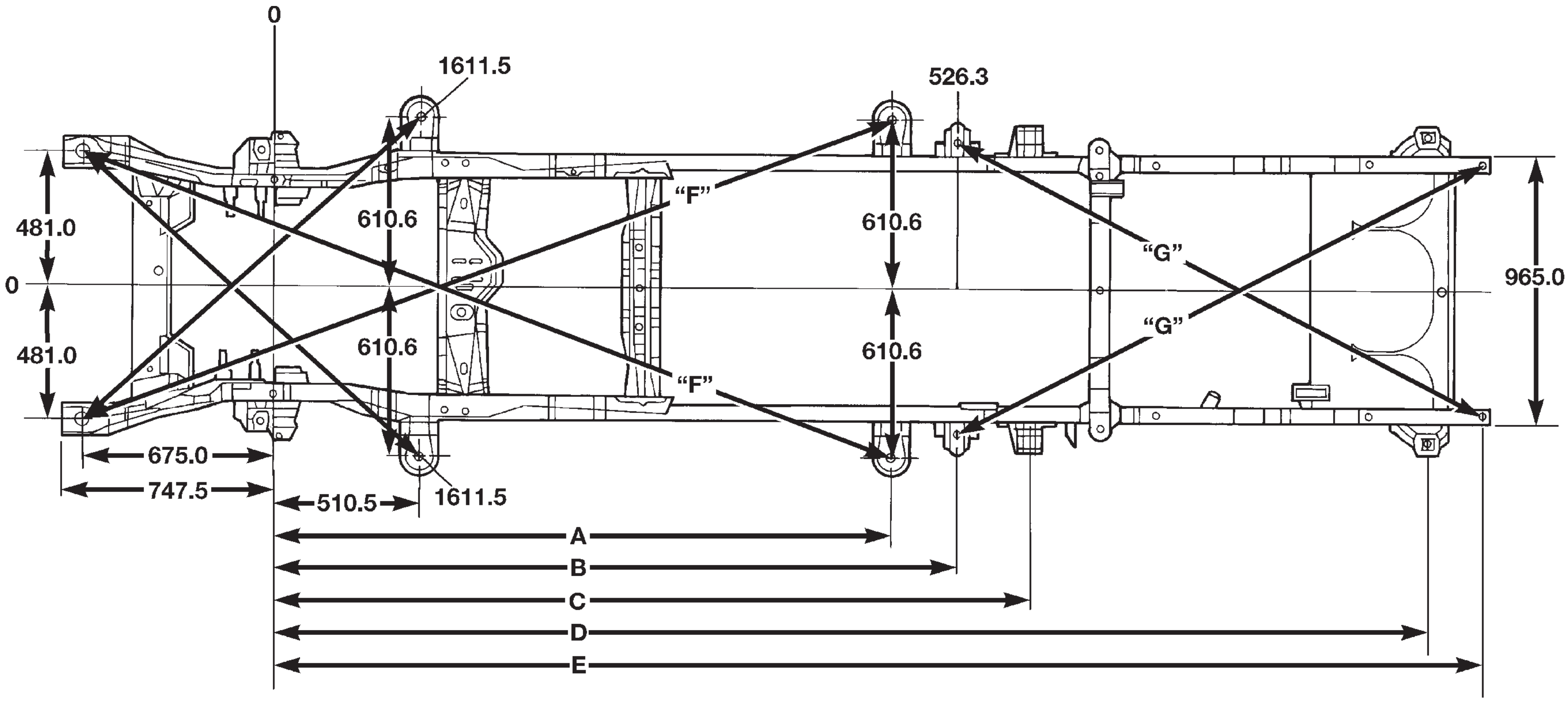
SPECIFICATIONS

FRAME DIMENSIONS

All dimensions are listed in millimeters.

SPECIFICATIONS (Continued)

4X4 FRAME TOP VIEW

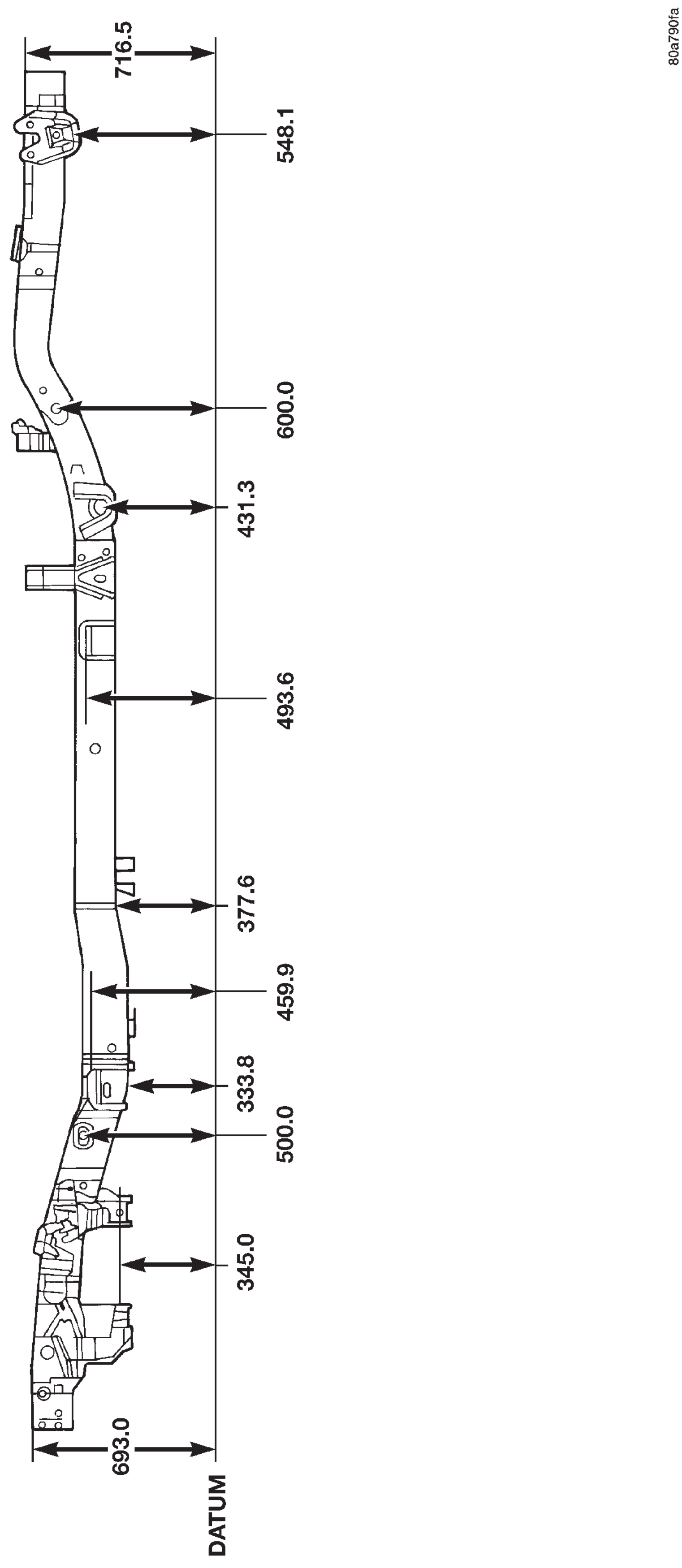


WHEEL BASE	4X2 4X4	DIMN A	DIMN B	DIMN C	DIMN D	DIMN E	DIMN F	DIMN G
112	4X4	1674.8	1901.0	2159.3	3539.4	3738.5	2591.0	2081.7
124	4X4	1674.8	1901.0	2464.0	3844.2	4208.5	2591.0	2506.1
131	4X4	2156.7	2383.0	2641.9	4022.0	4220.5	3034.9	2081.7

80a790fb

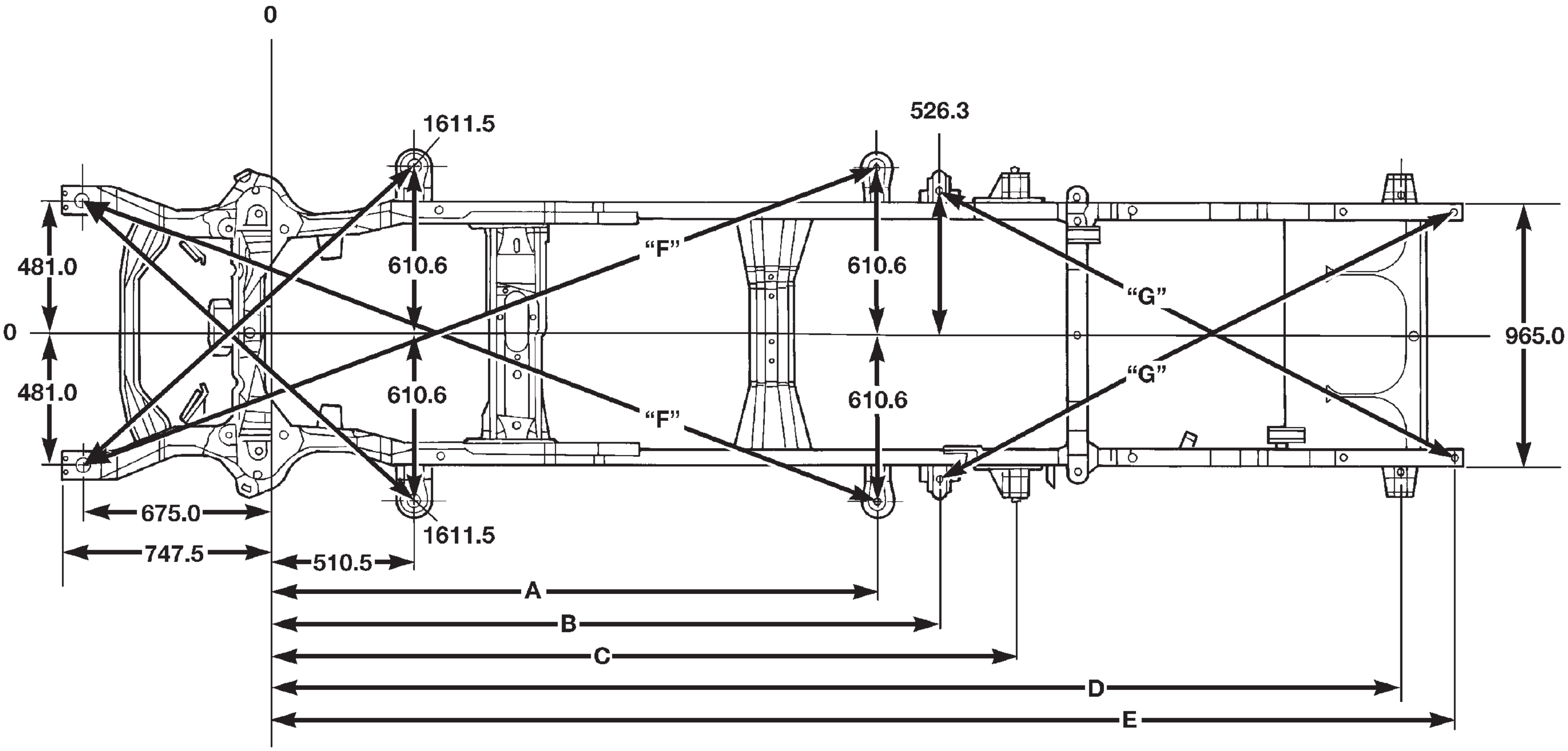
SPECIFICATIONS (Continued)

4X4 FRAME SIDE VIEW



SPECIFICATIONS (Continued)

4X2 FRAME TOP VIEW

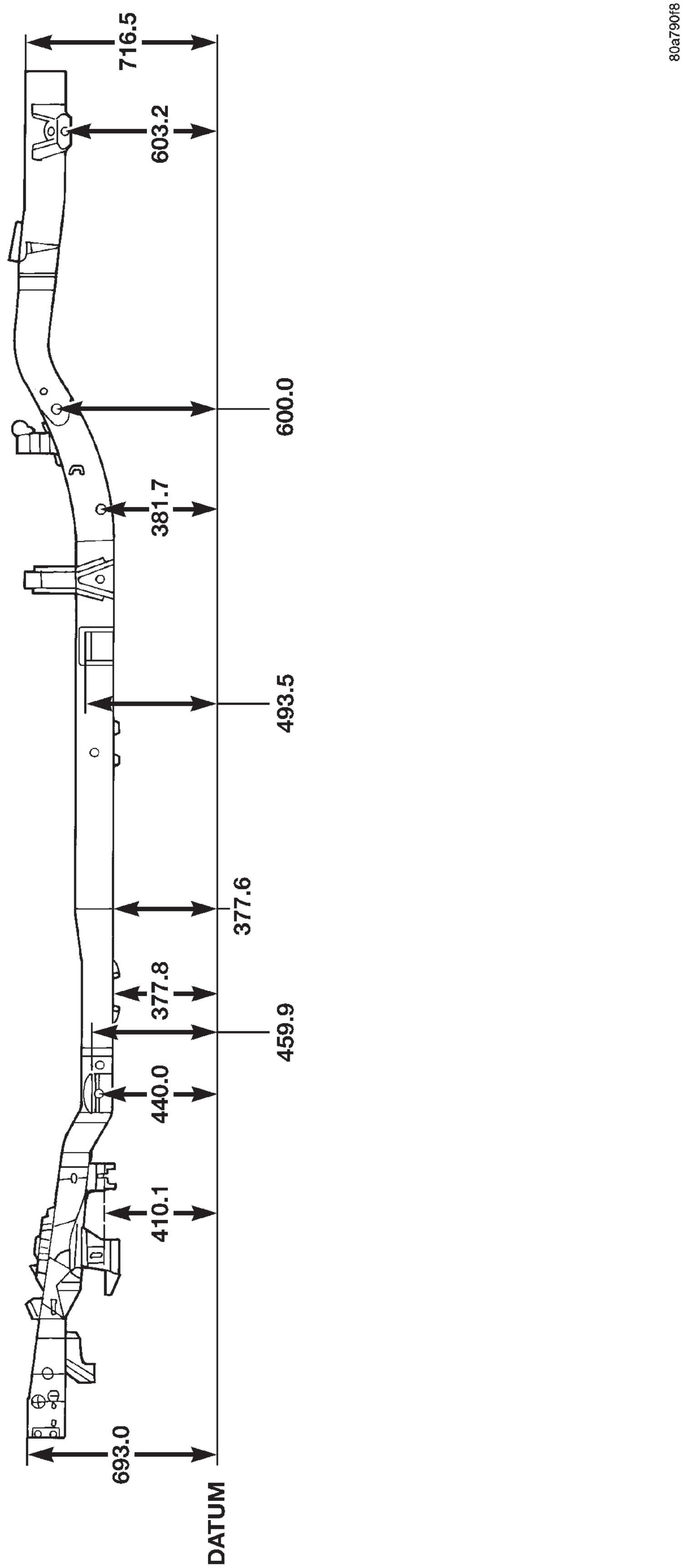


WHEEL BASE	4X2 4X4	DIMN A	DIMN B	DIMN C	DIMN D	DIMN E	DIMN F	DIMN G
112	4X2	1674.8	1901.0	2176.8	3539.5	3738.5	2591.0	2081.7
124	4X2	1674.8	1901.0	2481.6	3844.3	4208.5	2591.0	2506.1
131	4X2	2156.7	2383.0	2659.5	4022.1	4220.5	3034.9	2081.7

80a790f9

SPECIFICATIONS (Continued)

4X2 FRAME SIDE VIEW



SPECIFICATIONS (Continued)

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Cab bolts	81 N·m (60 ft. lbs.)
Front axle skid plate-to-front x-member bolt	23 N·m (17 ft. lbs.)
Front axle skid plate-to-trans x-member bolt	23 N·m (17 ft. lbs.)
Front bumper brkt-to-frame nut	94 N·m (70 ft. lbs.)
Front bumper outer brace bolt	94 N·m (70 ft. lbs.)
Fuel tank skid plate to x-member nut	41 N·m (30 ft. lbs.)
Fuel tank skid plate to side rail screws	23 N·m (200 in. lbs.)
Rear bumper-to-brace nut	94 N·m (70 ft. lbs.)
Rear bumper brace-to-brkt nut	94 N·m (70 ft. lbs.)
Rear bumper brkt-to-frame nut	94 N·m (70 ft. lbs.)
Transfer case skid plate-to-x-member bolt	23 N·m (17 ft. lbs.)
Trailer hitch nut	108 N·m (80 ft. lbs.)

FUEL SYSTEM

TABLE OF CONTENTS

FUEL DELIVERY SYSTEM 1
FUEL INJECTION SYSTEM 30

FUEL DELIVERY SYSTEM

TABLE OF CONTENTS

DESCRIPTION AND OPERATION
PCM VIN REPROGRAMMING 1
FUEL DELIVERY SYSTEM 1
FUEL PUMP MODULE 2
FUEL PUMP. 2
FUEL GAUGE SENDING UNIT 3
FUEL FILTER/FUEL PRESSURE REGULATOR. . . . 4
FUEL TANK 4
FUEL INJECTORS 4
FUEL RAIL—3.9/5.2/5.9L ENGINES 5
FUEL INJECTOR RAIL—4.7L ENGINE 5
FUEL INJECTOR RAIL/FUEL DAMPER—2.5L ENGINE 6
FUEL TANK FILLER TUBE CAP 7
FUEL TUBES/LINES/HOSES AND CLAMPS 7
QUICK-CONNECT FITTINGS 7
DIAGNOSIS AND TESTING
FUEL PUMP PRESSURE TEST 7
FUEL PUMP CAPACITY TEST 8
FUEL PRESSURE LEAK DOWN TEST 8
FUEL PUMP AMPERAGE TEST 9
FUEL GAUGE SENDING UNIT 10
FUEL INJECTOR TEST. 11
SERVICE PROCEDURES
FUEL SYSTEM PRESSURE RELEASE PROCEDURE 11
QUICK-CONNECT FITTINGS 11
REMOVAL AND INSTALLATION
FUEL PUMP MODULE 14
FUEL PUMP INLET FILTER 16
FUEL GAUGE SENDING UNIT 16
FUEL INJECTOR RAIL—3.9/5.2/5.9L ENGINES . . 18
FUEL INJECTOR RAIL/FUEL DAMPER—2.5L ENGINE 19
FUEL INJECTOR RAIL—4.7L V–8 ENGINE. 20
FUEL INJECTOR(S) 22
FUEL TANK 22
FUEL TANK FILLER TUBE CAP 24
ACCELERATOR PEDAL 24
THROTTLE CABLE 25
THROTTLE CABLE—4.7L V-8 ENGINE. 27
SPECIFICATIONS
FUEL TANK CAPACITY 27
FUEL SYSTEM PRESSURE 27
FUEL REQUIREMENTS 27
TORQUE CHART 29

DESCRIPTION AND OPERATION

PCM VIN REPROGRAMMING

OPERATION

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW POWERTRAIN CONTROL MODULE (PCM) WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

FUEL DELIVERY SYSTEM

DESCRIPTION

The fuel delivery system consists of:

- the fuel pump module containing the electric fuel pump, fuel filter/fuel pressure regulator, fuel gauge sending unit (fuel level sensor) and a separate fuel filter located at bottom of pump module
- fuel tubes/lines/hoses
- quick-connect fittings
- fuel injector rail
- fuel injectors
- fuel tank

DESCRIPTION AND OPERATION (Continued)

- fuel tank filler/vent tube assembly
- fuel tank filler tube cap
- accelerator pedal
- throttle cable

OPERATION

Fuel is returned through the fuel pump module and back into the fuel tank through the fuel filter/fuel pressure regulator. A separate fuel return line from the engine to the tank is not used.

The fuel tank assembly consists of: the fuel tank, fuel pump module assembly, fuel pump module locknut/gasket, and rollover valve (refer to Group 25, Emission Control System for rollover valve information).

A fuel filler/vent tube assembly using a pressure/vacuum, 1/4 turn fuel filler cap is used. The fuel filler tube contains a flap door located below the fuel fill cap.

Also to be considered part of the fuel system is the evaporation control system. This is designed to reduce the emission of fuel vapors into the atmosphere. The description and function of the Evaporative Control System is found in Group 25, Emission Control Systems.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

FUEL PUMP MODULE

DESCRIPTION

The fuel pump module on all models/all engines is installed in the top of the fuel tank (Fig. 1) or (Fig. 2). The fuel pump module contains the following components :

- A combination fuel filter/fuel pressure regulator
- Electric fuel pump
- Fuel pump reservoir
- A separate in-tank fuel filter (at bottom of module)
- Fuel gauge sending unit (fuel level sensor)
- Fuel supply line connection at filter/regulator
- A threaded locknut to retain pump module to fuel tank
- A rubber gasket between tank flange and pump module

The fuel gauge sending unit (fuel level sensor), and pick-up filter (at bottom of module) may be serviced separately. If the electrical fuel pump requires service, the entire fuel pump module must be replaced.

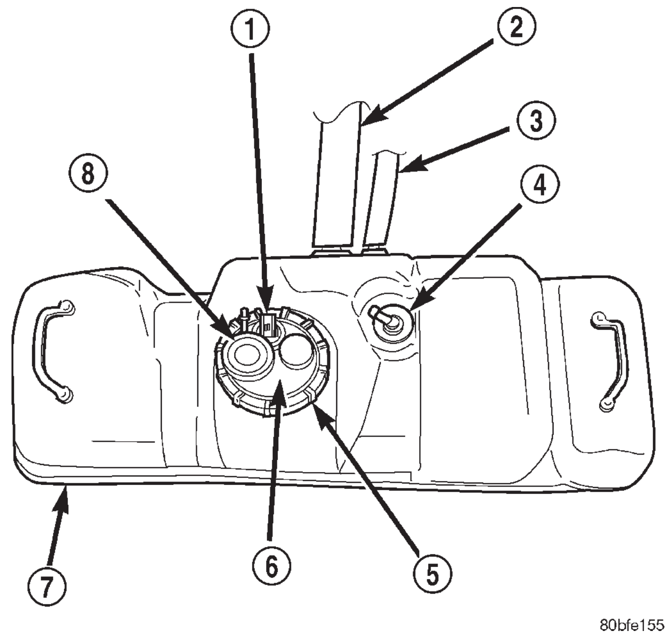


Fig. 1 Fuel Tank/Fuel Pump Module—2 Door Models

1 – MODULE ELECTRICAL CONNECTOR
2 – FILL HOSE
3 – VENT HOSE
4 – ROLLOVER VALVE
5 – LOCKNUT
6 – FUEL PUMP MODULE
7 – FUEL TANK
8 – FUEL FILTER/FUEL PRESSURE REGULATOR

OPERATION

Refer to Fuel Pump, Fuel Filter/Fuel Pressure Regulator and Fuel Gauge Sending Unit.

FUEL PUMP

DESCRIPTION

The fuel pump is located inside of the fuel pump module. A 12 volt, permanent magnet, electric motor powers the fuel pump.

OPERATION

Voltage to operate the electric pump is supplied through the fuel pump relay.

Fuel is drawn in through a filter at the bottom of the module and pushed through the electric motor gearset to the pump outlet.

DESCRIPTION AND OPERATION (Continued)

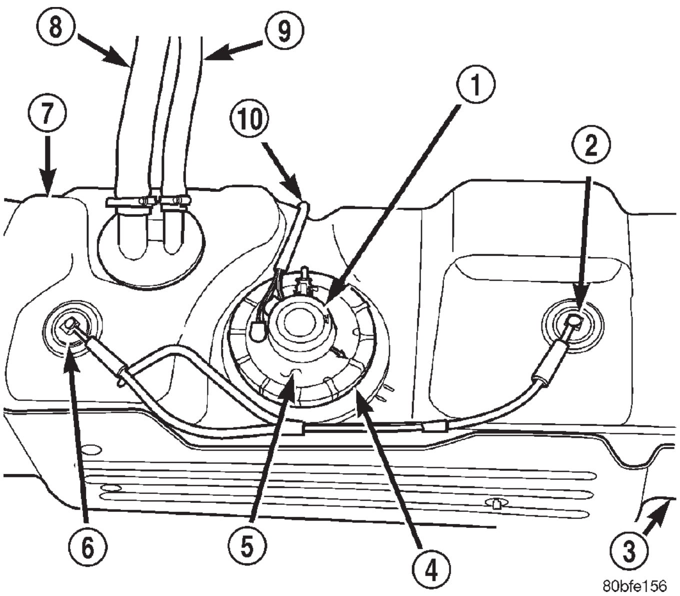


Fig. 2 Fuel Tank/Fuel Pump Module—4 Door Models

1 – FUEL FILTER/FUEL PRESSURE REGULATOR
2 – ROLLOVER VALVE
3 – FUEL TANK SHIELD
4 – LOCKNUT
5 – FUEL PUMP MODULE
6 – ROLLOVER VALVE
7 – FUEL TANK
8 – FILL HOSE
9 – VENT HOSE
10 – PIGTAIL HARNESS

Check Valve Operation: The pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** Refer to the Fuel Pressure Leak Down Test for more information.

FUEL GAUGE SENDING UNIT

DESCRIPTION

The fuel gauge sending unit (fuel level sensor) is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor track (card).

OPERATION

The fuel pump module has 4 different circuits (wires). Two of these circuits are used for the fuel gauge sending unit for fuel gauge operation, and for certain OBD II emission requirements. The other 2 wires are used for electric fuel pump operation.

For Fuel Gauge Operation: A constant current source of about 32 mA is supplied to the resistor track on the fuel gauge sending unit. This is fed directly from the Powertrain Control Module (PCM). The resistor track is used to vary the voltage depending on fuel tank float level. As fuel level increases, the float and arm move up, which decreases voltage. As fuel level decreases, the float and arm move down, which increases voltage. The varied voltage signal is returned back to the PCM through the sensor return circuit. Output voltages will vary from about.6 volts at FULL, to about 8.6 volts at EMPTY (Jeep models), or, about 7.0 volts at EMPTY (Dodge Truck models). **NOTE: For diagnostic purposes, this voltage can only be verified with the fuel gauge sending unit circuit closed (i.e. having all of the sending units electrical connectors connected).**

Both of the electrical circuits between the fuel gauge sending unit and the PCM are hard-wired (not multi-plexed). After the voltage signal is sent from the resistor track, and back to the PCM, the PCM will interpret the resistance (voltage) data and send a message across the multi-plex bus circuits to the instrument panel cluster. Here it is translated into the appropriate fuel gauge level reading. Refer to Instrument Panel for additional information.

For OBD II Emission Monitor Requirements: The PCM will monitor the voltage output sent from the resistor track on the sending unit to indicate fuel level. The purpose of this feature is to prevent the OBD II system from recording/setting false misfire and fuel system monitor diagnostic trouble codes. The feature is activated if the fuel level in the tank is less than approximately 15 percent of its rated capacity. If equipped with a Leak Detection Pump (EVAP system monitor), this feature will also be activated if the fuel level in the tank is more than approximately 85 percent of its rated capacity.

FUEL FILTER/FUEL PRESSURE REGULATOR

DESCRIPTION

A combination fuel filter and fuel pressure regulator (Fig. 3) is used on all engines. It is located on the top of the fuel pump module. A separate frame mounted fuel filter is not used with any engine.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

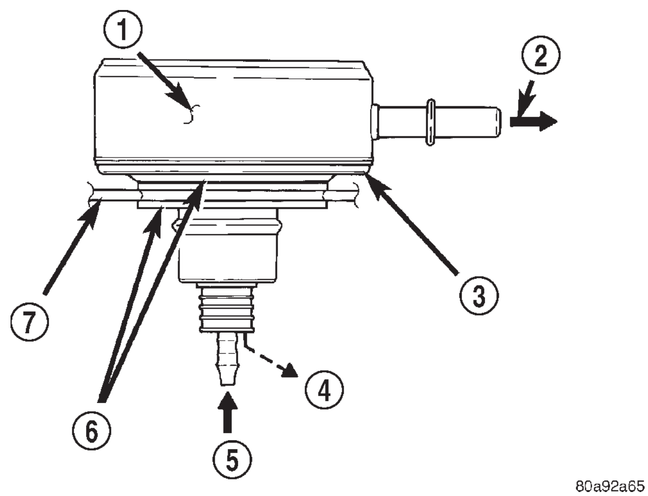


Fig. 3 Side View—Filter/Regulator

1 – INTERNAL FUEL FILTER
2 – FUEL FLOW TO FUEL INJECTORS
3 – FUEL FILTER/FUEL PRESSURE REGULATOR
4 – EXCESS FUEL BACK TO TANK
5 – FUEL INLET
6 – RUBBER GROMMET
7 – TOP OF PUMP MODULE

OPERATION

Fuel Pressure Regulator Operation: The pressure regulator is a mechanical device that is not controlled by engine vacuum or the powertrain control module (PCM).

The regulator is calibrated to maintain fuel system operating pressure of approximately 339 kPa ± 34 kPa (49.2 psi ± 5 psi) at the fuel injectors. It contains a diaphragm, calibrated springs and a fuel return valve. The internal fuel filter (Fig. 3) is also part of the assembly.

Fuel is supplied to the filter/regulator by the electric fuel pump through an opening tube at the bottom of filter/regulator (Fig. 3).

The regulator acts as a check valve to maintain some fuel pressure when the engine is not operating. This will help to start the engine. A second check valve is located at the outlet end of the electric fuel pump. **Refer to Fuel Pump—Description and Operation for more information. Also refer to the Fuel Pressure Leak Down Test and the Fuel Pump Pressure Tests.**

If fuel pressure at the pressure regulator exceeds approximately 49.2 psi, an internal diaphragm opens and excess fuel pressure is routed back into the tank through the bottom of pressure regulator.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

FUEL TANK

DESCRIPTION

The fuel tank is constructed of a plastic material. Its main functions are for fuel storage and for placement of the fuel pump module.

OPERATION

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

A rollover valve(s) is mounted into the top of the fuel tank (or pump module). Refer to Emission Control System for rollover valve information.

An evaporation control system is connected to the rollover valve(s) to reduce emissions of fuel vapors into the atmosphere. When fuel evaporates from the fuel tank, vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held. When the engine is running, the vapors are drawn into the intake manifold. Certain models are also equipped with a self-diagnosing system using a Leak Detection Pump (LDP). Refer to Emission Control System for additional information.

FUEL INJECTORS

DESCRIPTION

An individual fuel injector (Fig. 4) is used for each individual cylinder.

OPERATION

The top (fuel entry) end of the injector (Fig. 4) is attached into an opening on the fuel rail.

The fuel injectors are electrical solenoids. The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a pencil

DESCRIPTION AND OPERATION (Continued)

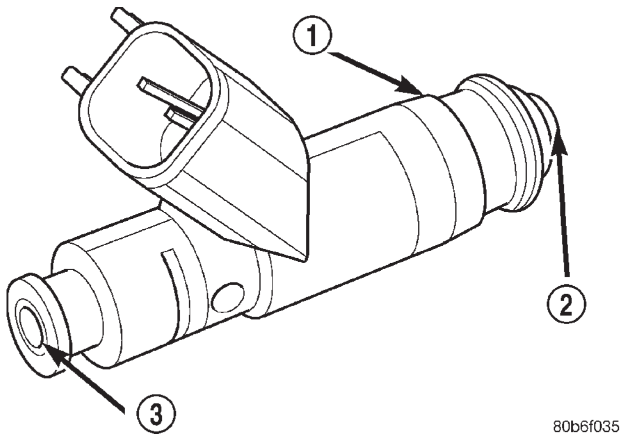


Fig. 4 Fuel Injector—Typical

1 – FUEL INJECTOR
2 – NOZZLE
3 – TOP (FUEL ENTRY)

stream. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber.

The nozzle (outlet) ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector.

The injectors are energized individually in a sequential order by the powertrain control module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage is supplied to the injectors through the ASD relay.

The PCM determines injector pulse width based on various inputs.

FUEL RAIL—3.9/5.2/5.9L ENGINES

DESCRIPTION

The fuel injector rail is used to attach the fuel injectors to the engine. It is mounted to the engine (Fig. 5).

OPERATION

High pressure from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

A fuel pressure test port is located on the fuel rail. A quick-connect fitting with a safety latch clip is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

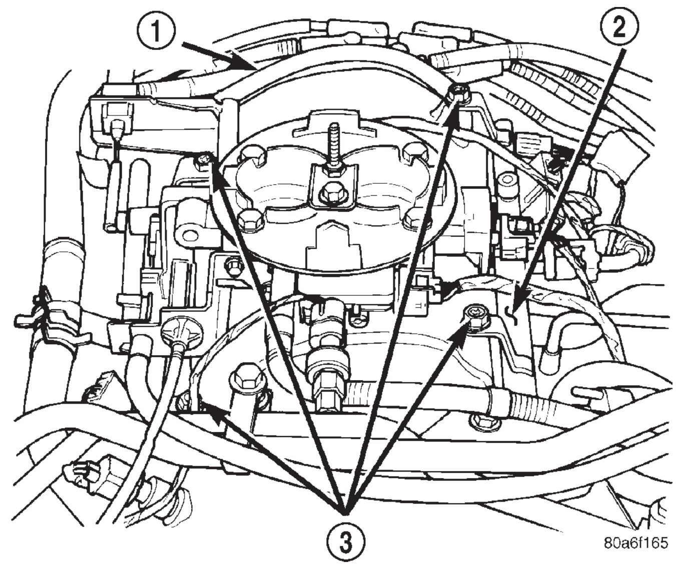


Fig. 5 Fuel Rail—3.9/5.2/5.9L Engine—Typical

1 – FUEL RAIL CONNECTING HOSE
2 – FUEL RAIL
3 – MOUNTING BOLTS (4)

CAUTION: The left and right sections of the fuel rail are connected with a flexible connecting hose. Do not attempt to separate the rail halves at this connecting hose. Due to the design of this connecting hose, it does not use any clamps. Never attempt to install a clamping device of any kind to the hose. When removing the fuel rail assembly for any reason, be careful not to bend or kink the connecting hose.

FUEL INJECTOR RAIL—4.7L ENGINE

DESCRIPTION

The fuel injector rail is used to mount the fuel injectors to the engine. It is mounted to the intake manifold (Fig. 6).

OPERATION

High pressure fuel from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

A fuel pressure test port is located on the fuel rail (Fig. 6). A quick-connect fitting with a safety latch is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

DESCRIPTION AND OPERATION (Continued)

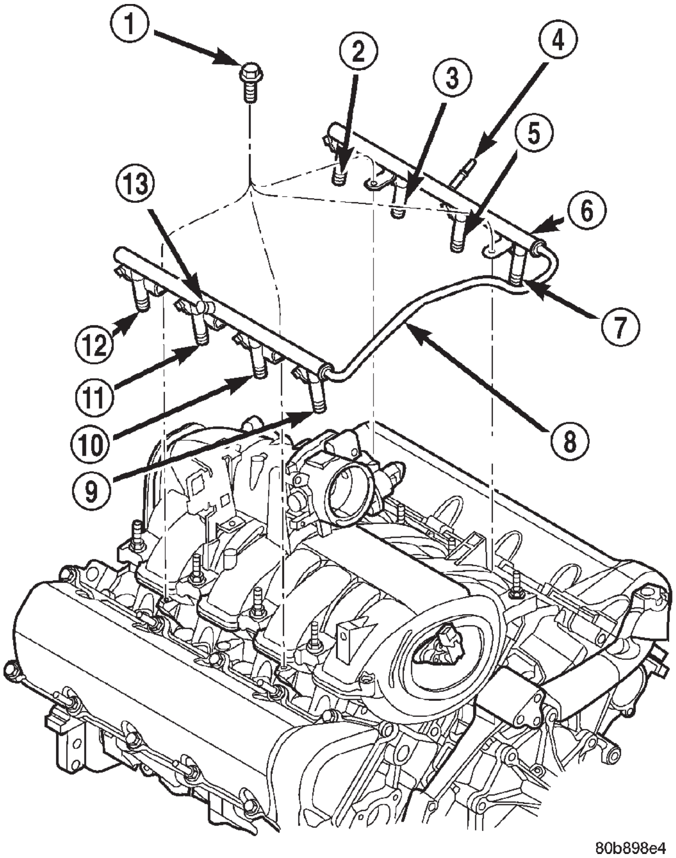


Fig. 6 Fuel Injector Rail—4.7L V-8 Engine

1 – MOUNTING BOLTS (4)
2 – INJ.#7
3 – INJ.#5
4 – QUICK-CONNECT FITTING
5 – INJ.#3
6 – FUEL INJECTOR RAIL
7 – INJ.#1
8 – CONNECTOR TUBE
9 – INJ.#2
10 – INJ.#4
11 – INJ.#6
12 – INJ.#8
13 – PRESSURE TEST PORT CAP

CAUTION: 4.7L Engine Only: The left and right sections of the fuel rail are joined with a connector tube (Fig. 6). Do not attempt to separate the rail halves at this tube. Due to the design of this connecting tube, it does not use any clamps. Never attempt to install a clamping device of any kind to the tube. When removing the fuel rail assembly for any reason, be careful not to bend or kink the connector tube.

FUEL INJECTOR RAIL/FUEL DAMPER—2.5L ENGINE

DESCRIPTION

The fuel injector rail is used to mount the fuel injectors to the engine (Fig. 7). On the 2.5L 4–cylinder engine, a **fuel damper** is located at the front of the fuel rail (Fig. 7).

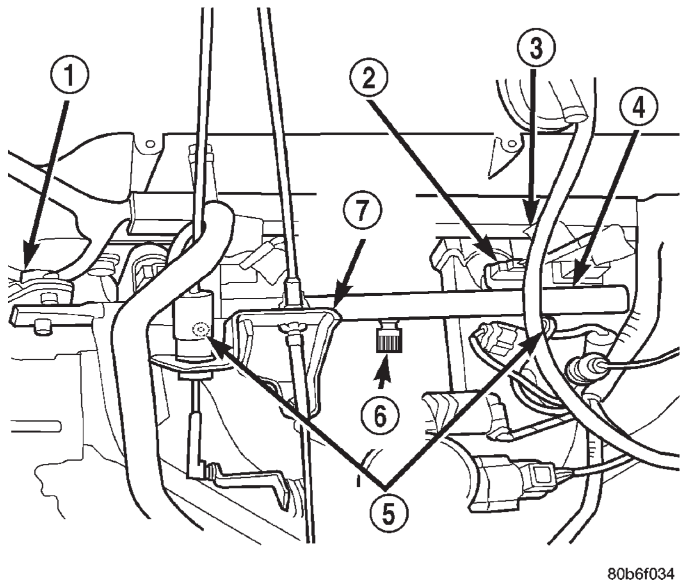


Fig. 7 Fuel Injector Rail/Fuel Damper—2.5L Engine

1 – FUEL DAMPER
2 – FUEL INJECTOR
3 – NUMBERED TAG
4 – FUEL RAIL
5 – FUEL RAIL MOUNTING BOLTS/NUTS
6 – TEST PORT
7 – CABLE BRACKET

OPERATION

The fuel injector rail supplies the necessary fuel to each individual fuel injector.

The fuel damper is used only to help control fuel pressure pulsations. These pulsations are the result of the firing of the fuel injectors. It is **not used** as a fuel pressure regulator. The fuel pressure regulator is **not mounted** to the fuel rail on any engine. It is located on the fuel tank mounted fuel pump module. Refer to Fuel Filter/Fuel Pressure Regulator in this group for information.

The fuel rail is not repairable.

DESCRIPTION AND OPERATION (Continued)

FUEL TANK FILLER TUBE CAP

DESCRIPTION

The plastic fuel tank filler tube cap is threaded onto the end of the fuel fill tube. Certain models are equipped with a 1/4 turn cap.

OPERATION

The loss of any fuel or vapor out of fuel filler tube is prevented by the use of a pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

CAUTION: Remove fill cap before servicing any fuel system component to relieve tank pressure. If equipped with a California emissions package and a Leak Detection Pump (LDP), the cap must be tightened securely. If cap is left loose, a Diagnostic Trouble Code (DTC) may be set.

FUEL TUBES/LINES/HOSES AND CLAMPS

DESCRIPTION

Also refer to Quick-Connect Fittings.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

If equipped: The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps.

QUICK-CONNECT FITTINGS

DESCRIPTION

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal. Refer to Quick-Connect Fittings Removal/Installation for more information.

CAUTION: The interior components (o-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.

DIAGNOSIS AND TESTING

FUEL PUMP PRESSURE TEST

Use this test in conjunction with the Fuel Pump Capacity Test, Fuel Pressure Leak Down Test and Fuel Pump Amperage Test found elsewhere in this group.

Check Valve Operation: The electric fuel pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** When the electric fuel pump is activated, fuel pressure should **immediately** (1–2 seconds) rise to specification.

All fuel systems are equipped with a fuel tank module mounted, combination fuel filter/fuel pressure regulator. The fuel pressure regulator is not controlled by engine vacuum.

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. BEFORE DISCONNECTING FUEL LINE AT FUEL RAIL, THIS PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

DIAGNOSIS AND TESTING (Continued)

(1) Remove protective cap at fuel rail test port. Connect the 0–414 kPa (0-60 psi) fuel pressure gauge (from gauge set 5069) to test port pressure fitting on fuel rail (Fig. 8). **The DRB III Scan Tool along with the PEP module, the 500 psi pressure transducer, and the transducer-to-test port adapter may also be used in place of the fuel pressure gauge.**

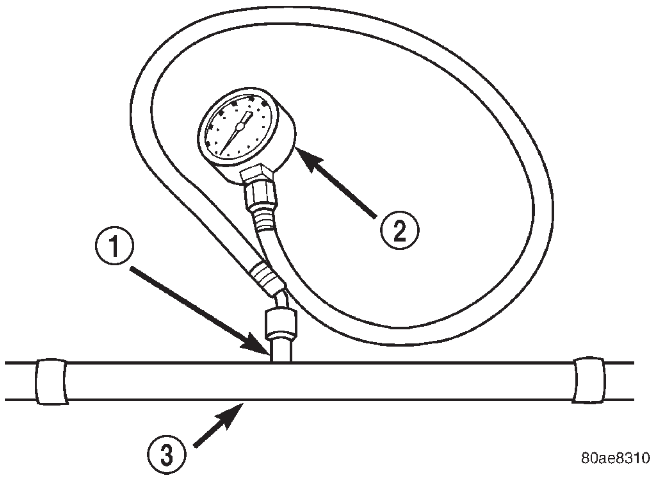


Fig. 8 Fuel Pressure Test Gauge (Typical Gauge Installation at Test Port)

1 – SERVICE (TEST) PORT
2 – FUEL PRESSURE TEST GAUGE
3 – FUEL RAIL

(2) Start and warm engine and note pressure gauge reading. Fuel pressure should be 339 kPa ± 34 kPa (49.2 psi ± 5 psi) at idle.

(3) If engine runs, but pressure is below 44.2 psi, check for a kinked fuel supply line somewhere between fuel rail and fuel pump module. If line is not kinked, but specifications for either the Fuel Pump Capacity, Fuel Pump Amperage or Fuel Pressure Leak Down Tests were not met, replace fuel pump module assembly. Refer to Fuel Pump Module Removal/Installation.

(4) If operating pressure is above 54.2 psi, electric fuel pump is OK, but fuel pressure regulator is defective. Replace fuel filter/fuel pressure regulator. Refer to Fuel Filter/Fuel Pressure Regulator Removal/Installation for more information.

(5) Install protective cap to fuel rail test port.

FUEL PUMP CAPACITY TEST

Before performing this test, verify fuel pump pressure. Refer to Fuel Pump Pressure Test. Use this test in conjunction with the Fuel Pressure Leak Down Test.

(1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure.

(2) Disconnect fuel supply line at fuel rail. Refer to Quick-Connect Fittings. Some engines may require air cleaner housing removal before line disconnection.

(3) Obtain correct Fuel Line Pressure Test Adapter Tool Hose. Tool number 6539 is used for 5/16” fuel lines and tool number 6631 is used for 3/8” fuel lines.

(4) Connect correct Fuel Line Pressure Test Adapter Tool Hose into disconnected fuel supply line. Insert other end of Adaptor Tool Hose into a graduated container.

(5) Remove fuel fill cap.

(6) To activate fuel pump and pressurize system, obtain DRB scan tool and actuate ASD Fuel System Test.

(7) A good fuel pump will deliver at least 1/4 liter of fuel in 7 seconds. Do not operate fuel pump for longer than 7 seconds with fuel line disconnected as fuel pump module reservoir may run empty.

(a) If capacity is lower than specification, but fuel pump can be heard operating through fuel fill cap opening, check for a kinked/damaged fuel supply line somewhere between fuel rail and fuel pump module.

(b) If line is not kinked/damaged, and fuel pressure is OK, but capacity is low, replace fuel filter/fuel pressure regulator. The filter/regulator may be serviced separately on certain applications. Refer to Fuel Filter/Fuel Pressure Regulator Removal/Installation for additional information.

(c) If both fuel pressure and capacity are low, replace fuel pump module assembly. Refer to Fuel Pump Module Removal/Installation.

FUEL PRESSURE LEAK DOWN TEST

Use this test in conjunction with the Fuel Pump Pressure Test and Fuel Pump Capacity Test.

Check Valve Operation: The electric fuel pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** When the electric fuel pump is activated, fuel pressure should **immediately** (1–2 seconds) rise to specification.

Abnormally long periods of cranking to restart a **hot** engine that has been shut down for a short period of time may be caused by:

- Fuel pressure bleeding past a fuel injector(s).
- Fuel pressure bleeding past the check valve in the fuel pump module.

DIAGNOSIS AND TESTING (Continued)

(1) Disconnect the fuel inlet line at fuel rail. Refer to Fuel Tubes/Lines/Hoses and Clamps in this section of the group for procedures. On some engines, air cleaner housing removal may be necessary before fuel line disconnection.

(2) Obtain correct Fuel Line Pressure Test Adapter Tool Hose. Tool number 6539 is used for 5/16” fuel lines and tool number 6631 is used for 3/8” fuel lines.

(3) Connect correct Fuel Line Pressure Test Adapter Tool Hose between disconnected fuel line and fuel rail (Fig. 9).

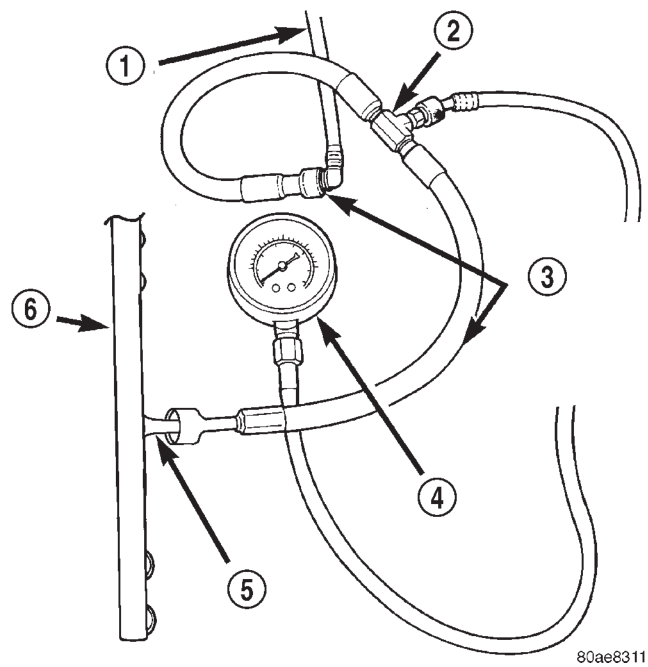


Fig. 9 Connecting Adapter Tool—Typical

1 – VEHICLE FUEL LINE
2 – TEST PORT “T”
3 – SPECIAL TOOL 6923, 6631, 6541 OR 6539
4 – FUEL PRESSURE TEST GAUGE
5 – FUEL LINE CONNECTION AT RAIL
6 – FUEL RAIL

(4) Connect the 0-414 kPa (0-60 psi) fuel pressure test gauge (from Gauge Set 5069) to the test port on the appropriate Adaptor Tool. **The DRB III Scan Tool along with the PEP module, the 500 psi pressure transducer, and the transducer-to-test port adapter may also be used in place of the fuel pressure gauge.**

The fittings on both tools must be in good condition and free from any small leaks before performing the proceeding test.

(5) Start engine and bring to normal operating temperature.

(6) Observe test gauge. Normal operating pressure should be 339 kPa ± 34 kPa (49.2 psi ± 5 psi).

(7) Shut engine off.

(8) Pressure should not fall below **30 psi for five minutes.**

(9) If pressure falls below 30 psi, it must be determined if a fuel injector, the check valve within the fuel pump module, or a fuel tube/line is leaking.

(10) Again, start engine and bring to normal operating temperature.

(11) Shut engine off.

(12) **Testing for fuel injector or fuel rail leakage:** Clamp off the rubber hose portion of Adaptor Tool between the fuel rail and the test port “T” on Adapter Tool. If pressure now holds at or above 30 psi, a fuel injector or the fuel rail is leaking.

(13) **Testing for fuel pump check valve, filter/regulator check valve or fuel tube/line leakage:** Clamp off the rubber hose portion of Adaptor Tool between the vehicle fuel line and test port “T” on Adapter Tool. If pressure now holds at or above 30 psi, a leak may be found at a fuel tube/line. If no leaks are found at fuel tubes or lines, one of the check valves in either the electric fuel pump or filter/regulator may be leaking.

Note: A quick loss of pressure usually indicates a defective check valve in the filter/regulator. A slow loss of pressure usually indicates a defective check valve in the electric fuel pump.

The electric fuel pump is not serviced separately. Replace the fuel pump module assembly. The filter/regulator may be replaced separately on certain applications. Refer to Fuel Filter/Fuel Pressure Regulator Removal/Installation for additional information.

FUEL PUMP AMPERAGE TEST

This amperage (current draw) test is to be done in conjunction with the Fuel Pump Pressure Test, Fuel Pump Capacity Test and Fuel Pressure Leak Down Test. Before performing the amperage test, be sure the temperature of the fuel tank is above 50° F (10° C).

The DRB Scan Tool along with the DRB Low Current Shunt (LCS) adapter (Fig. 10) and its test leads will be used to check fuel pump amperage specifications.

(1) Obtain LCS adapter.

(2) Plug cable from LCS adapter into DRB scan tool at SET 1 receptacle.

(3) Plug DRB into vehicle 16–way connector (data link connector).

(4) Connect (-) and (+) test cable leads into LCS adapter receptacles. Use **10 amp (10A +)** receptacle and common (-) receptacles.

(5) Gain access to MAIN MENU on DRB screen.

(6) Press DVOM button on DRB.

(7) Using left/right arrow keys, highlight CHANNEL 1 function on DRB screen.

DIAGNOSIS AND TESTING (Continued)

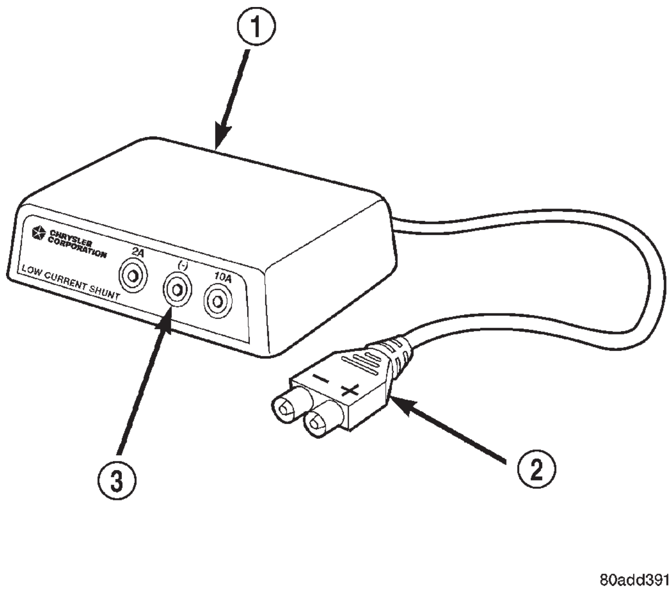


Fig. 10 Low Current Shunt Adapter

1 – LOW CURRENT SHUNT ADAPTER
2 – PLUG TO DRB
3 – TEST LEAD RECEPTACLES

(8) Press ENTER three times.

(9) Using up/down arrow keys, highlight RANGE on DRB screen (screen will default to 2 amp scale).

(10) Press ENTER to change 2 amp scale to 10 amp scale. **This step must be done to prevent damage to DRB scan tool or LCS adapter (blown fuse).**

(11) Remove cover from Power Distribution Center (PDC).

(12) Remove fuel pump relay from PDC. Refer to label on PDC cover for relay location.

WARNING: BEFORE PROCEEDING TO NEXT STEP, NOTE THE FUEL PUMP WILL BE ACTIVATED AND SYSTEM PRESSURE WILL BE PRESENT. THIS WILL OCCUR AFTER CONNECTING TEST LEADS FROM LCS ADAPTER INTO FUEL PUMP RELAY CAVITIES. THE FUEL PUMP WILL OPERATE EVEN WITH IGNITION KEY IN OFF POSITION. BEFORE ATTACHING TEST LEADS, BE SURE ALL FUEL LINES AND FUEL SYSTEM COMPONENTS ARE CONNECTED.

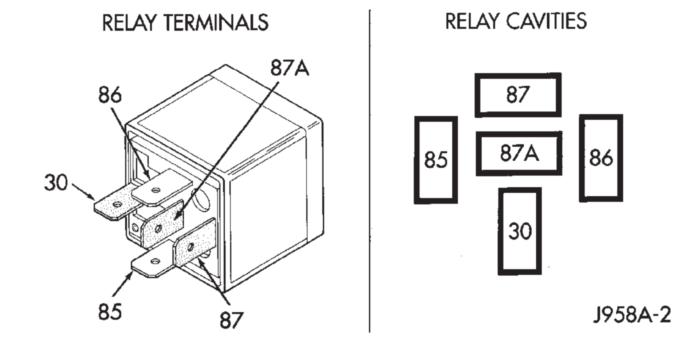
CAUTION: TO PREVENT POSSIBLE DAMAGE TO THE VEHICLE ELECTRICAL SYSTEM AND LCS ADAPTER, THE TEST LEADS MUST BE CONNECTED INTO RELAY CAVITIES EXACTLY AS SHOWN IN FOLLOWING STEPS.

Depending upon vehicle model, year or engine configuration, three different types of relays may be used: Type-1, type-2 and type–3.

(13) If equipped with **type–1 relay** (Fig. 11), attach test leads from LCS adapter into PDC relay cavities number 30 and 87. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 11).

(14) If equipped with **type–2 relay** (Fig. 12), attach test leads from LCS adapter into PDC relay cavities number 30 and 87. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 12).

(15) If equipped with **type–3 relay** (Fig. 13), attach test leads from LCS adapter into PDC relay cavities number 3 and 5. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 13).



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 11 Type–1 Relay

(16) When LCS adapter test leads are attached into relay cavities, fuel pump **will be activated.** Determine fuel pump amperage on DRB screen. Amperage should be below 10.0 amps. If amperage is below 10.0 amps, and specifications for the Fuel Pump Pressure, Fuel Pump Capacity and Fuel Pressure Leak Down tests were met, the fuel pump module is OK.

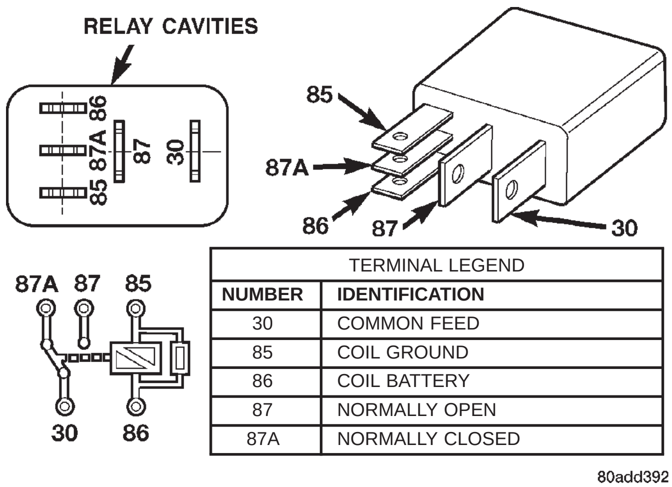
(17) If amperage is more than 10.0 amps, replace fuel pump module assembly. The electric fuel pump is not serviced separately.

(18) Disconnect test leads from relay cavities immediately after testing.

FUEL GAUGE SENDING UNIT

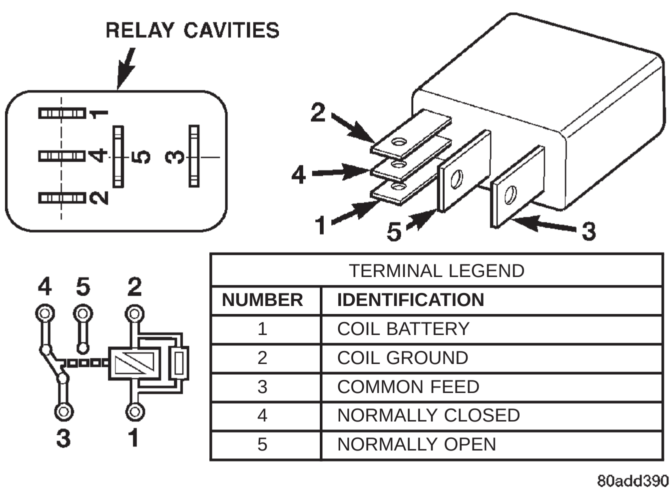
The fuel gauge sending unit contains a variable resistor (track). As the float moves up or down, electrical resistance will change. Refer to Group 8E,

DIAGNOSIS AND TESTING (Continued)



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 12 Type–2 Relay



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
1	COIL BATTERY
2	COIL GROUND
3	COMMON FEED
4	NORMALLY CLOSED
5	NORMALLY OPEN

Fig. 13 Type–3 Relay

Instrument Panel and Gauges for Fuel Gauge testing. To test the gauge sending unit only, it must be removed from vehicle. The unit is part of the fuel pump module. Refer to Fuel Pump Module Removal/ Installation for procedures. Measure the resistance across the sending unit terminals. With float in up position, resistance should be 20 ohms ±6 ohms. With float in down position, resistance should be 220 ohms ±6 ohms.

FUEL INJECTOR TEST

To perform a complete test of the fuel injectors and their circuitry, use the DRB scan tool and refer to the appropriate Powertrain Diagnostics Procedures manual. To test the injector only, refer to the following:

Disconnect the fuel injector wire harness connector from the injector. The injector is equipped with 2 electrical terminals (pins). Place an ohmmeter across the terminals. Resistance reading should be approximately 12 ohms ±1.2 ohms at 20°C (68°F).

SERVICE PROCEDURES

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

Use following procedure if the fuel injector rail is, or is not equipped with a fuel pressure test port.

(1) Remove fuel fill cap.

(2) Remove fuel pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.

(3) Start and run engine until it stalls.

(4) Attempt restarting engine until it will no longer run.

(5) Turn ignition key to OFF position.

CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

(6) Unplug connector from any fuel injector.

(7) Attach one end of a jumper wire with alligator clips (18 gauge or smaller) to either injector terminal.

(8) Connect other end of jumper wire to positive side of battery.

(9) Connect one end of a second jumper wire to remaining injector terminal.

CAUTION: Powering an injector for more than a few seconds will permanently damage the injector.

(10) Momentarily touch other end of jumper wire to negative terminal of battery for no more than a few seconds.

(11) Place a rag or towel below fuel line quick-connect fitting at fuel rail.

(12) Disconnect quick-connect fitting at fuel rail. Refer to Quick-Connect Fittings.

(13) Return fuel pump relay to PDC.

(14) One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. The DRB scan tool must be used to erase a DTC.

QUICK-CONNECT FITTINGS

Also refer to Fuel Tubes/Lines/Hoses and Clamps.

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Safety latch clips are used on certain components/lines. Certain fittings may require use of a special tool for disconnection.

DISCONNECTING

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSE, FITTING OR LINE, FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

CAUTION: The interior components (o-rings, spacers) of some types of quick-connect fitting are not serviced separately. If service parts are not available, do not attempt to repair a damaged fitting or fuel line. If repair is necessary, replace complete fuel line assembly.

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure in this group.

(2) Disconnect negative battery cable from battery.

(3) Clean fitting of any foreign material before disassembly.

(4) **Single-Tab Type Fitting:** This type of fitting is equipped with a single pull tab (Fig. 14). The tab is removable. After tab is removed, quick-connect fitting can be separated from fuel system component.

(a) Press release tab on side of fitting to release pull tab (Fig. 15). **If release tab is not pressed prior to releasing pull tab, pull tab will be damaged.**

(b) While pressing release tab on side of fitting, use screwdriver to pry up pull tab (Fig. 15).

(c) Raise pull tab until it separates from quick-connect fitting (Fig. 16).

(5) **Two-Tab Type Fitting:** This type of fitting is equipped with tabs located on both sides of fitting (Fig. 17). The tabs are supplied for disconnecting quick-connect fitting from component being serviced.

(a) To disconnect quick-connect fitting, squeeze plastic retainer tabs (Fig. 17) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer.

(b) Pull fitting from fuel system component being serviced.

(c) The plastic retainer will remain on component being serviced after fitting is disconnected. The o-rings and spacer will remain in quick-connect fitting connector body.

(6) **Plastic Retainer Ring Type Fitting:** This type of fitting can be identified by the use of a full-round plastic retainer ring (Fig. 18) usually black in color.

(a) To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (Fig. 18). With plastic ring depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**

(b) After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.

(c) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

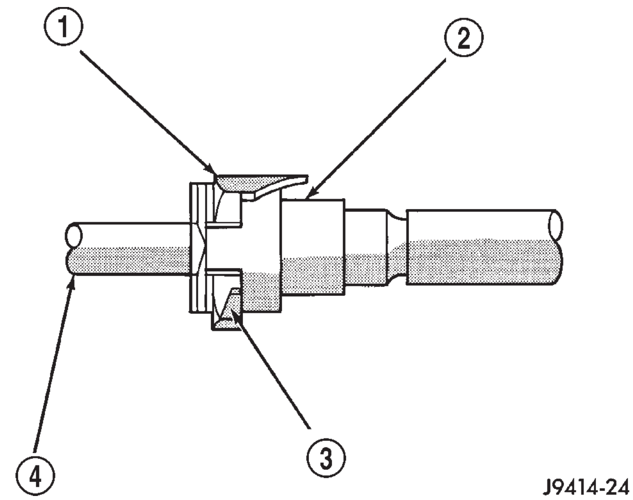


Fig. 14 Single-Tab Type Fitting

1 – PULL TAB
2 – QUICK-CONNECT FITTING
3 – PRESS HERE TO REMOVE PULL TAB
4 – INSERTED TUBE END

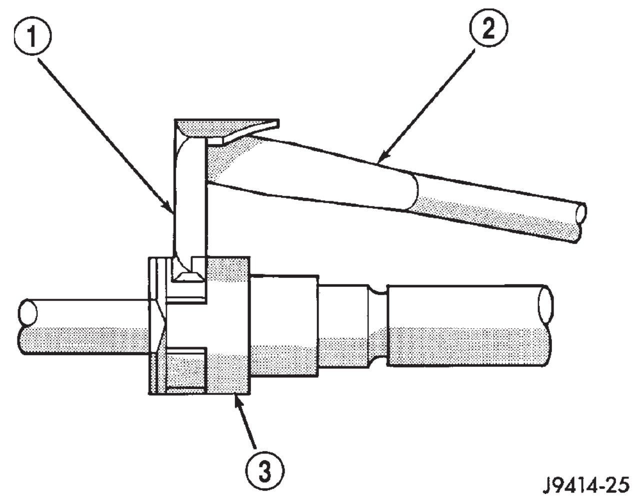


Fig. 15 Disconnecting Single-Tab Type Fitting

1 – PULL TAB
2 – SCREWDRIVER
3 – QUICK-CONNECT FITTING

SERVICE PROCEDURES (Continued)

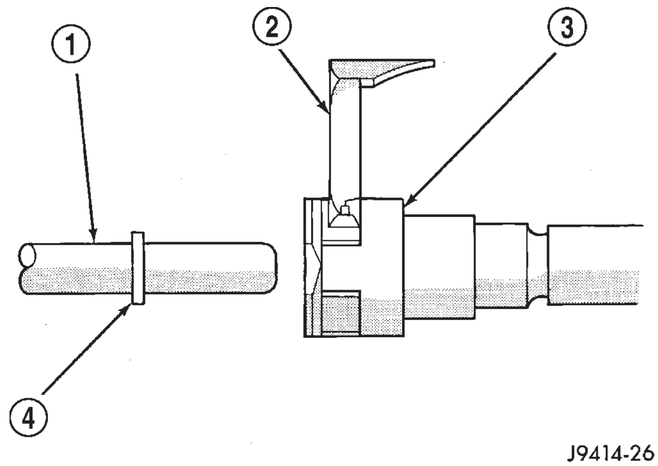


Fig. 16 Removing Pull Tab

1 – FUEL TUBE OR FUEL SYSTEM COMPONENT
2 – PULL TAB
3 – QUICK-CONNECT FITTING
4 – FUEL TUBE STOP

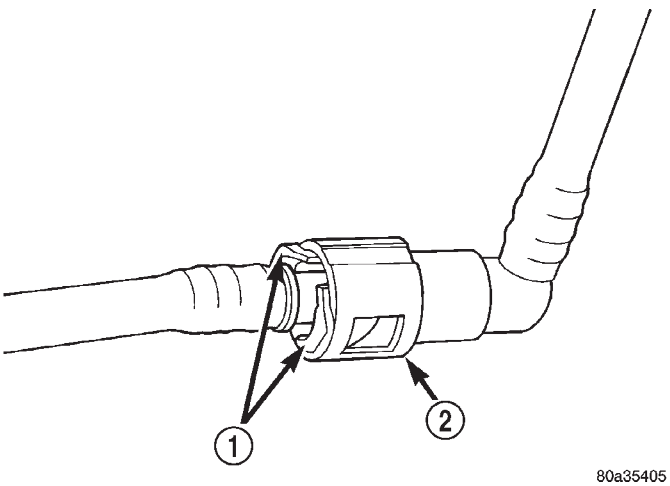


Fig. 17 Typical Two-Tab Type Quick-Connect Fitting

1 – TAB(S)
2 – QUICK-CONNECT FITTING

(7) **Latch Clips:** Depending on vehicle model and engine, 2 different types of safety latch clips are used (Fig. 19) or (Fig. 20). Type-1 is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.

(a) Type 1: Pry up on latch clip with a screwdriver (Fig. 19).

(b) Type 2: Separate and unlatch 2 small arms on end of clip (Fig. 20) and swing away from fuel line.

(c) Slide latch clip toward fuel rail while lifting with screwdriver.

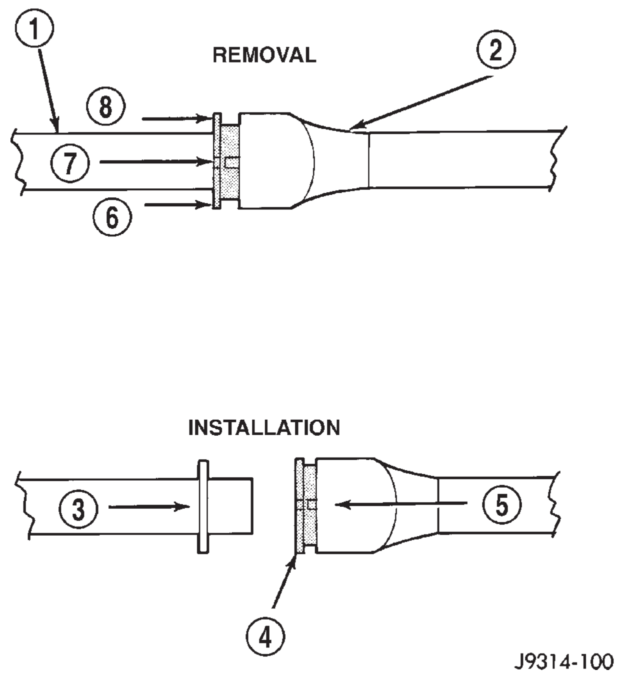


Fig. 18 Plastic Retainer Ring Type Fitting

1 – FUEL TUBE
2 – QUICK CONNECT FITTING
3 – PUSH
4 – PLASTIC RETAINER
5 – PUSH
6 – PUSH
7 – PUSH
8 – PUSH

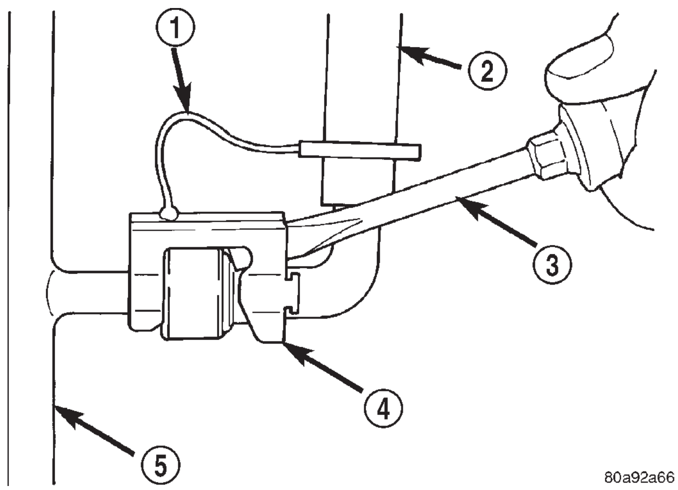


Fig. 19 Latch Clip—Type 1

1 – TETHER STRAP
2 – FUEL LINE
3 – SCREWDRIVER
4 – LATCH CLIP
5 – FUEL RAIL

SERVICE PROCEDURES (Continued)

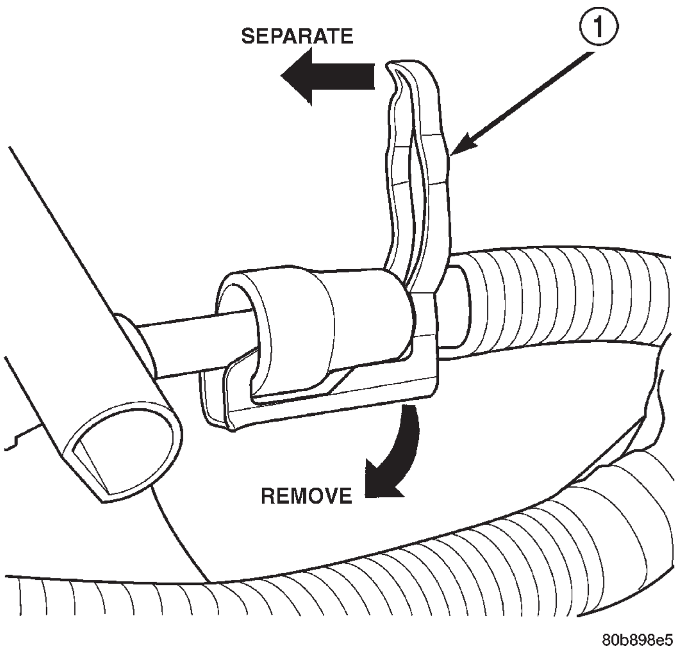


Fig. 20 Latch Clip—Type 2

1 – LATCH CLIP

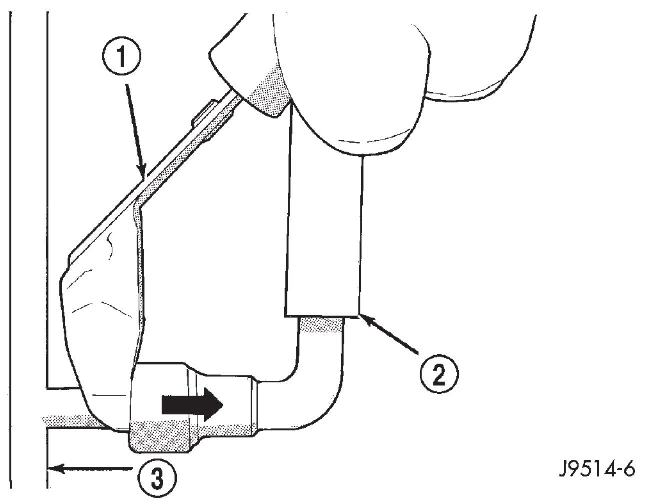


Fig. 21 Fuel Line Disconnection Using Special Tool

1 – SPECIAL FUEL LINE TOOL
2 – FUEL LINE
3 – FUEL RAIL

(d) Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (Fig. 21). Use tool to release locking fingers in end of line.

(e) With special tool still inserted, pull fuel line from fuel rail.

(f) After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.

(8) Disconnect quick-connect fitting from fuel system component being serviced.

CONNECTING

(1) Inspect quick-connect fitting body and fuel system component for damage. Replace as necessary.

(2) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

(3) Insert quick-connect fitting into fuel tube or fuel system component until built-on stop on fuel tube or component rests against back of fitting.

(4) Continue pushing until a click is felt.

(5) Single-tab type fitting: Push new tab down until it locks into place in quick-connect fitting.

(6) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(7) Latch Clip Equipped: Install latch clip (snaps into position). **If latch clip will not fit, this indicates fuel line is not properly installed to fuel rail (or other fuel line). Recheck fuel line connection.**

(8) Connect negative cable to battery.

(9) Start engine and check for leaks.

REMOVAL AND INSTALLATION

FUEL PUMP MODULE

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE OFF). BEFORE SERVICING FUEL PUMP MODULE, FUEL SYSTEM PRESSURE MUST BE RELEASED.

(1) Drain fuel tank and remove tank. Refer to Fuel Tank Removal.

(2) Thoroughly wash and clean area around pump module to prevent contaminants from entering tank.

(3) The fuel pump module locknut is threaded onto fuel tank (Fig. 22) or (Fig. 23). Install Special Tool 6856 to fuel pump module locknut and remove locknut (Fig. 24).

(4) Remove module from fuel tank.

REMOVAL AND INSTALLATION (Continued)

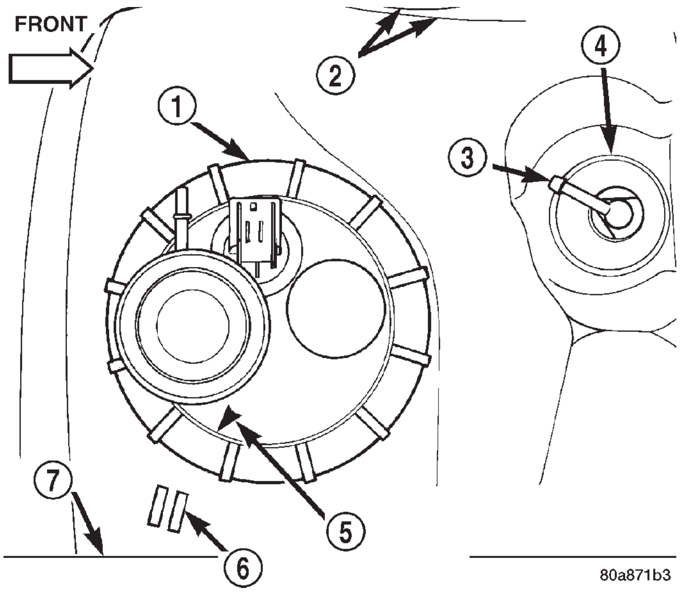


Fig. 22 Top View of Fuel Pump Module—2 Door Models

1 – LOCKNUT
2 – TANK FITTINGS
3 – EVAP FITTING
4 – ROLLOVER VALVE
5 – MODULE ALIGNMENT ARROW (7 O'CLOCK)
6 – TANK MARKINGS
7 – FUEL TANK

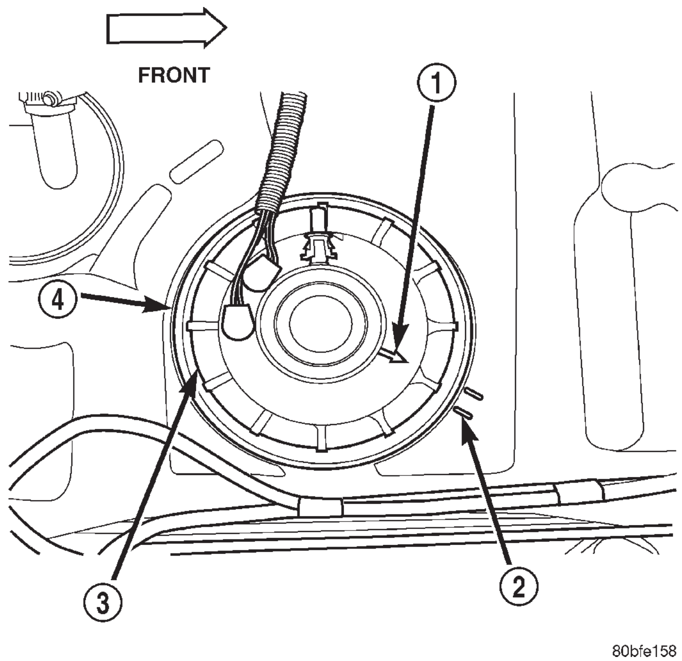


Fig. 23 Top View of Fuel Pump Module—4 Door Models

1 – MODULE ALIGNMENT ARROW (4 O'CLOCK)
2 – TANK MARKINGS
3 – LOCKNUT
4 – FUEL TANK

INSTALLATION

CAUTION: Whenever fuel pump module is serviced, the module gasket must be replaced.

(1) Using a new gasket, position fuel pump module into opening in fuel tank. Be sure rubber gasket remains in place. **2 Door Models:** Rotate module assembly until module alignment arrow is at 7 o'clock position (Fig. 22). The front of fuel tank is to the right in (Fig. 22). Arrow should be pointed to fuel tank markings (Fig. 22). **4 Door Models:** Rotate module assembly until module alignment arrow is at 4 o'clock position (Fig. 23). The front of fuel tank is to the right in (Fig. 23). Arrow should be pointed to fuel tank markings (Fig. 23). This step must be followed to prevent float/float rod from contacting sides of fuel tank.

(2) Position locknut over top of fuel pump module. Tighten finger tight.

(3) Carefully rotate fuel filter/fuel pressure regulator until fuel fitting is pointed towards drivers side of vehicle (Fig. 22) or (Fig. 23). The front of fuel tank is to the right in (Fig. 22) or (Fig. 23).

(4) Install Special Tool 6856 to locknut.

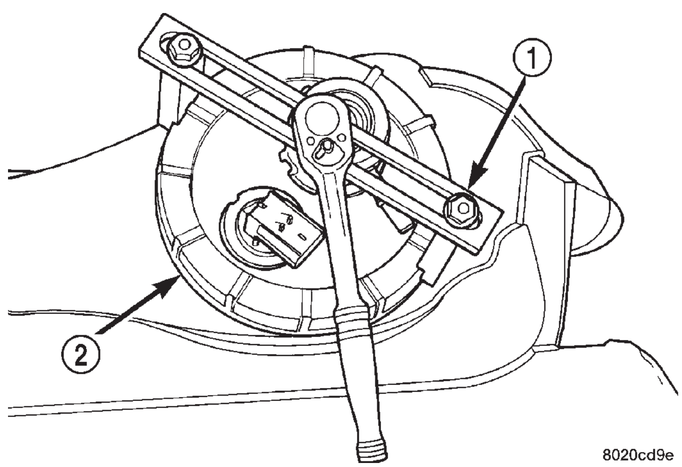


Fig. 24 Locknut Removal/Installation—Typical

1 – SPECIAL TOOL 6856
2 – LOCKNUT

(5) Tighten locknut to 54 N·m (40 ft. lbs.) torque. While tightening locknut, be sure module has not rotated.

(6) Install fuel tank. Refer to Fuel Tank Installation.

REMOVAL AND INSTALLATION (Continued)

FUEL PUMP INLET FILTER

The fuel pump inlet filter (strainer) is located on the bottom of the fuel pump module (Fig. 25) or (Fig. 26). The fuel pump module is located inside of fuel tank.

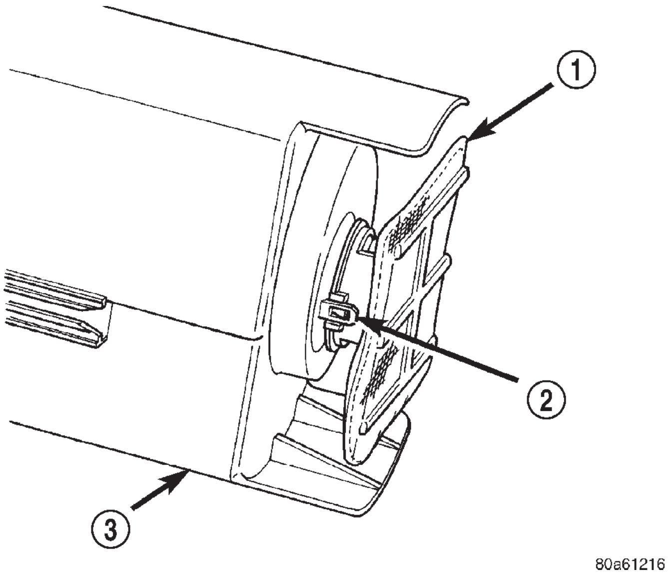


Fig. 25 Fuel Pump Inlet Filter—2 Door Models

1 – FUEL PUMP INLET FILTER
2 – LOCK TABS (2)
3 – FUEL PUMP MODULE (BOTTOM)

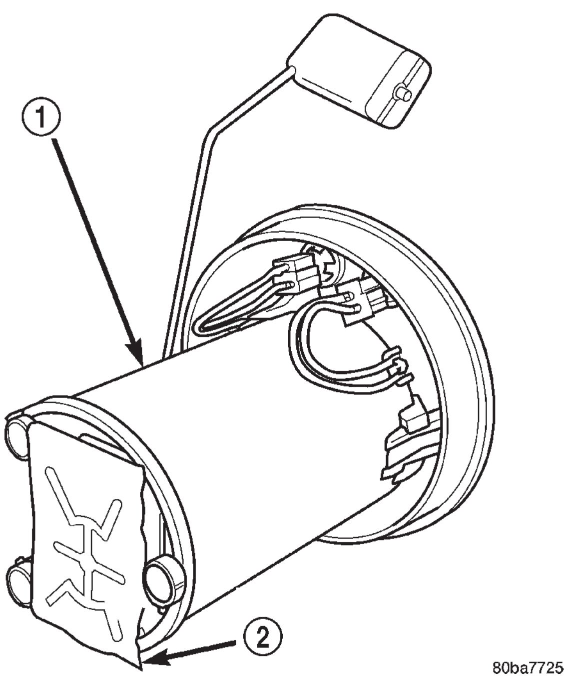


Fig. 26 Fuel Pump Inlet Filter—4 Door Models

1 – FUEL PUMP MODULE
2 – FUEL PUMP INLET FILTER

REMOVAL

(1) Remove fuel tank. Refer to Fuel Tank Removal/ Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) 2 Door Models: Remove filter by carefully prying 2 lock tabs at bottom of module with 2 screwdrivers. Filter is snapped to module.

(4) 4 Door Models: Remove filter by carefully prying it from bottom of pump module with 2 screwdrivers. Filter is snapped to module.

(5) Clean bottom of pump module.

INSTALLATION

(1) Snap new filter to bottom of module. Be sure o-ring is in correct position.

(2) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Install fuel tank. Refer to Fuel Tank Removal/ Installation.

FUEL GAUGE SENDING UNIT

The fuel gauge sending unit (fuel level sensor) and float assembly is located on the side of fuel pump module (Fig. 27) or (Fig. 28). The fuel pump module is located inside of fuel tank.

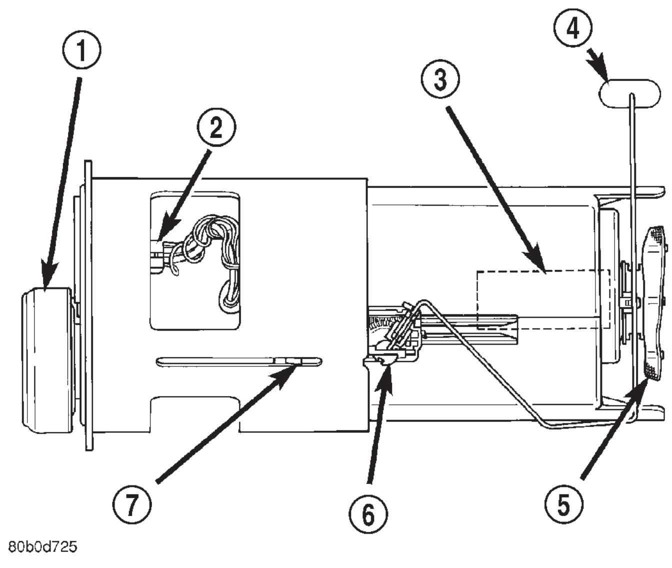


Fig. 27 Fuel Gauge Sending Unit Location—2 Door Models

1 – FUEL FILTER/PRESSURE REGULATOR
2 – ELECTRICAL CONNECTOR
3 – ELECTRIC FUEL PUMP
4 – FUEL GAUGE FLOAT
5 – FUEL PUMP INLET FILTER
6 – FUEL GAUGE SENDING UNIT
7 – MODULE LOCK TABS (3)

REMOVAL AND INSTALLATION (Continued)

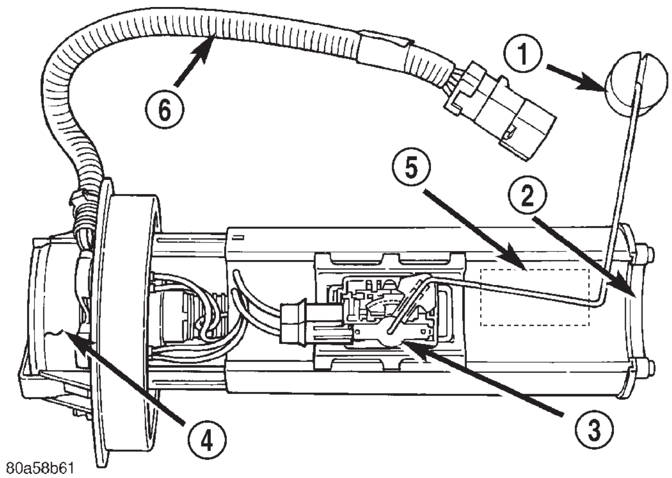


Fig. 28 Fuel Gauge Sending Unit Location—4 Door Models

1 – FUEL GAUGE FLOAT
2 – PICK-UP FILTER
3 – FUEL GAUGE SENDING UNIT
4 – FUEL FILTER/FUEL PRESSURE REGULATOR
5 – ELECTRIC FUEL PUMP
6 – PIGTAIL WIRING HARNESS

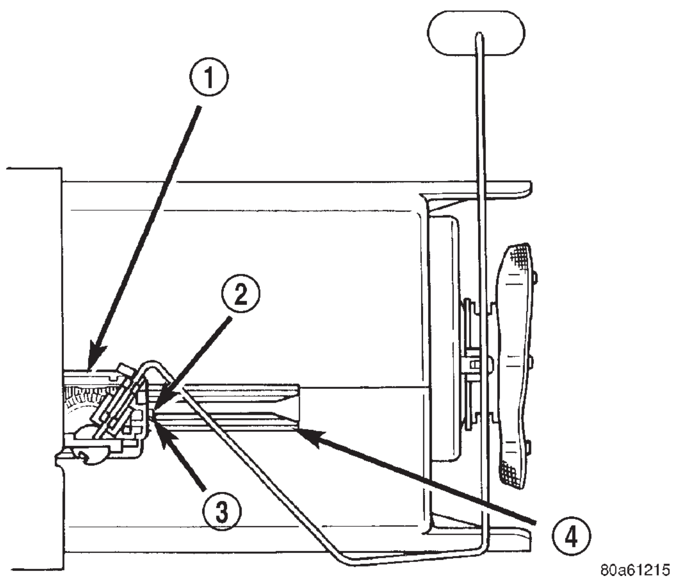


Fig. 29 Fuel Gauge Sending Unit Lock Tab/Tracks—2 Door Models

1 – FUEL GAUGE SENDING UNIT
2 – LOCK TAB
3 – NOTCH
4 – TRACKS

REMOVAL

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) **2 Door Models:**

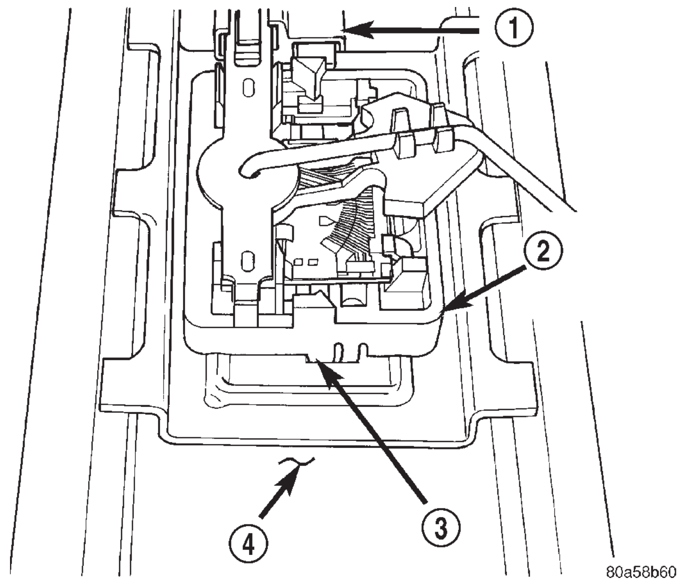


Fig. 30 Fuel Gauge Sending Unit Release Tab—4 Door Models

1 – ELECTRICAL CONNECTOR
2 – FUEL GAUGE SENDING UNIT
3 – RELEASE TAB
4 – FUEL PUMP MODULE

(a) Unplug 4–way electrical connector (Fig. 27).

(b) Disconnect 2 sending unit wires at 4–way connector. The locking collar of connector must be removed before wires can be released from connector. Note location of wires within 4–way connector.

(c) The sending unit is retained to pump module with a small lock tab and notch (Fig. 29). Carefully push lock tab to the side and away from notch while sliding sending unit downward on tracks for removal. Note wire routing while removing unit from module.

(4) **4 Door Models:**

(a) Remove electrical connector at sending unit terminals.

(b) Press on release tab (Fig. 30) to remove sending unit from pump module.

INSTALLATION

(1) **2 Door Models:**

(a) Position sending unit into tracks. Note wire routing.

(b) Push unit on tracks until lock tab snaps into notch.

(c) Connect 2 sending unit wires into 4–way connector and install locking collar.

(d) Connect 4–way electrical connector to module.

(2) **4 Door Models:**

(a) Position sending unit to pump module and snap into place.

REMOVAL AND INSTALLATION (Continued)

(b) Connect electrical connector to terminals.

(3) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(4) Install fuel tank. Refer to Fuel Tank Removal/Installation.

FUEL INJECTOR RAIL—3.9/5.2/5.9L ENGINES

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE TURNED OFF). BEFORE SERVICING FUEL RAIL ASSEMBLY, FUEL SYSTEM PRESSURE MUST BE RELEASED.

To release fuel pressure, refer to Fuel System Pressure Release Procedure in this group.

CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate rail halves at connecting hose (Fig. 31). Due to the design of this connecting hose, it does not use any clamps. Never attempt to install a clamping device of any kind to hose. When removing fuel rail assembly for any reason, be careful not to bend or kink connecting hose.

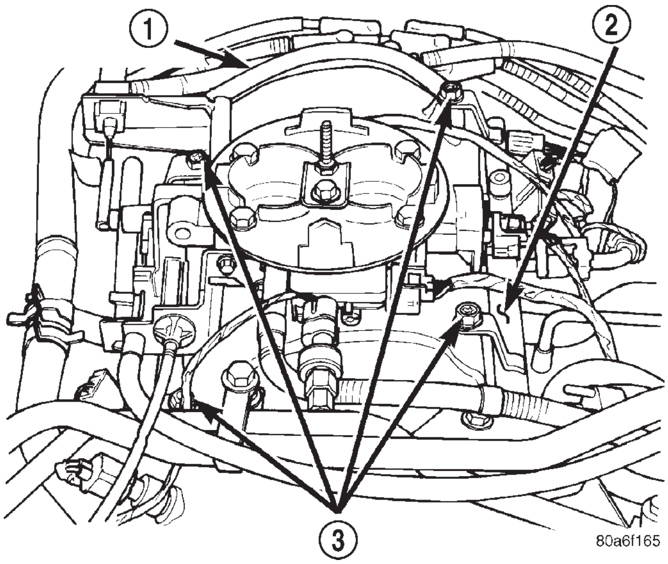


Fig. 31 Fuel Rail Assembly—3.9/5.2/5.9L Engine—Typical

1 – FUEL RAIL CONNECTING HOSE
2 – FUEL RAIL
3 – MOUNTING BOLTS (4)

REMOVAL

(1) Remove negative battery cable at battery.

(2) Remove air cleaner.

(3) Perform fuel pressure release procedure.

(4) Remove throttle body from intake manifold. Refer to Throttle Body removal in this group.

(5) If equipped with air conditioning, remove A-shaped A/C compressor-to-intake manifold support bracket (three bolts) (Fig. 32).

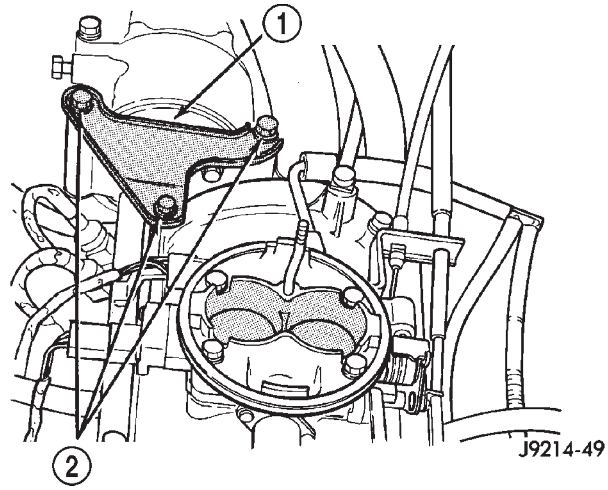


Fig. 32 A/C Compressor Support Bracket—Typical

1 – AIR CONDITIONING COMPRESSOR SUPPORT BRACKET
2 – MOUNTING BOLTS

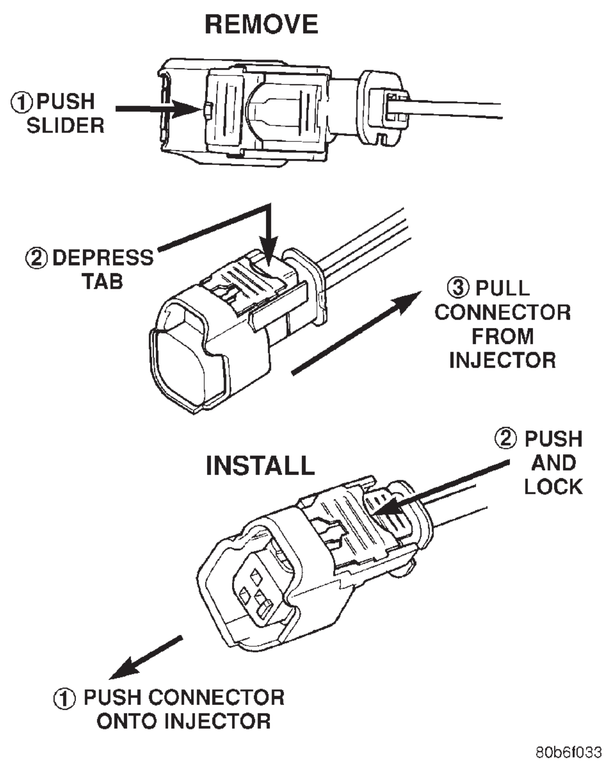


Fig. 33 Remove/Install Injector Connector

(6) Disconnect electrical connectors at all 8 fuel injectors. To remove connector refer to (Fig. 33). Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for

REMOVAL AND INSTALLATION (Continued)

injector position identification. If harness is not tagged, note wiring location before removal.

(7) 3.9L (V-6) engine only: Disconnect electrical connector at intake manifold air temperature sensor. Do not remove sensor.

(8) Disconnect fuel tube (line) at side of fuel rail. Refer to Quick-Connect Fittings for procedures,

(9) Remove remaining fuel rail mounting bolts.

(10) Clean dirt/debris from each fuel injector at intake manifold.

(11) Gently rock and pull **left** fuel rail until fuel injectors just start to clear intake manifold. Gently rock and pull **right** fuel rail until fuel injectors just start to clear intake manifold. Repeat this procedure (left/right) until all fuel injectors have cleared intake manifold.

(12) Remove fuel rail (with injectors attached) from engine.

(13) Remove clip(s) retaining injector(s) to fuel rail (Fig. 34) or (Fig. 35).

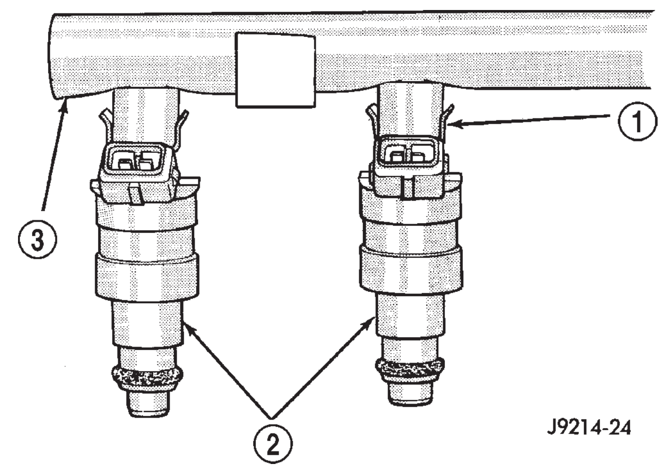


Fig. 34 Fuel Injector Mounting—Typical

1 – CLIP
2 – INJECTOR
3 – FUEL RAIL

INSTALLATION

(1) Apply a small amount of clean engine oil to each fuel injector o-ring. This will help in fuel rail installation.

(2) Install injector(s) and injector clip(s) to fuel rail.

(3) Position fuel rail/fuel injector assembly to injector openings on intake manifold.

(4) Guide each injector into intake manifold. Be careful not to tear injector o-ring.

(5) Push **right** fuel rail down until fuel injectors have bottomed on injector shoulder. Push **left** fuel rail down until fuel injectors have bottomed on injector shoulder.

(6) Install fuel rail mounting bolts.

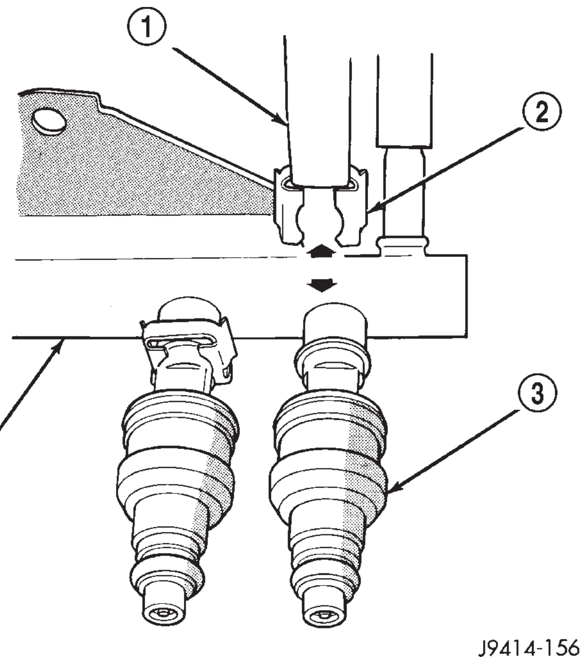


Fig. 35 Injector Retaining Clips—Typical Injector

1 – PLIERS
2 – INJECTOR CLIP
3 – FUEL INJECTOR
4 – FUEL RAIL

(7) Connect electrical connector to intake manifold air temperature sensor.

(8) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 33). Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

(9) Install A/C support bracket (if equipped).

(10) Install throttle body to intake manifold. Refer to Throttle Body installation in this group.

(11) Install fuel tube (line) at side of fuel rail. Refer to Quick-Connect Fittings for procedures.

(12) Install air cleaner.

(13) Connect battery cable to battery.

(14) Start engine and check for leaks.

FUEL INJECTOR RAIL/FUEL DAMPER—2.5L ENGINE

REMOVAL

The fuel damper is not serviced separately.

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL RAIL.

(1) Remove fuel tank filler tube cap.

REMOVAL AND INSTALLATION (Continued)

(2) Perform Fuel System Pressure Release Procedure as described in this Group.

(3) Disconnect negative battery cable from battery.

(4) Remove air tube at top of throttle body. Note: Some engine/vehicles may require removal of air cleaner ducts at throttle body.

(5) Remove injector harness electrical connectors at each injector. Each injector connector should have a numerical tag attached identifying its corresponding cylinder (Fig. 36). If not, identify each connector before removal.

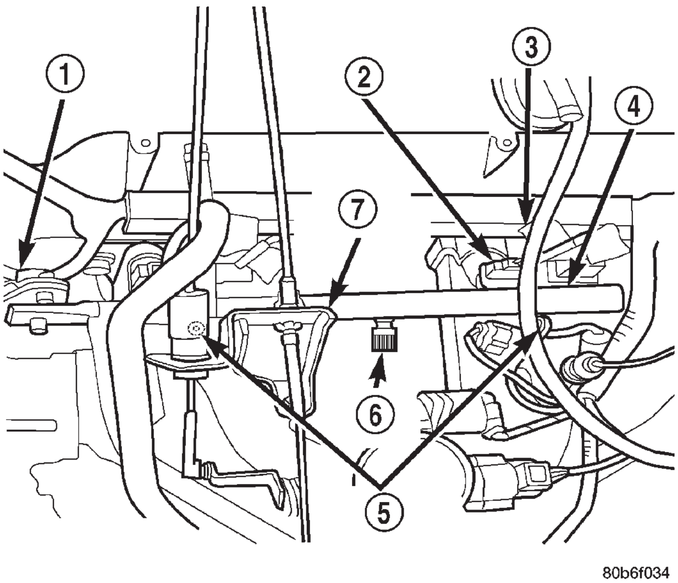


Fig. 36 Fuel Rail Mounting—2.5L Engine

1 – FUEL DAMPER
2 – FUEL INJECTOR
3 – NUMBERED TAG
4 – FUEL RAIL
5 – FUEL RAIL MOUNTING BOLTS/NUTS
6 – TEST PORT
7 – CABLE BRACKET

(6) Disconnect fuel supply line latch clip and fuel line at fuel rail. Refer to Quick-Connect Fittings in this group for procedures.

(7) Disconnect throttle cable at throttle body. Refer to Throttle Cable Removal/Installation in this group for procedures.

(8) Disconnect speed control cable at throttle body (if equipped). Refer to Speed Control Cable in Group 8H, Speed Control System for procedures.

(9) Disconnect automatic transmission cable at throttle body (if equipped).

(10) Remove cable routing bracket (Fig. 36) at intake manifold.

(11) Remove nut securing crankshaft position sensor pigtail harness to fuel rail mounting stud. Remove clamp and harness from fuel rail mounting stud.

(12) Clean dirt/debris from each fuel injector at intake manifold.

(13) Remove fuel rail mounting nuts/bolts (Fig. 36).

(14) Remove fuel rail by gently rocking until all the fuel injectors are out of intake manifold.

INSTALLATION

(1) Clean each injector bore at intake manifold.

(2) Apply a small amount of clean engine oil to each injector o-ring. This will aid in installation.

(3) Position tips of all fuel injectors into the corresponding injector bore in intake manifold. Seat injectors into manifold.

(4) Install and tighten fuel rail mounting bolts to 11 ±3 N·m (100 ±25 in. lbs.) torque.

(5) Position crankshaft position sensor pigtail wire harness clamp and wire harness to fuel rail mounting stud. Install nut securing harness to fuel rail mounting stud.

(6) Connect tagged injector harness connectors to appropriate injector.

(7) Connect fuel line and fuel line latch clip to fuel rail. Refer Quick-Connect Fittings in this group for procedures.

(8) Install protective cap to pressure test port fitting (if equipped).

(9) Install cable routing bracket to intake manifold.

(10) Connect throttle cable at throttle body.

(11) Connect speed control cable at throttle body (if equipped).

(12) Connect automatic transmission cable at throttle body (if equipped).

(13) Install air tube (or duct) at top of throttle body.

(14) Install fuel tank cap.

(15) Connect negative battery cable to battery.

(16) Start engine and check for fuel leaks.

FUEL INJECTOR RAIL—4.7L V–8 ENGINE

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL RAIL, FUEL SYSTEM PRESSURE MUST BE RELEASED.

CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate rail halves at connector tube (Fig. 37). Due to design of tube, it does not use any clamps. Never attempt to install a clamping device of any kind to tube. When removing fuel rail assembly for any reason, be careful not to bend or kink tube.

REMOVAL AND INSTALLATION (Continued)

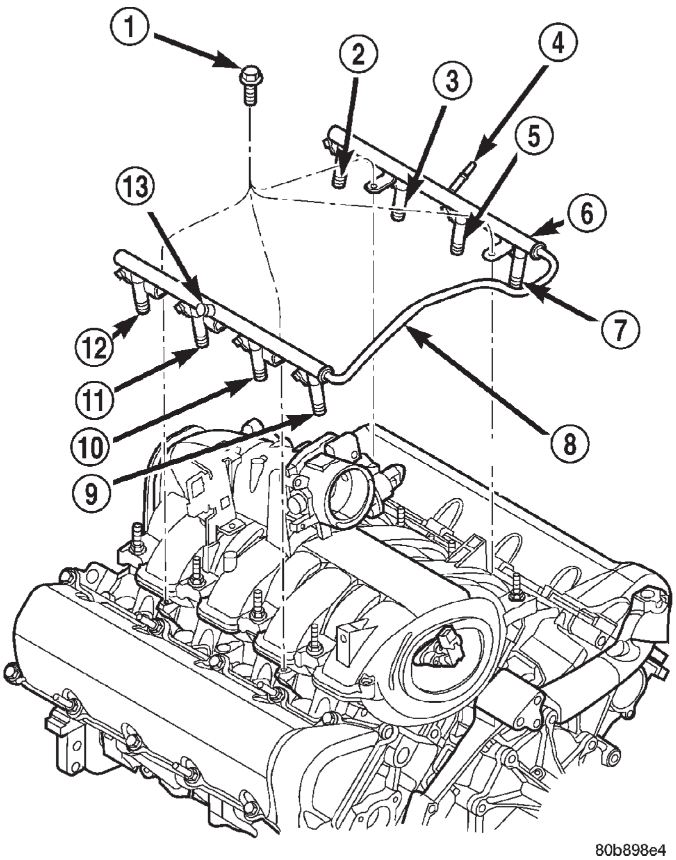


Fig. 37 Fuel Rail Mounting—4.7L V-8 Engine

1 – MOUNTING BOLTS (4)
2 – INJ.#7
3 – INJ.#5
4 – QUICK-CONNECT FITTING
5 – INJ.#3
6 – FUEL INJECTOR RAIL
7 – INJ.#1
8 – CONNECTOR TUBE
9 – INJ.#2
10 – INJ.#4
11 – INJ.#6
12 – INJ.#8
13 – PRESSURE TEST PORT CAP

REMOVAL

(1) Remove fuel tank filler tube cap.

(2) Perform Fuel System Pressure Release Procedure.

(3) Remove negative battery cable at battery.

(4) Remove air duct at throttle body air box.

(5) Remove air box at throttle body.

(6) Remove wiring at rear of generator.

(7) Disconnect fuel line latch clip and fuel line at fuel rail. A special tool will be necessary for fuel line disconnection. Refer to Quick-Connect Fittings.

(8) Remove vacuum lines at throttle body.

(9) Disconnect electrical connectors at all 8 fuel injectors. To remove connector refer to (Fig. 38). Push

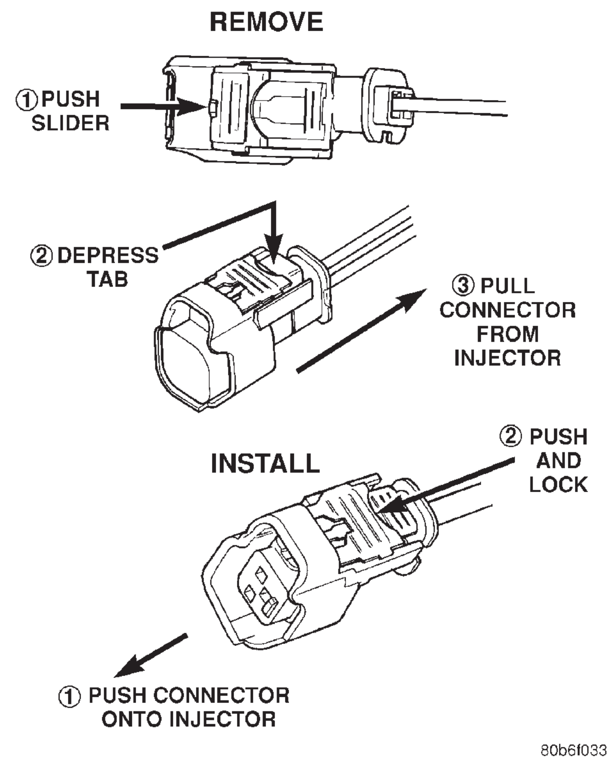


Fig. 38 Remove/Install Injector Connector—4.7L V-8 Engine

red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.

(10) Disconnect electrical connectors at throttle body.

(11) Disconnect electrical connectors at MAP and IAT sensors.

(12) Remove first three ignition coils on each bank (cylinders #1, 3, 5, 2, 4 and 6). Refer to Ignition Coil Removal/Installation.

(13) Remove 4 fuel rail mounting bolts (Fig. 37).

(14) Gently rock and pull **left** side of fuel rail until fuel injectors just start to clear machined holes in cylinder head. Gently rock and pull **right** side of rail until injectors just start to clear cylinder head holes. Repeat this procedure (left/right) until all injectors have cleared cylinder head holes.

(15) Remove fuel rail (with injectors attached) from engine.

(16) If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.

INSTALLATION

(1) If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.

REMOVAL AND INSTALLATION (Continued)

(2) Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.
(3) Position fuel rail/fuel injector assembly to machined injector openings in cylinder head.
(4) Guide each injector into cylinder head. Be careful not to tear injector o-rings.
(5) Push **right** side of fuel rail down until fuel injectors have bottomed on cylinder head shoulder. Push **left** fuel rail down until injectors have bottomed on cylinder head shoulder.
(6) Install 4 fuel rail mounting bolts and tighten to 27 N·m (20 ft. lbs.).
(7) Install ignition coils. Refer to Ignition Coil Removal/Installation.
(8) Connect electrical connectors to throttle body.
(9) Connect electrical connectors to MAP and IAT sensors.
(10) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 38). Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.
(11) Connect vacuum lines to throttle body.
(12) Connect fuel line latch clip and fuel line to fuel rail. Refer to Quick-Connect Fittings.
(13) Connect wiring to rear of generator.
(14) Install air box to throttle body.
(15) Install air duct to air box.
(16) Connect battery cable to battery.
(17) Start engine and check for leaks.

FUEL INJECTOR(S)

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE EVEN WITH ENGINE TURNED OFF. BEFORE SERVICING FUEL INJECTOR(S), FUEL SYSTEM PRESSURE MUST BE RELEASED.

To release fuel pressure, refer to Fuel System Pressure Release Procedure.

To remove one or more fuel injectors, fuel rail assembly must be removed from engine.

REMOVAL

(1) Remove air cleaner assembly.
(2) Remove fuel injector rail assembly. Refer to Fuel Injector Rail Removal/Installation in this group.
(3) Remove clip(s) retaining the injector(s) to fuel rail (Fig. 34) or (Fig. 35).
(4) Remove injector(s) from fuel rail.

INSTALLATION

(1) Apply a small amount of clean engine oil to each fuel injector o-ring. This will help in fuel rail installation.
(2) Install injector(s) and injector clip(s) to fuel rail.
(3) Install fuel rail assembly. Refer to Fuel Injector Rail Removal/Installation.
(4) Install air cleaner.
(5) Start engine and check for leaks.

FUEL TANK

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE OFF). BEFORE DRAINING FUEL TANK, FUEL SYSTEM PRESSURE MUST BE RELEASED.

The fuel tank **cannot** be drained through the fill or vent fittings at the top of the fuel tank. Two different procedures may be used to drain fuel tank (using an approved gasoline draining station, or using the DRB scan tool along with an approved gasoline draining station). Draining is done from the disconnected fuel line, at the fuel rail, with either procedure.

(1) Remove fuel tank filler tube cap.
(2) Perform Fuel System Pressure Release procedure.
(3) Disconnect negative battery cable at battery.
(4) Disconnect quick-connect fuel line at fuel rail. Refer to Quick-Connect Fittings for procedures.
(5) The hose from the gasoline draining station must be adapted into the 5/16” quick-connect fitting on disconnected fuel line. One way to accomplish this is to obtain a 5/16” test fitting such as from Snap-On ® Fuel Injection Adapter Set # FIDA44. Snap the fitting into the disconnected fuel line and attach hose from gasoline draining station.
(6) Operate the gasoline draining station to drain fuel tank. As an alternative procedure, the electric fuel pump may be activated. Refer to DRB scan tool for fuel pump activation procedures. Activate electric fuel pump, or gasoline draining station, and drain tank until empty. If electric fuel pump is not operating, the gasoline draining station must be used.
(7) Raise vehicle and remove splash shield in front of left/rear wheelhouse.
(8) Remove hose clamps and disconnect rubber fill and vent hoses (Fig. 40) at fill and vent tubes (Fig. 39). Do not disconnect hoses at fuel tank.
(9) Place and secure a transmission jack under center of fuel tank and apply slight pressure.
(10) Remove two tank mounting nuts from mounting straps (Fig. 41). Position tank mounting straps to side of vehicle and lower tank just enough to allow access to connections at top of tank.
(11) Clean quick-connect fittings of any dirt/contaminants before removal.

REMOVAL AND INSTALLATION (Continued)

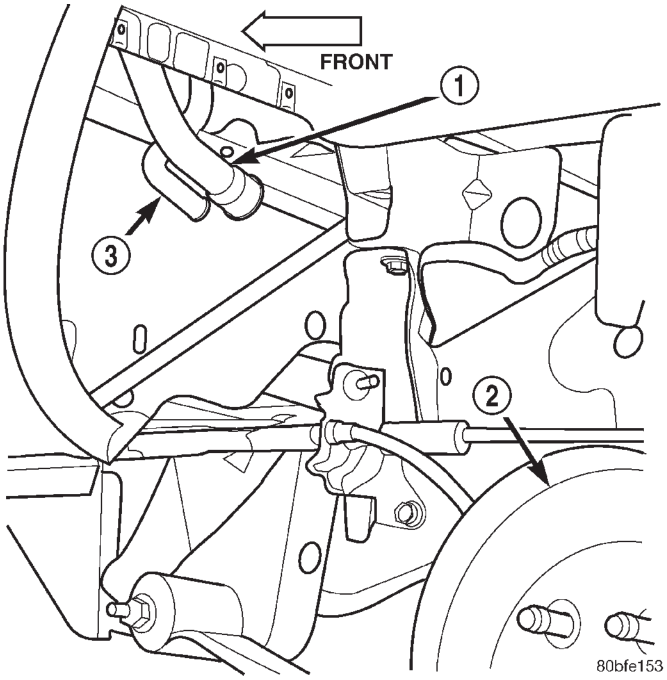


Fig. 39 Fuel Fill and Vent Tubes

1 – FUEL FILL TUBE
2 – L. R. BRAKE DRUM
3 – FUEL VENT TUBE

(12) Disconnect fuel supply line from fuel filter/ fuel pressure regulator fitting at top of tank. Refer to Quick-Connect Fittings for procedures.

(13) Disconnect fuel vapor line(s) from rollover valve(s) at top of tank.

(14) Disconnect electrical connector at pump module at top of tank.

(15) Lower tank from vehicle. On certain models, the tank must first be moved rearward, and then down, for removal.

(16) Remove tank from hydraulic jack.

(17) If fuel pump module requires service, refer to Fuel Pump Module Removal/Installation.

(18) If fill and vent hoses are to be removed from tank, note their position on fuel tank fittings before removal.

INSTALLATION

(1) If fuel pump module is being installed, refer to Fuel Pump Module Removal/Installation.

(2) Install fill and vent hoses to tank fittings.

(3) Place and secure fuel tank to transmission jack.

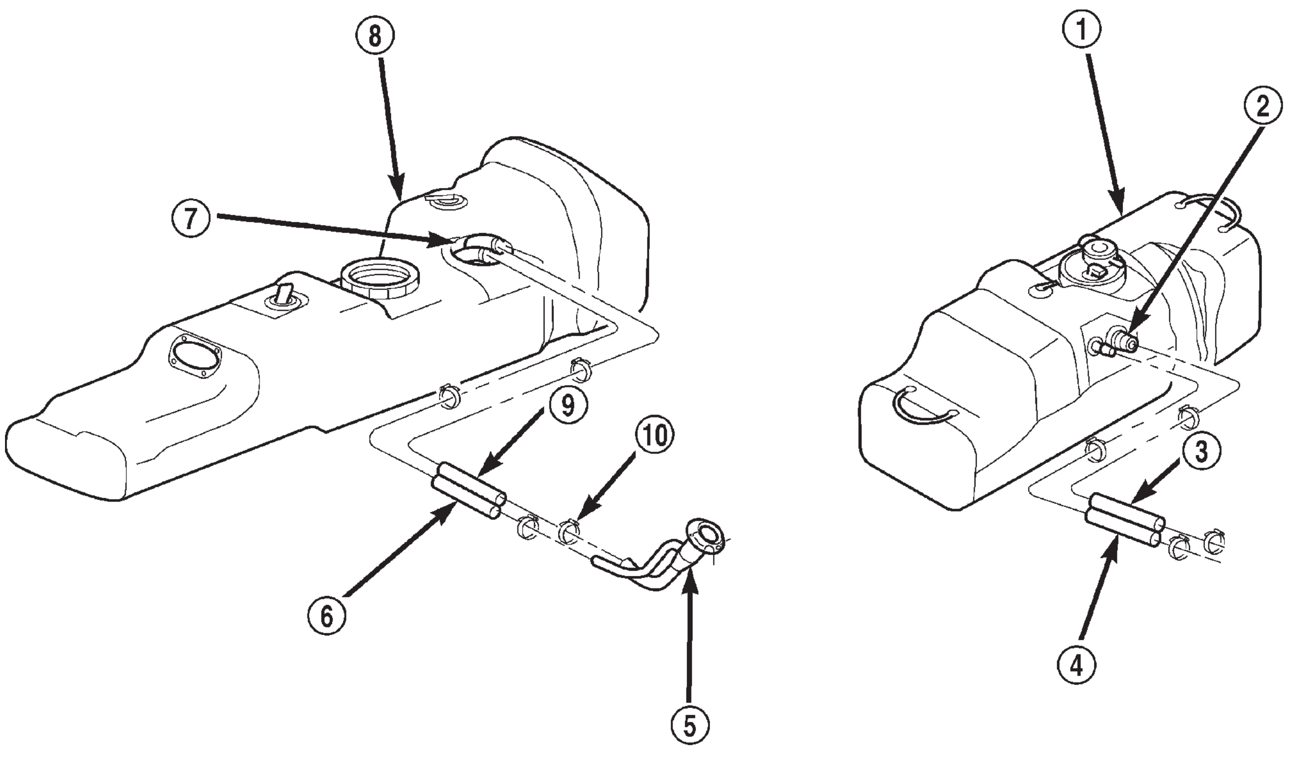


Fig. 40 Fuel Tank and Hoses

1 – FUEL TANK (4—DOOR)
2 – TANK FITTINGS
3 – FILL HOSE
4 – VENT HOSE
5 – FUEL TUBE ASSEMBLY
6 – VENT HOSE
7 – TANK FITTINGS
8 – FUEL TANK (4—DOOR)
9 – FILL HOSE
10 – CLAMPS

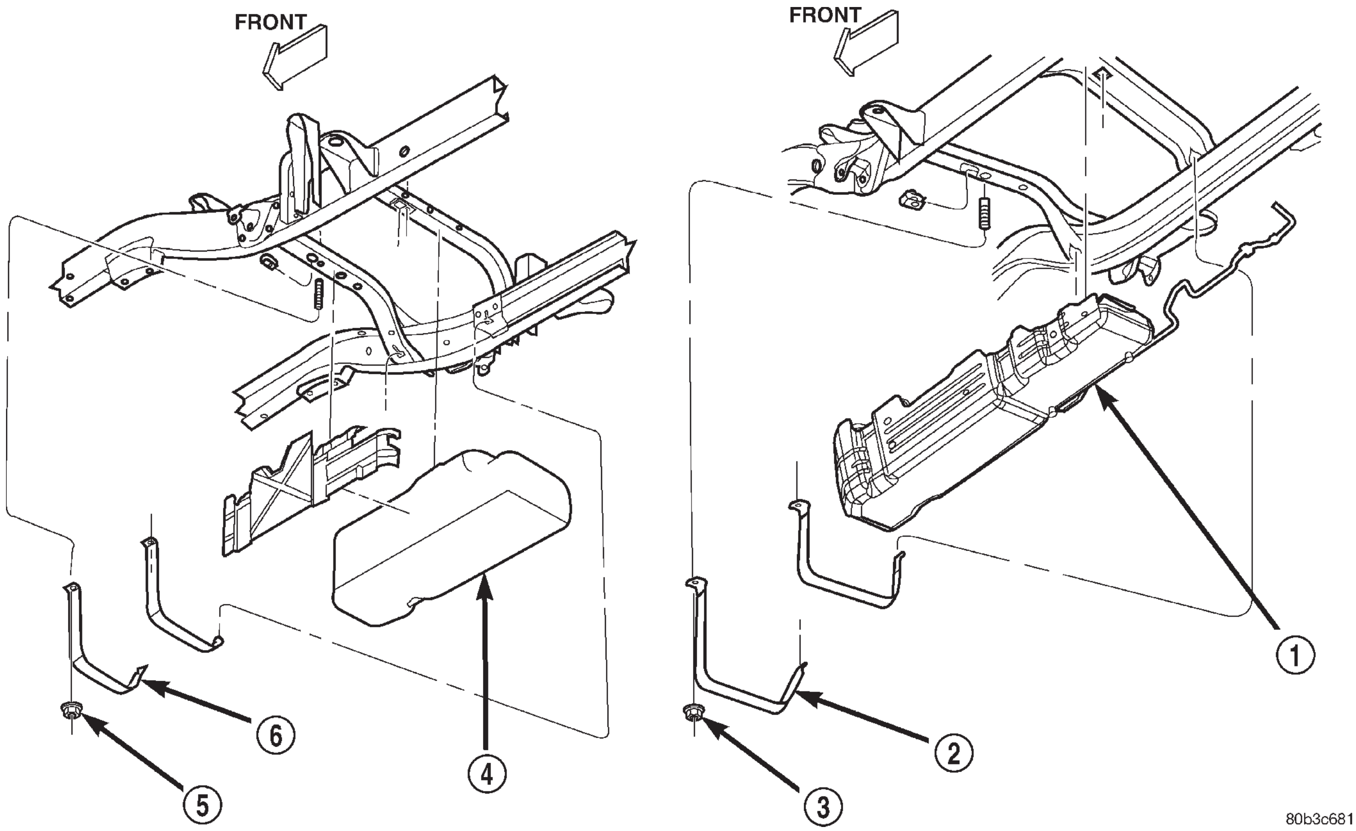


Fig. 41 Fuel Tank Mounting

1 – FUEL TANK (2—DOOR)
2 – STRAPS (2)
3 – NUTS (2)
4 – FUEL TANK (2—DOOR)
5 – NUTS (2)
6 – STRAPS (2)

(4) Raise tank up enough to connect fuel line, electrical connector and vapor hoses to top of fuel tank. Refer to Quick-Connect Fittings for fuel line procedures.

(5) Continue raising tank into position and install mounting straps and nuts. Tighten nuts to 27–54 N·m (20–40 ft. lbs.) torque. **Do not over tighten mounting strap nuts.**

(6) Remove transmission jack.

(7) Install fill and vent hoses to fill and vent tubes.

(8) Install splash shield in front of left/rear wheelhouse.

(9) Connect negative cable to battery.

(10) Refill fuel tank and install fill cap.

(11) Inspect all hoses and lines for leaks.

FUEL TANK FILLER TUBE CAP

REMOVAL/INSTALLATION

If replacement of the 1/4 turn fuel tank filler tube cap is necessary, it must be replaced with an identical cap to be sure of correct system operation.

CAUTION: Remove the fuel tank filler tube cap to relieve fuel tank pressure. The cap must be removed prior to disconnecting any fuel system component or before draining the fuel tank.

ACCELERATOR PEDAL

All engines are equipped with torsion return springs located on the throttle body shaft. 3.9L V-6 and 5.2/5.9L V-8 engines equipped with a manual transmission have an additional pedal return spring on the throttle body linkage.

REMOVAL

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or cables.

(1) From inside the vehicle, hold up accelerator pedal. Remove plastic cable retainer and throttle cable core wire from upper end of pedal arm (Fig. 42). Plastic cable retainer snaps into pedal arm.

REMOVAL AND INSTALLATION (Continued)

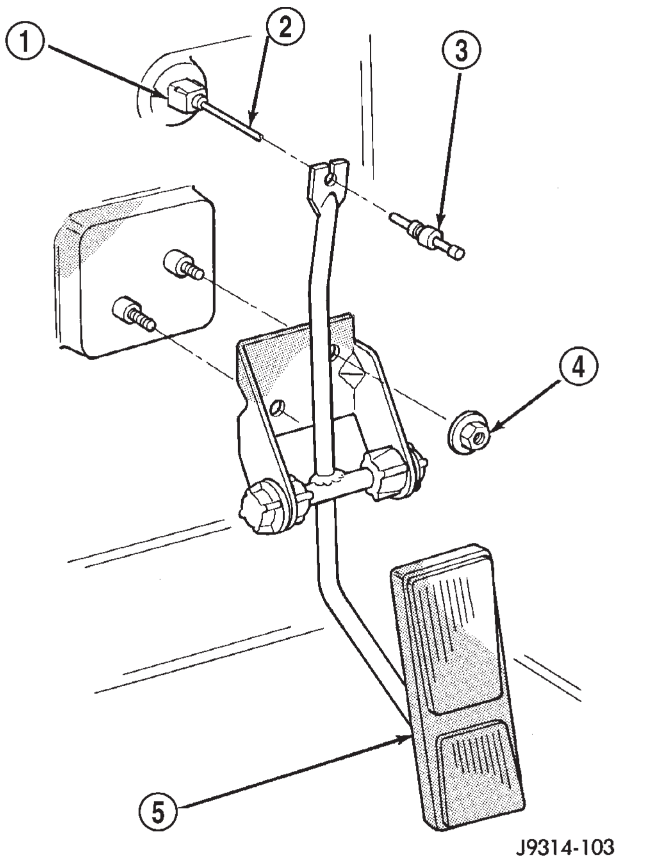


Fig. 42 Accelerator Pedal—Removal or Installation

1 – PINCH SIDES
2 – CABLE
3 – CABLE RETAINER
4 – NUTS (2)
5 – ACCELERATOR PEDAL

(2) Remove two accelerator pedal/bracket nuts (Fig. 42) and remove pedal/bracket assembly from vehicle.

INSTALLATION

(1) Position pedal/bracket assembly over the two dash panel mounting studs and install retaining nuts.

(2) Tighten nuts to 7 N·m (65 in. lbs.) torque.

(3) From inside the vehicle, hold up the accelerator pedal. Install the throttle cable core wire and plastic cable retainer into the upper end of the pedal arm. The plastic retainer is snapped into the pedal arm. When installing the plastic retainer to the accelerator pedal arm, note the index tab on the pedal arm (Fig. 43). Align the index slot (Fig. 43) on the plastic cable retainer to this index tab.

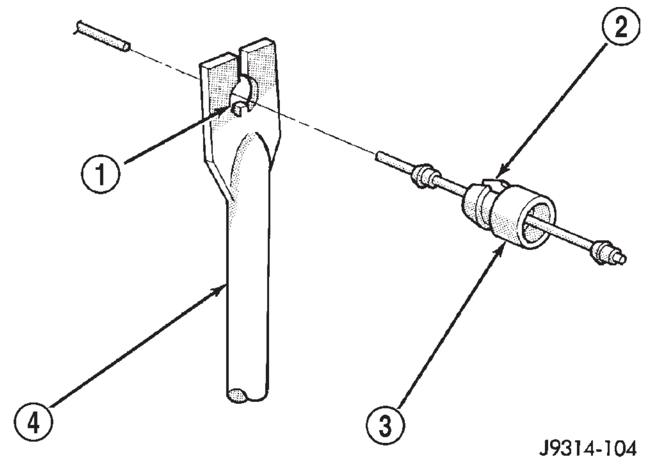


Fig. 43 Index Tab and Slot

1 – INDEX TAB
2 – INDEX SLOT
3 – CABLE RETAINER
4 – PEDAL ARM

THROTTLE CABLE

CAUTION: Be careful not to damage or kink cable core wire (within cable sheathing) while servicing accelerator pedal or cables.

REMOVAL

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer and throttle cable core wire from upper end of pedal arm (Fig. 42). Plastic cable retainer snaps into pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, pinch both sides of cable housing retainer at dash panel (Fig. 42). Remove cable housing from dash panel and pull into engine compartment.

(4) Remove air tube at top of throttle body.

(5) **3.9/5.2/5.9L Engines:**

(a) Operate throttle body lever (by hand) to full open throttle position. Slip cable end rearward from pin on throttle lever (Fig. 44).

(b) Remove cable housing at throttle body mounting bracket by pressing forward on release tab with a small screwdriver (Fig. 45). **To prevent cable housing breakage, press on tab only enough to release cable from bracket.** Lift cable housing straight up from bracket while pressing on release tab. Remove cable housing.

(6) **2.5L Engine:**

(a) Remove cable ball socket at throttle body linkage (snaps off toward rear of vehicle).

(b) Pinch sides of cable housing clips at cable mounting bracket (Fig. 46) to release housing from bracket.

REMOVAL AND INSTALLATION (Continued)

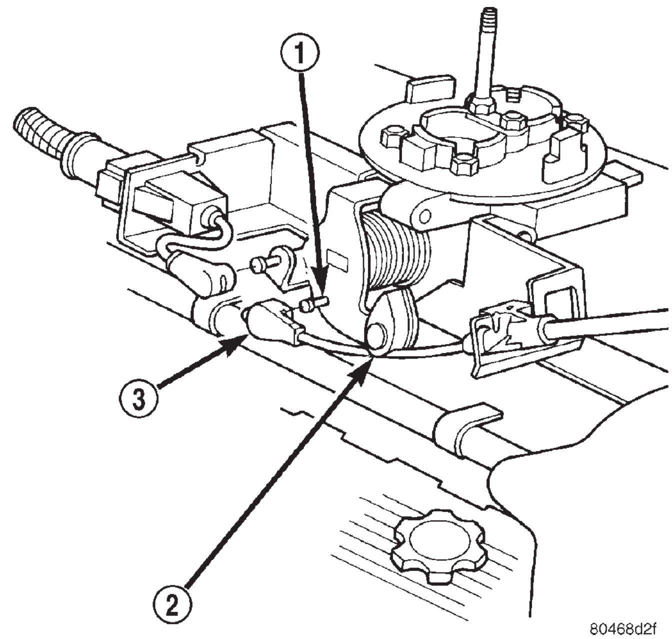


Fig. 44 Throttle Cable at Throttle Body—Typical (V-8 Shown)

1 – THROTTLE LEVER PIN
2 – CAM (V-8 ENGINE ONLY)
3 – THROTTLE CABLE END

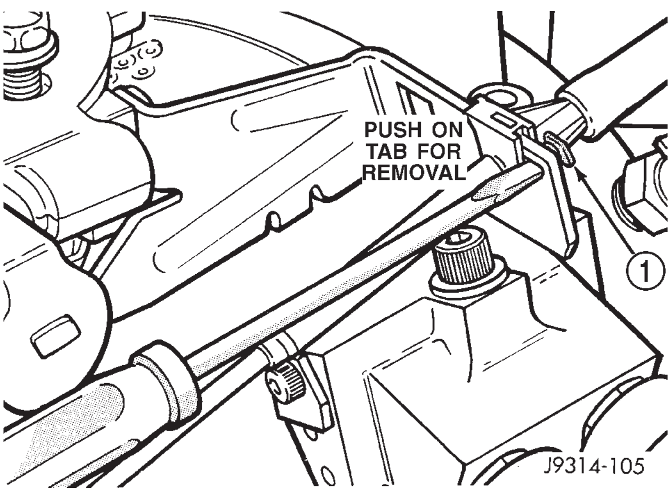


Fig. 45 Cable Release Tab—Typical V-6/V8 Engine

1 – TAB

(c) Unsnap cable housing at valve cover retainer.
(d) Remove cable from vehicle.
(7) Remove cable from vehicle.

INSTALLATION

(1) **3.9/5.2/5.9L Engines:**

(a) Snap cable end onto lever pin (Fig. 44). On models with V-8 engines, be sure cable is routed **under** plastic cam (Fig. 44).

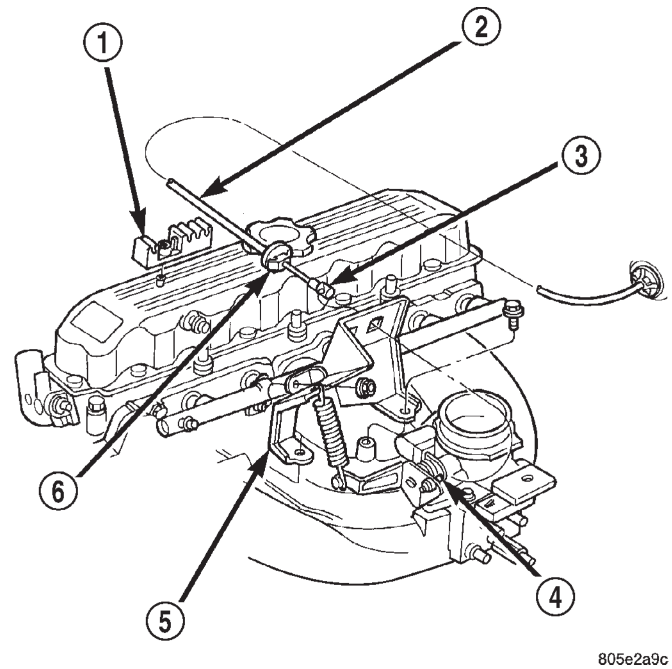


Fig. 46 Throttle Cable—2.5L Engine

1 – VALVE COVER RETAINER
2 – CABLE AND HOUSING
3 – BALL SOCKET
4 – THROTTLE LINKAGE BAIL
5 – MOUNTING BRACKET
6 – CABLE HOUSING CLIPS

(b) Connect cable to throttle body mounting bracket (push down and lock).

(2) **2.5L Engine:**

(a) Slip cable housing through hole in mounting bracket and snap cable into bracket.

(b) Attach ball socket at throttle body linkage (snaps on).

(c) Attach cable housing at valve cover retainer (snaps on).

(3) Install remaining cable housing end into dash panel opening (snaps into position).

(4) Install ball end of cable wire through hole in pedal arm. Install plastic cable retainer. The plastic retainer is snapped into pedal arm. When installing retainer to accelerator pedal arm, note index tab on pedal arm (Fig. 43). Align index slot (Fig. 46) on plastic retainer to this index tab.

(5) Operate and test throttle before starting engine.

(6) Install air tube to throttle body.

REMOVAL AND INSTALLATION (Continued)

THROTTLE CABLE—4.7L V-8 ENGINE

REMOVAL

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 42). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, remove clip holding cable to dashpanel (Fig. 42).

(4) Remove air box at throttle body.

(5) Unsnap cable from dashpanel routing clip.

(6) Remove cable housing from dash panel and pull into engine compartment.

(7) Using finger pressure only, disconnect accelerator cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 47). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(8) Lift accelerator cable from top of cable cam (Fig. 47).

(9) Press tab (Fig. 48) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (Fig. 48) towards passenger side of vehicle to remove cable from bracket.

(10) Remove throttle cable from vehicle.

INSTALLATION

(1) Slide accelerator cable plastic mount into bracket. Continue sliding until tab (Fig. 48) is aligned to hole in mounting bracket.

(2) Route accelerator cable over top of cable cam.

(3) Connect cable end to throttle body bellcrank pin (snaps on rearward).

(4) Slide rubber grommet away from plastic cable housing.

(5) Install rubber grommet into dash panel until seated.

(6) Push cable housing into rubber grommet and through opening in dash panel.

(7) From inside vehicle, install clip holding cable to dashpanel (Fig. 42).

(8) From inside vehicle, slide throttle cable core wire into opening in top of pedal arm.

(9) Push cable retainer (clip) into pedal arm opening until it snaps in place.

(10) Snap cable into dashpanel routing clip.

(11) Install air box to throttle body.

(12) Before starting engine, operate accelerator pedal to check for any binding.

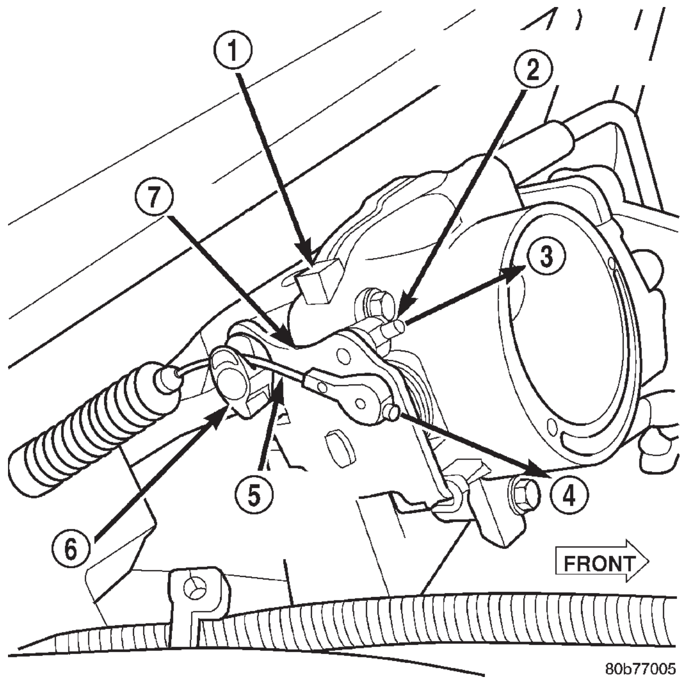


Fig. 47 Accelerator Cable at Bell Crank—4.7L V-8 Engine

1 – THROTTLE BODY
2 – SPEED CONTROL CABLE CONNECTOR
3 – OFF
4 – OFF
5 – ACCELERATOR CABLE CONNECTOR
6 – CABLE CAM
7 – BELLCRANK

SPECIFICATIONS

FUEL TANK CAPACITY

FUEL SYSTEM PRESSURE

All Engines: 339 kPa ± 34 kPa (49.2 psi ± 5 psi)

FUEL REQUIREMENTS

Your engine is designed to meet all emissions regulations and provide excellent fuel economy and performance when using high quality unleaded gasoline having an octane rating of 87. The use of premium gasoline is not recommended. The use of premium gasoline will provide no benefit over high quality regular gasoline, and in some circumstances may result in poorer performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and immediate service is required. Engine damage resulting from operation with a heavy spark knock may not be covered by the new vehicle warranty.

SPECIFICATIONS (Continued)

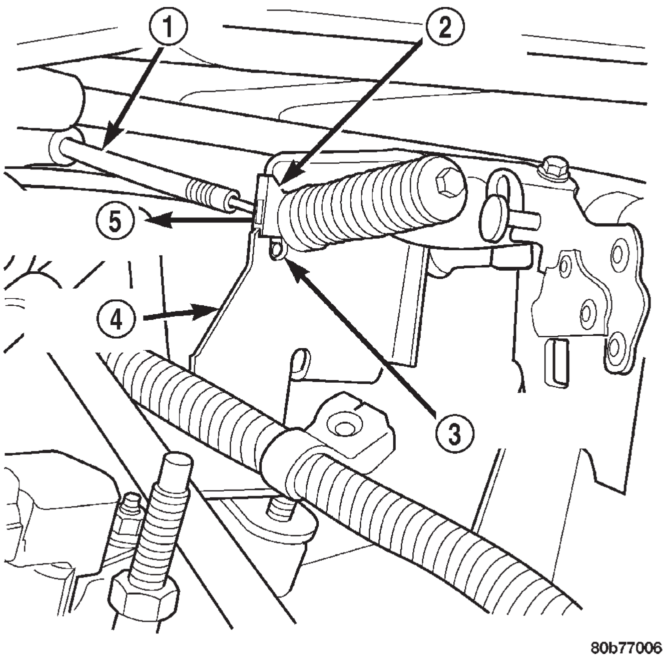


Fig. 48 Accelerator Cable Release Tab—4.7L V-8 Engine

1 – ACCELERATOR CABLE
2 – PLASTIC CABLE MOUNT
3 – PRESS TAB FOR REMOVAL
4 – CABLE BRACKET
5 – SLIDE FOR REMOVAL

Models	Liters	U. S. Gallons.
2-door	83	22
4-door	91	24
Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		

Poor quality gasoline can cause problems such as hard starting, stalling and hesitations. If you experience these symptoms, try another brand of gasoline before considering service for the vehicle.

Over 40 auto manufacturers world-wide have issued and endorsed consistent gasoline specifications (the Worldwide Fuel Charter, WWFC) to define fuel properties necessary to deliver enhanced emissions, performance and durability for your vehicle. We recommend the use of gasolines that meet the WWFC specifications if they are available.

REFORMULATED GASOLINE

Many areas of the country require the use of cleaner burning gasoline referred to as "reformulated" gasoline. Reformulated gasoline contain oxygenates, and are specifically blended to reduce vehicle emissions and improve air quality.

We strongly supports the use of reformulated gasoline. Properly blended reformulated gasoline will provide excellent performance and durability for the engine and fuel system components.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with oxygenates such as 10% ethanol, MTBE, and ETBE. Oxygenates are required in some areas of the country during the winter months to reduce carbon monoxide emissions. Fuels blended with these oxygenates may be used in your vehicle.

CAUTION: DO NOT use gasoline containing METHANOL. Gasoline containing methanol may damage critical fuel system components.

MMT IN GASOLINE

MMT is a manganese-containing metallic additive that is blended into some gasoline to increase octane. Gasoline blended with MMT provide no performance advantage beyond gasoline of the same octane number without MMT. Gasoline blended with MMT reduce spark plug life and reduce emission system performance in some vehicles. We recommend that gasolines free of MMT be used in your vehicle. The MMT content of gasoline may not be indicated on the gasoline pump; therefore, you should ask your gasoline retailer whether or not his/her gasoline contains MMT.

It is even more important to look for gasoline without MMT in Canada because MMT can be used at levels higher than allowed in the United States. MMT is prohibited in Federal and California reformulated gasoline.

SULFUR IN GASOLINE

If you live in the northeast United States, your vehicle may have been designed to meet California low emission standards with Cleaner-Burning California reformulated gasoline with low sulfur. If such fuels are not available in states adopting California emission standards, your vehicles will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be adversely affected. Gasoline sold outside of California is permitted to have higher sulfur levels which may affect the performance of the vehicle's catalytic converter. This may cause the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light to illuminate. We recommend that you try a different brand of unleaded gasoline having lower sulfur to determine if the problem is fuel related prior to returning your vehicle to an authorized dealer for service.

SPECIFICATIONS (Continued)

CAUTION: If the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light is flashing, immediate service is required; see on-board diagnostics system section.

MATERIALS ADDED TO FUEL

All gasoline sold in the United States and Canada are required to contain effective detergent additives. Use of additional detergents or other additives is not needed under normal conditions.

FUEL SYSTEM CAUTIONS

CAUTION: Follow these guidelines to maintain your vehicle's performance:

- The use of leaded gas is prohibited by Federal law. Using leaded gasoline can impair engine performance, damage the emission control system, and could result in loss of warranty coverage.
- An out-of-tune engine, or certain fuel or ignition malfunctions, can cause the catalytic converter to overheat. If you notice a pungent burning odor or some light smoke, your engine may be out of tune or malfunctioning and may require immediate service. Contact your dealer for service assistance.
- When pulling a heavy load or driving a fully loaded vehicle when the humidity is low and the temperature is high, use a premium unleaded fuel to help prevent spark knock. If spark knock persists, lighten the load, or engine piston damage may result.
- The use of fuel additives which are now being sold as octane enhancers is not recommended. Most of these products contain high concentrations of methanol. Fuel system damage or vehicle performance problems resulting from the use of such fuels or additives is not the responsibility of DaimlerChrysler Corporation and may not be covered under the new vehicle warranty.

NOTE: Intentional tampering with emissions control systems can result in civil penalties being assessed against you.

TORQUE CHART

DESCRIPTION	TORQUE
Accelerator Pedal Bracket Mounting Nuts	7 N·m (65 in. lbs.)
Fuel Pump Module Locknut	54 N·m (40 ft. lbs.)
Fuel Rail Mounting Bolts—3.9/5.2/5.9L Engines	23 N·m (200 in. lbs.)
Fuel Rail Mounting Bolts—2.5L Engine	11 N·m (100 in. lbs.)
Fuel Tank Mounting Nuts	27–54 N·m (20–40 ft. lbs.)
Fuel Hose Clamps (if equipped)	3 N·m (25 in. lbs.)

FUEL INJECTION SYSTEM

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
- POWERTRAIN CONTROL MODULE (PCM) 31
- MODES OF OPERATION 32
- AUTOMATIC SHUTDOWN (ASD) RELAY SENSE—PCM INPUT 34
- BATTERY VOLTAGE—PCM INPUT. 34
- BRAKE SWITCH—PCM INPUT. 34
- ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT. 35
- FIVE VOLT SENSOR SUPPLIES—PRIMARY AND SECONDARY 35
- FUEL LEVEL SENSOR—PCM INPUT 35
- IGNITION CIRCUIT SENSE—PCM INPUT 35
- INTAKE MANIFOLD AIR TEMPERATURE SENSOR—PCM INPUT. 35
- MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT. 36
- OIL PRESSURE SENSOR—PCM INPUT 37
- OXYGEN SENSOR (O2S)—PCM INPUT. 37
- POWER GROUNDS 38
- POWER STEERING PRESSURE SWITCH— PCM INPUT 38
- SENSOR RETURN—PCM INPUT. 39
- SIGNAL GROUND—PCM INPUT 39
- THROTTLE POSITION SENSOR (TPS)—PCM INPUT. 39
- VEHICLE SPEED AND DISTANCE—PCM INPUT. 40
- AUTO SHUTDOWN (ASD) RELAY—PCM OUTPUT 40
- CCD BUS (+/-) CIRCUITS-PCM OUTPUTS 40
- DATA LINK CONNECTOR—PCM INPUT AND OUTPUT 40
- FUEL INJECTORS—PCM OUTPUT 40
- FUEL PUMP RELAY-PCM OUTPUT 40
- IDLE AIR CONTROL (IAC) MOTOR—PCM OUTPUT 41
- OXYGEN SENSOR HEATER RELAYS—PCM OUTPUT 41
- RADIATOR COOLING FAN RELAY—PCM OUTPUT 42
- THROTTLE BODY 42

DIAGNOSIS AND TESTING
- VISUAL INSPECTION—3.9/5.2/5.9L ENGINES . . . 42
- VISUAL INSPECTION—2.5L ENGINE 46
- ASD AND FUEL PUMP RELAYS. 49
- THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE. 50
- THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE. 51

REMOVAL AND INSTALLATION
- AUTOMATIC SHUTDOWN (ASD) RELAY 51
- FUEL PUMP RELAY 52
- OXYGEN SENSOR HEATER RELAYS 52
- THROTTLE BODY—3.9/5.2/5.9L ENGINES. 52
- THROTTLE BODY—2.5L ENGINE 53
- THROTTLE BODY—4.7L V-8 ENGINE 53
- THROTTLE POSITION SENSOR (TPS)—3.9/ 5.2/5.9L ENGINES. 54
- THROTTLE POSITION SENSOR (TPS)—4.7L V-8 ENGINE 54
- THROTTLE POSITION SENSOR—2.5L ENGINE 55
- IDLE AIR CONTROL (IAC) MOTOR—3.9/5.2/ 5.9L ENGINES 56
- IDLE AIR CONTROL (IAC) MOTOR—4.7L V–8 ENGINE 56
- IDLE AIR CONTROL (IAC) MOTOR—2.5L ENGINE 56
- MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—3.9/5.2/5.9L ENGINES 57
- MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—4.7L V–8 ENGINE 58
- MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—2.5L ENGINE. 58
- POWERTRAIN CONTROL MODULE (PCM) 59
- OXYGEN SENSOR—EXCEPT 2.5L ENGINE. 59
- OXYGEN SENSOR—2.5L ENGINE. 61
- AIR CLEANER ELEMENT (FILTER) 62
- ENGINE COOLANT TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES 62
- ENGINE COOLANT TEMPERATURE SENSOR—4.7L V-8 ENGINE. 63
- ENGINE COOLANT TEMPERATURE SENSOR—2.5L ENGINE. 63
- INTAKE MANIFOLD AIR TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES 64
- INTAKE MANIFOLD AIR TEMPERATURE SENSOR—4.7L V-8 ENGINE. 64
- INTAKE MANIFOLD AIR TEMPERATURE SENSOR—2.5L ENGINE. 64
- POWER STEERING PRESSURE SWITCH 65

SPECIFICATIONS
- TORQUE CHART 66

SPECIAL TOOLS
- FUEL SYSTEM. 66

DESCRIPTION AND OPERATION

POWERTRAIN CONTROL MODULE (PCM)

DESCRIPTION

The Powertrain Control Module (PCM) is located in the engine compartment (Fig. 1). The PCM is referred to as JTEC.

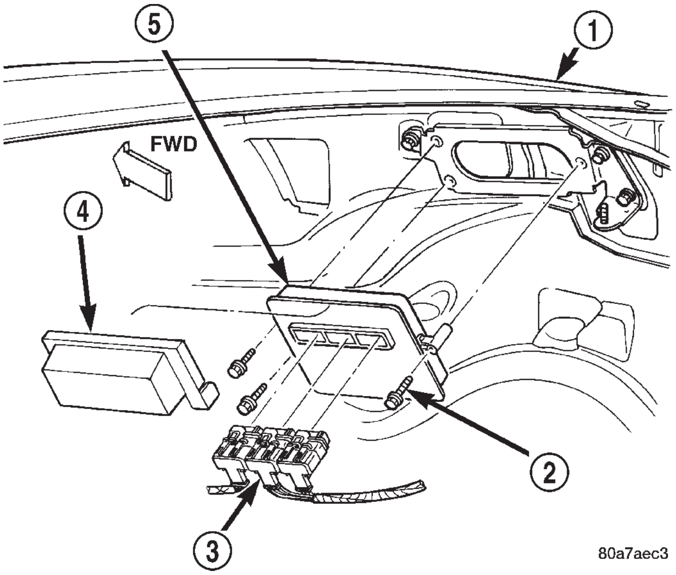


Fig. 1 PCM Location

1 – RIGHT FRONT FENDER
2 – PCM MOUNTING BOLTS (3)
3 – 32–WAY CONNECTORS (3)
4 – COVER
5 – POWERTRAIN CONTROL MODULE (PCM)

OPERATION

The PCM operates the fuel system. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

NOTE: PCM Inputs:

- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- CCD bus (+) circuits
- CCD bus (-) circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connection for DRB scan tool
- Engine coolant temperature sensor
- Fuel level
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure
- Output shaft speed sensor
- Overdrive/override switch
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transmission governor pressure sensor
- Transmission temperature sensor
- Vehicle speed inputs from ABS or RWAL system

NOTE: PCM Outputs:

- A/C clutch relay
- Auto shutdown (ASD) relay
- CCD bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Data link connection for DRB scan tool
- EGR valve control solenoid (if equipped)
- EVAP canister purge solenoid

DESCRIPTION AND OPERATION (Continued)

- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Generator lamp (if equipped)
- Idle air control (IAC) motor
- Ignition coil
- Leak detection pump (if equipped)
- Malfunction indicator lamp (Check engine lamp). Driven through CCD circuits.
- Overdrive indicator lamp (if equipped)
- Radiator cooling fan (2.5L engine only)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through CCD circuits.
- Transmission convertor clutch circuit
- Transmission 3–4 shift solenoid
- Transmission relay
- Transmission temperature lamp (if equipped)
- Transmission variable force solenoid

MODES OF OPERATION

OPERATION

As input signals to the Powertrain Control Module (PCM) change, the PCM adjusts its response to the output devices. For example, the PCM must calculate different injector pulse width and ignition timing for idle than it does for wide open throttle (WOT).

The PCM will operate in two different modes: **Open Loop and Closed Loop**.

During Open Loop modes, the PCM receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensors is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensors input. This input indicates to the PCM whether or not the calculated injector pulse width results in the ideal air-fuel ratio. This ratio is 14.7 parts air-to-1 part fuel. By monitoring the exhaust oxygen content through the O2S sensor, the PCM can fine tune the injector pulse width. This is done to achieve optimum fuel economy combined with low emission engine performance.

The fuel injection system has the following modes of operation:

- Ignition switch ON
- Engine start-up (crank)
- Engine warm-up
- Idle
- Cruise
- Acceleration
- Deceleration
- Wide open throttle (WOT)
- Ignition switch OFF

The ignition switch On, engine start-up (crank), engine warm-up, acceleration, deceleration and wide open throttle modes are Open Loop modes. The idle and cruise modes, (with the engine at operating temperature) are Closed Loop modes.

IGNITION SWITCH (KEY-ON) MODE

This is an Open Loop mode. When the fuel system is activated by the ignition switch, the following actions occur:

- The PCM pre-positions the idle air control (IAC) motor.
- The PCM determines atmospheric air pressure from the MAP sensor input to determine basic fuel strategy.
- The PCM monitors the engine coolant temperature sensor input. The PCM modifies fuel strategy based on this input.
- Intake manifold air temperature sensor input is monitored.
- Throttle position sensor (TPS) is monitored.
- The auto shutdown (ASD) relay is energized by the PCM for approximately three seconds.
- The fuel pump is energized through the fuel pump relay by the PCM. The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.
- The O2S sensor heater element is energized via the ASD relay. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The PCM receives inputs from:

- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Starter motor relay
- Camshaft position sensor signal

The PCM monitors the crankshaft position sensor. If the PCM does not receive a crankshaft position sensor signal within 3 seconds of cranking the engine, it will shut down the fuel injection system.

The fuel pump is activated by the PCM through the fuel pump relay.

Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by

DESCRIPTION AND OPERATION (Continued)

turning the ground circuit to each individual injector on and off.

The PCM determines the proper ignition timing according to input received from the crankshaft position sensor.

ENGINE WARM-UP MODE

This is an Open Loop mode. During engine warm-up, the PCM receives inputs from:

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)

Based on these inputs the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM adjusts engine idle speed through the idle air control (IAC) motor and adjusts ignition timing.
- The PCM operates the A/C compressor clutch through the clutch relay. This is done if A/C has been selected by the vehicle operator and requested by the A/C thermostat.
- When engine has reached operating temperature, the PCM will begin monitoring O2S sensor input. The system will then leave the warm-up mode and go into closed loop operation.

IDLE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At idle speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio by varying injector pulse width. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by increasing and decreasing spark advance.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

CRUISE MODE

When the engine is at operating temperature, this is a Closed Loop mode. At cruising speed, the PCM receives inputs from:

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen (O2S) sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then adjust the injector pulse width by turning the ground circuit to each individual injector on and off.
- The PCM monitors the O2S sensor input and adjusts air-fuel ratio. It also adjusts engine idle speed through the idle air control (IAC) motor.
- The PCM adjusts ignition timing by turning the ground path to the coil on and off.
- The PCM operates the A/C compressor clutch through the clutch relay. This happens if A/C has been selected by the vehicle operator and requested by the A/C thermostat.

ACCELERATION MODE

This is an Open Loop mode. The PCM recognizes an abrupt increase in throttle position or MAP pressure as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased throttle opening.

DESCRIPTION AND OPERATION (Continued)

DECELERATION MODE

When the engine is at operating temperature, this is an Open Loop mode. During hard deceleration, the PCM receives the following inputs.

- Air conditioning select signal (if equipped)
- Air conditioning request signal (if equipped)
- Battery voltage
- Engine coolant temperature sensor
- Crankshaft position sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Vehicle speed sensor

If the vehicle is under hard deceleration with the proper rpm and closed throttle conditions, the PCM will ignore the oxygen sensor input signal. The PCM will enter a fuel cut-off strategy in which it will not supply a ground to the injectors. If a hard deceleration does not exist, the PCM will determine the proper injector pulse width and continue injection.

Based on the above inputs, the PCM will adjust engine idle speed through the idle air control (IAC) motor.

The PCM adjusts ignition timing by turning the ground path to the coil on and off.

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the PCM receives the following inputs.

- Battery voltage
- Crankshaft position sensor
- Engine coolant temperature sensor
- Intake manifold air temperature sensor
- Manifold absolute pressure (MAP) sensor
- Throttle position sensor (TPS)
- Camshaft position sensor signal (in the distributor)

During wide open throttle conditions, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the PCM. The PCM will then control the injection sequence and injector pulse width by turning the ground circuit to each individual injector on and off. The PCM ignores the oxygen sensor input signal and provides a predetermined amount of additional fuel. This is done by adjusting injector pulse width.
- The PCM adjusts ignition timing by turning the ground path to the coil on and off.

IGNITION SWITCH OFF MODE

When ignition switch is turned to OFF position, the PCM stops operating the injectors, ignition coil, ASD relay and fuel pump relay.

AUTOMATIC SHUTDOWN (ASD) RELAY SENSE—PCM INPUT

DESCRIPTION

The ASD relay is located in the Power Distribution Center (PDC). The PDC is located in the engine compartment. Refer to label on PDC cover for relay location.

OPERATION

A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The relay is used to connect the oxygen sensor heater element, ignition coil and fuel injectors to 12 volt + power supply.

This input is used only to sense that the ASD relay is energized. If the powertrain control module (PCM) does not see 12 volts at this input when the ASD should be activated, it will set a diagnostic trouble code (DTC).

BATTERY VOLTAGE—PCM INPUT

OPERATION

The battery voltage input provides power to the Powertrain Control Module (PCM). It also informs the PCM what voltage level is supplied to the ignition coil and fuel injectors.

If battery voltage is low, the PCM will increase injector pulse width (period of time that the injector is energized). This is done to compensate for the reduced flow through injector caused by the lowered voltage.

BRAKE SWITCH—PCM INPUT

OPERATION

When the brake light switch is activated, the Powertrain Control Module (PCM) receives an input indicating that the brakes are being applied. After receiving this input, the PCM maintains idle speed to a scheduled rpm through control of the Idle Air Control (IAC) motor. The brake switch input is also used to disable vent and vacuum solenoid output signals to the speed control servo.

DESCRIPTION AND OPERATION (Continued)

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION

At key-on, the Powertrain Control Module (PCM) sends out a regulated 5 volt signal to the ECT sensor. The PCM then monitors the signal as it passes through the ECT sensor to the sensor ground (sensor return).

When the engine is cold, the PCM will operate in Open Loop cycle. It will demand slightly richer air-fuel mixtures and higher idle speeds. This is done until normal operating temperatures are reached.

The PCM uses inputs from the ECT sensor for the following calculations:

- for engine coolant temperature gauge operation through CCD or PCI (J1850) communications
- Injector pulse-width
- Spark-advance curves
- ASD relay shut-down times
- Idle Air Control (IAC) motor key-on steps
- Pulse-width prime-shot during cranking
- O2 sensor closed loop times
- Purge solenoid on/off times
- EGR solenoid on/off times (if equipped)
- Leak Detection Pump operation (if equipped)
- Radiator fan relay on/off times (if equipped)
- Target idle speed

FIVE VOLT SENSOR SUPPLIES—PRIMARY AND SECONDARY

DESCRIPTION

Two different Powertrain Control Module (PCM) five volt supply circuits are used; primary and secondary.

OPERATION

These 2 circuits will:

- supply the required 5 volt power source to the Crankshaft Position (CKP) sensor.
- supply the required 5 volt power source to the Camshaft Position (CMP) sensor.
- supply a reference voltage for the Manifold Absolute Pressure (MAP) sensor.
- supply a reference voltage for the Throttle Position Sensor (TPS) sensor.
- supply the required 5 volt power source to the oil pressure sensor.
- supply the required 5 volt power source for the Vehicle Speed Sensor (VSS) (if equipped).
- supply the 5 volt power source to the transmission pressure sensor (if equipped with an RE automatic transmission).

FUEL LEVEL SENSOR—PCM INPUT

DESCRIPTION

The fuel level sensor (fuel gauge sending unit) is located on the fuel pump module.

OPERATION

Refer to Fuel Gauge Sending Unit in the Fuel Delivery section for information.

IGNITION CIRCUIT SENSE—PCM INPUT

DESCRIPTION

This circuit ties the ignition switch to the Powertrain Control Module (PCM).

OPERATION

The ignition circuit sense input tells the PCM the ignition switch has energized the ignition circuit.

Battery voltage is supplied to the PCM through the ignition switch when the ignition is in the RUN or START position. This is referred to as the “ignition sense” circuit and is used to “wake up” the PCM. Voltage on the ignition input can be as low as 6 volts and the PCM will still function. Voltage is supplied to this circuit to power the PCM’s 5 volt primary and 5 volt secondary circuits. This allows the PCM to perform fuel, ignition and emissions control functions.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—PCM INPUT

DESCRIPTION

The 2–wire Intake Manifold Air Temperature (IAT) sensor is installed in the intake manifold with the sensor element extending into the air stream.

The IAT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as intake manifold temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The IAT sensor provides an input voltage to the Powertrain Control Module (PCM) indicating the density of the air entering the intake manifold based upon intake manifold temperature. At key-on, a 5–volt power circuit is supplied to the sensor from the PCM. The sensor is grounded at the PCM through a low-noise, sensor-return circuit.

The PCM uses this input to calculate the following:

- Injector pulse-width
- Adjustment of spark timing (to help prevent spark knock with high intake manifold air-charge temperatures)

The resistance values of the IAT sensor is the same as for the Engine Coolant Temperature (ECT) sensor.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

DESCRIPTION

The Manifold Absolute Pressure (MAP) sensor is attached to the side of the engine throttle body with 2 screws. The sensor is connected to the throttle body with a rubber L-shaped fitting.

OPERATION

The MAP sensor is used as an input to the Powertrain Control Module (PCM). It contains a silicon based sensing unit to provide data on the manifold vacuum that draws the air/fuel mixture into the combustion chamber. The PCM requires this information to determine injector pulse width and spark advance. When manifold absolute pressure (MAP) equals Barometric pressure, the pulse width will be at maximum.

A 5 volt reference is supplied from the PCM and returns a voltage signal to the PCM that reflects manifold pressure. The zero pressure reading is 0.5V and full scale is 4.5V. For a pressure swing of 0–15 psi, the voltage changes 4.0V. To operate the sensor, it is supplied a regulated 4.8 to 5.1 volts. Ground is provided through the low-noise, sensor return circuit at the PCM.

The MAP sensor input is the number one contributor to fuel injector pulse width. The most important function of the MAP sensor is to determine barometric pressure. The PCM needs to know if the vehicle is at sea level or at a higher altitude, because the air density changes with altitude. It will also help to correct for varying barometric pressure. Barometric pressure and altitude have a direct inverse correlation; as altitude goes up, barometric goes down. At key-on, the PCM powers up and looks at MAP voltage, and based upon the voltage it sees, it knows the current barometric pressure (relative to altitude). Once the engine starts, the PCM looks at the voltage again, continuously every 12 milliseconds, and compares the current voltage to what it was at key-on. The difference between current voltage and what it was at key-on, is manifold vacuum.

During key-on (engine not running) the sensor reads (updates) barometric pressure. A normal range can be obtained by monitoring a known good sensor.

As the altitude increases, the air becomes thinner (less oxygen). If a vehicle is started and driven to a very different altitude than where it was at key-on, the barometric pressure needs to be updated. Any time the PCM sees Wide Open Throttle (WOT), based upon Throttle Position Sensor (TPS) angle and RPM, it will update barometric pressure in the MAP memory cell. With periodic updates, the PCM can make its calculations more effectively.

The PCM uses the MAP sensor input to aid in calculating the following:

- Manifold pressure
- Barometric pressure
- Engine load
- Injector pulse-width
- Spark-advance programs
- Shift-point strategies (certain automatic transmissions only)
- Idle speed
- Decel fuel shutoff

The MAP sensor signal is provided from a single piezoresistive element located in the center of a diaphragm. The element and diaphragm are both made of silicone. As manifold pressure changes, the diaphragm moves causing the element to deflect, which stresses the silicone. When silicone is exposed to stress, its resistance changes. As manifold vacuum increases, the MAP sensor input voltage decreases proportionally. The sensor also contains electronics that condition the signal and provide temperature compensation.

The PCM recognizes a decrease in manifold pressure by monitoring a decrease in voltage from the reading stored in the barometric pressure memory cell. The MAP sensor is a linear sensor; meaning as pressure changes, voltage changes proportionately. The range of voltage output from the sensor is usually between 4.6 volts at sea level to as low as 0.3 volts at 26 in. of Hg. Barometric pressure is the pressure exerted by the atmosphere upon an object. At sea level on a standard day, no storm, barometric pressure is approximately 29.92 in Hg. For every 100 feet of altitude, barometric pressure drops.10 in. Hg. If a storm goes through it can change barometric pressure from what should be present for that altitude. You should know what the average pressure and corresponding barometric pressure is for your area.

DESCRIPTION AND OPERATION (Continued)

OIL PRESSURE SENSOR—PCM INPUT

DESCRIPTION

The 2–wire, electrical/mechanical engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

The oil pressure sensor uses two circuits. They are:

- A signal to the PCM relating to engine oil pressure
- A sensor ground through the PCM's sensor return

The oil pressure sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on a CCD bus circuit to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

OXYGEN SENSOR (O2S)—PCM INPUT

DESCRIPTION

The Oxygen Sensors (O2S) are attached to, and protrude into the vehicle exhaust system. Depending on the emission package, the vehicle may use a total of either 2 or 4 sensors.

Federal Emissions Package: Two sensors are used: upstream (referred to as 1/1) and downstream (referred to as 1/2). With this emission package, the upstream sensor (1/1) is located just before the main catalytic convertor. The downstream sensor (1/2) is located just after the main catalytic convertor.

4.7L California Engines: On this emissions package, 4 sensors are used: 2 upstream (referred to as 1/1 and 2/1) and 2 downstream (referred to as 1/2 and 2/2). With this emission package, the right upstream sensor (2/1) is located in the right exhaust downpipe just before the mini-catalytic convertor. The left upstream sensor (1/1) is located in the left exhaust downpipe just before the mini-catalytic convertor. The right downstream sensor (2/2) is located in the right exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor. The left downstream sensor (1/2) is located in the left exhaust downpipe just after the mini-catalytic convertor, and before the main catalytic convertor.

OPERATION

An O2 sensor is a galvanic battery that provides the PCM with a voltage signal (0-1 volt) inversely proportional to the amount of oxygen in the exhaust. In other words, if the oxygen content is low, the voltage output is high; if the oxygen content is high the output voltage is low. The PCM uses this information to adjust injector pulse-width to achieve the 14.7–to–1 air/fuel ratio necessary for proper engine operation and to control emissions.

The O2 sensor must have a source of oxygen from outside of the exhaust stream for comparison. Current O2 sensors receive their fresh oxygen (outside air) supply through the wire harness. This is why it is important to never solder an O2 sensor connector, or pack the connector with grease.

Four wires (circuits) are used on each O2 sensor: a 12–volt feed circuit for the sensor heating element; a ground circuit for the heater element; a low-noise sensor return circuit to the PCM, and an input circuit from the sensor back to the PCM to detect sensor operation.

Oxygen Sensor Heaters/Heater Relays: Depending on the emissions package, the heating elements within the sensors will be supplied voltage from either the ASD relay, or 2 separate oxygen sensor relays. Refer to Wiring Diagrams to determine which relays are used.

The O2 sensor uses a Positive Thermal Co-efficient (PTC) heater element. As temperature increases, resistance increases. At ambient temperatures around 70°F, the resistance of the heating element is approximately 4.5 ohms on 2.5/3.9/5.2 and 5.9L engines. It is approximately 13.5 ohms on the 4.7L engine. As the sensor's temperature increases, resistance in the heater element increases. This allows the heater to maintain the optimum operating temperature of approximately 930°-1100°F (500°-600° C). Although the sensors operate the same, there are physical differences, due to the environment that they operate in, that keep them from being interchangeable.

Maintaining correct sensor temperature at all times allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop operation, the PCM monitors certain O2 sensor input(s) along with other inputs, and adjusts the injector pulse width accordingly. During Open Loop operation, the PCM ignores the O2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

Upstream Sensor (Non-California Emissions): The upstream sensor (1/1) provides an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune fuel delivery to maintain the correct oxygen content at the downstream oxygen sensor. The PCM will change the air/fuel ratio until the upstream sensor inputs a voltage that the PCM has

determined will make the downstream sensor output (oxygen content) correct.

The upstream oxygen sensor also provides an input to determine catalytic convertor efficiency.

Downstream Sensor (Non-California Emissions): The downstream oxygen sensor (1/2) is also used to determine the correct air-fuel ratio. As the oxygen content changes at the downstream sensor, the PCM calculates how much air-fuel ratio change is required. The PCM then looks at the upstream oxygen sensor voltage and changes fuel delivery until the upstream sensor voltage changes enough to correct the downstream sensor voltage (oxygen content).

The downstream oxygen sensor also provides an input to determine catalytic convertor efficiency.

Upstream Sensors (4.7L California Engines): Two upstream sensors are used (1/1 and 2/1). The 1/1 sensor is the first sensor to receive exhaust gases from the #1 cylinder. They provide an input voltage to the PCM. The input tells the PCM the oxygen content of the exhaust gas. The PCM uses this information to fine tune fuel delivery to maintain the correct oxygen content at the downstream oxygen sensors. The PCM will change the air/fuel ratio until the upstream sensors input a voltage that the PCM has determined will make the downstream sensors output (oxygen content) correct.

The upstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

Downstream Sensors (4.7L California Engines: Two downstream sensors are used (1/2 and 2/2). The downstream sensors are used to determine the correct air-fuel ratio. As the oxygen content changes at the downstream sensor, the PCM calculates how much air-fuel ratio change is required. The PCM then looks at the upstream oxygen sensor voltage, and changes fuel delivery until the upstream sensor voltage changes enough to correct the downstream sensor voltage (oxygen content).

The downstream oxygen sensors also provide an input to determine mini-catalyst efficiency. Main catalytic convertor efficiency is not calculated with this package.

Engines equipped with either a downstream sensor(s), or a post-catalytic sensor, will monitor catalytic convertor efficiency. If efficiency is below emission standards, the Malfunction Indicator Lamp (MIL) will be illuminated and a Diagnostic Trouble Code (DTC) will be set. Refer to Monitored Systems in Emission Control Systems for additional information.

POWER GROUNDS

OPERATION

The Powertrain Control Module (PCM) has 2 main grounds. Both of these grounds are referred to as power grounds. All of the high-current, noisy, electrical devices are connected to these grounds as well as all of the sensor returns. Sensor return is a low-noise, low-current, dedicated ground.

The power ground is used to control ground circuits for the following PCM loads:

- Generator field winding
- Fuel injectors
- Ignition coil(s)
- Certain relays/solenoids
- Certain sensors

POWER STEERING PRESSURE SWITCH—PCM INPUT

DESCRIPTION

A pressure sensing switch (Fig. 2) or (Fig. 3) is included in the power steering system (mounted on the high-pressure line). This switch will be used only on vehicles equipped with either a 2.5L 4–cylinder, or a 4.7L V-8 engine, and power steering.

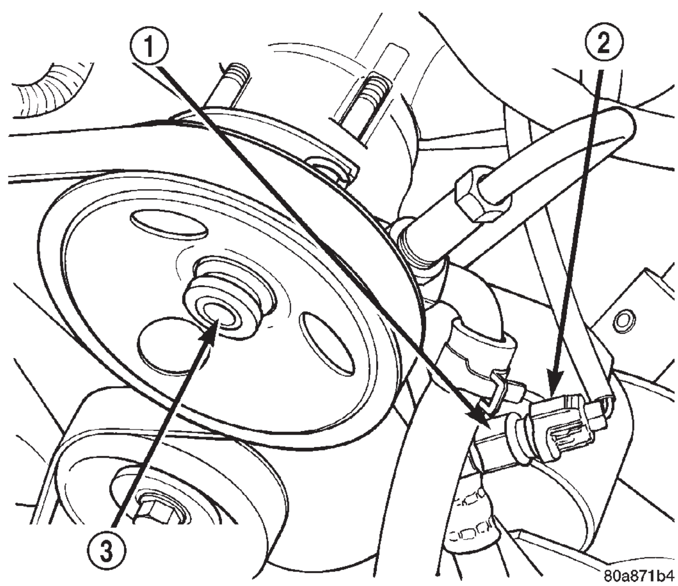


Fig. 2 Power Steering Pump Pressure Switch—2.5L Engine

1 – POWER STEERING PRESSURE SWITCH
2 – ELECTRICAL CONNECTOR
3 – POWER STEERING PUMP

DESCRIPTION AND OPERATION (Continued)

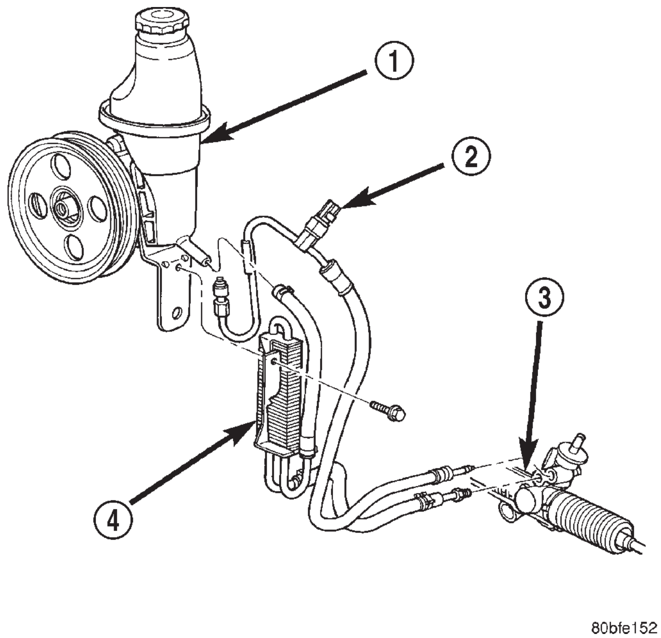


Fig. 3 Power Steering Pump Pressure Switch—4.7L V–8 Engine

1 – HYDRAULIC PUMP
2 – POWER STEERING PRESSURE SWITCH
3 – RACK AND PINION GEAR
4 – OIL COOLER

OPERATION

The power steering pressure switch provides an input to the Powertrain Control Module (PCM). This input is provided during periods of high pump load and low engine rpm; such as during parking maneuvers. The PCM will then increase the idle speed through the Idle Air Control (IAC) motor. This is done to prevent the engine from stalling under the increased load.

When steering pump pressure exceeds 3275 kPa ± 690 kPa (475 psi ± 100 psi), the Normally Closed (NC) switch will open and the PCM will increase the engine idle speed. This will prevent the engine from stalling.

When pump pressure drops to approximately 1379 kPa (200 psi), the switch circuit will re-close and engine idle speed will return to its previous setting.

SENSOR RETURN—PCM INPUT

OPERATION

The Sensor Return circuits are internal to the Powertrain Control Module (PCM).

Sensor Return provides a low–noise ground reference for all engine control system sensors. Refer to Power Grounds for more information.

SIGNAL GROUND—PCM INPUT

OPERATION

Signal ground provides a low noise ground to the data link connector.

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

DESCRIPTION

The 3–wire Throttle Position Sensor (TPS) is mounted on the throttle body and is connected to the throttle blade.

OPERATION

The TPS is a 3–wire variable resistor that provides the Powertrain Control Module (PCM) with an input signal (voltage) that represents the throttle blade position of the throttle body. The sensor is connected to the throttle blade shaft. As the position of the throttle blade changes, the resistance (output voltage) of the TPS changes.

The PCM supplies approximately 5 volts to the TPS. The TPS output voltage (input signal to the PCM) represents the throttle blade position. The PCM receives an input signal voltage from the TPS. This will vary in an approximate range of from.26 volts at minimum throttle opening (idle), to 4.49 volts at wide open throttle. Along with inputs from other sensors, the PCM uses the TPS input to determine current engine operating conditions. In response to engine operating conditions, the PCM will adjust fuel injector pulse width and ignition timing.

The PCM needs to identify the actions and position of the throttle blade at all times. This information is needed to assist in performing the following calculations:

- Ignition timing advance
- Fuel injection pulse-width
- Idle (learned value or minimum TPS)
- Off-idle (0.06 volt)
- Wide Open Throttle (WOT) open loop (2.608 volts above learned idle voltage)
- Deceleration fuel lean out
- Fuel cutoff during cranking at WOT (2.608 volts above learned idle voltage)
- A/C WOT cutoff (certain automatic transmissions only)

DESCRIPTION AND OPERATION (Continued)

VEHICLE SPEED AND DISTANCE—PCM INPUT

OPERATION

Vehicle speed and distance covered are measured by the Rear Wheel Speed Sensor. The sensor is mounted to the rear axle. A signal is sent from this sensor to the Controller Antilock Brake (CAB) computer. A signal is then sent from the CAB to the Powertrain Control Module (PCM) to determine vehicle speed and distance covered. The PCM will then determine strategies for fuel system and speed control system operation.

Refer to Odometer and Trip Odometer in Group 8E, Instrument Panel for additional information.

AUTO SHUTDOWN (ASD) RELAY—PCM OUTPUT

DESCRIPTION

The 5–pin, 12–volt, Automatic Shutdown (ASD) relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

OPERATION

The ASD relay supplies battery voltage (12+ volts) to the fuel injectors and ignition coil(s). With certain emissions packages it also supplies 12–volts to the oxygen sensor heating elements.

The ground circuit for the coil within the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM operates the ASD relay by switching its ground circuit on and off.

The ASD relay will be shut–down, meaning the 12–volt power supply to the ASD relay will be de-activated by the PCM if:

- the ignition key is left in the ON position. This is if the engine has not been running for approximately 1.8 seconds.
- there is a crankshaft position sensor signal to the PCM that is lower than pre-determined values.

The PCM will sense if or when the ASD relay has been activated through a “sense circuit”. Refer to Automatic Shut-Down (ASD) Relay Sense-PCM Input for additional information.

CCD BUS (+/-) CIRCUITS-PCM OUTPUTS

OPERATION

The Powertrain Control Module (PCM) sends certain output signals through the CCD bus circuits. These signals are used to control certain instrument panel located items and to determine certain identification numbers.

Refer to Group 8E, Instrument Panel and Gauges for additional information.

DATA LINK CONNECTOR—PCM INPUT AND OUTPUT

DESCRIPTION

The data link connector is located at the lower edge of the instrument panel near the steering column.

OPERATION

The 16–way data link connector (diagnostic scan tool connector) links the Diagnostic Readout Box (DRB) scan tool or the Mopar Diagnostic System (MDS) with the Powertrain Control Module (PCM).

FUEL INJECTORS—PCM OUTPUT

DESCRIPTION

The fuel injectors are connected to the engine with the fuel injector rail.

OPERATION

The nozzle ends of the injectors are positioned into openings in the intake manifold just above the intake valve ports of the cylinder head. The engine wiring harness connector for each fuel injector is equipped with an attached numerical tag (INJ 1, INJ 2 etc.). This is used to identify each fuel injector with its respective cylinder number.

The injectors are energized individually in a sequential order by the Powertrain Control Module (PCM). The PCM will adjust injector pulse width by switching the ground path to each individual injector on and off. Injector pulse width is the period of time that the injector is energized. The PCM will adjust injector pulse width based on various inputs it receives.

Battery voltage (12 volts +) is supplied to the injectors through the ASD relay. The ASD relay will shut-down the 12 volt power source to the fuel injectors if the PCM senses the ignition is on, but the engine is not running. This occurs after the engine has not been running for approximately 1.8 seconds.

The PCM determines injector on-time (pulse width) based on various inputs.

FUEL PUMP RELAY-PCM OUTPUT

DESCRIPTION

The 5–pin, 12–volt, fuel pump relay is located in the Power Distribution Center (PDC). Refer to the label on the PDC cover for relay location.

OPERATION

The Powertrain Control Module (PCM) energizes the electric fuel pump through the fuel pump relay. The fuel pump relay is energized by first applying

DESCRIPTION AND OPERATION (Continued)

battery voltage to it when the ignition key is turned ON, and then applying a ground signal to the relay from the PCM.

Whenever the ignition key is turned ON, the electric fuel pump will operate. But, the PCM will shutdown the ground circuit to the fuel pump relay in approximately 1–3 seconds unless the engine is operating or the starter motor is engaged.

IDLE AIR CONTROL (IAC) MOTOR—PCM OUTPUT

DESCRIPTION

The IAC stepper motor is mounted to the throttle body, and regulates the amount of air bypassing the control of the throttle plate. As engine loads and ambient temperatures change, engine rpm changes. A pintle on the IAC stepper motor protrudes into a passage in the throttle body, controlling air flow through the passage. The IAC is controlled by the Powertrain Control Module (PCM) to maintain the target engine idle speed.

OPERATION

At idle, engine speed can be increased by retracting the IAC motor pintle and allowing more air to pass through the port, or it can be decreased by restricting the passage with the pintle and diminishing the amount of air bypassing the throttle plate.

The IAC is called a stepper motor because it is moved (rotated) in steps, or increments. Opening the IAC opens an air passage around the throttle blade which increases RPM.

The PCM uses the IAC motor to control idle speed (along with timing) and to reach a desired MAP during decel (keep engine from stalling).

The IAC motor has 4 wires with 4 circuits. Two of the wires are for 12 volts and ground to supply electrical current to the motor windings to operate the stepper motor in one direction. The other 2 wires are also for 12 volts and ground to supply electrical current to operate the stepper motor in the opposite direction.

To make the IAC go in the opposite direction, the PCM just reverses polarity on both windings. If only 1 wire is open, the IAC can only be moved 1 step (increment) in either direction. To keep the IAC motor in position when no movement is needed, the PCM will energize both windings at the same time. This locks the IAC motor in place.

In the IAC motor system, the PCM will count every step that the motor is moved. This allows the PCM to determine the motor pintle position. If the memory is cleared, the PCM no longer knows the position of the pintle. So at the first key ON, the PCM drives the IAC motor closed, regardless of where it was before. This zeros the counter. From this point the PCM will back out the IAC motor and keep track of its position again.

When engine rpm is above idle speed, the IAC is used for the following:

- Off-idle dashpot (throttle blade will close quickly but idle speed will not stop quickly)
- Deceleration air flow control
- A/C compressor load control (also opens the passage slightly before the compressor is engaged so that the engine rpm does not dip down when the compressor engages)
- Power steering load control

The PCM can control polarity of the circuit to control direction of the stepper motor.

IAC Stepper Motor Program: The PCM is also equipped with a memory program that records the number of steps the IAC stepper motor most recently advanced to during a certain set of parameters. For example: The PCM was attempting to maintain a 1000 rpm target during a cold start-up cycle. The last recorded number of steps for that may have been 125. That value would be recorded in the memory cell so that the next time the PCM recognizes the identical conditions, the PCM recalls that 125 steps were required to maintain the target. This program allows for greater customer satisfaction due to greater control of engine idle.

Another function of the memory program, which occurs when the power steering switch (if equipped), or the A/C request circuit, requires that the IAC stepper motor control engine rpm, is the recording of the last targeted steps into the memory cell. The PCM can anticipate A/C compressor loads. This is accomplished by delaying compressor operation for approximately 0.5 seconds until the PCM moves the IAC stepper motor to the recorded steps that were loaded into the memory cell. Using this program helps eliminate idle-quality changes as loads change. Finally, the PCM incorporates a “No-Load” engine speed limiter of approximately 1800 - 2000 rpm, when it recognizes that the TPS is indicating an idle signal and IAC motor cannot maintain engine idle.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the IAC motor through the PCM.

OXYGEN SENSOR HEATER RELAYS—PCM OUTPUT

DESCRIPTION

The 2 oxygen (O2) sensor heater relays (upstream and downstream) are located in the Powertrain Distribution Center (PDC).

DESCRIPTION AND OPERATION (Continued)

OPERATION

Engines equipped with the California (NAE) Emissions Package use **four O2 sensors.**

Two of the four sensor heater elements (upstream sensors 1/1 and 2/1) are controlled by the upstream heater relay through output signals from the Powertrain Control Module (PCM).

The other two heater elements (downstream sensors 1/2 and 2/2) are controlled by the downstream heater relay through output signals from the PCM.

To avoid a large simultaneous current surge, power is delayed to the 2 downstream heater elements by the PCM for approximately 2 seconds.

RADIATOR COOLING FAN RELAY—PCM OUTPUT

DESCRIPTION

The radiator cooling fan relay is a 5–pin, solenoid type, mini-relay. It is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

OPERATION

The electric radiator cooling fan is controlled by the Powertrain Control Module (PCM) through the radiator cooling fan relay. The PCM will activate the relay after receiving inputs from the engine coolant temperature sensor and/or an air conditioning on/off signal. **Not Equipped With A/C:** The relay is energized when coolant temperature is above approximately 103°C (217°F). It will then de-energize when coolant temperature drops to approximately 98°C (208°F). Refer to Cooling Systems for additional information. **Equipped With A/C:** In addition to using coolant temperatures to control cooling fan operation, the cooling fan will also be engaged when the air conditioning system has been activated. Refer to Heating and Air Conditioning for additional information.

THROTTLE BODY

DESCRIPTION

The throttle body is located on the intake manifold. Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors.

OPERATION

Filtered air from the air cleaner enters the intake manifold through the throttle body. The throttle body contains an air control passage controlled by an Idle Air Control (IAC) motor. The air control passage is used to supply air for idle conditions. A throttle valve (plate) is used to supply air for above idle conditions.

Certain sensors are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle body linkage arm.

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the PCM.

DIAGNOSIS AND TESTING

VISUAL INSPECTION—3.9/5.2/5.9L ENGINES

A visual inspection for loose, disconnected or incorrectly routed wires and hoses should be made. This should be done before attempting to diagnose or service the fuel injection system. A visual check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Verify three 32–way electrical connectors are fully inserted into connector of powertrain control module (PCM) (Fig. 4).

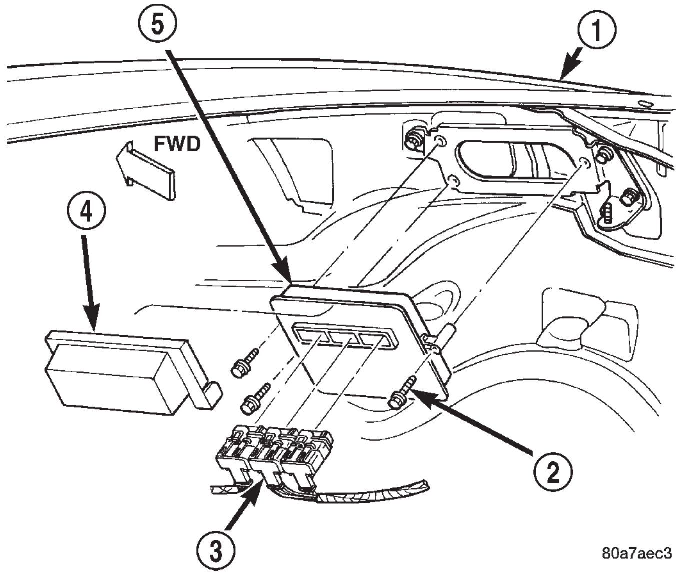


Fig. 4 Powertrain Control Module (PCM)

1 – RIGHT FRONT FENDER
2 – PCM MOUNTING BOLTS (3)
3 – 32–WAY CONNECTORS (3)
4 – COVER
5 – POWERTRAIN CONTROL MODULE (PCM)

(2) Inspect battery cable connections. Be sure they are clean and tight.

(3) Inspect fuel pump relay and air conditioning compressor clutch relay (if equipped). Inspect ASD relay connections. Inspect starter motor relay connections. Inspect relays for signs of physical damage and

DIAGNOSIS AND TESTING (Continued)

corrosion. The relays are located in Power Distribution Center (PDC) (Fig. 5). Refer to label on PDC cover for relay location.

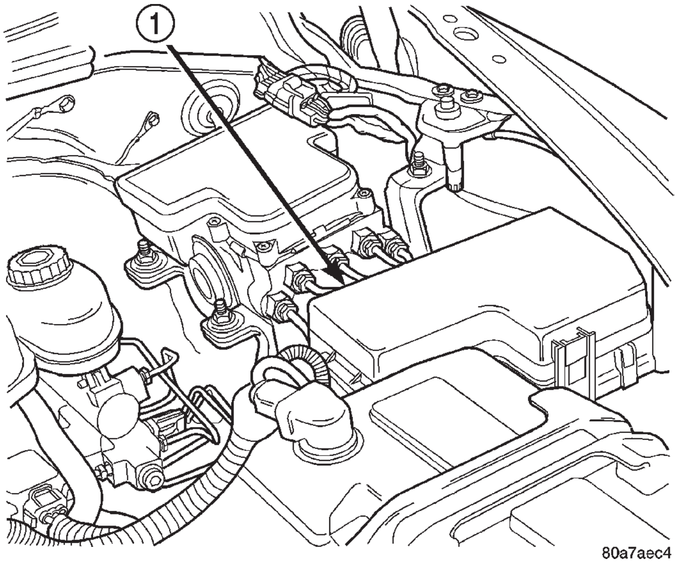


Fig. 5 Power Distribution Center (PDC)

1 – POWER DISTRIBUTION CENTER (PDC)

(4) Inspect ignition coil connections. Verify coil secondary cable is firmly connected to coil (Fig. 6).

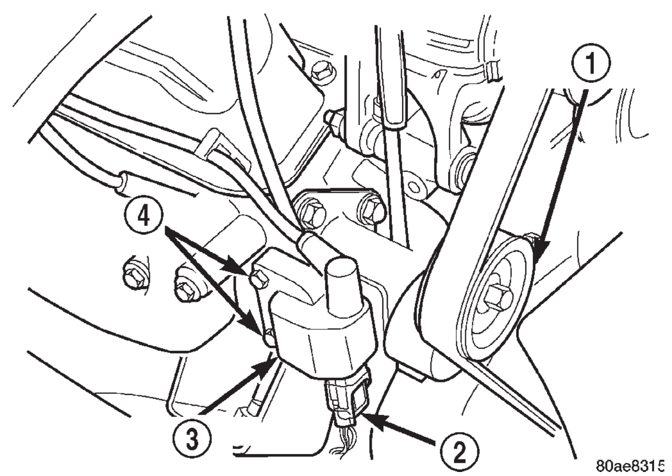


Fig. 6 Ignition Coil—3.9/5.2/5.9L Engines—Typical

1 – ACCESSORY DRIVE BELT TENSIONER
2 – COIL CONNECTOR
3 – IGNITION COIL
4 – COIL MOUNTING BOLTS

(5) Verify distributor cap is correctly attached to distributor. Be sure spark plug cables are firmly connected to the distributor cap and the spark plugs are in their correct firing order. Be sure coil cable is firmly connected to distributor cap and coil. Be sure camshaft position sensor wire connector (at the distributor) is firmly connected to harness connector. Inspect spark plug condition. Refer to Group 8D, Ignition. Connect vehicle to an oscilloscope and inspect spark events for fouled or damaged spark plugs or cables.

(6) Verify generator output wire, generator connector and ground wire are firmly connected to generator.

(7) Inspect system body grounds for loose or dirty connections. Refer to Group 8, Wiring for ground locations.

(8) Verify positive crankcase ventilation (PCV) valve operation. Refer to Group 25, Emission Control System for additional information. Verify PCV valve hose is firmly connected to PCV valve and manifold (Fig. 7).

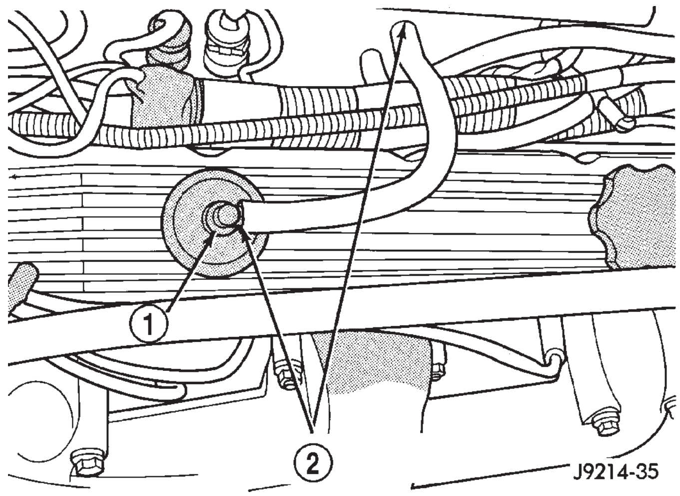


Fig. 7 PCV Valve Hose Connections—3.9/5.2/5.9L Engines—Typical

1 – PCV VALVE
2 – PCV VALVE HOSE CONNECTIONS

(9) Inspect fuel tube quick-connect fitting-to-fuel rail connections.

(10) Verify hose connections to all ports of vacuum fittings on intake manifold are tight and not leaking.

(11) Inspect accelerator cable, transmission throttle cable (if equipped) and cruise control cable connections (if equipped). Check their connections to throttle arm of throttle body for any binding or restrictions.

(12) If equipped with vacuum brake booster, verify vacuum booster hose is firmly connected to fitting on intake manifold. Also check connection to brake vacuum booster.

(13) Inspect air cleaner inlet and air cleaner element for dirt or restrictions.

(14) Inspect radiator grille area, radiator fins and air conditioning condenser for restrictions.

DIAGNOSIS AND TESTING (Continued)

(15) Verify intake manifold air temperature sensor wire connector is firmly connected to harness connector (Fig. 8).

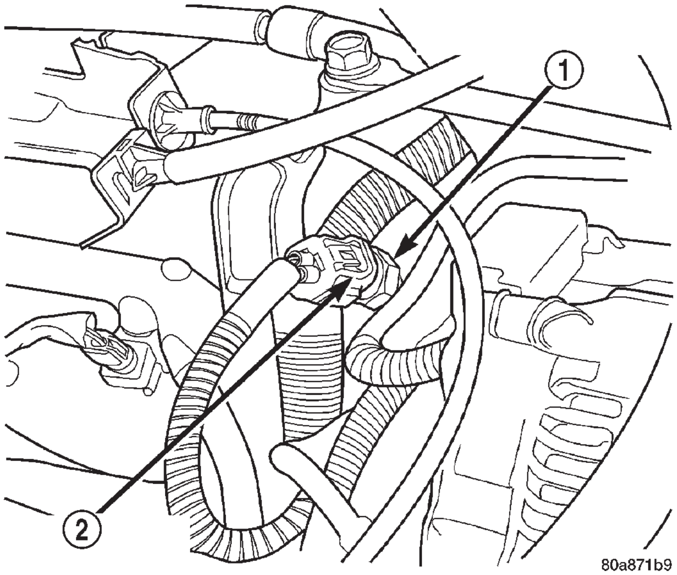


Fig. 8 Intake Manifold Air Temperature Sensor—Typical

1 – INTAKE MANIFOLD AIR TEMPERATURE SENSOR
2 – ELECTRICAL CONNECTOR

(16) Verify MAP sensor electrical connector is firmly connected to MAP sensor (Fig. 9). Also verify rubber L-shaped fitting from MAP sensor to throttle body is firmly connected (Fig. 10).

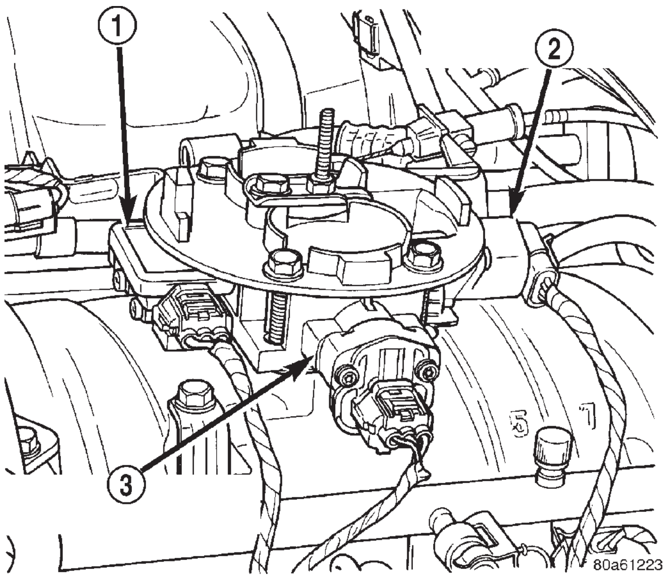


Fig. 9 Sensor and IAC Motor Location—Typical (V-8 Shown)

1 – MAP SENSOR
2 – IDLE AIR CONTROL MOTOR
3 – THROTTLE POSITION SENSOR

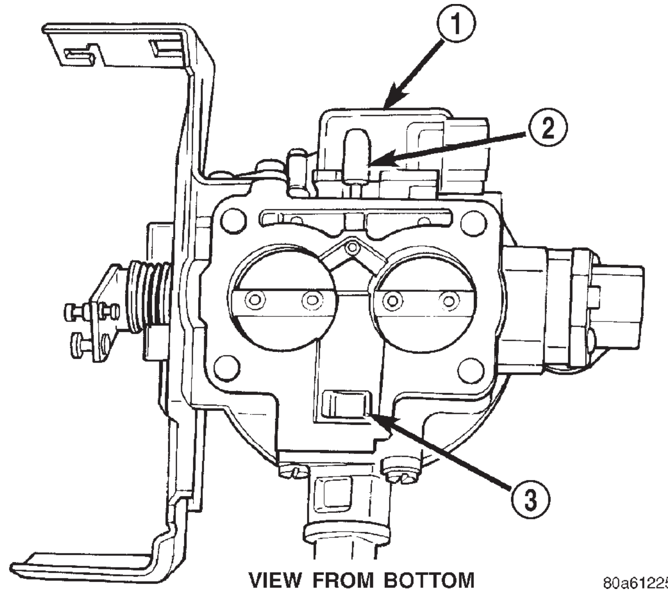


Fig. 10 Rubber L-Shaped Fitting—MAP Sensor-to-Throttle Body

1 – MAP SENSOR
2 – RUBBER FITTING
3 – IDLE AIR PASSAGE

(17) Verify fuel injector wire harness connectors are firmly connected to injectors in correct order. Each harness connector is numerically tagged with injector number (INJ 1, INJ 2 etc.) of its corresponding fuel injector and cylinder number.

(18) Verify harness connectors are firmly connected to idle air control (IAC) motor, throttle position sensor (TPS) and manifold absolute pressure (MAP) sensor (Fig. 9).

(19) Verify wire harness connector is firmly connected to engine coolant temperature sensor (Fig. 11).

(20) Raise and support vehicle.

(21) **All 3.9L V-6 and 5.2L V-8. All 5.9L V-8 With Four Wheel Drive (4WD) :** Verify both upstream and downstream oxygen sensor wire connectors are firmly connected to sensors. Inspect sensors and connectors for damage (Fig. 12) or (Fig. 13).

(22) **5.9L V-8 Engine With Two Wheel Drive (2WD):**

(a) This engine/transmission is equipped with 4 oxygen sensors. Verify both pre-catalyst and post-catalyst oxygen sensor wire connectors (before and after catalytic convertor) are firmly connected to sensors (Fig. 14). Inspect sensors and connectors for damage.

DIAGNOSIS AND TESTING (Continued)

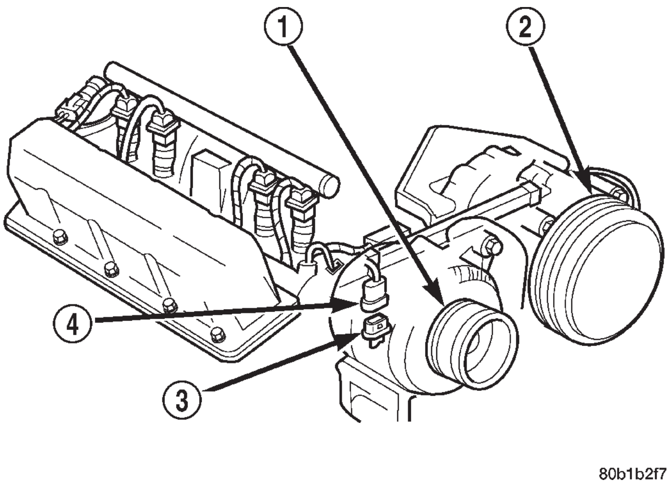


Fig. 11 Engine Coolant Temperature Sensor—3.9/5.2L Engines—Typical

1 – GENERATOR
2 – A/C COMPRESSOR
3 – ENGINE COOLANT TEMPERATURE SENSOR
4 – ELEC. CONN.

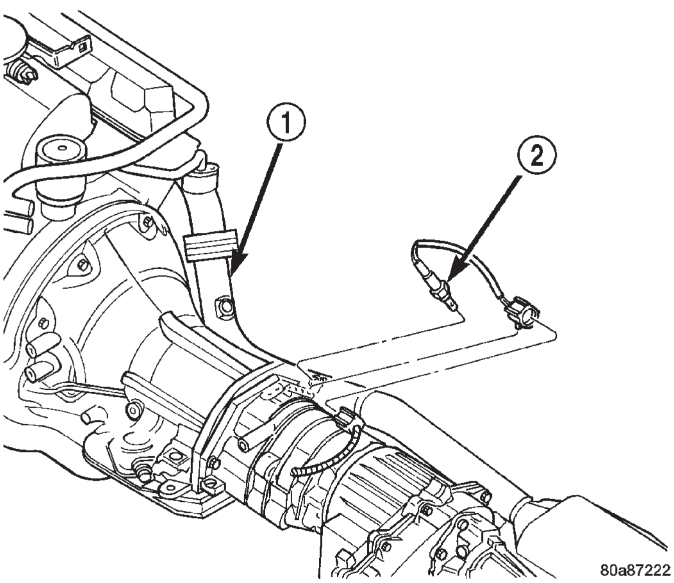


Fig. 12 Upstream Oxygen Sensor—All 3.9/5.2L Engines or 5.9L Engine With 4WD

1 – EXHAUST PIPE
2 – UPSTREAM OXYGEN SENSOR

(b) Verify left and right oxygen sensor wire connectors (at exhaust downpipes) are firmly connected to sensors (Fig. 15). Inspect sensors and connectors for damage.

(23) Inspect for pinched or leaking fuel tubes. Inspect for pinched, cracked or leaking fuel hoses.

(24) Inspect for exhaust system restrictions such as pinched exhaust pipes, collapsed muffler or plugged catalytic convertor.

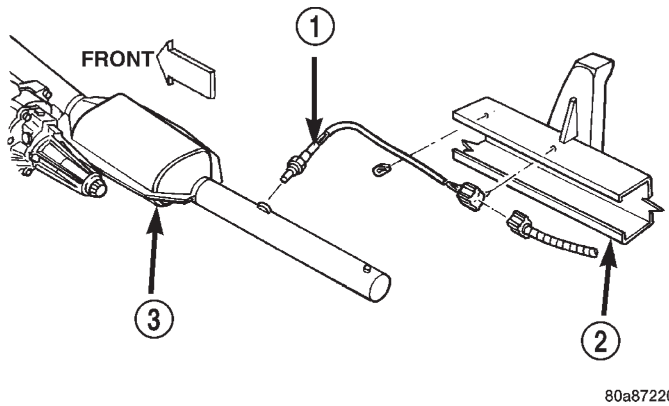


Fig. 13 Downstream Oxygen Sensor—3.9/5.2L Engines or 5.9L Engine With 4WD

1 – DOWNSTREAM OXYGEN SENSOR
2 – FRAME RAIL
3 – CATALYTIC CONVERTER

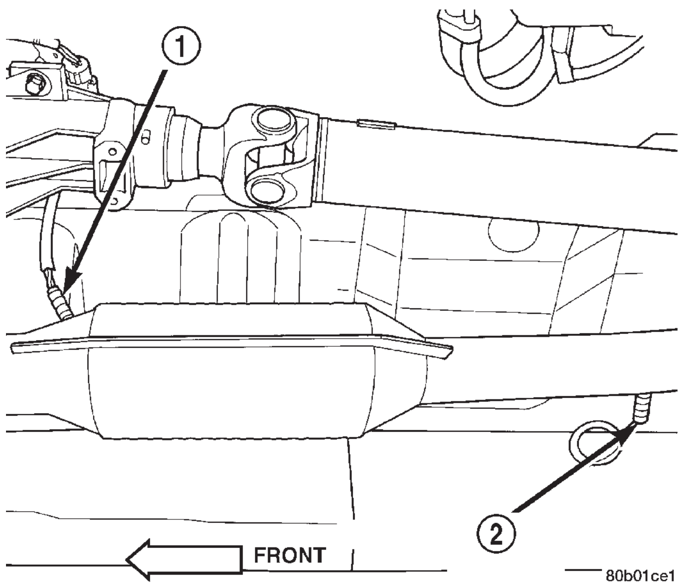


Fig. 14 Pre-Catalyst/Post-Catalyst Oxygen Sensors—5.9L Engine With 2WD

1 – PRE-CATALYST OXYGEN SENSOR
2 – POST-CATALYST OXYGEN SENSOR

(25) If equipped with automatic transmission, verify electrical harness is firmly connected to park/neutral switch. Refer to Automatic Transmission section of Group 21.

(26) Verify electrical harness is firmly connected to rear wheel speed sensor. Verify rear wheel speed sensor is firmly attached to rear axle with proper air gap. Refer to Group 5, Brakes for information.

(27) If equipped with 4–wheel antilock brake system, verify electrical harness is firmly connected to each front wheel speed sensor. Verify both front wheel speed sensors are firmly attached. Refer to Group 5, Brakes for information.

DIAGNOSIS AND TESTING (Continued)

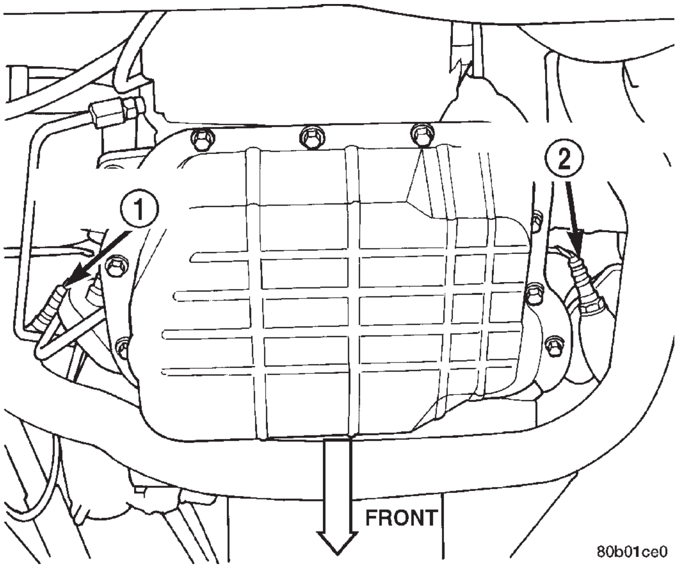


Fig. 15 Left/Right Oxygen Sensors—5.9L Engine With 2WD

1 – LEFT OXYGEN SENSOR
2 – RIGHT OXYGEN SENSOR

(28) Verify fuel pump/gauge sender unit wire connector is firmly connected to harness connector.

(29) Inspect fuel hoses at fuel pump/gauge sender unit for cracks or leaks.

(30) Inspect transmission torque convertor housing (automatic transmission) or clutch housing (manual transmission) for damage to timing ring on drive plate/flywheel.

(31) Verify battery cable and solenoid feed wire connections to starter solenoid are tight and clean. Inspect for chaffed wires or wires rubbing against other components.

VISUAL INSPECTION—2.5L ENGINE

A visual inspection for loose, disconnected or incorrectly routed wires and hoses should be made. This should be done before attempting to diagnose or service the fuel injection system. A visual check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Verify three 32–way electrical connectors are fully inserted into connector of powertrain control module (PCM) (Fig. 16).

(2) Inspect battery cable connections. Be sure they are clean and tight.

(3) Inspect fuel pump relay connections. Inspect ASD relay connections. Inspect starter motor relay connections. Inspect relays for signs of physical damage and corrosion. The relays are located in Power Distribution Center (PDC) (Fig. 17). Refer to label on PDC cover for relay location.

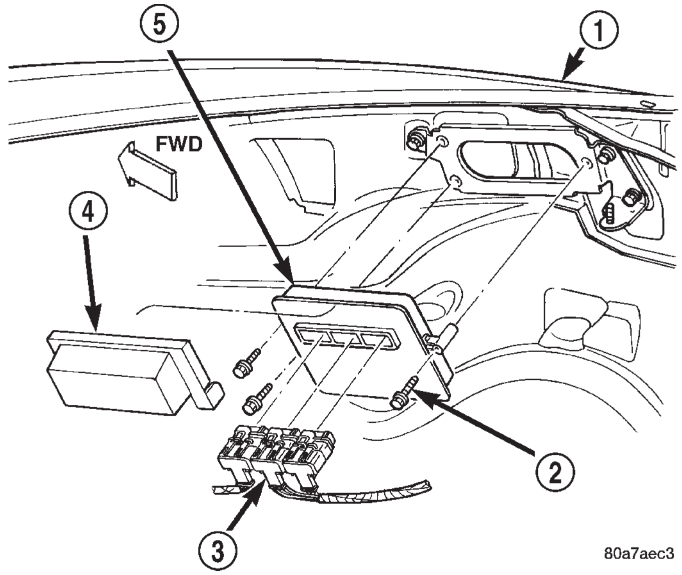


Fig. 16 Powertrain Control Module (PCM)

1 – RIGHT FRONT FENDER
2 – PCM MOUNTING BOLTS (3)
3 – 32–WAY CONNECTORS (3)
4 – COVER
5 – POWERTRAIN CONTROL MODULE (PCM)

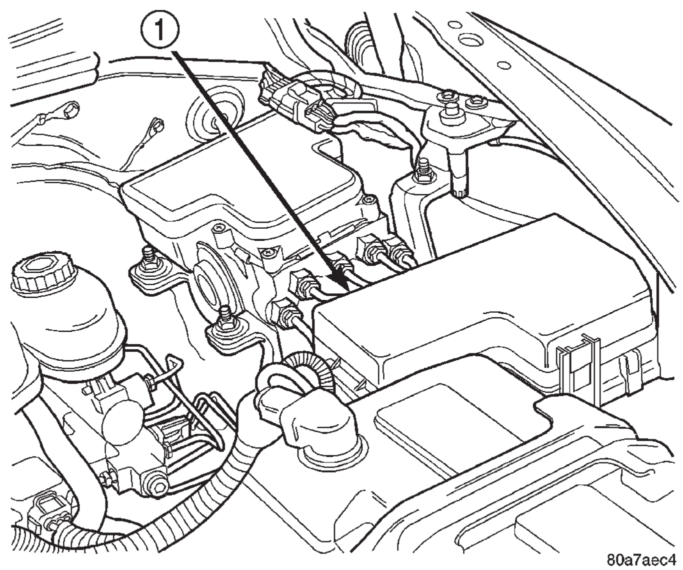


Fig. 17 Power Distribution Center (PDC)

1 – POWER DISTRIBUTION CENTER (PDC)

(4) Inspect ignition coil connections. Verify coil secondary cable is firmly connected to coil (Fig. 18).

(5) Verify distributor cap is correctly attached to distributor. Be sure spark plug cables are firmly connected to distributor cap and the spark plugs are in their correct firing order. Be sure coil cable is firmly connected to distributor cap and coil. Be sure cam-

DIAGNOSIS AND TESTING (Continued)

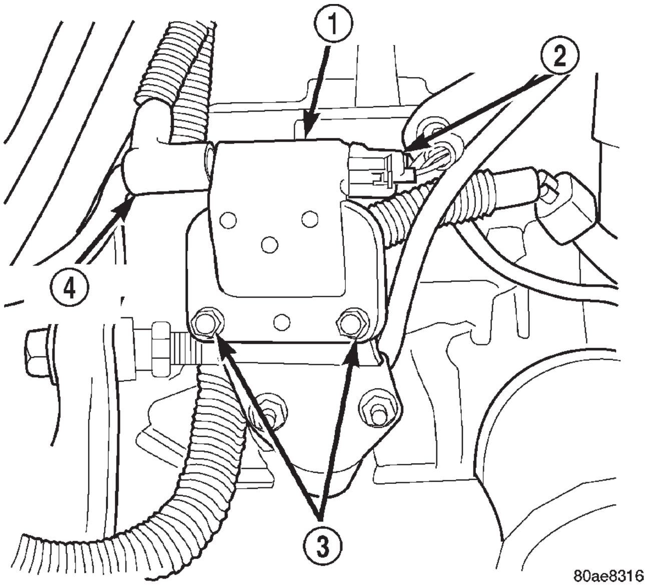


Fig. 18 Ignition Coil—2.5L Engine

1 – IGNITION COIL
2 – ELECTRICAL CONNECTOR
3 – MOUNTING BOLTS (2)
4 – SECONDARY CABLE

shaft position sensor wire connector (at the distributor) is firmly connected to harness connector. Inspect spark plug condition. Refer to Group 8D, Ignition. Connect vehicle to an oscilloscope and inspect spark events for fouled or damaged spark plugs or cables.

(6) Verify generator output wire, generator connector and ground wire are firmly connected to the generator.

(7) Inspect system body grounds for loose or dirty connections. Refer to Group 8, Wiring for ground locations.

(8) Verify Crankcase Ventilation (CCV) system operation. Verify CCV system hoses and fixed orifice fitting are firmly connected (Fig. 19). Refer to Group 25, Emission Control System for additional information.

(9) Inspect fuel tube quick-connect fitting-to-fuel rail connections.

(10) Verify hose connections to all ports of vacuum fittings on intake manifold are tight and not leaking.

(11) Inspect accelerator cable and throttle cable. Check their connections to throttle arm of throttle body for any binding or restrictions.

(12) If equipped with vacuum brake booster, verify vacuum booster hose is firmly connected to fitting on intake manifold. Also check connection to brake vacuum booster.

(13) Inspect air cleaner inlet and air cleaner element for dirt or restrictions.

(14) Inspect radiator grille area, radiator fins and air conditioning condenser for restrictions.

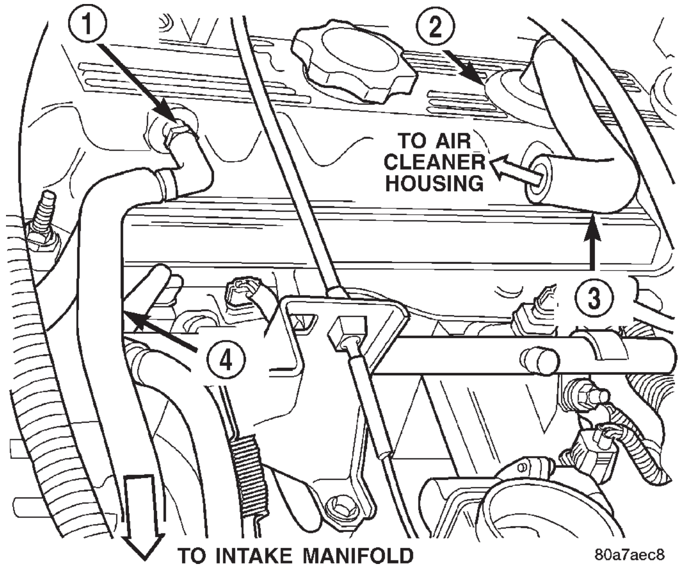


Fig. 19 CCV System—2.5L Engine

1 – FIXED ORIFICE FITTING
2 – AIR INLET FITTING
3 – CCV TUBE
4 – CCV TUBE

(15) Verify intake manifold air temperature sensor wire connector is firmly connected to harness connector (Fig. 20).

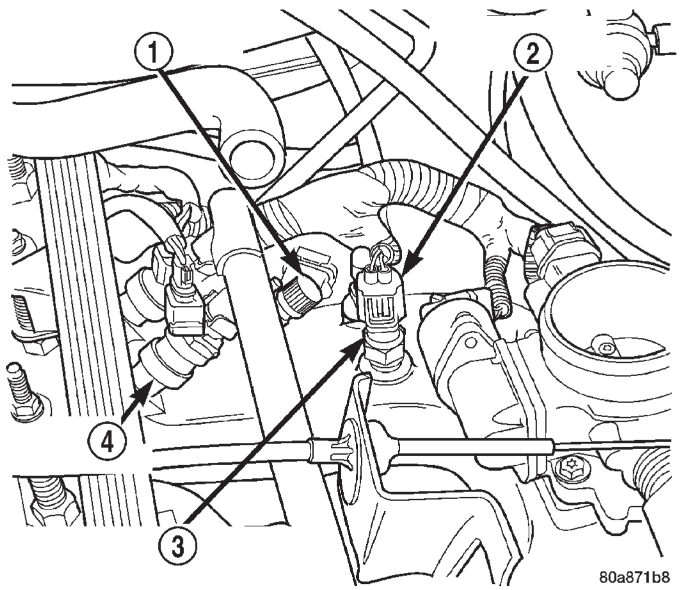


Fig. 20 Intake Manifold Air Temperature Sensor—2.5L Engine

1 – FUEL PRESSURE TEST PORT
2 – ELECTRICAL CONNECTOR
3 – INTAKE MANIFOLD AIR TEMPERATURE SENSOR
4 – FUEL INJECTOR

DIAGNOSIS AND TESTING (Continued)

(16) Verify MAP sensor electrical connector is firmly connected to MAP sensor (Fig. 21). Also verify rubber L-shaped fitting from MAP sensor to throttle body is firmly connected.

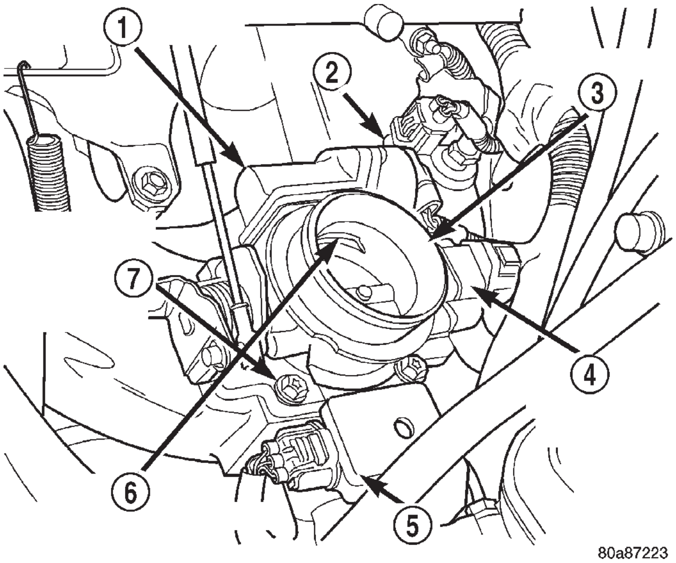


Fig. 21 Sensor Location—2.5L Engine

1 – IDLE AIR CONTROL MOTOR
2 – IAT SENSOR
3 – THROTTLE BODY
4 – THROTTLE POSITION SENSOR
5 – MAP SENSOR
6 – IDLE AIR CONTROL PASSAGE INLET
7 – THROTTLE BODY MOUNTING BOLTS (4)

(17) Verify fuel injector wire harness connectors are firmly connected to injectors in the correct order. Each harness connector is numerically tagged with injector number (INJ 1, INJ 2 etc.) of its corresponding fuel injector and cylinder number.

(18) Verify harness connectors are firmly connected to idle air control (IAC) motor, throttle position sensor (TPS) and manifold absolute pressure (MAP) sensor (Fig. 21).

(19) Verify wire harness connector is firmly connected to engine coolant temperature sensor (Fig. 22).

(20) Raise and support the vehicle.

(21) Verify both upstream and downstream oxygen sensor wire connectors are firmly connected to sensors. Inspect sensors and connectors for damage (Fig. 23) or (Fig. 24).

(22) Inspect for pinched or leaking fuel tubes. Inspect for pinched, cracked or leaking fuel hoses.

(23) Inspect for exhaust system restrictions such as pinched exhaust pipes, collapsed muffler or plugged catalytic convertor.

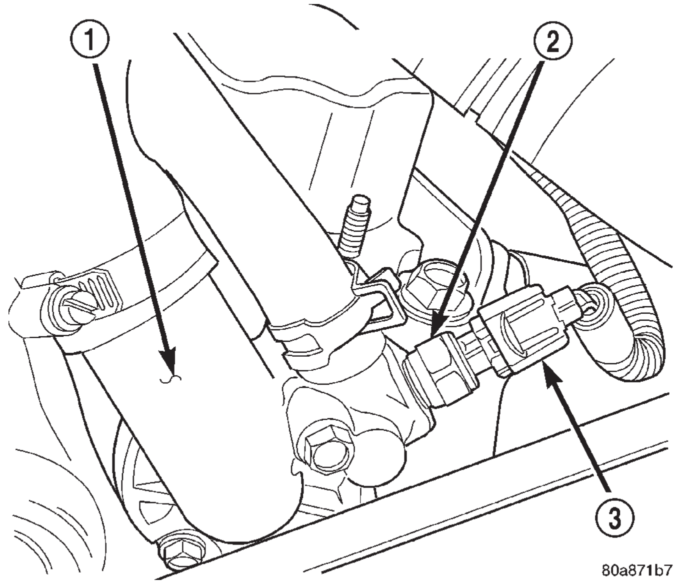


Fig. 22 Engine Coolant Temperature Sensor—2.5L Engine

1 – THERMOSTAT HOUSING
2 – ENGINE COOLANT TEMPERATURE SENSOR
3 – ELECTRICAL CONNECTOR

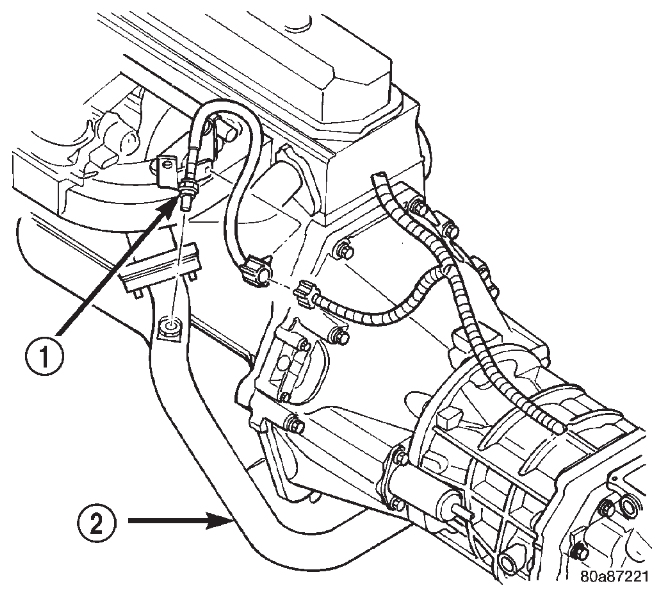


Fig. 23 Upstream Oxygen Sensor—2.5L Engine

1 – UPSTREAM OXYGEN SENSOR
2 – EXHAUST PIPE

(24) Verify electrical harness is firmly connected to rear wheel speed sensor. Verify rear wheel speed sensor is firmly attached to rear axle with proper air gap. Refer to Group 5, Brakes for information.

(25) If equipped with 4–wheel antilock brake system, verify electrical harness is firmly connected to each front wheel speed sensor. Verify both front wheel speed sensors are firmly attached. Refer to Group 5, Brakes for information.

DIAGNOSIS AND TESTING (Continued)

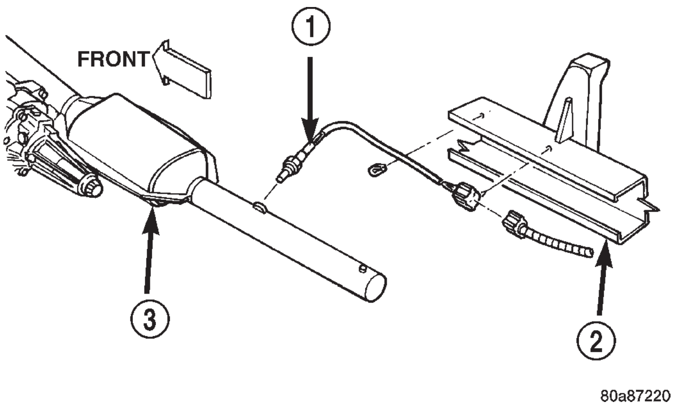


Fig. 24 Downstream Oxygen Sensor—2.5L Engine

1 – DOWNSTREAM OXYGEN SENSOR
2 – FRAME RAIL
3 – CATALYTIC CONVERTER

(26) Verify fuel pump/gauge sender unit wire connector is firmly connected to harness connector.

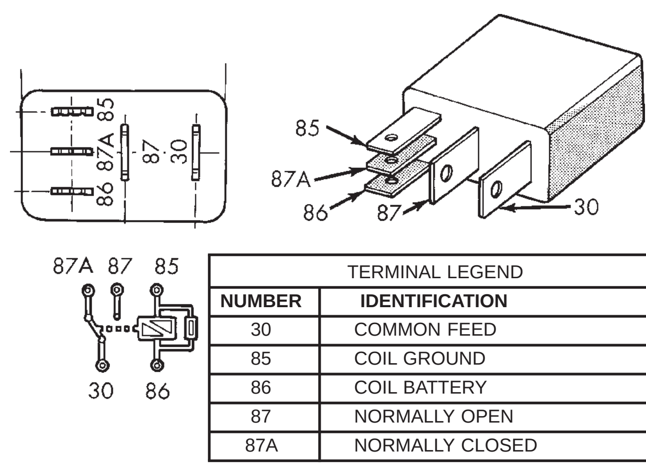
(27) Inspect fuel hoses at fuel pump/gauge sender unit for cracks or leaks.

(28) Inspect clutch housing for damage to timing ring on drive plate/flywheel.

(29) Verify battery cable and solenoid feed wire connections to the starter solenoid are tight and clean. Inspect for chaffed wires or wires rubbing against other components.

ASD AND FUEL PUMP RELAYS

The following description of operation and tests apply only to the Automatic Shutdown (ASD) and fuel pump relays. The terminals on the bottom of each relay are numbered (Fig. 25).



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 25 ASD and Fuel Pump Relay Terminals

OPERATION

• Terminal number 30 is connected to battery voltage. For both the ASD and fuel pump relays, terminal 30 is connected to battery voltage at all times.

• The PCM grounds the coil side of the relay through terminal number 85.

• Terminal number 86 supplies voltage to the coil side of the relay.

• When the PCM de-energizes the ASD and fuel pump relays, terminal number 87A connects to terminal 30. This is the Off position. In the off position, voltage is not supplied to the rest of the circuit. Terminal 87A is the center terminal on the relay.

• When the PCM energizes the ASD and fuel pump relays, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

TESTING

The following procedure applies to the ASD and fuel pump relays.

(1) Remove relay from connector before testing.

(2) With the relay removed from the vehicle, use an ohmmeter to check the resistance between terminals 85 and 86. The resistance should be 75 ±5 ohms.

(3) Connect the ohmmeter between terminals 30 and 87A. The ohmmeter should show continuity between terminals 30 and 87A.

(4) Connect the ohmmeter between terminals 87 and 30. The ohmmeter should not show continuity at this time.

(5) Connect one end of a jumper wire (16 gauge or smaller) to relay terminal 85. Connect the other end of the jumper wire to the ground side of a 12 volt power source.

(6) Connect one end of another jumper wire (16 gauge or smaller) to the power side of the 12 volt power source. **Do not attach the other end of the jumper wire to the relay at this time.**

WARNING: DO NOT ALLOW OHMMETER TO CONTACT TERMINALS 85 OR 86 DURING THIS TEST.

(7) Attach the other end of the jumper wire to relay terminal 86. This activates the relay. The ohmmeter should now show continuity between relay terminals 87 and 30. The ohmmeter should not show continuity between relay terminals 87A and 30.

(8) Disconnect jumper wires.

(9) Replace the relay if it did not pass the continuity and resistance tests. If the relay passed the tests, it operates properly. Check the remainder of the ASD and fuel pump relay circuits. Refer to group 8W, Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE

3.9/5.2/5.9L ENGINES

The following test procedure has been developed to check throttle body calibrations for correct idle conditions. The procedure should be used to diagnose the throttle body for conditions that may cause idle problems. **This procedure should be used only after normal diagnostic procedures have failed to produce results that indicate a throttle body related problem. Be sure to check for proper operation of the idle air control motor before performing this test.**

A special fixed orifice tool (number 6714) (Fig. 26) must be used for the following test.

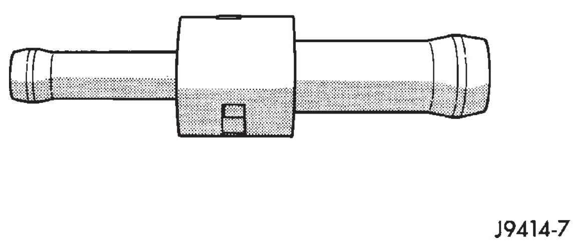


Fig. 26 Fixed Orifice Tool

(1) Start the engine and bring to operating temperature. Be sure all accessories are off before performing this test.

(2) Shut off the engine and remove the air duct at throttle body.

(3) Disconnect the vacuum line at the PCV valve (Fig. 27).

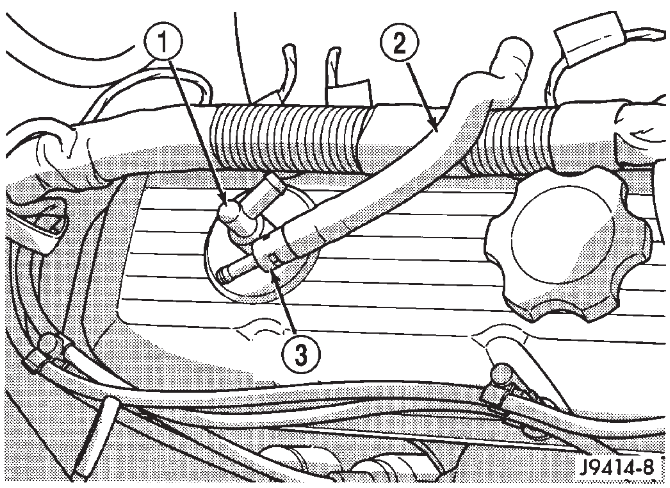


Fig. 27 Install Orifice Tool

1 – PCV VALVE
2 – VACUUM LINE
3 – ORIFICE TOOL

(4) Install the 0.185 inch orifice tool (number 6714) into the disconnected vacuum line in place of the PCV valve (Fig. 27).

(5) Disconnect the idle purge vacuum line from fitting at throttle body. This vacuum line is located on the front of throttle body next to the MAP sensor (Fig. 28). Cap the fitting at throttle body after vacuum line has been removed.

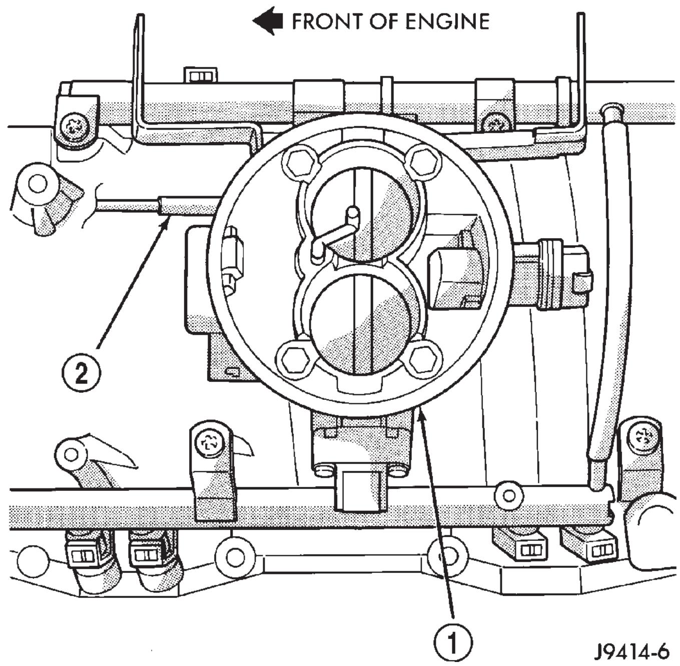


Fig. 28 Idle Purge Line

1 – THROTTLE BODY
2 – PURGE VACUUM LINE

(6) Connect the DRB scan tool to the 16–way data link connector. This connector is located under the instrument panel to the left of the steering column. Refer to the appropriate Powertrain Diagnostic Procedures service manual for DRB operation.

(7) Start the engine and allow to warm up.

(8) Using the DRB scan tool, scroll through the menus as follows: select—Stand Alone DRB III, select the year 2000 Diagnostics, select—Engine, select—System Test, select—Minimum Air Flow.

(9) The DRB scan tool will count down to stabilize the idle rpm and display the minimum air flow idle rpm. The idle rpm should be between **500 and 900 rpm.** If the idle speed is outside of these specifications, replace the throttle body. Refer to Throttle Body in the Component Removal/Installation section of this group.

(10) Disconnect the DRB scan tool from the vehicle.

(11) Remove cap from idle purge fitting at throttle body and install vacuum line.

(12) Remove orifice tool and connect vacuum line to PCV valve.

(13) Install air duct to throttle body.

DIAGNOSIS AND TESTING (Continued)

THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE

2.5L ENGINE

The following test procedure has been developed to check throttle body calibrations for correct idle conditions. The procedure should be used to diagnose the throttle body for conditions that may cause idle problems. **This procedure should be used only after normal diagnostic procedures have failed to produce results that indicate a throttle body related problem. Be sure to check for proper operation of the idle air control motor before performing this test.**

A special fixed orifice tool (number 6714) (Fig. 29) must be used for the following test. This tool has a fixed internal diameter of 0.185”.

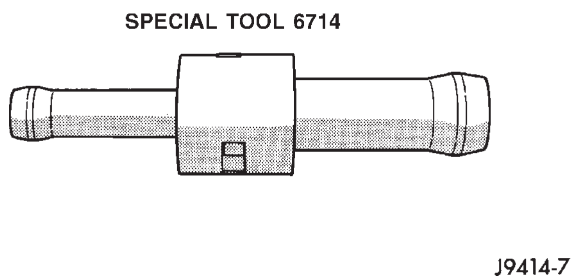


Fig. 29 6714 Fixed Orifice Tool

(1) Start the engine and bring to operating temperature. Be sure all accessories are off before performing this test.

(2) Shut off engine and remove air duct at throttle body.

(3) Near front/top of valve cover, disconnect CCV tube at fixed orifice fitting (Fig. 30). Insert Special Tool 6714 into end of disconnected CCV tube (insert either end of tool into tube). Let tool and tube hang disconnected at side of engine.

(4) Connect DRB scan tool to 16–way data link connector. This connector is located at lower edge of instrument panel near steering column. Refer to appropriate Powertrain Diagnostic Procedures service manual for DRB operation.

(5) Start engine and allow to warm up.

(6) Using the DRB scan tool, scroll through menus as follows: select—Stand Alone DRB III, select 1999 Diagnostics, select—Engine, select—System Test, select—Minimum Air Flow.

(7) The DRB scan tool will count down to stabilize idle rpm and display minimum air flow idle rpm. The idle rpm should be between **500 and 900 rpm.** If idle speed is outside these specifications, replace throttle body. Refer to Throttle Body Removal/Installation.

(8) Disconnect DRB scan tool from vehicle.

(9) Remove orifice tool and connect CCV tube to engine.

(10) Install air duct to throttle body.

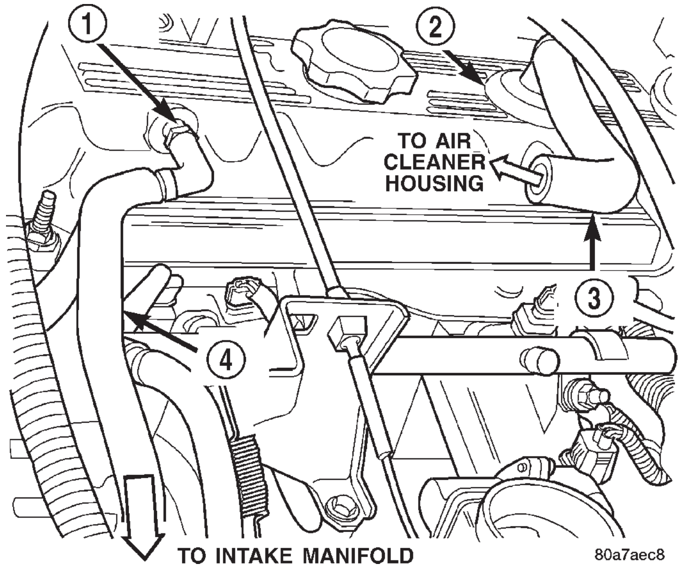


Fig. 30 Install Orifice Tool 2.5L 4–Cylinder Engine

1 – FIXED ORIFICE FITTING
2 – AIR INLET FITTING
3 – CCV TUBE
4 – CCV TUBE

REMOVAL AND INSTALLATION

AUTOMATIC SHUTDOWN (ASD) RELAY

The ASD relay is located in the Power Distribution Center (PDC) (Fig. 31). Refer to label on PDC cover for relay location.

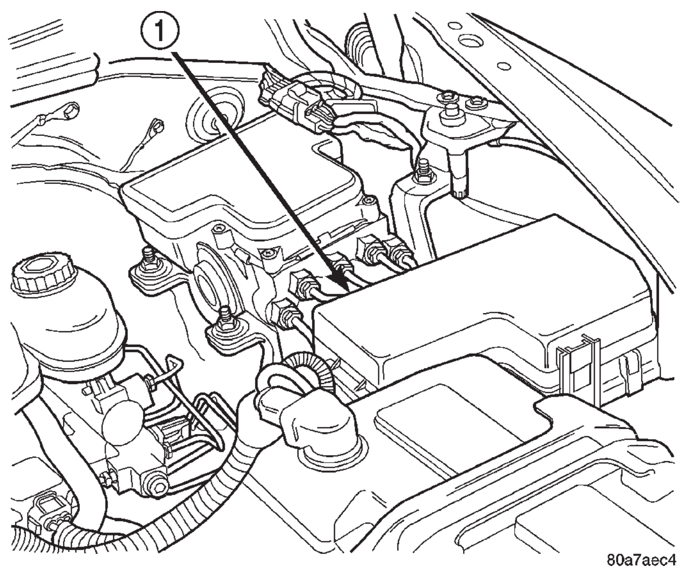


Fig. 31 Power Distribution Center (PDC) Location

1 – POWER DISTRIBUTION CENTER (PDC)

REMOVAL

(1) Remove PDC cover.

(2) Remove relay from PDC.

REMOVAL AND INSTALLATION (Continued)

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

(1) Install relay to PDC.

(2) Install cover to PDC.

FUEL PUMP RELAY

The fuel pump relay is located in the Power Distribution Center (PDC) (Fig. 31). Refer to label on PDC cover for relay location.

REMOVAL

(1) Remove PDC cover.

(2) Remove relay from PDC.

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

(1) Install relay to PDC.

(2) Install cover to PDC.

OXYGEN SENSOR HEATER RELAYS

The oxygen sensor heater relays are located in the Power Distribution Center (PDC) (Fig. 31). Refer to label on PDC cover for relay location.

REMOVAL

(1) Remove PDC cover.

(2) Remove relay from PDC.

(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.

(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

(1) Install relay to PDC.

(2) Install cover to PDC.

THROTTLE BODY—3.9/5.2/5.9L ENGINES

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the powertrain control module (PCM).

REMOVAL

(1) Remove the air duct at throttle body.

(2) Disconnect throttle body electrical connectors at MAP sensor, IAC motor and TPS (Fig. 32).

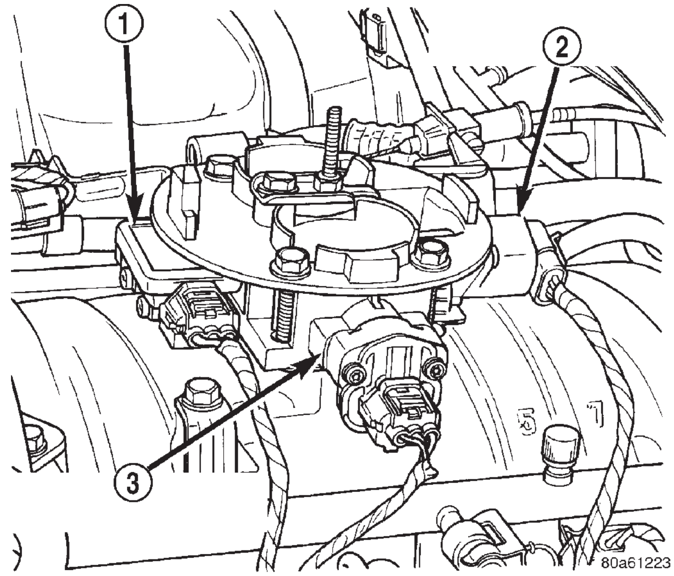


Fig. 32 Sensor Electrical Connectors—3.9/5.2/5.9L Engines—Typical

1 – MAP SENSOR
2 – IDLE AIR CONTROL MOTOR
3 – THROTTLE POSITION SENSOR

(3) Remove vacuum line at throttle body.

(4) Remove all control cables from throttle body (lever) arm. Refer to the Accelerator Pedal and Throttle Cable section of this group for additional information.

(5) Remove four throttle body mounting bolts (Fig. 33).

(6) Remove throttle body from intake manifold.

(7) Discard old throttle body-to-intake manifold gasket.

INSTALLATION

(1) Clean the mating surfaces of the throttle body and the intake manifold.

(2) Install new throttle body-to-intake manifold gasket.

(3) Install throttle body to intake manifold.

(4) Install four mounting bolts. Tighten bolts to 23 N·m (200 in. lbs.) torque.

(5) Install control cables.

(6) Install vacuum line to throttle body.

(7) Install electrical connectors.

(8) Install air duct at throttle body.

REMOVAL AND INSTALLATION (Continued)

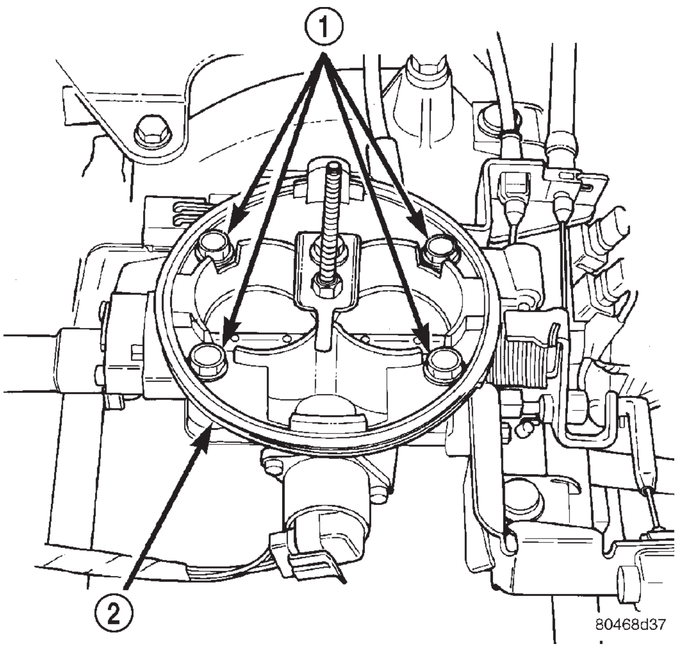


Fig. 33 Throttle Body Mounting Bolts—3.9/5.2/5.9L Engines—Typical

1 – THROTTLE BODY MOUNTING BOLTS (4)
2 – THROTTLE BODY

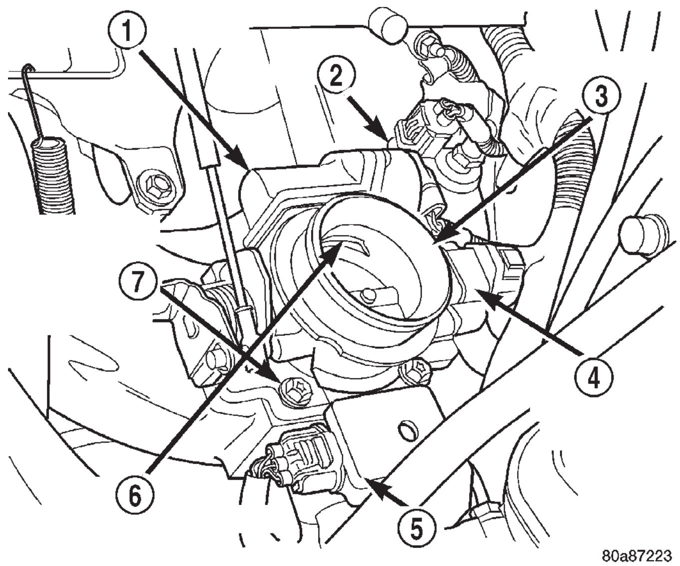


Fig. 34 Throttle Body—2.5L Engine

1 – IDLE AIR CONTROL MOTOR
2 – IAT SENSOR
3 – THROTTLE BODY
4 – THROTTLE POSITION SENSOR
5 – MAP SENSOR
6 – IDLE AIR CONTROL PASSAGE INLET
7 – THROTTLE BODY MOUNTING BOLTS (4)

THROTTLE BODY—2.5L ENGINE

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the powertrain control module (PCM).

REMOVAL

(1) Remove air duct at throttle body.
(2) Disconnect throttle body electrical connectors at MAP sensor, IAC motor and TPS (Fig. 34).
(3) Remove all control cables from throttle body (lever) arm. Refer to the Accelerator Pedal and Throttle Cable section of this group for additional information.
(4) Remove throttle body from intake manifold.
(5) Discard old throttle body-to-intake manifold gasket.

INSTALLATION

(1) Clean the mating surfaces of the throttle body and the intake manifold.
(2) Install new throttle body-to-intake manifold gasket.
(3) Install throttle body to intake manifold.
(4) Install four mounting bolts. Tighten bolts to 11 N·m (100 in. lbs.) torque.
(5) Install control cables.
(6) Install electrical connectors.
(7) Install air duct at throttle body.

THROTTLE BODY—4.7L V-8 ENGINE

A (factory adjusted) set screw is used to mechanically limit the position of the throttle body throttle plate. **Never attempt to adjust the engine idle speed using this screw.** All idle speed functions are controlled by the Powertrain Control Module (PCM).

REMOVAL

(1) Remove the air duct and air resonator box at throttle body.
(2) Disconnect throttle body electrical connectors at IAC motor and TPS (Fig. 35).
(3) Remove vacuum line at throttle body.
(4) Remove all control cables from throttle body (lever) arm. Refer to Accelerator Pedal and Throttle Cable.
(5) Remove three throttle body mounting bolts (Fig. 35).
(6) Remove throttle body from intake manifold.

INSTALLATION

(1) Clean throttle body-to-intake manifold o-ring.
(2) Clean mating surfaces of throttle body and intake manifold.
(3) Install throttle body to intake manifold by positioning throttle body to manifold alignment pins.
(4) Install three mounting bolts. Tighten bolts to 12 N·m (105 in. lbs.) torque.
(5) Install control cables.

REMOVAL AND INSTALLATION (Continued)

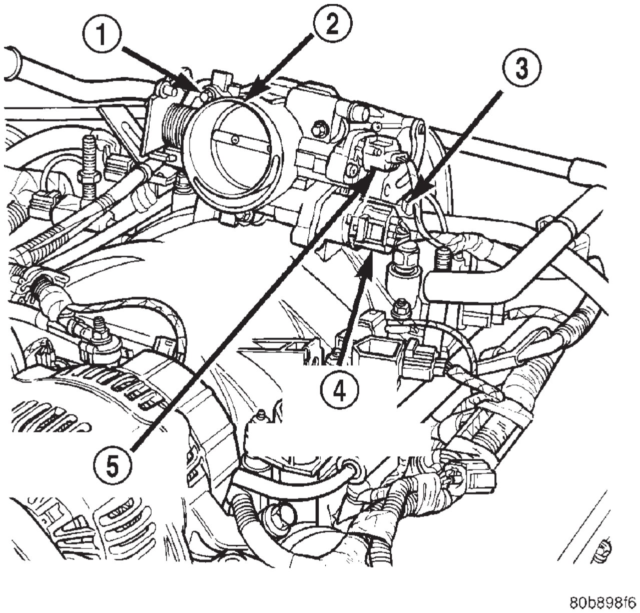


Fig. 35 Throttle Body, Sensors and Electrical Connectors—4.7L V-8 Engine

1 – MOUNTING BOLTS (3)
2 – THROTTLE BODY
3 – IAT SENSOR CONNECTOR
4 – IAC MOTOR CONNECTOR
5 – TPS CONNECTOR

(6) Install vacuum line to throttle body.
(7) Install electrical connectors.
(8) Install air duct/air box at throttle body.

THROTTLE POSITION SENSOR (TPS)—3.9/5.2/5.9L ENGINES

REMOVAL

The TPS is located on side of throttle body.
(1) Remove air duct at throttle body.
(2) Disconnect TPS electrical connector.
(3) Remove two TPS mounting bolts (Fig. 36).
(4) Remove TPS from throttle body.

INSTALLATION

The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 37). The TPS must be installed so that it can be rotated a few degrees. If the sensor will not rotate, install the sensor with the throttle shaft on the other side of the socket tangs. The TPS will be under slight tension when rotated.
(1) Install the TPS and two retaining bolts.
(2) Tighten bolts to 7 N·m (60 in. lbs.) torque.
(3) Manually operate the throttle control lever by hand to check for any binding of the TPS.
(4) Connect TPS electrical connector to TPS.
(5) Install air duct at throttle body.

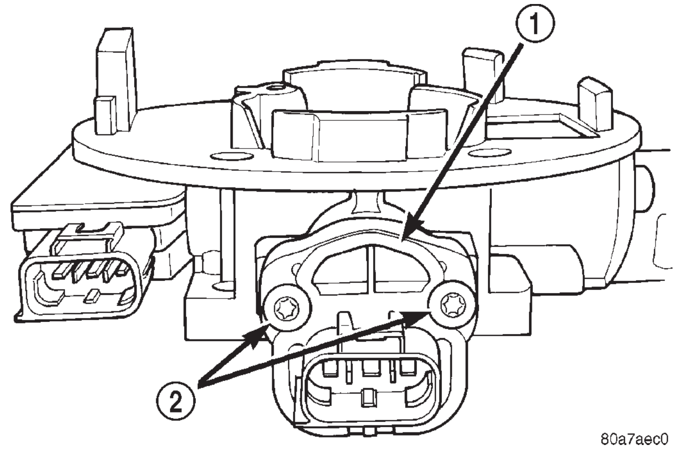


Fig. 36 TPS Mounting Bolts—3.9/5.2/5.9L Engines

1 – THROTTLE POSITION SENSOR
2 – MOUNTING SCREWS

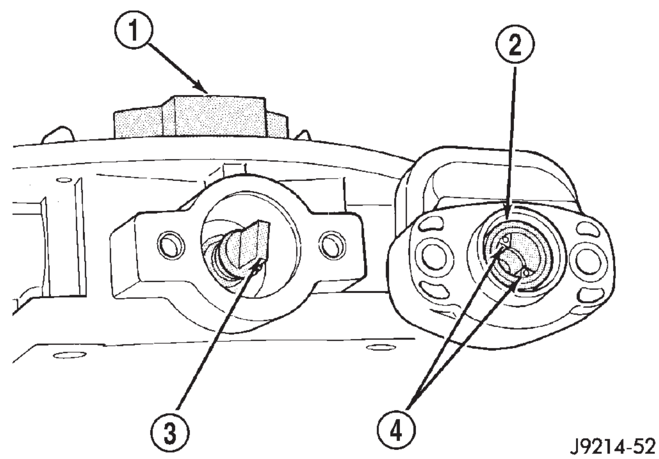


Fig. 37 Installation—3.9/5.2/5.9L Engines—Typical

1 – THROTTLE BODY
2 – THROTTLE POSITION SENSOR
3 – THROTTLE SHAFT
4 – SOCKET LOCATING TANGS

THROTTLE POSITION SENSOR (TPS)—4.7L V-8 ENGINE

REMOVAL

The TPS is located on the throttle body.
(1) Remove air duct and air resonator box at throttle body.
(2) Disconnect TPS electrical connector (Fig. 35).
(3) Remove two TPS mounting bolts (screws) (Fig. 38).
(4) Remove TPS from throttle body.

REMOVAL AND INSTALLATION (Continued)

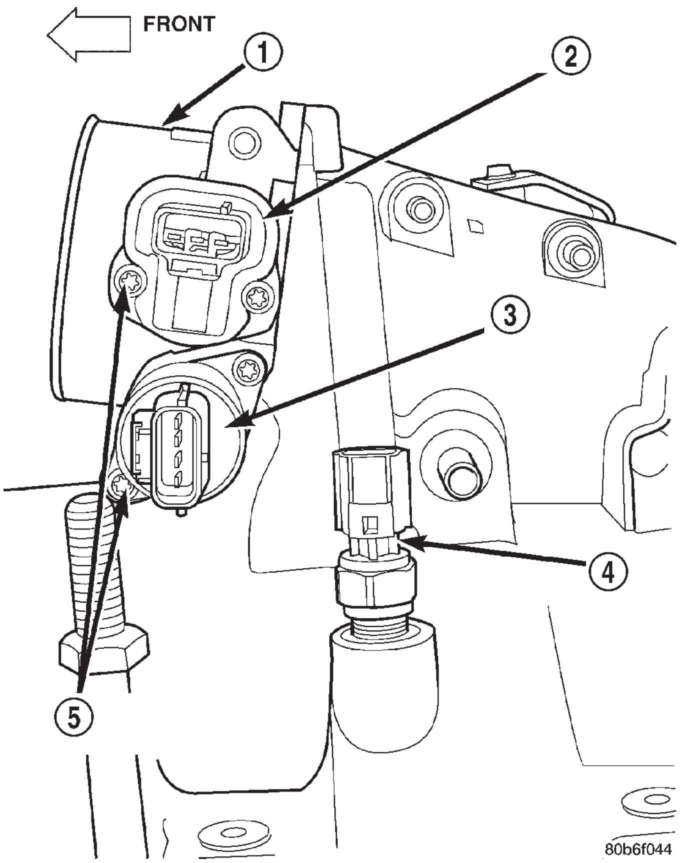


Fig. 38 TPS Mounting Bolts—4.7L V–8 Engine

1 – THROTTLE BODY
2 – TPS
3 – IAC MOTOR
4 – IAT SENSOR
5 – MOUNTING SCREWS

INSTALLATION

The throttle shaft end of throttle body slides into a socket in TPS (Fig. 39). The TPS must be installed so that it can be rotated a few degrees. If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs. The TPS will be under slight tension when rotated.

(1) Install TPS and two retaining bolts.
(2) Tighten bolts to 7 N·m (60 in. lbs.) torque.
(3) Manually operate throttle control lever by hand to check for any binding of TPS.
(4) Connect TPS electrical connector to TPS.
(5) Install air duct/air box to throttle body.

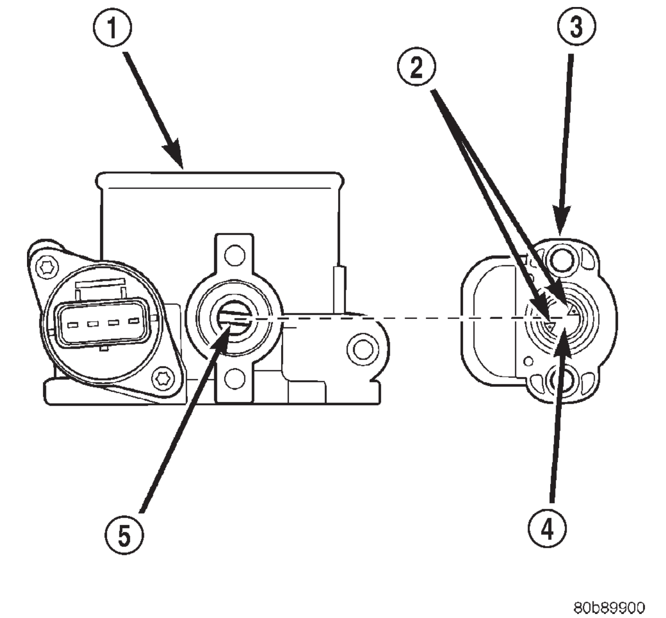


Fig. 39 TPS Installation—4.7L V–8 Engine

1 – THROTTLE BODY
2 – LOCATING TANGS
3 – THROTTLE POSITION SENSOR
4 – SOCKET
5 – THROTTLE SHAFT

THROTTLE POSITION SENSOR—2.5L ENGINE

The TPS is mounted to the throttle body (Fig. 34).

REMOVAL

(1) Remove air duct at throttle body.
(2) Disconnect TPS electrical connector.
(3) Remove TPS mounting screws (Fig. 40).
(4) Remove TPS.

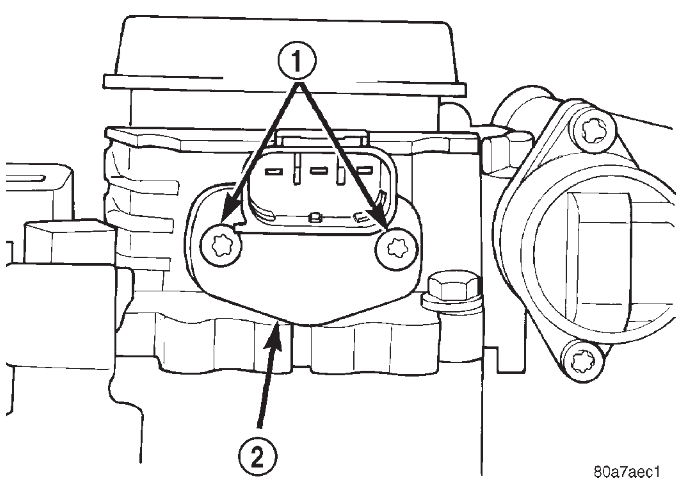


Fig. 40 TPS Mounting Screws—2.5L Engine

1 – MOUNTING SCREWS
2 – TPS

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 41). The TPS must be installed so that it can be rotated a few degrees. (If the sensor will not rotate, install the sensor with the throttle shaft on the other side of the socket tangs). The TPS will be under slight tension when rotated.

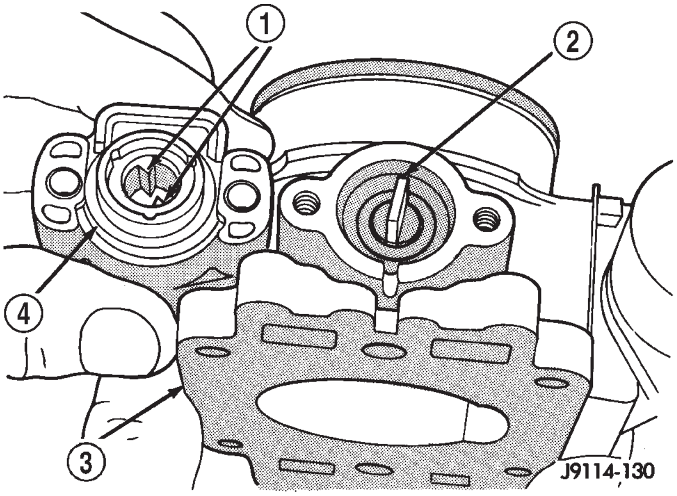


Fig. 41 Throttle Position Sensor Installation—2.5L Engine

1 – TANGS
2 – THROTTLE SHAFT
3 – THROTTLE BODY
4 – TPS

(1) Install the TPS and retaining screws.
(2) Tighten screws to 7 N·m (60 in. lbs.) torque.
(3) Connect TPS electrical connector to TPS.
(4) Manually operate the throttle (by hand) to check for any TPS binding before starting the engine.
(5) Install air duct at throttle body.

IDLE AIR CONTROL (IAC) MOTOR—3.9/5.2/5.9L ENGINES

The IAC motor is located on the back of the throttle body (Fig. 42).

REMOVAL

(1) Remove air duct at throttle body.
(2) Disconnect electrical connector from IAC motor.
(3) Remove two mounting bolts (screws) (Fig. 42).
(4) Remove IAC motor from throttle body.

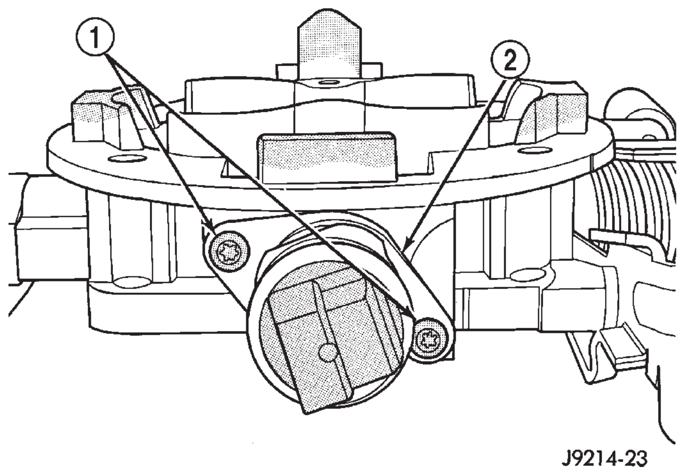


Fig. 42 Mounting Bolts (Screws)—IAC Motor—3.9/5.2/5.9L Engines

1 – MOUNTING SCREWS
2 – IDLE SPEED MOTOR

INSTALLATION

(1) Install IAC motor to throttle body.
(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.
(3) Install electrical connector.
(4) Install air duct at throttle body.

IDLE AIR CONTROL (IAC) MOTOR—4.7L V–8 ENGINE

The IAC motor is located on the throttle body.

REMOVAL

(1) Remove air duct and air resonator box at throttle body.
(2) Disconnect electrical connector from IAC motor (Fig. 35).
(3) Remove two mounting bolts (screws) (Fig. 36).
(4) Remove IAC motor from throttle body.

INSTALLATION

(1) Install IAC motor to throttle body.
(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.
(3) Install electrical connector.
(4) Install air duct/air box to throttle body.

IDLE AIR CONTROL (IAC) MOTOR—2.5L ENGINE

The IAC motor is located on the side of the throttle body (Fig. 43).

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove air duct at throttle body.
(2) Disconnect electrical connector from IAC motor.
(3) Remove two mounting bolts (screws) (Fig. 43).
(4) Remove IAC motor from throttle body.

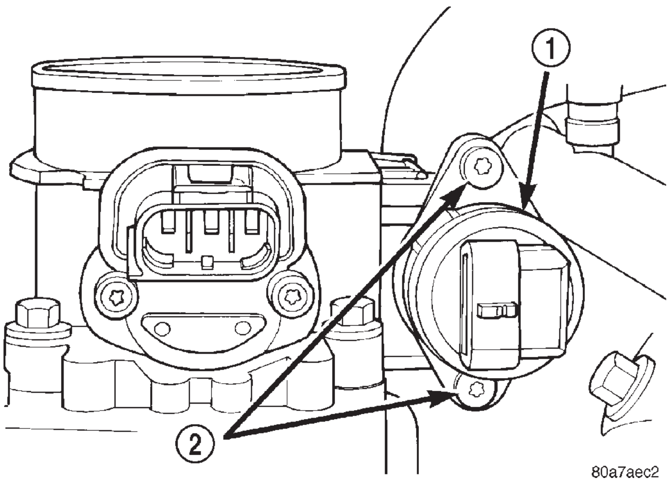


Fig. 43 Mounting Bolts (Screws)—IAC Motor—2.5L Engine

1 – IDLE AIR CONTROL MOTOR
2 – MOUNTING SCREWS

INSTALLATION

(1) Install IAC motor to throttle body.
(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.
(3) Install electrical connector.
(4) Install air duct at throttle body.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—3.9/5.2/5.9L ENGINES

The MAP sensor is located on the front of the throttle body (Fig. 44). An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 45).

REMOVAL

(1) Remove air duct at throttle body.
(2) Remove two MAP sensor mounting bolts (screws) (Fig. 44).
(3) While removing MAP sensor, slide the vacuum rubber L-shaped fitting (Fig. 45) from the throttle body.
(4) Remove rubber L-shaped fitting from MAP sensor.

INSTALLATION

(1) Install rubber L-shaped fitting to MAP sensor.
(2) Position sensor to throttle body while guiding rubber fitting over throttle body vacuum nipple.

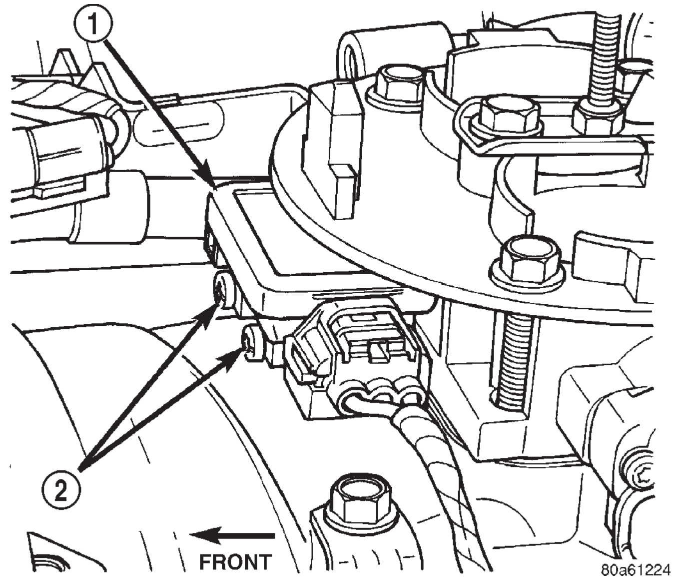


Fig. 44 MAP Sensor Location—3.9/5.2/5.9L Engines

1 – MAP SENSOR
2 – MOUNTING SCREWS (2)

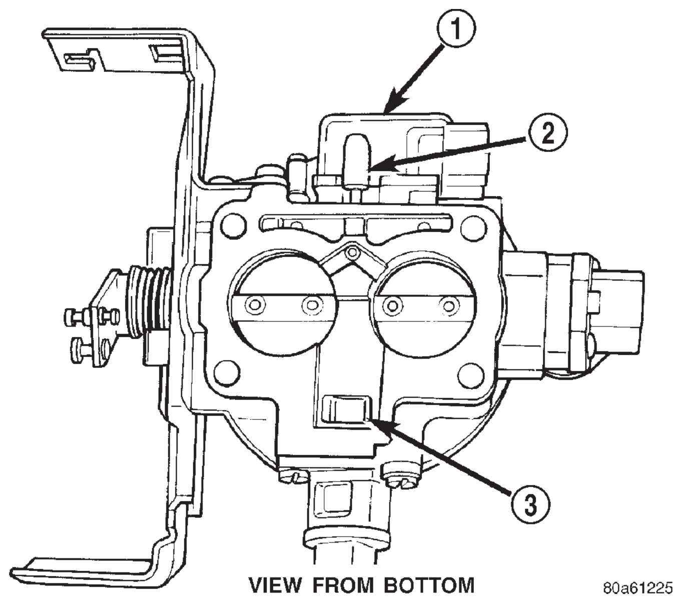


Fig. 45 MAP Sensor L-Shaped Rubber Fitting—3.9/5.2/5.9L Engines

1 – MAP SENSOR
2 – RUBBER FITTING
3 – IDLE AIR PASSAGE

(3) Install MAP sensor mounting bolts (screws). Tighten screws to 3 N·m (25 in. lbs.) torque.
(4) Install air duct at throttle body.

REMOVAL AND INSTALLATION (Continued)

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—4.7L V–8 ENGINE

The MAP sensor is located on the front of the intake manifold (Fig. 46). An o-ring seals the sensor to the intake manifold.

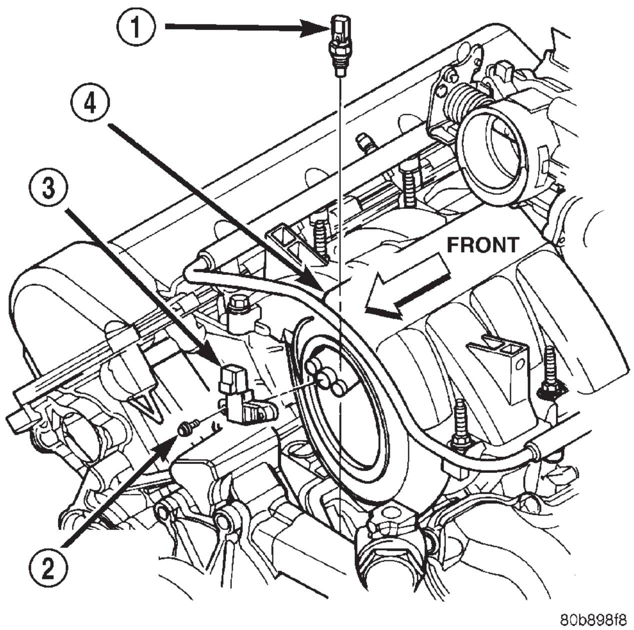


Fig. 46 MAP and ECT Sensor Locations—4.7L V–8 Engine

1 – ECT SENSOR
2 – MOUNTING BOLTS (2)
3 – MAP SENSOR
4 – INTAKE MANIFOLD

REMOVAL

(1) Disconnect electrical connector at sensor.
(2) Clean area around MAP sensor.
(3) Remove 2 sensor mounting bolts (Fig. 46).
(4) Remove MAP sensor from intake manifold.

INSTALLATION

(1) Clean MAP sensor mounting hole at intake manifold.
(2) Check MAP sensor o-ring seal for cuts or tears.
(3) Position sensor into manifold.
(4) Install MAP sensor mounting bolts (screws). Tighten screws to 3 N·m (25 in. lbs.) torque.
(5) Connect electrical connector.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—2.5L ENGINE

The MAP sensor is mounted to the side of the throttle body (Fig. 47). An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 48).

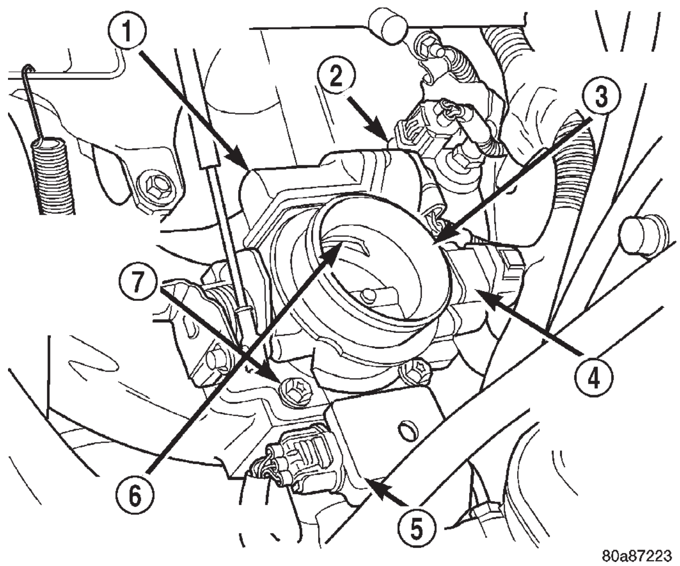


Fig. 47 MAP Sensor Location—2.5L Engine

1 – IDLE AIR CONTROL MOTOR
2 – IAT SENSOR
3 – THROTTLE BODY
4 – THROTTLE POSITION SENSOR
5 – MAP SENSOR
6 – IDLE AIR CONTROL PASSAGE INLET
7 – THROTTLE BODY MOUNTING BOLTS (4)

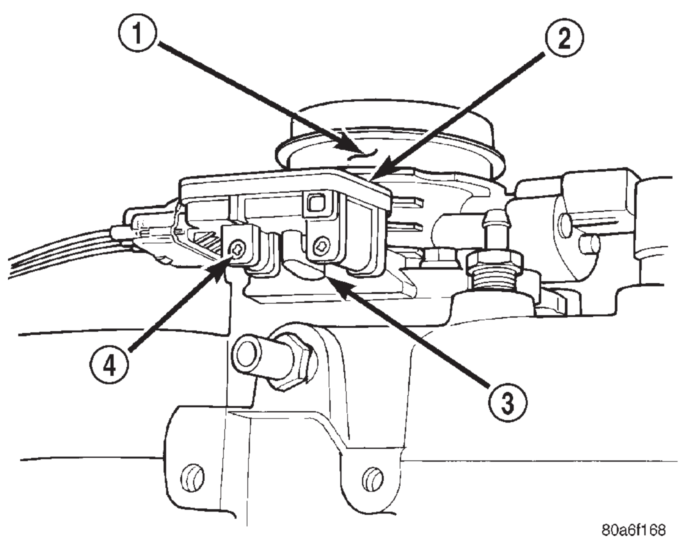


Fig. 48 MAP Sensor Mounting and Rubber Fitting—2.5L Engine

1 – THROTTLE BODY
2 – MAP SENSOR
3 – RUBBER FITTING
4 – MOUNTING SCREWS (2)

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove air duct at throttle body.

(2) Remove electrical connector at sensor.

(3) Remove two MAP sensor mounting bolts (screws) (Fig. 48).

(4) While removing MAP sensor, slide the rubber L-shaped fitting (Fig. 48) from the throttle body.

(5) Remove rubber L-shaped fitting from MAP sensor.

INSTALLATION

(1) Install rubber L-shaped fitting to MAP sensor.

(2) Position sensor to throttle body while guiding rubber fitting over throttle body vacuum nipple.

(3) Install MAP sensor mounting bolts (screws). Tighten screws to 3 N·m (25 in. lbs.) torque.

(4) Install electrical connector at sensor.

(5) Install air duct at throttle body.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is located in the engine compartment (Fig. 49).

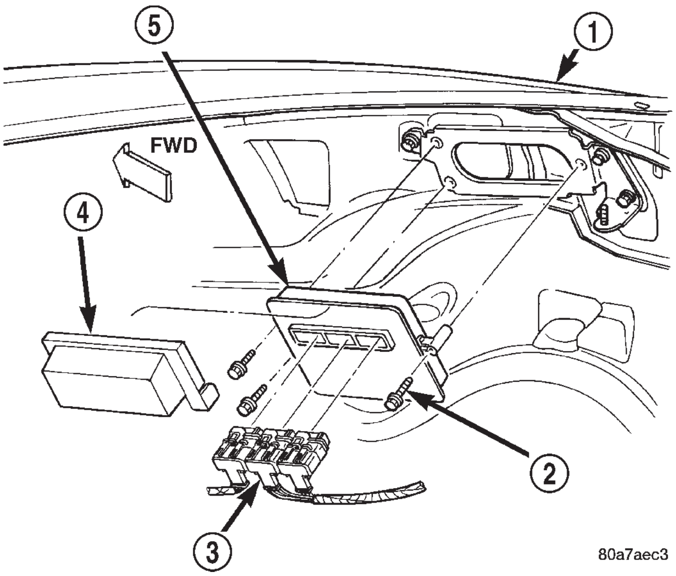


Fig. 49 PCM Location and Mounting

1 – RIGHT FRONT FENDER
2 – PCM MOUNTING BOLTS (3)
3 – 32–WAY CONNECTORS (3)
4 – COVER
5 – POWERTRAIN CONTROL MODULE (PCM)

REMOVAL

To avoid possible voltage spike damage to the PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

(1) Disconnect negative battery cable at battery.

(2) Remove cover over electrical connectors. Cover snaps onto PCM.

(3) Carefully unplug the three 32–way connectors from PCM.

(4) Remove three PCM mounting bolts and remove PCM from vehicle.

INSTALLATION

(1) Install PCM and mounting bolts to vehicle.

(2) Tighten bolts to 3–5 N·m (30–40 in. lbs.).

(3) Check pin connectors in the PCM and the three 32–way connectors for corrosion or damage. Repair as necessary.

(4) Install three 32–way connectors.

(5) Install cover over electrical connectors. Cover snaps onto PCM.

(6) Install battery cable.

(7) Use the DRB scan tool to reprogram new PCM with vehicles original Identification Number (VIN) and original vehicle mileage. If this step is not done, a Diagnostic Trouble Code (DTC) may be set.

OXYGEN SENSOR—EXCEPT 2.5L ENGINE

REMOVAL

Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness. For sensor operation, it must have a comparison source of oxygen from outside the exhaust system. This fresh air is supplied to the sensor through its pigtail wiring harness.

For sensor locations, refer to (Fig. 50), (Fig. 51), (Fig. 52) (Fig. 53) or (Fig. 54).

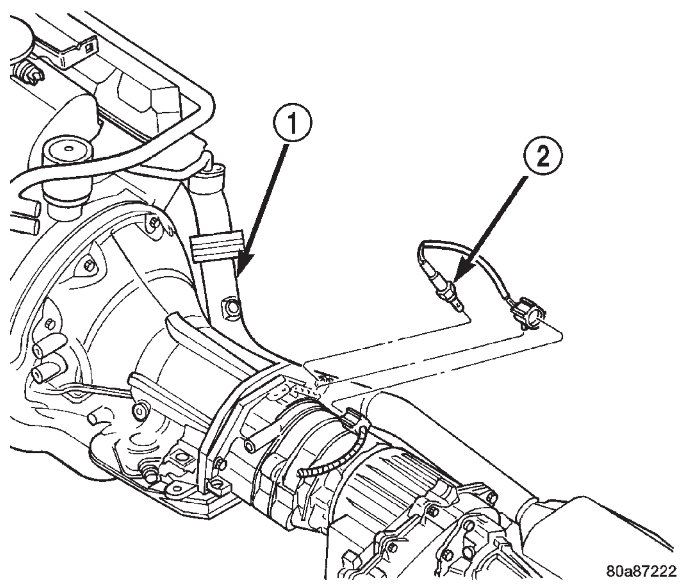


Fig. 50 Upstream Oxygen Sensor Locations—Except 4.7L V-8 Engine

1 – EXHAUST PIPE
2 – UPSTREAM OXYGEN SENSOR

REMOVAL AND INSTALLATION (Continued)

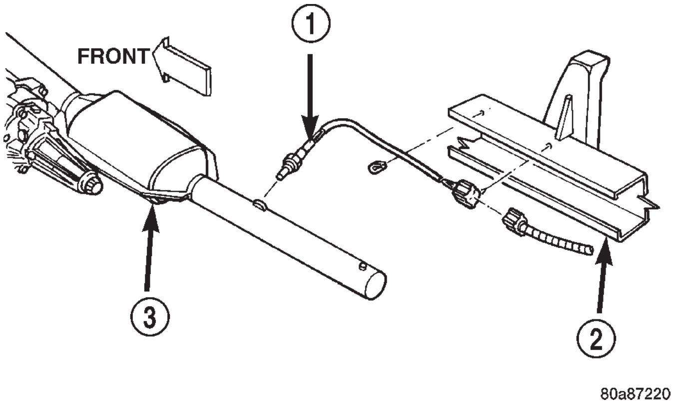


Fig. 51 Downstream Oxygen Sensor Location—Except 4.7L V-8 Engine

1 – DOWNSTREAM OXYGEN SENSOR
2 – FRAME RAIL
3 – CATALYTIC CONVERTER

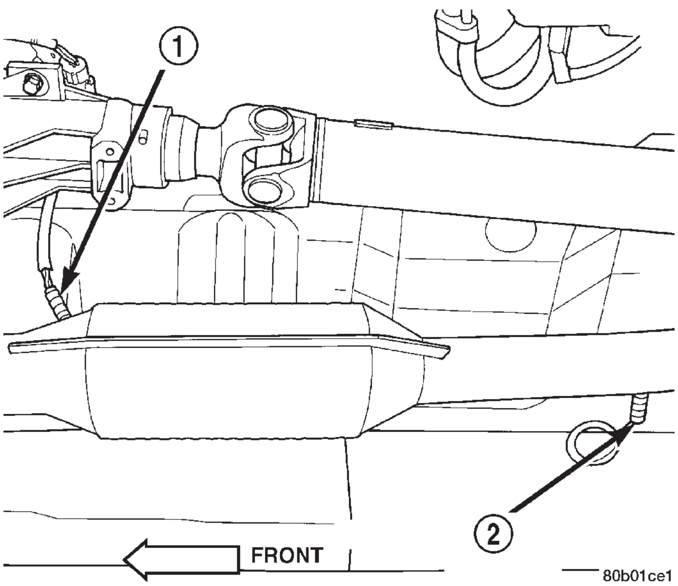


Fig. 52 Pre-Catalyst/Post-Catalyst Oxygen Sensor Locations—Except 4.7L V-8 Engine

1 – PRE-CATALYST OXYGEN SENSOR
2 – POST-CATALYST OXYGEN SENSOR

WARNING: THE EXHAUST MANIFOLD, EXHAUST PIPES AND CATALYTIC CONVERTER BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

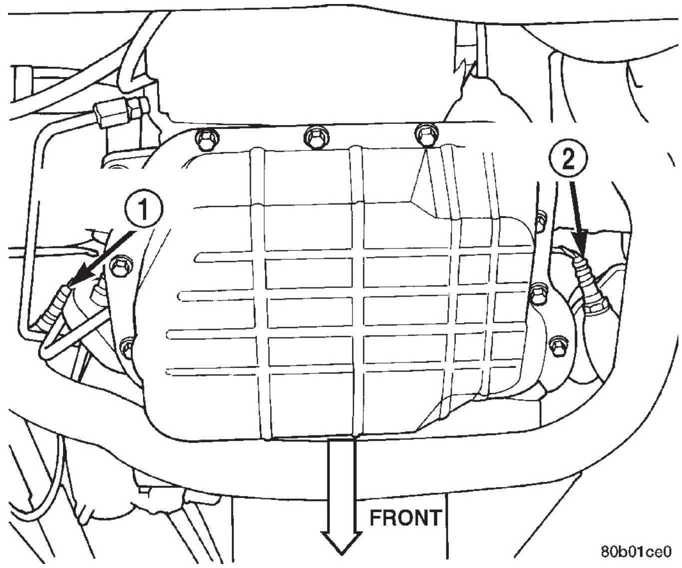


Fig. 53 Left/Right Oxygen Sensor Locations—Except 4.7L V-8 Engine

1 – LEFT OXYGEN SENSOR
2 – RIGHT OXYGEN SENSOR

(1) Raise and support the vehicle.
(2) Disconnect the wire connector from the O2S sensor.

CAUTION: When disconnecting the sensor electrical connector, do not pull directly on wire going into sensor.

(3) Remove the O2S sensor with an oxygen sensor removal and installation tool.

INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT add any additional anti-seize compound to the threads of a new oxygen sensor.**

(1) Install the O2S sensor. Tighten to 30 N·m (22 ft. lbs.) torque.
(2) Connect the O2S sensor wire connector.
(3) Lower the vehicle.

REMOVAL AND INSTALLATION (Continued)

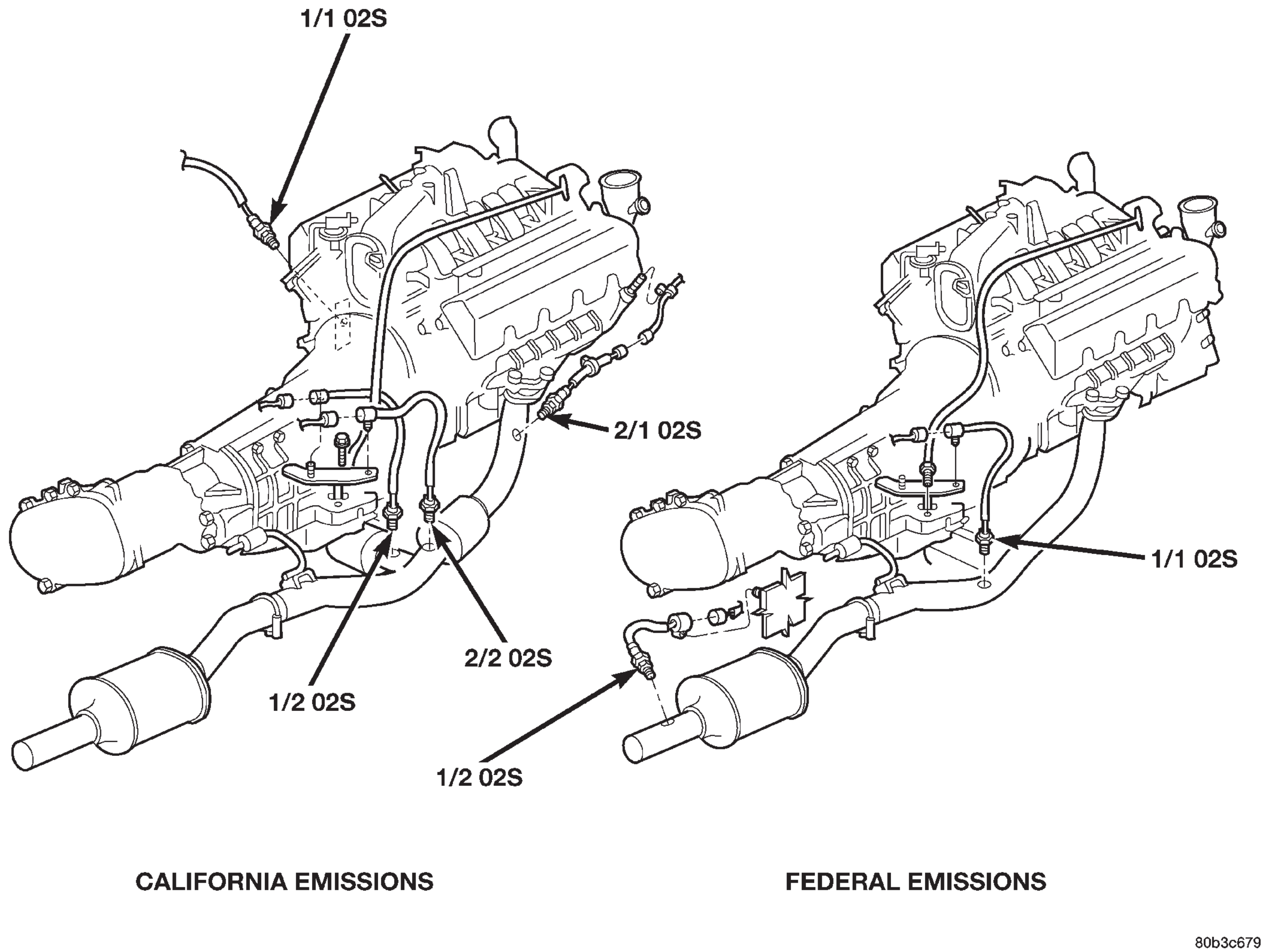


Fig. 54 Oxygen Sensor Locations—4.7L V-8 Engine

OXYGEN SENSOR—2.5L ENGINE

REMOVAL

Never apply any type of grease to the oxygen sensor electrical connector, or attempt any soldering of the sensor wiring harness. For sensor operation, it must have a comparison source of oxygen from outside the exhaust system. This fresh air is supplied to the sensor through its pigtail wiring harness.

The upstream O2S sensor is located in the exhaust downpipe. The downstream sensor is located near outlet end of catalytic converter. Refer to (Fig. 55) or (Fig. 56).

WARNING: THE EXHAUST MANIFOLD, EXHAUST PIPES AND CATALYTIC CONVERTER BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

(1) Raise and support the vehicle.

(2) Disconnect the wire connector from the O2S sensor.

CAUTION: When disconnecting the sensor electrical connector, do not pull directly on wire going into sensor.

(3) Remove the O2S sensor with an oxygen sensor removal and installation tool.

INSTALLATION

Threads of new oxygen sensors are factory coated with anti-seize compound to aid in removal. **DO NOT add any additional anti-seize compound to the threads of a new oxygen sensor.**

(1) Install the O2S sensor. Tighten to 30 N·m (22 ft. lbs.) torque.

(2) Connect the O2S sensor wire connector.

(3) Lower the vehicle.

REMOVAL AND INSTALLATION (Continued)

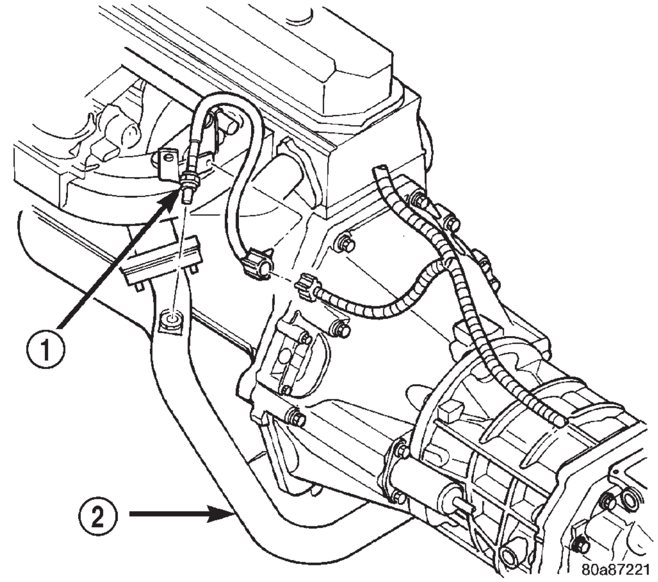


Fig. 55 Upstream Oxygen Sensor Location—2.5L Engine

1 – UPSTREAM OXYGEN SENSOR
2 – EXHAUST PIPE

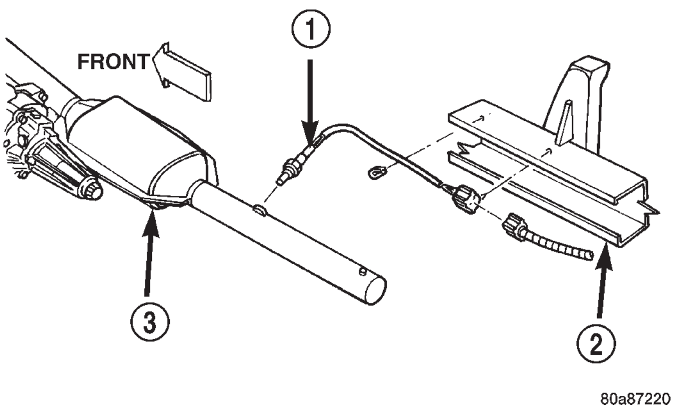


Fig. 56 Downtream Oxygen Sensor Location—2.5L Engine

1 – DOWNSTREAM OXYGEN SENSOR
2 – FRAME RAIL
3 – CATALYTIC CONVERTER

AIR CLEANER ELEMENT (FILTER)

REMOVAL

Housing removal is not necessary for element (filter) replacement.

(1) Pry up spring clips from housing cover (spring clips retain cover to housing).

(2) Release housing cover from locating tabs on housing (Fig. 57) and remove cover.

(3) Remove air cleaner element (filter) from housing.

(4) Clean inside of housing before replacing element.

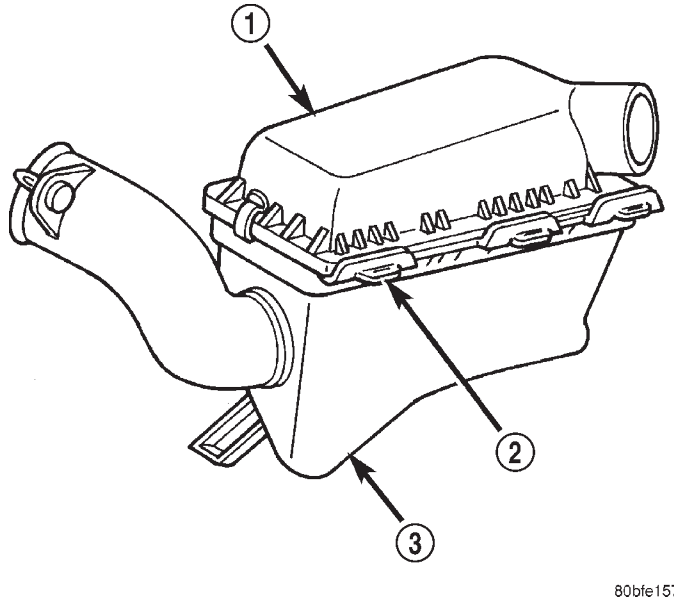


Fig. 57 Air Cleaner Housing Assembly

1 – AIR CLEANER ELEMENT COVER
2 – TABS
3 – HOUSING

INSTALLATION

(1) Install element into housing.

(2) Position housing cover into housing locating tabs.

(3) Pry up spring clips and lock cover to housing.

ENGINE COOLANT TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES

The engine coolant temperature sensor is installed into a water jacket at front of intake manifold near rear of generator (Fig. 58).

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7, COOLING.

(1) Partially drain cooling system. Refer to Group 7, Cooling.

(2) Disconnect electrical connector from sensor (Fig. 58).

REMOVAL AND INSTALLATION (Continued)

(3) **Engines with air conditioning:** When removing the connector from sensor, do not pull directly on wiring harness. Fabricate an L-shaped hook tool from a coat hanger (approximately eight inches long). Place the hook part of tool under the connector for removal. The connector is snapped onto the sensor. It is not equipped with a lock type tab.

(4) Remove sensor from intake manifold.

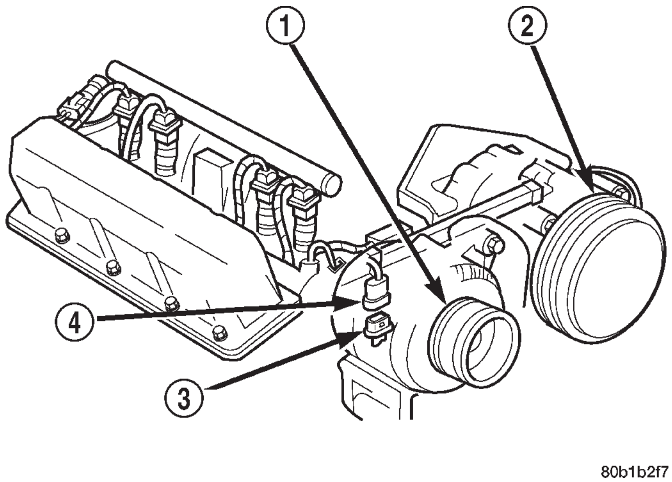


Fig. 58 Engine Coolant Temperature Sensor—3.9/5.2/5.9L Engines—Typical

1 – GENERATOR
2 – A/C COMPRESSOR
3 – ENGINE COOLANT TEMPERATURE SENSOR
4 – ELEC. CONN.

INSTALLATION

(1) Install sensor.

(2) Tighten to 11 N·m (8 ft. lbs.) torque.

(3) Use long needlenose pliers to connect electrical connector to sensor. The sensor connector is symmetrical (not indexed). It can be installed to the sensor in either direction.

(4) Replace any lost engine coolant. Refer to Group 7, Cooling System.

ENGINE COOLANT TEMPERATURE SENSOR—4.7L V-8 ENGINE

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR. REFER TO GROUP 7, COOLING.

The ECT sensor is located near the front of the intake manifold (Fig. 59).

(1) Partially drain cooling system. Refer to Group 7, Cooling.

(2) Disconnect electrical connector from ECT sensor.

(3) Remove sensor from intake manifold.

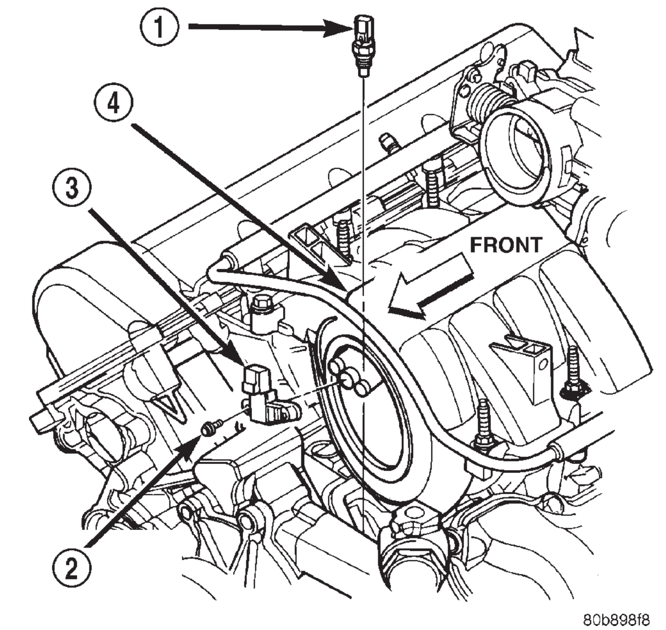


Fig. 59 Engine Coolant Temperature Sensor—4.7L V–8 Engine

1 – ECT SENSOR
2 – MOUNTING BOLTS (2)
3 – MAP SENSOR
4 – INTAKE MANIFOLD

INSTALLATION

(1) Install sensor.

(2) Tighten to 11 N·m (8 ft. lbs.) torque.

(3) Connect electrical connector to sensor.

(4) Replace any lost engine coolant. Refer to Group 7, Cooling System.

ENGINE COOLANT TEMPERATURE SENSOR—2.5L ENGINE

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE COOLANT TEMPERATURE SENSOR. REFER TO GROUP 7, COOLING.

REMOVAL AND INSTALLATION (Continued)

(1) Partially drain cooling system. Refer to Group 7, Cooling.

(2) Disconnect electrical connector from sensor (Fig. 60).

(3) Remove sensor from thermostat housing.

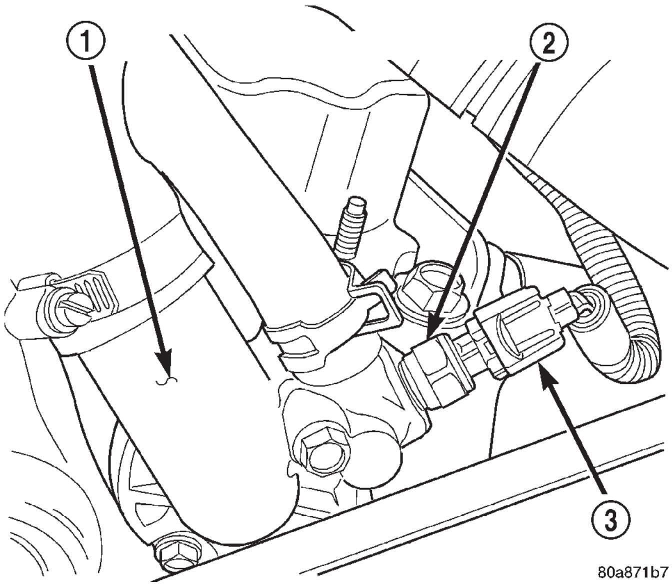


Fig. 60 Engine Coolant Temperature Sensor—2.5L Engines

1 – THERMOSTAT HOUSING
2 – ENGINE COOLANT TEMPERATURE SENSOR
3 – ELECTRICAL CONNECTOR

INSTALLATION

(1) Install sensor.

(2) Tighten to 11 N·m (8 ft. lbs.) torque.

(3) Replace any lost engine coolant. Refer to Group 7, Cooling System.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES

The intake manifold air temperature sensor is located in the front/side of the intake manifold (Fig. 61).

REMOVAL

(1) Remove air duct at throttle body.

(2) Disconnect electrical connector at sensor (Fig. 61).

(3) Remove sensor from intake manifold.

INSTALLATION

(1) Install sensor to intake manifold. Tighten to 28 N·m (20 ft. lbs.) torque.

(2) Install electrical connector.

(3) Install air duct at throttle body.

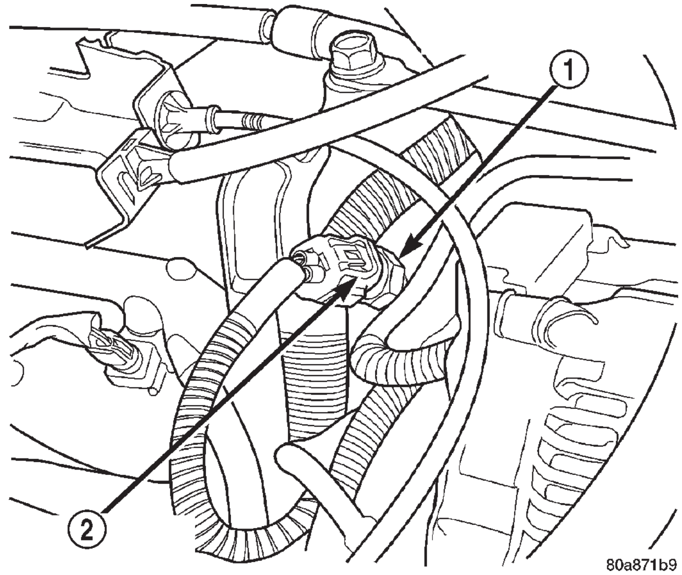


Fig. 61 Intake Manifold Air Temperature Sensor—3.9/5.2/5.9L Engines—Typical

1 – INTAKE MANIFOLD AIR TEMPERATURE SENSOR
2 – ELECTRICAL CONNECTOR

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—4.7L V-8 ENGINE

The Intake Manifold Air Temperature (IAT) sensor is installed into the intake manifold plenum near the left side of the throttle body (Fig. 62).

REMOVAL

(1) Disconnect electrical connector from sensor.

(2) Remove sensor from intake manifold.

INSTALLATION

(1) Install sensor into intake manifold. Tighten sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect electrical connector to sensor.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—2.5L ENGINE

The intake manifold air temperature sensor is located in the intake manifold (Fig. 63).

REMOVAL

(1) Remove air duct at throttle body.

(2) Disconnect electrical connector at sensor (Fig. 63).

(3) Remove sensor from intake manifold.

INSTALLATION

(1) Install sensor to intake manifold. Tighten to 28 N·m (20 ft. lbs.) torque.

(2) Install electrical connector.

(3) Install air duct at throttle body.

REMOVAL AND INSTALLATION (Continued)

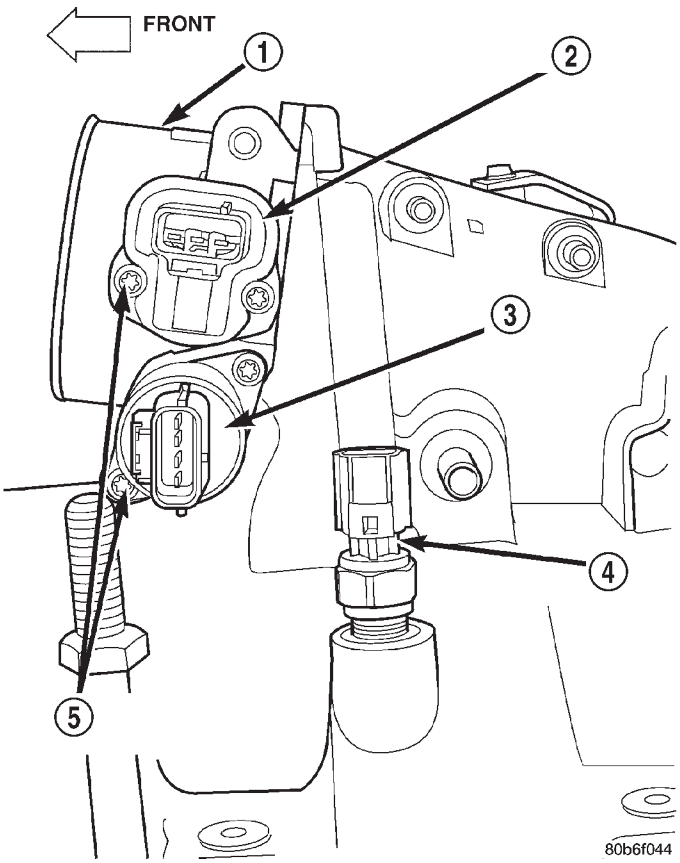


Fig. 62 Intake Manifold Air Sensor Location—4.7L V-8 Engine

1 – THROTTLE BODY
2 – TPS
3 – IAC MOTOR
4 – IAT SENSOR
5 – MOUNTING SCREWS

POWER STEERING PRESSURE SWITCH

This switch is used only with the 2.5L 4–cylinder and 4.7L V-8 engine.

The power steering pressure switch is installed in the power steering high-pressure hose (Fig. 64) or (Fig. 65).

REMOVAL

(1) Disconnect electrical connector from power steering pressure switch.

(2) Place a small container or shop towel beneath switch to collect any excess fluid.

(3) Remove switch. Use back-up wrench on power steering line to prevent line bending.

INSTALLATION

(1) Install power steering switch into power steering line.

(2) Tighten to 14–22 N·m (124–195 in. lbs.) torque.

(3) Connect electrical connector to switch.

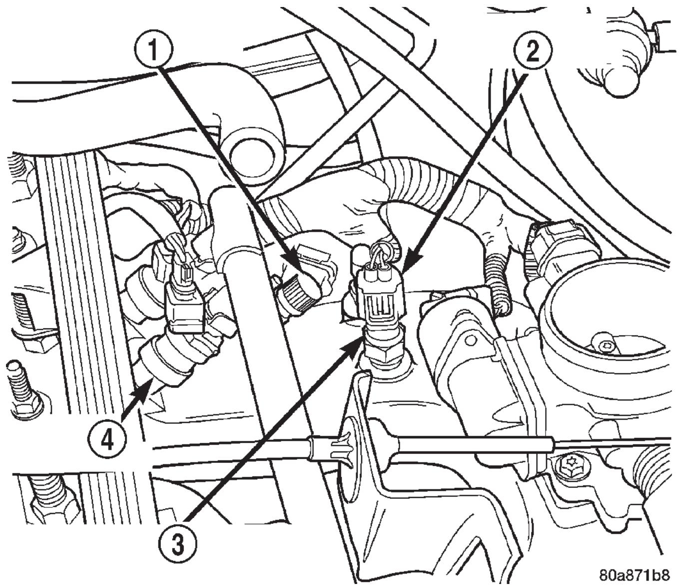


Fig. 63 Intake Manifold Air Temperature Sensor—2.5L Engine

1 – FUEL PRESSURE TEST PORT
2 – ELECTRICAL CONNECTOR
3 – INTAKE MANIFOLD AIR TEMPERATURE SENSOR
4 – FUEL INJECTOR

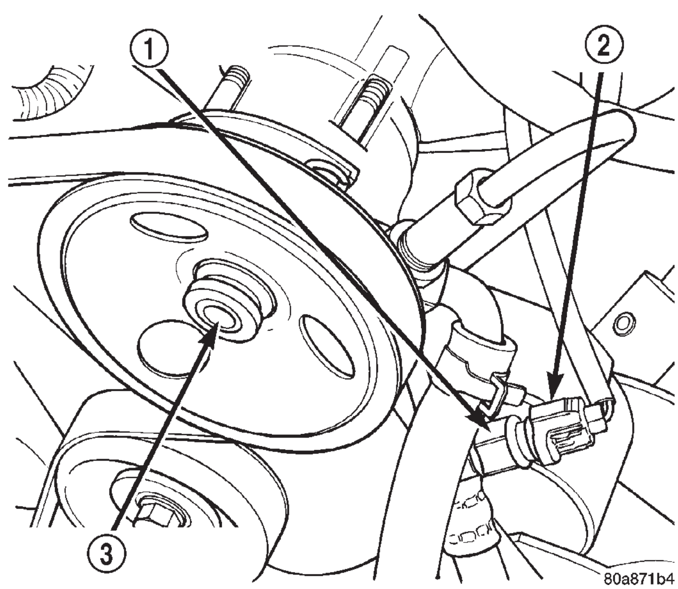


Fig. 64 Power Steering Pressure Switch—2.5L Engine

1 – POWER STEERING PRESSURE SWITCH
2 – ELECTRICAL CONNECTOR
3 – POWER STEERING PUMP

(4) Check power steering fluid and add as necessary.

(5) Start engine and again check power steering fluid. Add fluid if necessary.

REMOVAL AND INSTALLATION (Continued)

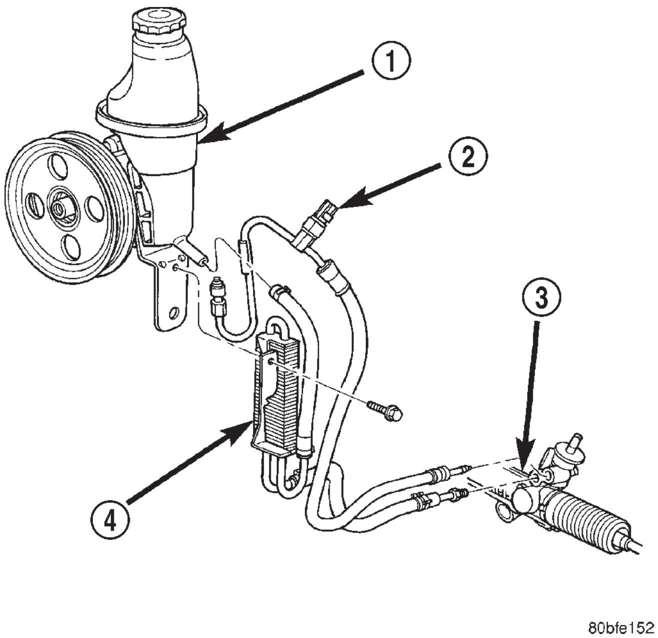


Fig. 65 Power Steering Pressure Switch—4.7L Engine

1 – HYDRAULIC PUMP
2 – POWER STEERING PRESSURE SWITCH
3 – RACK AND PINION GEAR
4 – OIL COOLER

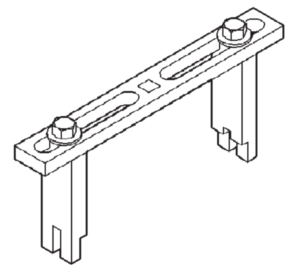
SPECIFICATIONS

TORQUE CHART

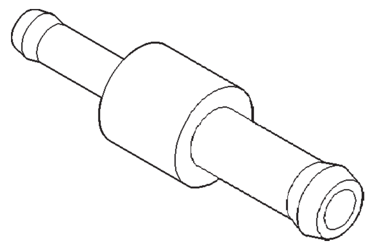
DESCRIPTION	TORQUE
Engine Coolant Temperature Sensor—All Engines	11 N·m (96 in. lbs.)
IAC Motor-To-Throttle Body Bolts	7 N·m (60 in. lbs.)
Intake Manifold Air Temp. Sensor—All Engines	28 N·m (20 ft. lbs.)
MAP Sensor Mounting Screws—All Engines	3 N·m (25 in. lbs.)
Oxygen Sensor—All Engines	30 N·m (22 ft. lbs.)
Power Steering Pressure Switch	14-22 N·m (124–195 in. lbs.)
Powertrain Control Module Mounting Screws	3–5 N·m (30–40 in. lbs.)
Throttle Body Mounting Bolts—2.5L Engine	11 N·m (100 in. lbs.)
Throttle Body Mounting Bolts—3.9L/5.2L Engines	23 N·m (200 in. lbs.)
Throttle Position Sensor Mounting Screws—All Engines	7 N·m (60 in. lbs.)

SPECIAL TOOLS

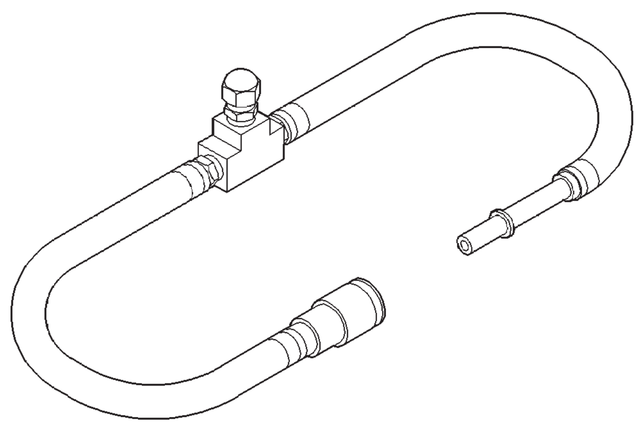
FUEL SYSTEM



Spanner Wrench—6856



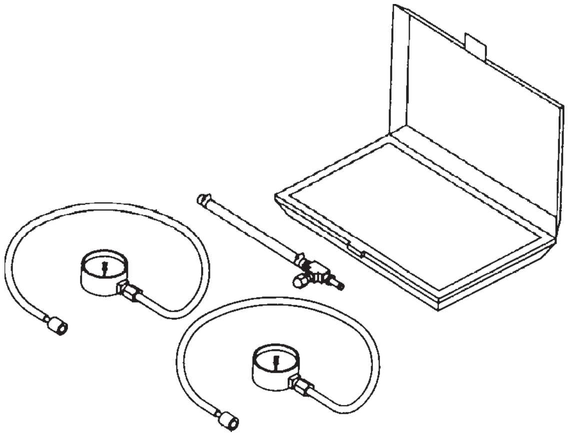
Fitting, Air Metering—6714



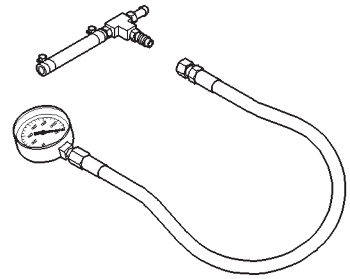
Adapters, Fuel Pressure Test—6539 and/or 6631

O2S (Oxygen Sensor) Remover/Installer—C-4907

SPECIAL TOOLS (Continued)



Test Kit, Fuel Pressure—5069



Test Kit, Fuel Pressure—C-4799-B

Fuel Line Removal Tool—6782

STEERING

TABLE OF CONTENTS

page page

POWER STEERING 1
POWER STEERING PUMP 6
RACK & PINION STEERING GEAR 11
STEERING COLUMN 15

POWER STEERING

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
STEERING SYSTEM 1
DIAGNOSIS AND TESTING
POWER STEERING SYSTEM 2
POWER STEERING FLOW AND PRESSURE 4

DESCRIPTION AND OPERATION

STEERING SYSTEM

DESCRIPTION

Power steering systems consist of:

- Rack and pinion steering gear
- Belt driven hydraulic steering pump
- Pump pressure and return hoses
- Steering Column

OPERATION

The steering column shaft is attached to the gear pinion. The rotation of the pinion moves the gear rack from side-to-side. This lateral action of the rack pushes and pulls the tie rods to change the direction of the front wheels.

Power assist is provided by an engine mounted hydraulic pump, (Fig. 1), (Fig. 2) and (Fig. 3) the pump supplies hydraulic fluid pressure to the steering gear. Some vehicles are equipped with an oil cooler.

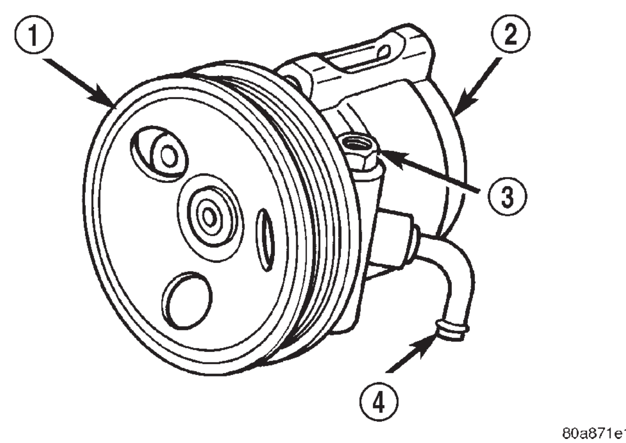


Fig. 1 Steering Pump - 2.5L

1 – DRIVE PULLEY
2 – PUMP BODY
3 – PRESSURE OUTLET
4 – RETURN INLET

DESCRIPTION AND OPERATION (Continued)

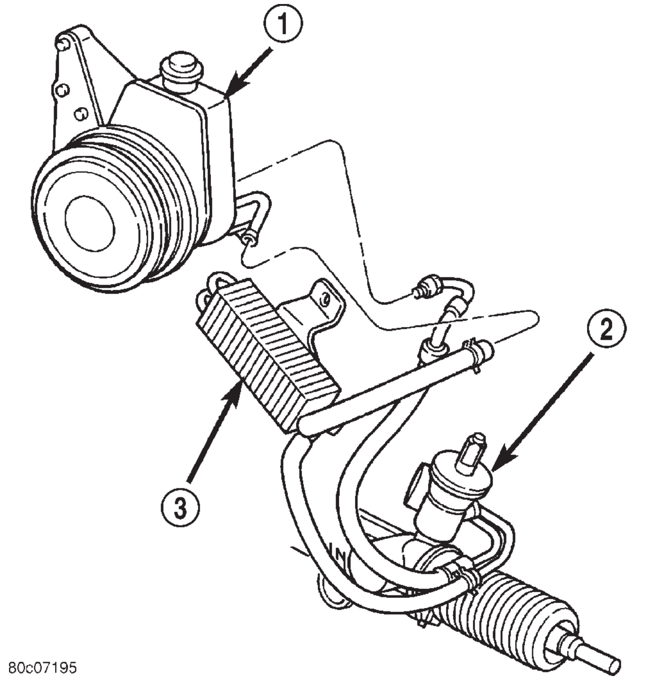


Fig. 2 Steering Pump, Gear And Oil Cooler - 3.9L & 5.9L

1 – HYDRAULIC PUMP
2 – RACK AND PINION GEAR
3 – OIL COOLER

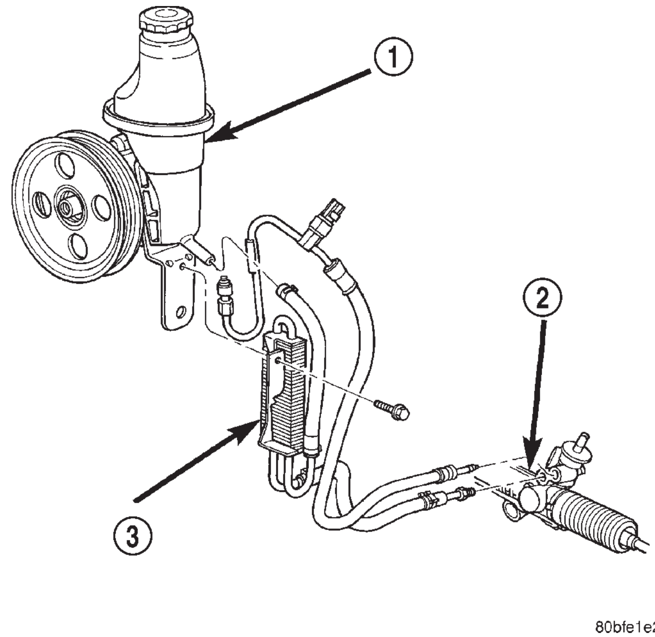


Fig. 3 Steering Pump, Gear And Oil Cooler - 4.7L

1 – HYDRAULIC PUMP
2 – RACK AND PINION GEAR
3 – OIL COOLER

DIAGNOSIS AND TESTING

POWER STEERING SYSTEM

STEERING NOISE

There is some noise in all power steering systems. One of the most common is a hissing sound evident at a standstill parking. Or when the steering wheel is at the end of it's travel. Hiss is a high frequency noise similar to that of a water tap being closed slowly. The noise is present in all valves that have a high velocity fluid passing through an orifice. There is no relationship between this noise and steering performance.

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Steering intermediate shaft to dash panel seal.	1. Check and repair seal at dash panel.
	2. Noisy valve in power steering gear.	2. Replace steering gear.
RATTLE OR CLUNK	1. Gear mounting bolts loose.	1. Tighten bolts to specification.
	2. Loose or damaged suspension components.	2. Inspect and repair suspension.
	3. Internal gear noise.	3. Replace steering gear.
	4. Pressure hose in contact with other components.	4. Reposition hose.
	5. Loose or damaged intermediate shaft or column.	5. Inspect and repair or replace.
CHIRP OR SQUEAL	1. Loose belt.	1. Adjust or replace.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
WHINE OR GROWL	1. Low fluid level.	1. Fill to proper level.
	2. Pressure hose in contact with other components.	2. Reposition hose.
	3. Internal pump noise.	3. Replace pump.
SUCKING AIR SOUND	1. Loose return line clamp.	1. Replace clamp.
	2. O-ring missing or damaged on hose fitting.	2. Replace o-ring.
	3. Low fluid level.	3. Fill to proper level.
	4. Air leak between pump and reservoir.	4. Repair as necessary.
	5. Reservoir cap not installed correctly.	5. Install reservoir cap correctly.
SCRUBBING OR KNOCKING	1. Wrong tire size.	1. Verify tire size.
	2. Wrong gear.	2. Verify gear.

BINDING AND STICKING

CONDITION	POSSIBLE CAUSE	CORRECTION
DIFFICULT TO TURN WHEEL STICKS OR BINDS	1. Low fluid level.	1. Fill to proper level.
	2. Tire pressure.	2. Adjust tire pressure.
	3. Steering components (ball joints/tie rod ends).	3 Inspect and repair as necessary.
	4. Loose belt.	4. Adjust or replace.
	5. Low pump pressure.	5. Pressure test and replace if necessary.
	6. Column shaft coupler binding.	6. Replace coupler.
	7. Steering gear worn.	7. Replace gear.

INSUFFICIENT ASST. OR POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSE	CORRECTION
HARD TURNING OR MOMENTARY INCREASE IN TURNING EFFORT	1. Tire pressure.	1. Adjust tire pressure.
	2. Low fluid level.	2. Fill to proper level.
	3. Loose belt.	3. Adjust or replace.
	4. Low pump pressure.	4. Pressure test and repair as necessary.
	5. Internal gear leak.	5. Replace gear.
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Tire pressure.	1. Adjust tire pressure.
	2. Wheel alignment.	2. Align front end.
	3. Lack of lubrication.	3. Inspect and lubricate suspension compnents.
	4. High friction in steering gear.	4. Replace gear.

DIAGNOSIS AND TESTING (Continued)

LOOSE STEERING AND VEHICLE LEAD

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE PLAY IN STEERING WHEEL	1. Worn or loose suspension or steering components.	1. Inspect and repair as necessary.
	2. Worn or loose wheel bearings.	2. Inspect and repair or adjust bearings.
	3. Steering gear mounting.	3. Tighten gear mounting bolts to specification.
	4. Gear out of adjustment.	4. Replace gear.
	5. Worn or loose steering coupler.	5. Inspect and replace as necessary.
VEHICLE PULLS OR LEADS TO ONE SIDE.	1. Tire Pressure.	1. Adjust tire pressure.
	2. Radial tire lead.	2. Rotate tires.
	3. Brakes dragging.	3. Repair as necessary.
	4. Wheel alignment.	4. Align front end.

POWER STEERING FLOW AND PRESSURE

The following procedure is used to test the operation of the power steering system on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with the maximum relief pressure. Perform test any time a power steering system problem is present. This test will determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Analyzer Tool kit 6815 (Fig. 4) and (Fig. 5) Adapter Kit 6893.

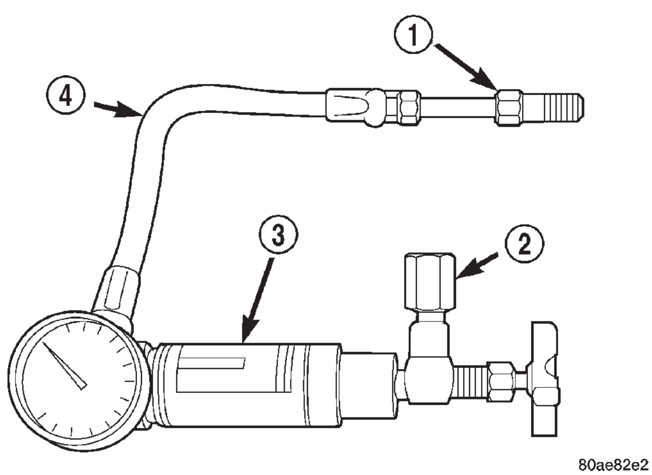


Fig. 4 Analyzer With Tube And Adapter For 2.5L & 4.7L

1 – TUBE
2 – ADAPTER FITTINGS
3 – ANALYZER
4 – GAUGE HOSE

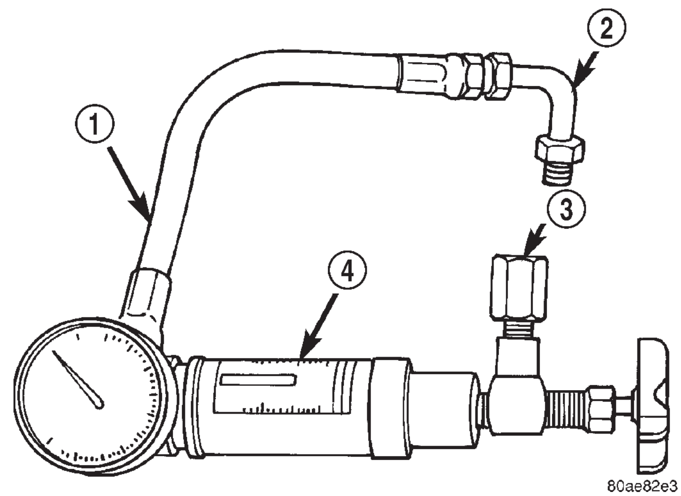


Fig. 5 Analyzer With Tube and Adapter For 3.9L & 5.9L

1 – GAUGE HOSE
2 – TUBE
3 – ADAPTER FITTINGS
4 – ANALYZER

FLOW AND PRESSURE TEST

(1) Check the power steering belt to ensure it is in good condition and adjusted properly.

(2) Connect pressure gauge hose from the Power Steering Analyzer to Tube 6865 for 2.5L engines or 6844 for 3.9L, 5.2L and 5.9L engines.

(3) Connect Adapter 6826 to Power Steering Analyzer test valve end.

(4) Disconnect the high pressure hose from the power steering pump.

(5) Connect the tube to the pump hose fitting.

(6) Connect the power steering hose from the steering gear to the adapter.

(7) Open the test valve completely.

DIAGNOSIS AND TESTING (Continued)

(8) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test gauge and to get air out of the fluid. Then shut off engine.

(9) Check fluid level, add fluid as necessary. Start engine again and let idle.

(10) Gauge should read below 862 kPa (125 psi), if above, inspect the hoses for restrictions and repair as necessary. The initial pressure reading should be in the range of 345-552 kPa (50-80 psi).

(11) Increase the engine speed to 1500 RPM and read the flow meter. If the flow rate (GPM) is below specification, (refer to pump specification chart for GPM) the pump should be replaced.

CAUTION: The following test procedure involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than three seconds as the pump could be damaged.

(12) Close valve fully three times and record highest pressure indicated each time. **All three readings must be above specifications and within 345 kPa (50 psi) of each other.**

- Pressures above specifications but not within 345 kPa (50 psi) of each other, replace pump.
- Pressures within 345 kPa (50 psi) of each other but below specifications, replace pump.

(13) Open the test valve and turn the steering wheel to the extreme left and right positions three times against the stops. Record the highest pressure reading at each position. Compare readings to the pump specifications chart. If pressures readings are not within 50 psi of each other, the gear is leaking internally and must be replaced.

CAUTION: Do not force the pump to operate against the stops for more than 2 to 3 seconds at a time because, pump damage will result.

PUMP SPECIFICATION

ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM) AT 1500 RPM
2.5L	8618 kPa (1250 psi)	1.9 - 2.3
3.9L	9997 kPa (1500 psi)	2.4 - 2.8
4.7L	9997 kPa (1450 psi)	2.4 - 2.8
5.9L	9997 kPa (1500 psi)	2.4 - 2.8

POWER STEERING PUMP

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
POWER STEERING PUMP 6
DIAGNOSIS AND TESTING
PUMP LEAKAGE 7
SERVICE PROCEDURES
POWER STEERING PUMP - INITIAL OPERATION 7
REMOVAL AND INSTALLATION
POWER STEERING PUMP - 2.5L. 7
PUMP RESERVOIR - 2.5L ENGINE 8
POWER STEERING PUMP - 3.9L & 5.9L ENGINES 8
POWER STEERING PUMP - 4.7L. 9
DISASSEMBLY AND ASSEMBLY
PUMP PULLEY 9
SPECIFICATIONS
TORQUE CHART 10
SPECIAL TOOLS
POWER STEERING PUMP 10

DESCRIPTION AND OPERATION

POWER STEERING PUMP

DESCRIPTION

The power steering pumps are constant flow rate and displacement, vane type pumps. The pump shaft has a pressed-on pulley that is belt driven by the crankshaft pulley.

Trailer tow option vehicles are equipped with a power steering pump oil cooler. The oil cooler is mounted to the radiator support on 2.5L. On 3.9L and 5.9L the oil cooler is mounted to the engine block. On the 4.7L the oil cooler is mounted to the power steering pump.

NOTE: Power steering pumps are not interchangeable with pumps installed on other vehicles.

OPERATION

Hydraulic pressure is provided for the power steering gear by the belt driven power steering pump (Fig. 1), (Fig. 2) and (Fig. 3). The pump is connected to the steering gear via the pressure hose and the return hose.

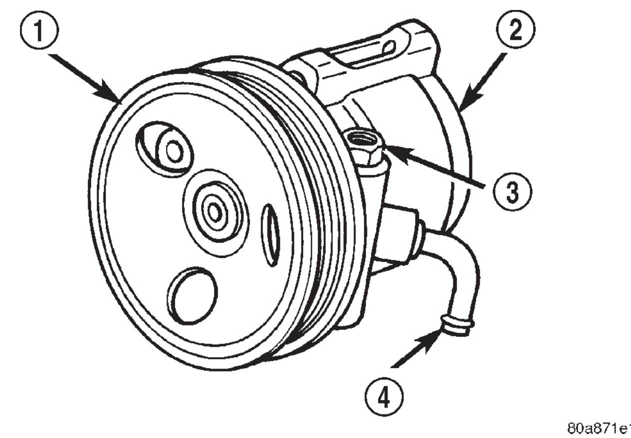


Fig. 1 Steering Pump - 2.5L

1 – DRIVE PULLEY
2 – PUMP BODY
3 – PRESSURE OUTLET
4 – RETURN INLET

DESCRIPTION AND OPERATION (Continued)

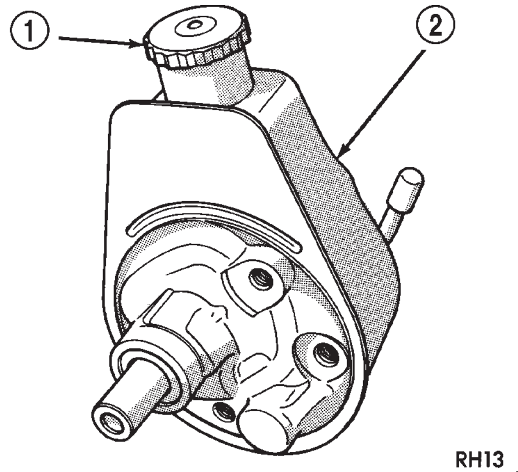


Fig. 2 Power Steering Pump - 3.9L & 5.9L

1 – RESERVOIR CAP AND DIPSTICK
2 – RESERVOIR

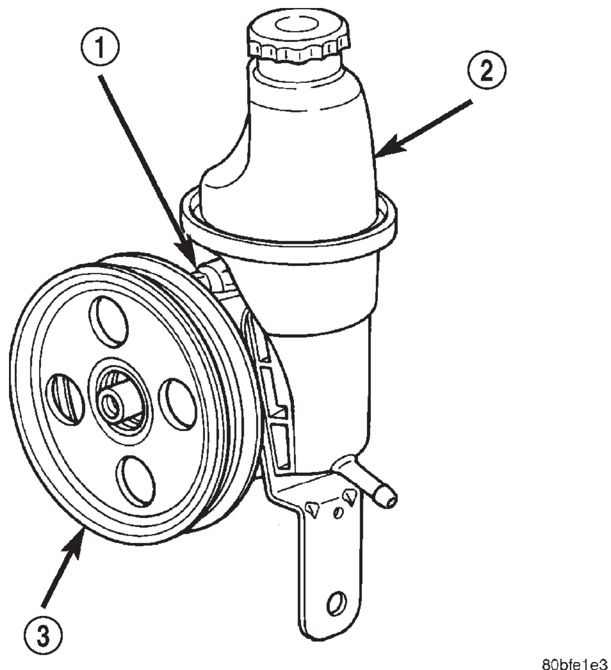


Fig. 3 Power Steering Pump - 4.7L

1 – PUMP
2 – RESERVOIR
3 – PULLEY

DIAGNOSIS AND TESTING

PUMP LEAKAGE

The pump is serviced as an assembly and should not be disassembled. Plastic pump reservoirs can be replace and the reservoir O-ring.

Check for leaks in the following areas:

- Pump shaft seal behind the pulley
- Pump to reservoir O-ring
- Reservoir cap
- Pressure and return lines
- Flow control valve fitting

SERVICE PROCEDURES

POWER STEERING PUMP - INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: Use MOPAR Power Steering Fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal temperature.

(1) Turn steering wheel all the way to the left

(2) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(3) Raise the front wheels off the ground.

(4) Slowly turn the steering wheel lock-to-lock 20 times with the engine off while checking the fluid level.

NOTE: Vehicles with long return lines or oil coolers turn wheel 40 times.

(5) Start the engine. With the engine idling maintain the fluid level.

(6) Lower the front wheels and let the engine idle for two minutes.

(7) Turn the steering wheel in both direction and verify power assist and quiet operation of the pump.

If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

REMOVAL AND INSTALLATION

POWER STEERING PUMP - 2.5L

REMOVAL

(1) Remove pump drive belt, refer to Group 7 Cooling.

(2) Place a drain pan under the power steering pump.

(3) Disconnect the hoses from the power steering pump. Cap hose open ends to prevent entry of foreign material.

(4) Remove pump mounting bolts (Fig. 4).

(5) Loosen the pump bracket bolts and remove the pump.

REMOVAL AND INSTALLATION (Continued)

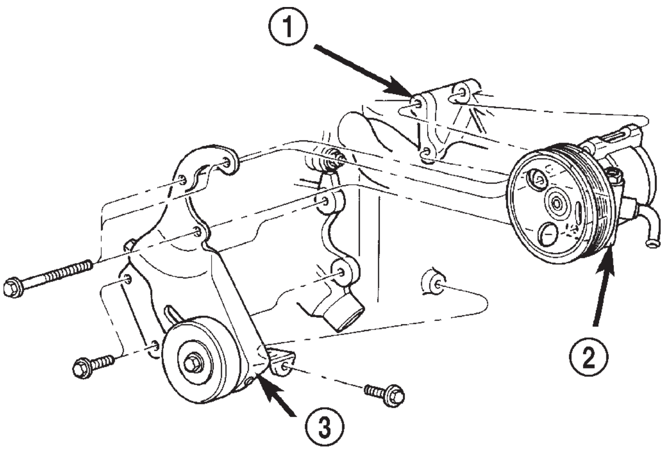


Fig. 4 Pump Mounting - 2.5L

1 – INTAKE MANIFOLD
2 – PUMP ASSEMBLY 2.5L
3 – PUMP BRACKET

INSTALLATION

(1) If removed, attach the front mounting bracket to the pump.

(2) Position the pump in the rear mounting bracket. Install the retaining bolts/nuts and tighten to 28 N·m (21 ft. lbs.).

(3) Install front bracket-to-engine bolts and tighten to 28 N·m (21 ft. lbs.).

(4) Connect fluid hoses to pump.

(5) Install and adjust drive belt, refer to Group 7 Cooling.

(6) Fill reservoir with power steering fluid, refer to Power Steering Pump-Initial Operation.

PUMP RESERVOIR - 2.5L ENGINE

REMOVAL

(1) Place drain pan under the reservoir and remove reservoir hoses.

(2) Remove mounting screws and remove the reservoir (Fig. 5).

INSTALLATION

(1) Install reservoir on mounting bracket and tighten screws to 5 N·m (40 in. lbs.).

(2) Install hoses and clamps.

(3) Fill reservoir to correct level.

POWER STEERING PUMP - 3.9L & 5.9L ENGINES

REMOVAL

(1) Remove the serpentine drive belt, refer to Group 7 Cooling.

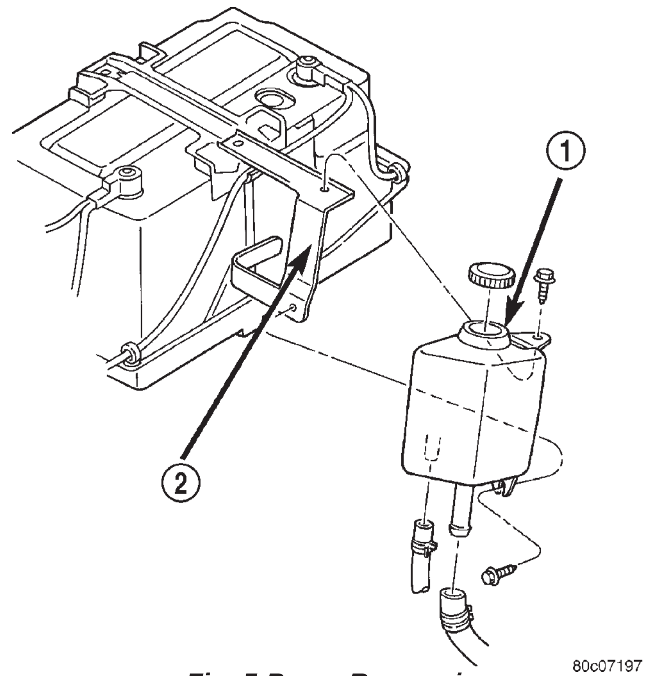


Fig. 5 Pump Reservoir

1 – RESERVOIR
2 – RESERVOIR BRACKET

(2) Clamp the fluid return hose and disconnect the hoses from the power steering pump. Cap the fittings.

(3) Remove battery ground cable and bracket bolts.

(4) Remove the pump assembly (Fig. 6).

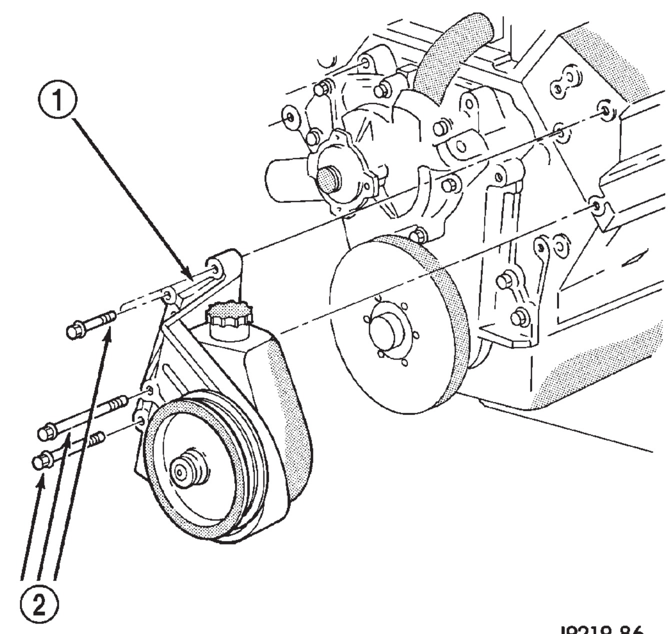


Fig. 6 Pump Assembly

1 – PUMP ASSEMBLY
2 – BOLTS

REMOVAL AND INSTALLATION (Continued)

(5) Remove the pump pulley, refer to Pump Pulley Removal. This will allow access to the pump attaching screws.

(6) Remove the pump bracket bolts (Fig. 7) and remove the bracket.

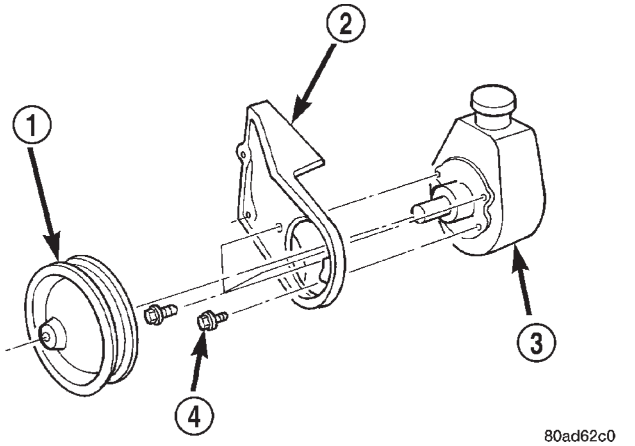


Fig. 7 Pump Mounting Bracket

1 – PULLEY
2 – PUMP BRACKET
3 – STEERING PUMP
4 – BOLT

INSTALLATION

(1) Install the bracket on the pump and tighten bolts to 41 N·m (30 ft. lbs.).

(2) Install the pump pulley, refer to Pump Pulley Installation.

(3) Install pump assembly on the engine block and tighten the bolts to 41 N·m (30 ft. lbs.).

(4) Install the battery ground wire and tighten nut to 41 N·m (30 ft. lbs.).

(5) Connect the fluid hoses to the pump.

(6) Install the serpentine drive belt refer to Group 7 Cooling.

(7) Fill the reservoir with power steering fluid, refer to Power Steering Pump Initial–Operation.

POWER STEERING PUMP - 4.7L

REMOVAL

(1) Remove the serpentine drive belt, refer to Group 7 Cooling.

(2) Remove return hose from the pump reservoir and drain the pump.

(3) Remove power steering pressure switch connector and remove pressure line from the bottom of the pump.

(4) Remove the oil cooler mounting bolt from the pump bracket if equipped.

(5) Remove 3 pump mounting bolts (Fig. 8) through pulley access holes.

(6) Remove the pump from the left cylinder head.

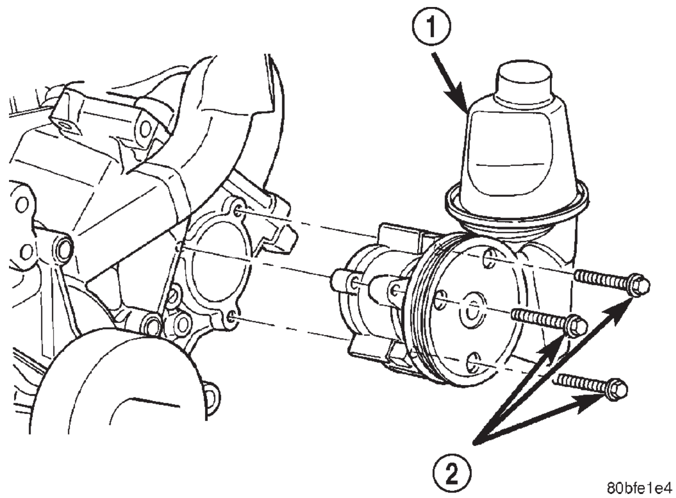


Fig. 8 Power Steering Pump - 4.7L

1 – PUMP
2 – MOUNTING BOLTS

INSTALLATION

(1) Align the pump with the mounting holes in the left cylinder head.

(2) Install 3 pump mounting bolts through the pulley access holes. Tighten the bolts to 28 N·m (21 ft. lbs.).

(3) Install the oil cooler to the pump bracket if equipped. Install the oil cooler mounting bolt.

(4) Install the pressure line and return hose to the pump. Tighten the pressure line to 35 N·m (25 ft. lbs.).

(5) Install power steering pressure switch connector.

(6) Install the serpentine drive belt, refer to Group 7 Cooling.

(7) Fill the power steering pump and perform Power Steering Pump Initial Operation.

DISASSEMBLY AND ASSEMBLY

PUMP PULLEY

DISASSEMBLY

(1) Remove pump assembly.

(2) Remove pulley from pump with Puller C-4333 (Fig. 9).

ASSEMBLY

(1) Replace pulley if bent, cracked, or loose.

(2) Install pulley on pump with Installer C-4063-B (Fig. 10) flush with the end of the shaft. Ensure the tool and pulley remain aligned with the pump shaft.

(3) Install pump assembly.

(4) With Serpentine Belts; Run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If

DISASSEMBLY AND ASSEMBLY (Continued)

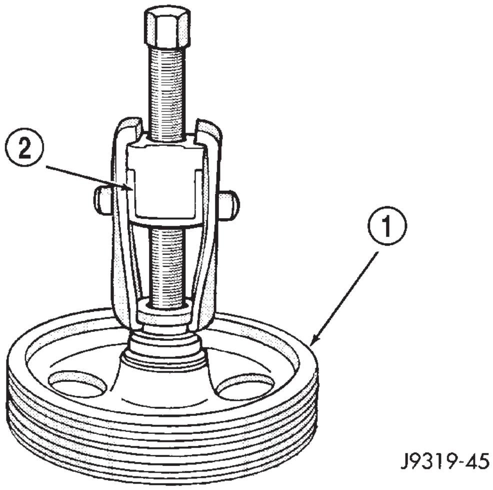


Fig. 9 Pulley Removal

1 – POWER STEERING PUMP DRIVE PULLEY
2 – SPECIAL TOOL C-4333

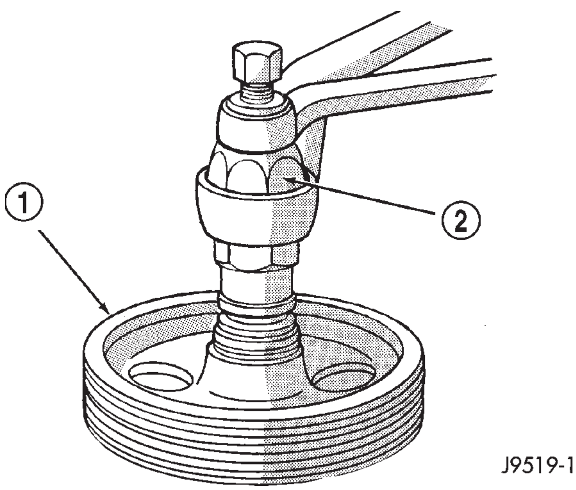


Fig. 10 Pulley Installation

1 – POWER STEERING PUMP DRIVE PULLEY
2 – SPECIAL TOOL C-4063–B

noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**

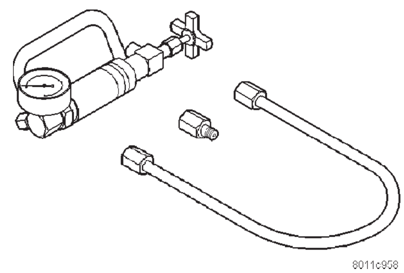
SPECIFICATIONS

TORQUE CHART

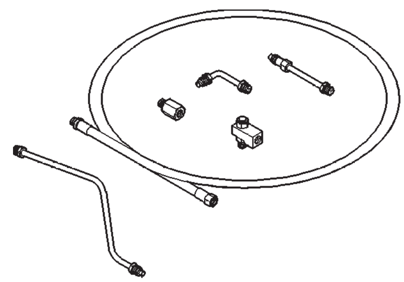
DESCRIPTION	TORQUE
3.9L/5.9L Power Steering Pump	
Pump Bracket Bolts	41 N·m (30 ft. lbs.)
Pump Mounting Bolts	41 N·m (30 ft. lbs.)
Flow Control Valve	75 N·m (55 ft. lbs.)
Pressure Line	35 N·m (25 ft. lbs.)
4.7L Power Steering Pump	
Pump Mounting Bolts	28 N·m (21 ft. lbs.)
Flow Control Valve	81 N·m (60 ft. lbs.)
Pressure Line	35 N·m (25 ft. lbs.)
2.5L Power Steering Pump	
Pump Mounting Bolts	28 N·m (21 ft. lbs.)
Flow Control Valve	75 N·m (55 ft. lbs.)
Pressure Line	35 N·m (25 ft. lbs.)

SPECIAL TOOLS

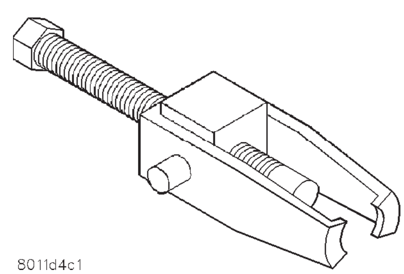
POWER STEERING PUMP



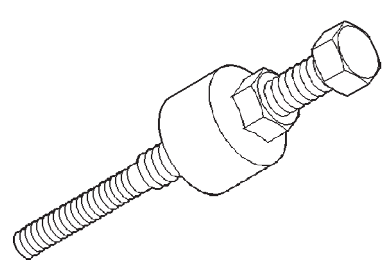
Analyzer Set, Power Steering Flow/Pressure 6815



Adapters, Power Steering Flow/Pressure Tester 6893



Puller C-4333



Installer, Power Steering Pulley C-4063–B

RACK & PINION STEERING GEAR

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
RACK & PINION STEERING GEAR 11
REMOVAL AND INSTALLATION
TIE ROD END 11
RACK & PINION STEERING GEAR - 4x2 12
RACK & PINION STEERING GEAR - 4x4 13

page

DISASSEMBLY AND ASSEMBLY
BOOT SEAL. 14
SPECIFICATIONS
TORQUE CHART 14
SPECIAL TOOLS
RACK & PINION STEERING GEAR 14

DESCRIPTION AND OPERATION

RACK & PINION STEERING GEAR

DESCRIPTION

A rack and pinion steering gears (Fig. 1) is made up of two main components, the pinon shaft and the rack. The gear cannot be adjusted or internally serviced. If a malfunction or a fluid leak occurs, the gear must be replaced as an assembly. If a boot seal becomes damaged, the steering gear must be removed to replace the boot seal.

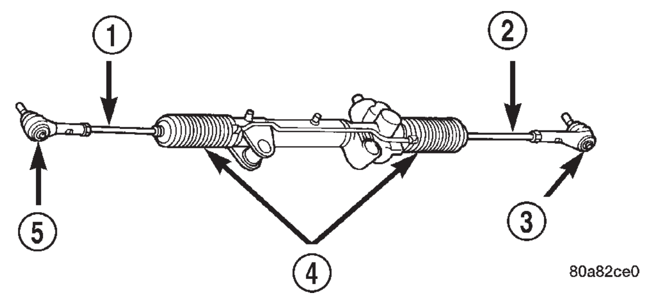


Fig. 1 Rack & Pinion Steering Gear

1 – TIE ROD
2 – TIE ROD
3 – TIE ROD END
4 – BOOTS
5 – TIE ROD END

OPERATION

The steering column shaft is attached to the gear pinion. The rotation of the pinion moves the gear rack from side-to-side. This lateral action of the rack pushes and pulls the tie rods to change the direction of the front wheels.

REMOVAL AND INSTALLATION

TIE ROD END

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the nut from the tie rod end.
(3) Separate the tie rod end from the steering knuckle with Puller C-3894-A.
(4) Loosen the jam nut (Fig. 2) and unthread the tie rod end.

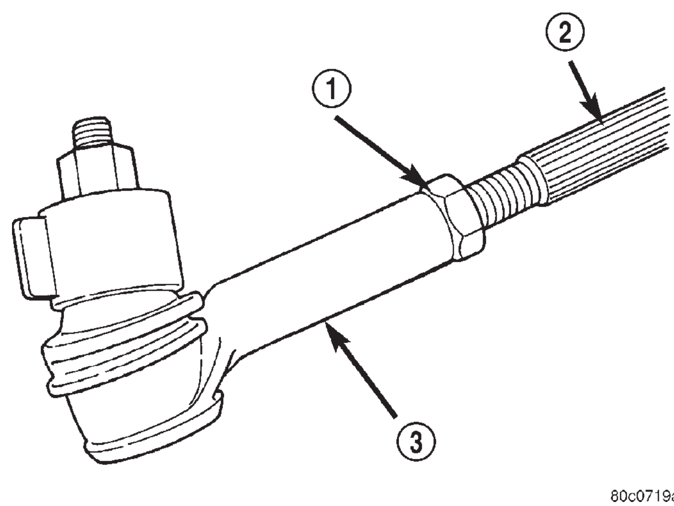


Fig. 2 Tie Rod End

1 – JAM NUT
2 – TIE ROD
3 – TIE ROD END

INSTALLATION

(1) Thread the tie rod end onto the tie rod.
(2) Clean the tie rod end stud and knuckle taper.
(3) Install the tie rod end stud into the steering knuckle and tighten the nut to 108 N·m (80 ft. lbs.).
(4) Tighten the jam nut to 75 N·m (55 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

NOTE: Do not twist boot while tighten the jam nut.

(5) Remove support and lower vehicle.

(6) Adjust the wheel toe position, Refer to Group 2 Suspension.

RACK & PINION STEERING GEAR - 4x2

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the nuts from the tie rod ends.

(3) Separate tie rod ends from the knuckles with Puller C-3894-A (Fig. 3).

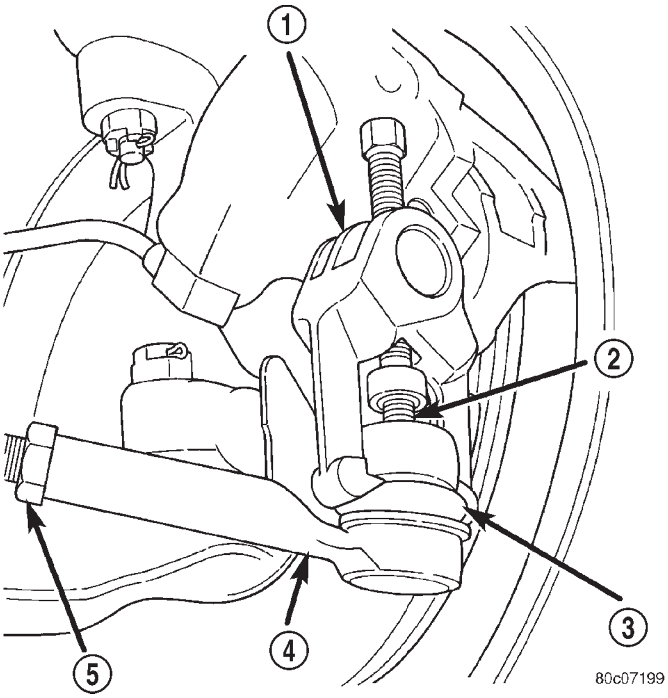


Fig. 3 Tie Rod End Puller

1 – TOOL C—3894—A
2 – BALL STUD
3 – SEAL
4 – TIE—ROD END
5 – LOCKNUT

(4) Remove the power steering lines from the gear.

(5) Remove the lower coupler bolt and slide the coupler off the gear (Fig. 4).

(6) Remove the mounting bolts from the gear to the front crossmember and remove the gear (Fig. 5).

INSTALLATION

NOTE: Before installing gear inspect bushings and replace if worn or damaged.

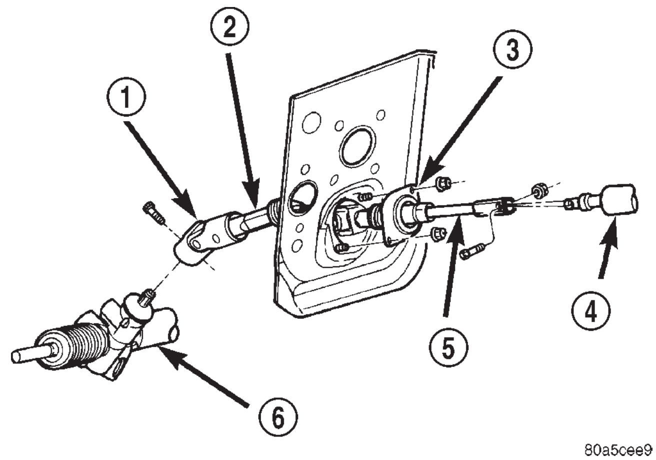


Fig. 4 Gear Coupler

1 – COUPLER
2 – LOWER SHAFT
3 – TOE PLATE
4 – STEERING COLUMN
5 – UPPER SHAFT
6 – RACK AND PINION STEERING GEAR

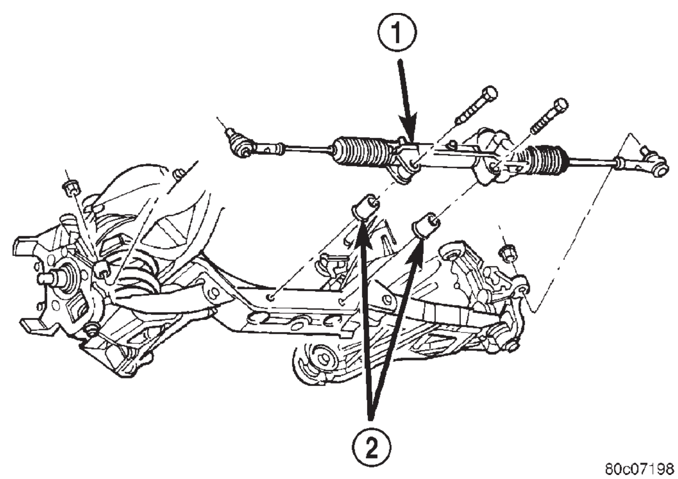


Fig. 5 Rack & Pinion Steering Gear - 4x2

1 – RACK AND PINION STEERING GEAR
2 – BUSHING

(1) Install gear on front crossmember and tighten mounting bolts to 258 N·m (190 ft. lbs.).

(2) Slide shaft coupler onto gear. Install **new** bolt and tighten to 49 N·m (36 ft. lbs.).

(3) Clean tie rod end studs and knuckle tapers.

(4) Install tie rod ends into the steering knuckles and tighten the nuts to 108 N·m (80 ft. lbs.).

(5) Install power steering lines to steering gear.

(6) Remove support and lower vehicle.

(7) Fill system with fluid and perform Power Steering Pump Initial Operation.

(8) Adjust the toe position. Refer to Group 2 Suspension.

REMOVAL AND INSTALLATION (Continued)

RACK & PINION STEERING GEAR - 4x4

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the splash shield from under the front end to gain access to the gear.

(3) Remove the nuts from the tie rod ends.

(4) Separate tie rod ends from the knuckles with Puller C-3894-A (Fig. 6).

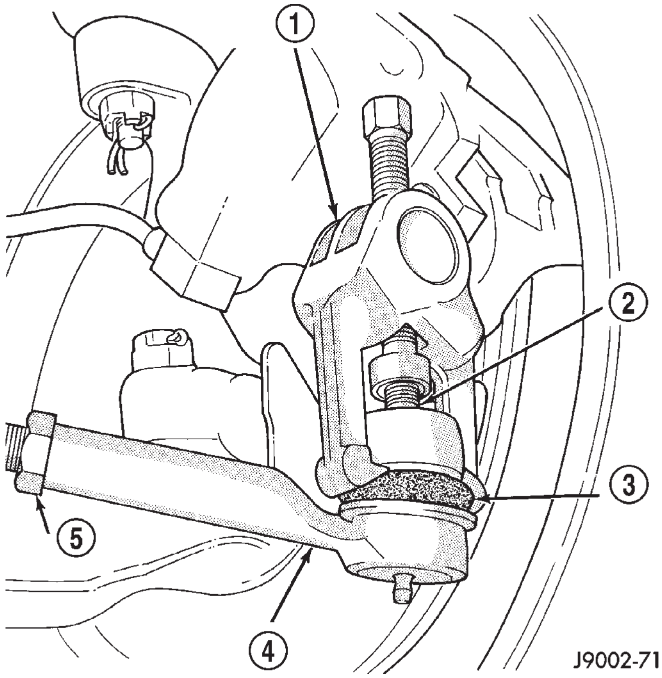


Fig. 6 Tie Rod End Puller

1 – TOOL C-3894–A
2 – BALL STUD
3 – SEAL
4 – TIE-ROD END
5 – LOCK NUT

(5) Remove the power steering lines from the gear.

(6) Remove the lower coupler bolt and slide the coupler off the gear (Fig. 7).

(7) Remove the mounting bolts (Fig. 8) from the gear to the front crossmember. Slide the gear to the right side of the vehicle. Then tilt the left end of the gear down and remove the gear.

INSTALLATION

NOTE: Before installing gear inspect bushings and replace if worn or damaged.

(1) Install gear on front crossmember and tighten mounting bolts to 230 N·m (170 ft. lbs.).

(2) Slide shaft coupler onto gear. Install **new** bolt and tighten to 49 N·m (36 ft. lbs.).

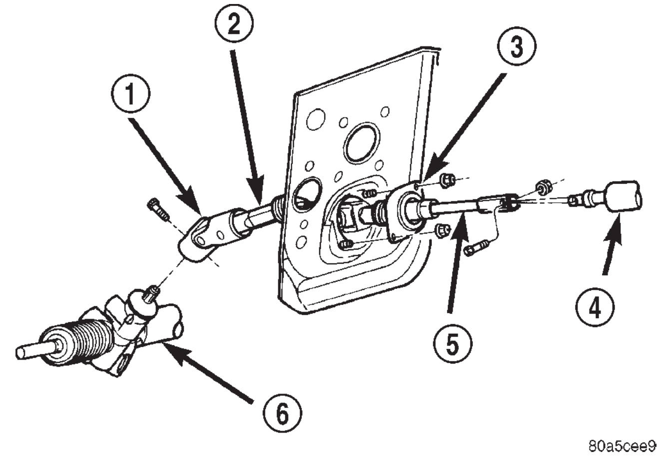


Fig. 7 Gear Coupler

1 – COUPLER
2 – LOWER SHAFT
3 – TOE PLATE
4 – STEERING COLUMN
5 – UPPER SHAFT
6 – RACK AND PINION STEERING GEAR

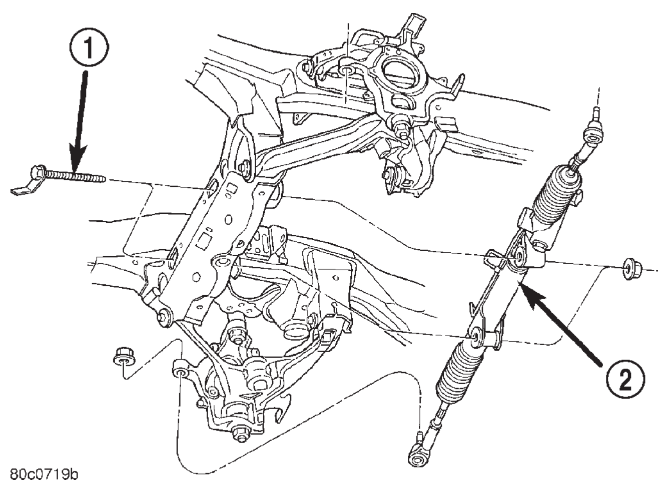


Fig. 8 Rack & Pinion Steering Gear - 4x4

1 – MOUNTING BOLT
2 – RACK AND PINION STEERING GEAR

(3) Clean tie rod end studs and knuckle tapers.

(4) Install tie rod ends into the steering knuckles and tighten the nuts to 88 N·m (65 ft. lbs.).

(5) Install power steering lines to steering gear.

(6) Install the splash shield.

(7) Remove support and lower vehicle.

(8) Fill system with fluid and perform Power Steering Pump Initial Operation.

(9) Adjust the toe position. Refer to Group 2 Suspension.

DISASSEMBLY AND ASSEMBLY

BOOT SEAL

REMOVAL

(1) Remove steering gear.

(2) Loosen the jam nut then remove the tie rod end and jam nut.

(3) Remove the outer clamp from the rubber boot (Fig. 9).

(4) Remove the boot inner clamp.

(5) On 4x2 vehicles mark the breather tube location on steering gear before removing the rubber boot (Fig. 9).

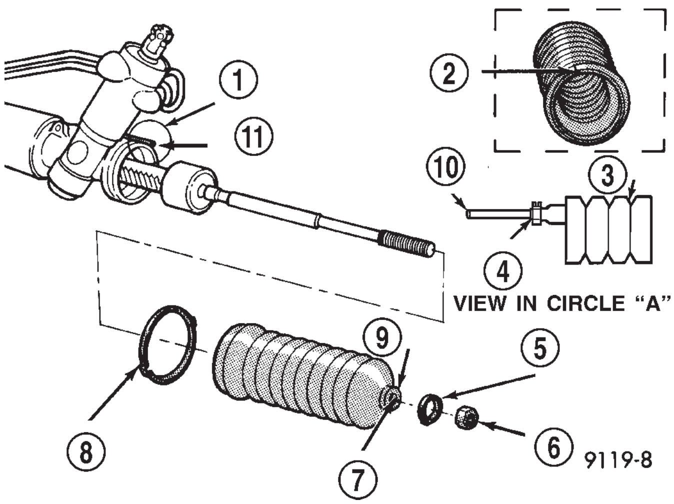


Fig. 9 Boot Seal - 4x2

1 – CIRCLE "A"
2 – MARK BREATHER TUBE LOCATION
3 – BOOT
4 – SNORKEL CLAMP
5 – BOOT CLAMP (OUTER)
6 – JAM NUT
7 – USE LUBE HERE
8 – BOOT CLAMP (INNER)
9 – BOOT SEAL
10 – BREATHER TUBE
11 – BREATHER TUBE

INSTALLATION

(1) Lubricate the boot outer groove (tie rod) with silicone type lubricant. Ensure that the boot is not twisted.

(2) On 4x2 vehicles align the breather tube with the reference mark on the steering gear.

(3) Position and align the new boot over the housing.

(4) Install inner clamp on the rubber boot.

(5) Install the snorkel clamp on 4x2 vehicles.

(6) Install outer clamp on the inner tie rod.

(7) Install the jam nut and the tie rod end.

(8) Install steering gear.

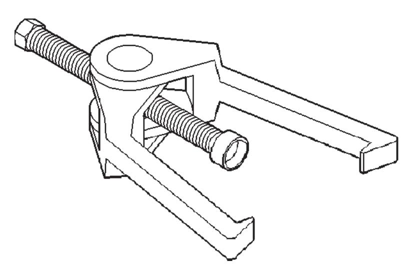
SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Rack and Pinion Steering Gear	
Gear to Frame Bolts	258 N·m (190 ft. lbs.)
Intermediate Shaft Bolt	49 N·m (36 ft. lbs.)
Tie Rod End	
Knuckle Nut	108 N·m (80 ft. lbs.)
Jam Nut	75 N·m (55 ft. lbs.)
Lines	
Pressure Line	35 N·m (25 ft. lbs.)
Return Line	35 N·m (25 ft. lbs.)

SPECIAL TOOLS

RACK & PINION STEERING GEAR



Puller C-3894-A

STEERING COLUMN

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
STEERING COLUMN 15
DIAGNOSIS AND TESTING
IGNITION SWITCH. 16
REMOVAL AND INSTALLATION
STEERING COLUMN 16
GEAR SHIFT LEVER 18
SPECIFICATIONS
TORQUE CHART 19

DESCRIPTION AND OPERATION

STEERING COLUMN

The tilt and standard column (Fig. 1) has been designed to be serviced as an assembly; less wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the steering column from the vehicle.

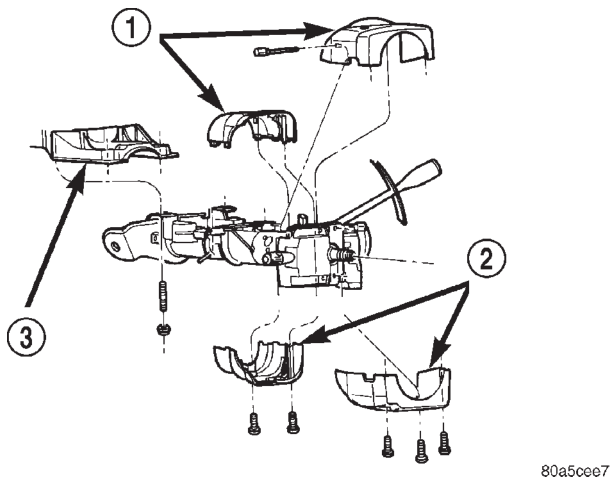


Fig. 1 Steering Column

1 – UPPER SHROUD
2 – LOWER SHROUD
3 – PANEL BRACKET

SERVICE PRECAUTIONS

Safety goggles should be worn at all times when working on steering columns.

To service the steering wheel, switches or airbag, refer to Group 8M and follow all WARNINGS and CAUTIONS.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIRBAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIRBAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS.

CAUTION: Do not hammer on steering column shaft or shift tube. This may cause damage to the shaft, shift tube or bearing.

CAUTION: Do not attempt to remove or modify the park lock slider or link.

CAUTION: Do not attempt to remove the pivot pins to disassemble the tilting mechanism. Do not remove shaft lock plate or plate retainer. This will damage the column (Fig. 2) and (Fig. 3).

DESCRIPTION AND OPERATION (Continued)

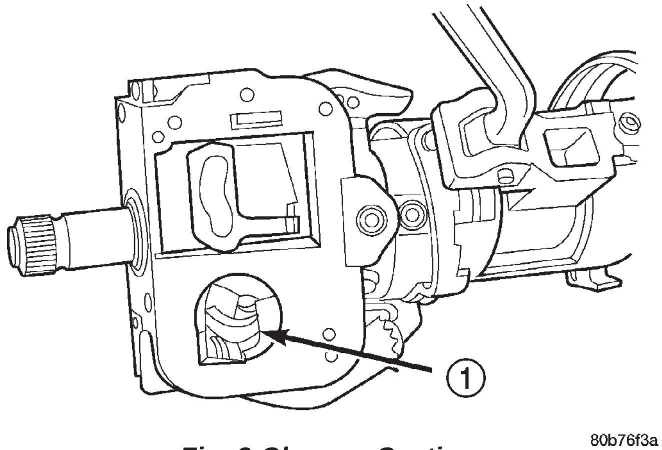


Fig. 2 Observe Cautions

1 – CAUTION: NEVER REMOVE SHAFT LOCK PLATE

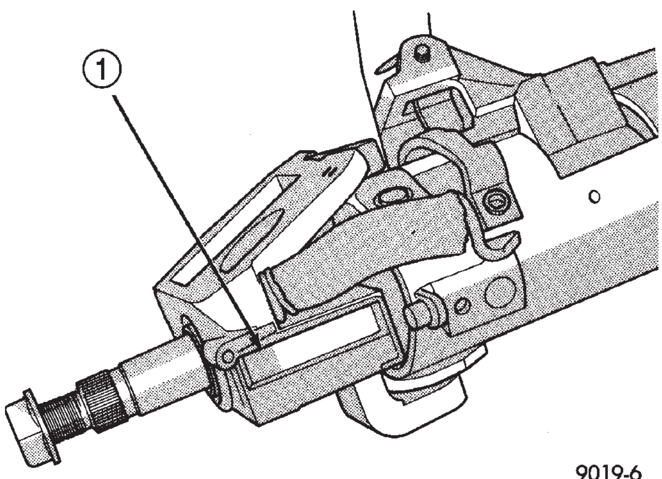


Fig. 3 Observe Cautions

1 – CAUTION: NEVER REMOVE SHAFT LOCK PLATE RETAINER

DIAGNOSIS AND TESTING

IGNITION SWITCH

TEST AND REPAIR

If the key removal effort is excessive on a vehicle with a automatic transmission first adjust the shift linkage, refer to Group 21 Transmission And Transfer Case for procedure.

If the ignition switch effort is excessive remove the ignition key cylinder from the steering column. Refer to Group 8D Ignition System. Check the turning effort of the key cylinder. If the ignition key cylinder effort is excessive replace the key cylinder. If the ignition key cylinder operates properly look for the following conditions.

(1) Look for rough areas or flash in the casting and if found remove with a file (Fig. 4).

(2) Grease the lock plate actuator, lock plate, slider and locking link.

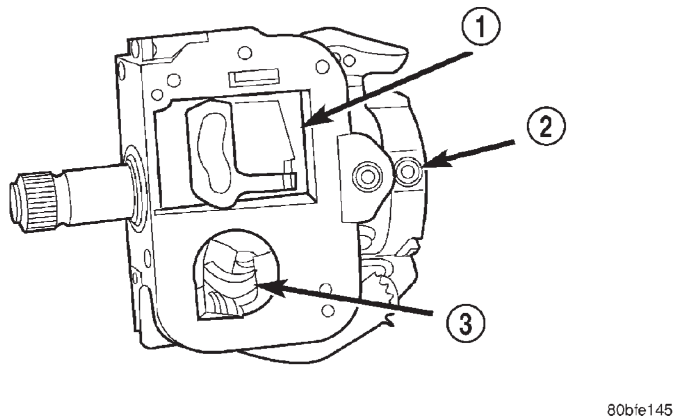


Fig. 4 Steering Column Flash Removal

1 – FILE THIS AREA TO REMOVE FLASHING AND PROVIDE CLEARANCE TO ELIMINATE BINDING
2 – PARK LOCK SLIDER
3 – CAUTION: NEVER REMOVE SHAFT LOCK PLATE

REMOVAL AND INSTALLATION

STEERING COLUMN

WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED, REFER TO GROUP 8M RESTRAINT SYSTEMS FOR SERVICE PROCEDURES. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY.

CAUTION: All fasteners must be torqued to specification to ensure proper operation of the steering column.

REMOVAL

(1) Position front wheels straight ahead.

(2) Remove the negative (ground) cable from the battery.

(3) Remove the airbag, refer to Group 8M Restraint Systems.

(4) Remove the steering wheel with an appropriate puller.

CAUTION: Ensure the puller bolts are fully engaged into the steering wheel and not into the clockspring, before attempting to remove the wheel. Failure to do so may damage the steering wheel/ clockspring.

(5) Remove the steering column opening cover and knee blocker, refer to Group 8E Instrument Panel Systems.

REMOVAL AND INSTALLATION (Continued)

(6) Disconnect shift cable (column shift vehicles). Pry shift cable from the shift lever and remove from cable bracket (Fig. 5).

(7) Remove PRNDL cable (column shift vehicles). Put shift lever in **Park** position. Pull cable and twist to remove from PRNDL lever. Push tab on top of cable retainer, then squeeze sides to remove retainer from the column (Fig. 6).

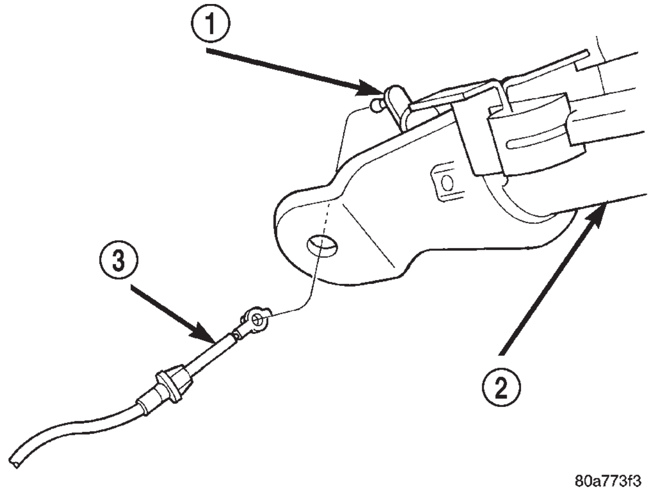


Fig. 5 Shift Cable

1 – SHIFT LEVER
2 – STEERING COLUMN
3 – SHIFT CABLE

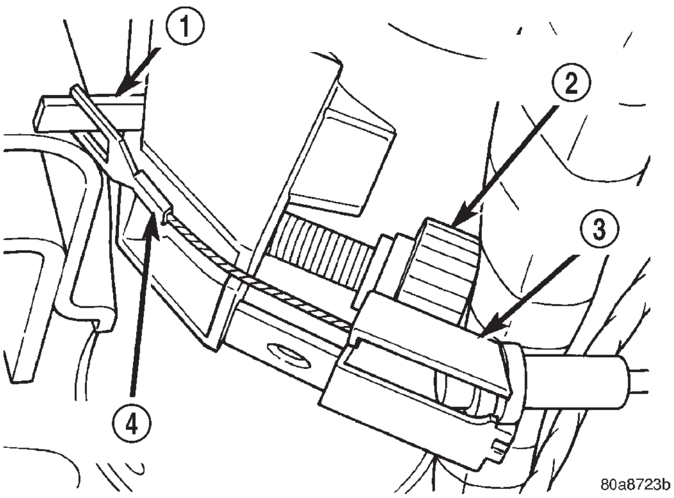


Fig. 6 PRNDL Drive Cable

1 – PRNDL LEVER
2 – THUMB SCREW
3 – CABLE RETAINER
4 – PRNDL CABLE

(8) Remove tilt lever (if equipped) from column.

(9) Remove the lower and upper shrouds (Fig. 7).

(10) Remove the turn signal multi-function switch connector with a 7 mm socket (Fig. 8).

(11) Remove remaining electrical connections from the column switches (Fig. 8).

(12) Remove the bolt and nut from upper shaft (Fig. 9). Slide upper shaft off column shaft.

(13) Remove column mounting nuts (Fig. 10).

(14) Remove column from vehicle.

(15) Remove clockspring, switches and key cylinder, refer to Group 8 Electrical for procedures.

CAUTION: Failure to follow Group 8 Electrical procedure for clockspring removal, may damage the clockspring plastic latches.

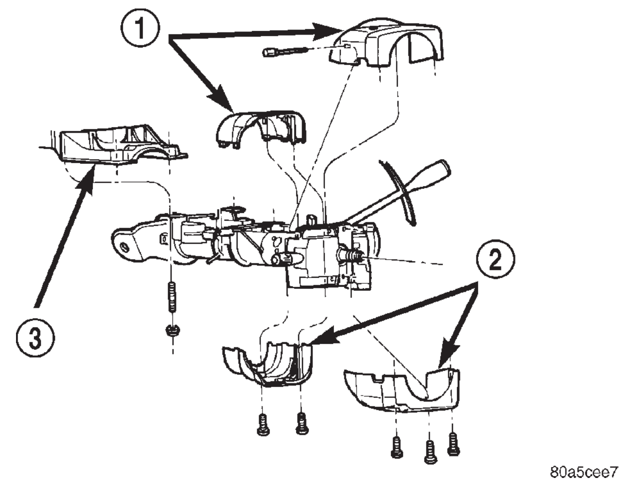


Fig. 7 Column Shrouds

1 – UPPER SHROUD
2 – LOWER SHROUD
3 – PANEL BRACKET

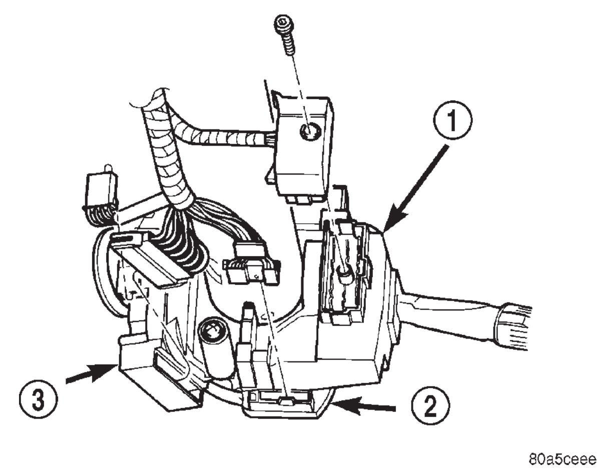


Fig. 8 Multi-function Switch & Column Wiring

1 – MULTI-FUNCTION SWITCH
2 – SPEED CONTROL
3 – IGNITION SWITCH

REMOVAL AND INSTALLATION (Continued)

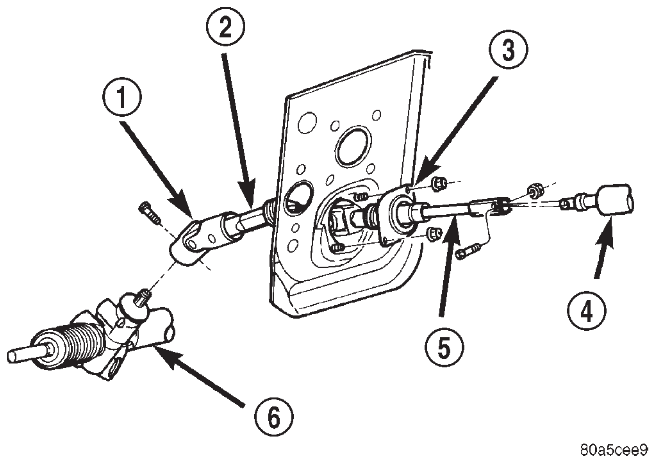


Fig. 9 Column Shafts & Couplers

1 – COUPLER
2 – LOWER SHAFT
3 – TOE PLATE
4 – STEERING COLUMN
5 – UPPER SHAFT
6 – RACK AND PINION STEERING GEAR

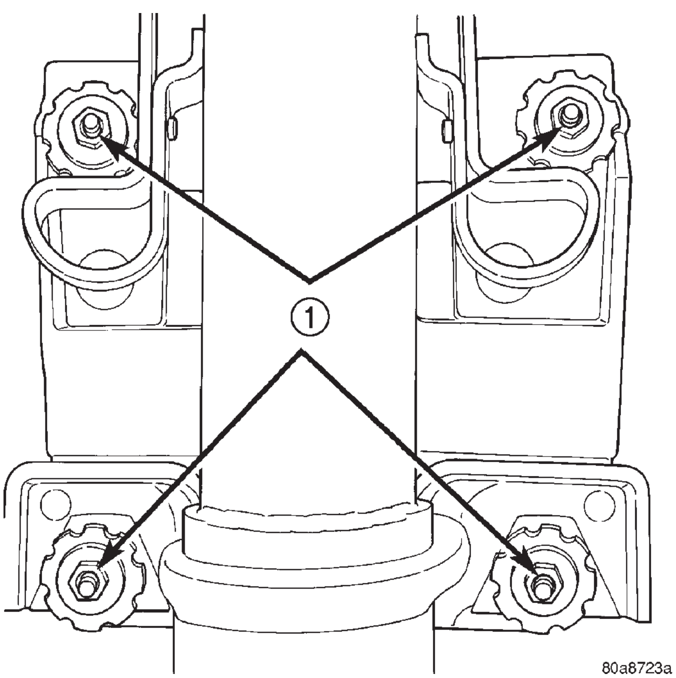


Fig. 10 Column Mounting Nuts

1 – MOUNTING NUTS

INSTALLATION

(1) Install switches, clockspring and key cylinder, refer to Group 8 Electrical for procedures.

(2) Position the column to the panel bracket and attaching studs. Install, but **loose assemble** the mounting nuts.

(3) Slide upper shaft onto the column shaft. Install a **new** bolt and nut and tighten to 49 N·m (36 ft. lbs.).

(4) Tighten column mounting nuts to 12 N·m (105 in. lbs.).

(5) Connect the multi-function switch wiring and tighten with 7mm socket to 2 N·m (17 in. lbs.).

(6) Install the wiring connections to the column switches.

(7) Install the lower and upper shrouds.

(8) Install the PRNDL cable (column shift vehicles). Place shifter in Park position. If indicator needs adjusting turn thumb screw on cable retainer to adjust cable.

(9) Install shift cable (column shift vehicles).

(10) Install the tilt lever (if equipped).

(11) Install the knee blocker and steering column opening cover, refer to Group 8E Instrument Panel Systems for procedures.

(12) Install steering wheel and tighten nut to 47 N·m (35 ft. lbs.).

(13) Install airbag, refer to Group 8M Restraint Systems for procedure.

(14) Connect the battery ground (negative) cable.

(15) Check operation of the automatic transmission shift linkage and adjust as necessary. Refer to Group 21, Transmission and Transfer Case for adjustment procedure.

GEAR SHIFT LEVER

REMOVAL

(1) Support the steering column assembly as shown in (Fig. 11) using a suitable size socket and back-up support.

(2) Disconnect over drive switch wiring.

(3) Using a drift of the appropriate size drive the knurled pin out of the steering column and gear shift lever. Remove the gear shift lever from the steering column assembly.

CAUTION: The pin can only be removed from the direction shown (Fig. 11).

INSTALLATION

(1) Support the steering column using a suitable size socket and back-up support.

(2) Install the gear shift lever into the steering column assembly. Align the pin holes in the gear shift lever and the steering column assembly.

CAUTION: The pin must be installed in the original direction.

REMOVAL AND INSTALLATION (Continued)

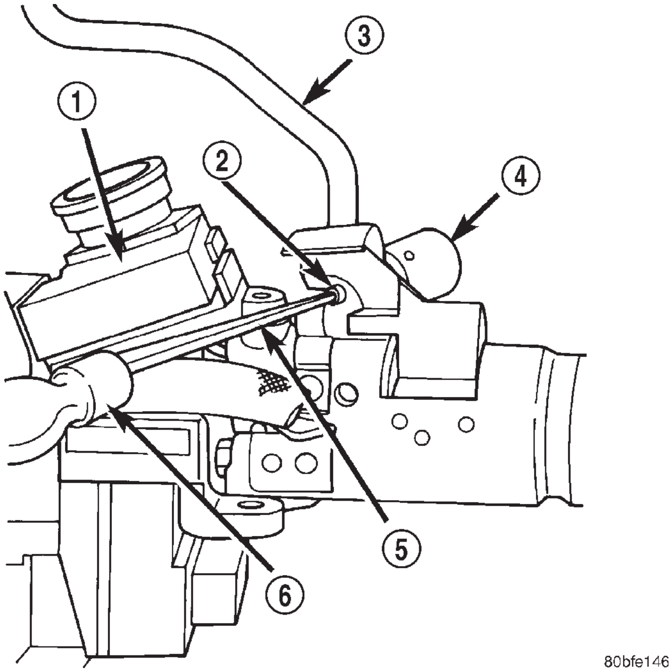


Fig. 11 Gear Shift Lever Removal

1 – IGNITION SWITCH
2 – KNURLED PIN
3 – GEARSHIFT LEVER
4 – SOCKET
5 – DRIFT
6 – HAMMER

(3) Carefully Install the pin into the steering column assembly and through the shift lever. If the pin binds check the alignment on the holes. Be sure pin is fully installed into the steering column assembly.

(4) Connect over drive switch wiring.

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Steering Column	
Steering Wheel Nut	47 N·m (35 ft. lbs.)
Column Bracket Nuts	12 N·m (105 in. lbs.)
Shaft Coupler Bolts	49 N·m (36 ft. lbs.)
Multi-function Switch Bolt	2 N·m (17 in. lbs.)

TRANSMISSION AND TRANSFER CASE

TABLE OF CONTENTS

	page
NV1500 MANUAL TRANSMISSION	1
NV3500 MANUAL TRANSMISSION	36
42RE AUTOMATIC TRANSMISSION	84
46RE AUTOMATIC TRANSMISSION	247
45RFE AUTOMATIC TRANSMISSION	416
NV231 TRANSFER CASE	506
NV242 TRANSFER CASE	533

NV1500 MANUAL TRANSMISSION

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
NV1500 MANUAL TRANSMISSION	1
LUBRICANT	3
DIAGNOSIS AND TESTING	
LOW LUBRICANT LEVEL	3
HARD SHIFTING	4
TRANSMISSION NOISE	4
REMOVAL AND INSTALLATION	
TRANSMISSION	4
SHIFT TOWER	5
OUTPUT SHAFT SEAL	6
OUTPUT SHAFT BUSHING	6
DISASSEMBLY AND ASSEMBLY	
TRANSMISSION	7
CLEANING AND INSPECTION	
TRANSMISSION COMPONENTS	32
SPECIFICATIONS	
TORQUE	34
SPECIAL TOOLS	
NV1500 MANUAL TRANSMISSION	34

DESCRIPTION AND OPERATION

NV1500 MANUAL TRANSMISSION

DESCRIPTION

The NV1500 is a medium-duty, 5-speed, constant mesh, fully synchronized manual transmission. Fifth gear is an overdrive range with a ratio of 0.80:1. The NV1500 is available in 4-cyl. equipped 2WD models.

The transmission gear case consists of two aluminum gear housings and a detachable clutch housing. The mainshaft is supported by two sealed ball bearings, and the countershaft is supported by two tapered roller bearings. The transmission gears all rotate on caged type needle bearings. A roller bearing is used between the input and output shaft.

The NV1500 has a single shaft shift mechanism with three shift forks all mounted on the shaft. The shaft is supported in the front and rear housings by bushings. Internal shift components consist of the forks, shaft, shift lever socket, and detent components (Fig. 1).

DESCRIPTION AND OPERATION (Continued)

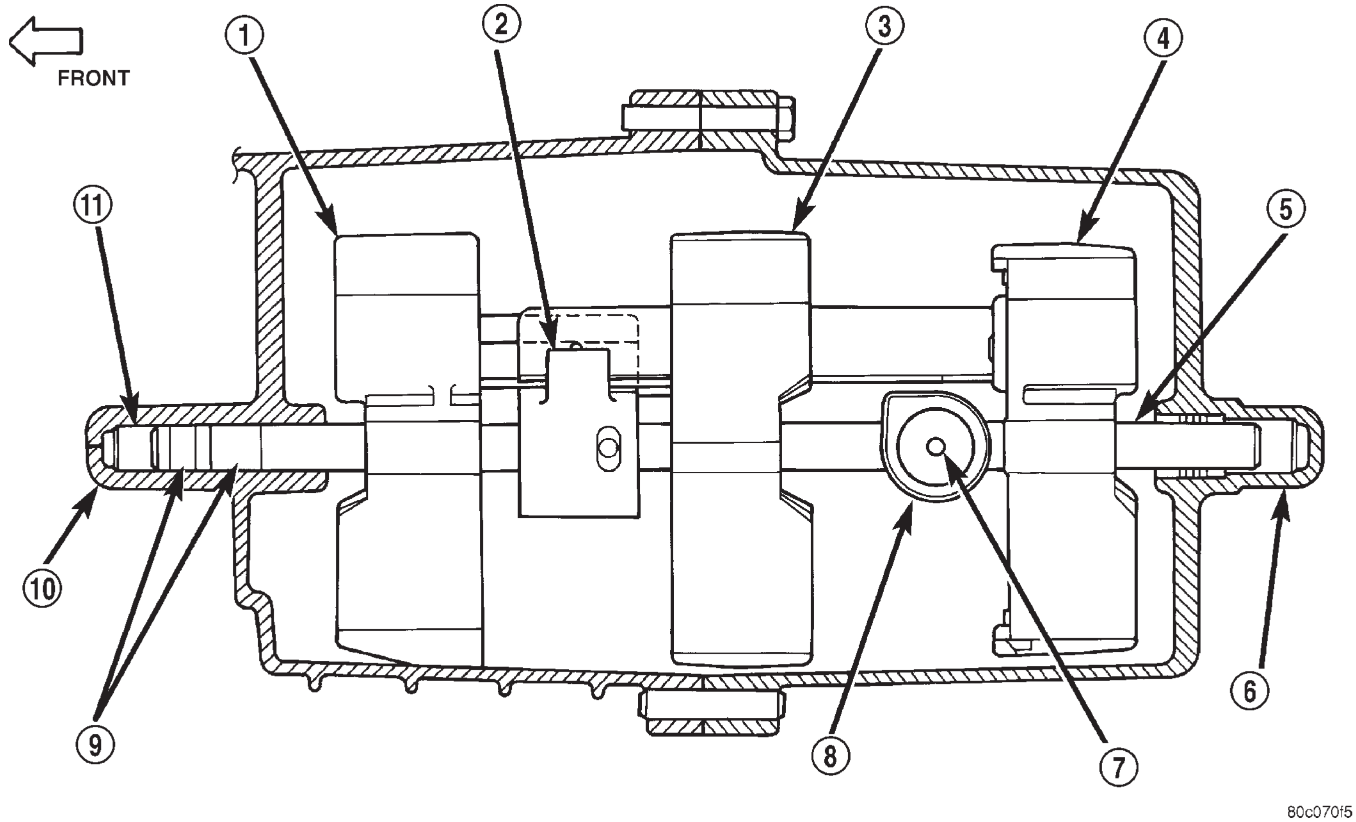


Fig. 1 NV1500 Shift Mechanism

1 – 3–4 FORK
2 – SHIFT SHAFT LEVER AND BUSHING
3 – 1–2 FORK
4 – FIFTH-REVERSE FORK
5 – SHIFT SHAFT
6 – REAR HOUSING
7 – ROLL PIN
8 – SHIFT LEVER SOCKET
9 – SHAFT RAIL DETENTS
10 – FRONT HOUSING
11 – SHIFT SHAFT

GEAR RATIOS

NV1500 GEAR RATIOS ARE AS FOLLOWS:

RANGE	RATIO
FIRST	3.85 :1
SECOND	2.25 :1
THIRD	1.48 :1
FOURTH	1.00 :1
FIFTH	0.80 :1
REVERSE	3.52 :1

IDENTIFICATION

The NV1500 identification bar code tags (Fig. 2) are located on each side of the transmission, below the shift tower. The tag located on the right side has the part number and the tag located on the left side has the build sequence and date information.

OPERATION

The manual transmission receives power through the clutch assembly from the engine. The clutch disc is splined to the transmission input shaft and is turned at engine speed at all times that the clutch is engaged. The input shaft is connected to the transmission countershaft through the mesh of fourth speed gear on the input shaft and the fourth countershaft gear. At this point, all the transmission gears are spinning.

The driver selects a particular gear by moving the shift lever to the desired gear position. This movement moves the internal transmission shift components to begin the shift sequence. As the shift lever moves the selected shift rail, the shift fork attached to that rail begins to move. The fork is positioned in a groove in the outer circumference of the synchronizer sleeve. As the shift fork moves the synchronizer sleeve, the synchronizer begins to speed-up or slow down the selected gear (depending on whether we are up-shifting or down-shifting). The synchronizer does

DESCRIPTION AND OPERATION (Continued)

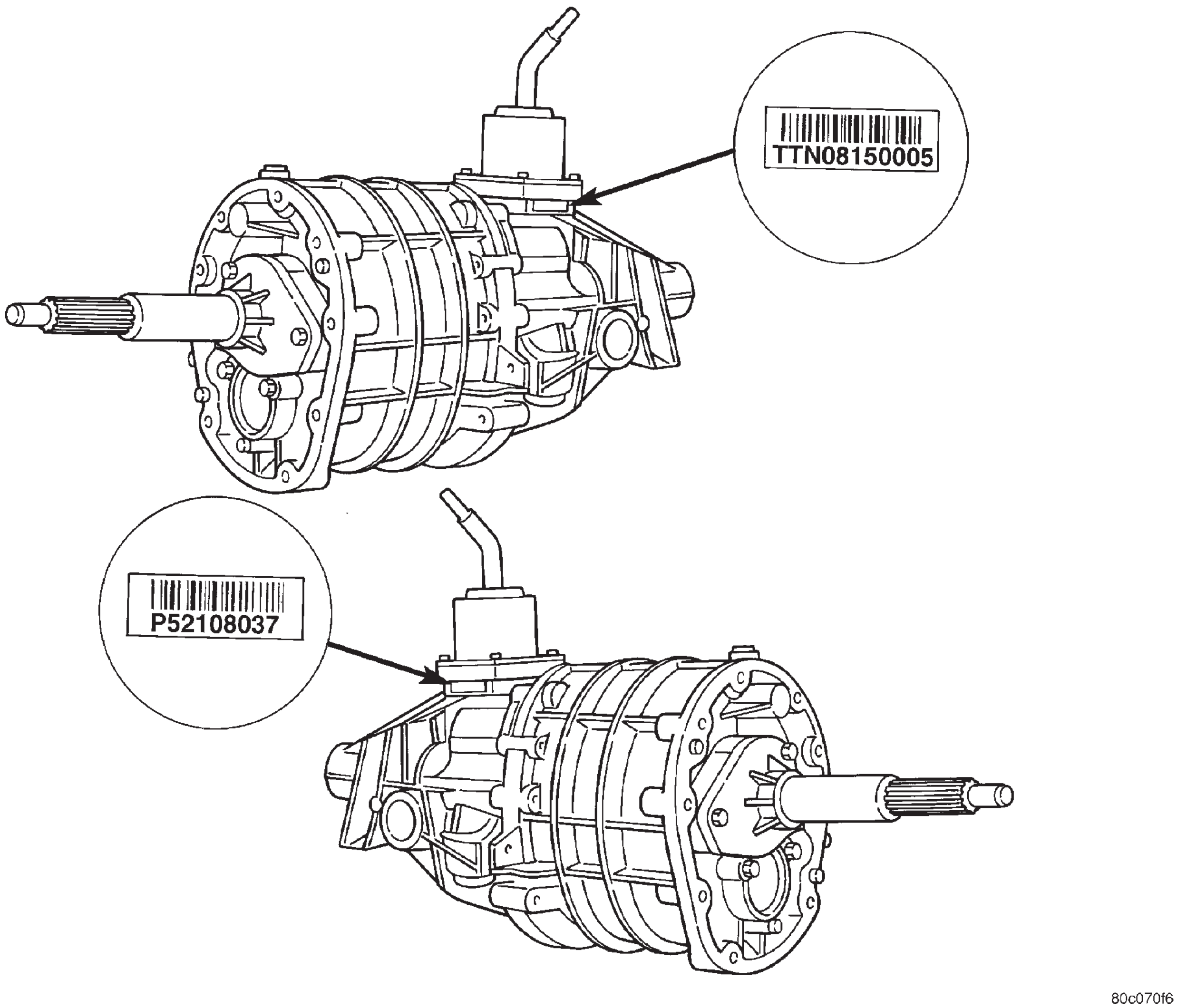


Fig. 2 NV1500 Identification

this by having the synchronizer hub splined to the mainshaft, or the countershaft in some cases, and moving the blocker ring into contact with the gear's friction cone. As the blocker ring and friction cone come together, the gear speed is brought up or down to the speed of the synchronizer. As the two speeds match, the splines on the inside of the synchronizer sleeve become aligned with the teeth on the blocker ring and the friction cone and eventually will slide over the teeth, locking the gear to the mainshaft, or countershaft, through the synchronizer.

LUBRICANT

DESCRIPTION

Required lubricant for the NV1500 is Mopar® Manual Transmission Lubricant, P/N 4761526. This is the **only** lubricant to be used in NV1500 transmissions. No other lubricants are acceptable, or recommended.

The correct transmission lubricant level is to the bottom edge of the fill plug hole (Fig. 3).

The transmission must be level to obtain an accurate lubricant level check. A drive–on type of hoist is recommended for this purpose.

Lubricant capacity of the NV1500 is approximately 2.3 liters (4.86 pints). This represents the approximate quantity needed to refill the transmission after a lubricant change or overhaul.

DRAIN AND FILL PLUG LOCATIONS

The NV1500 fill and drain plugs are both located in the front housing. The fill plug is at the passenger side of the housing. The drain plug is at the bottom of the housing (Fig. 3).

DIAGNOSIS AND TESTING

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill, or an incorrect lubricant level check.

DIAGNOSIS AND TESTING (Continued)

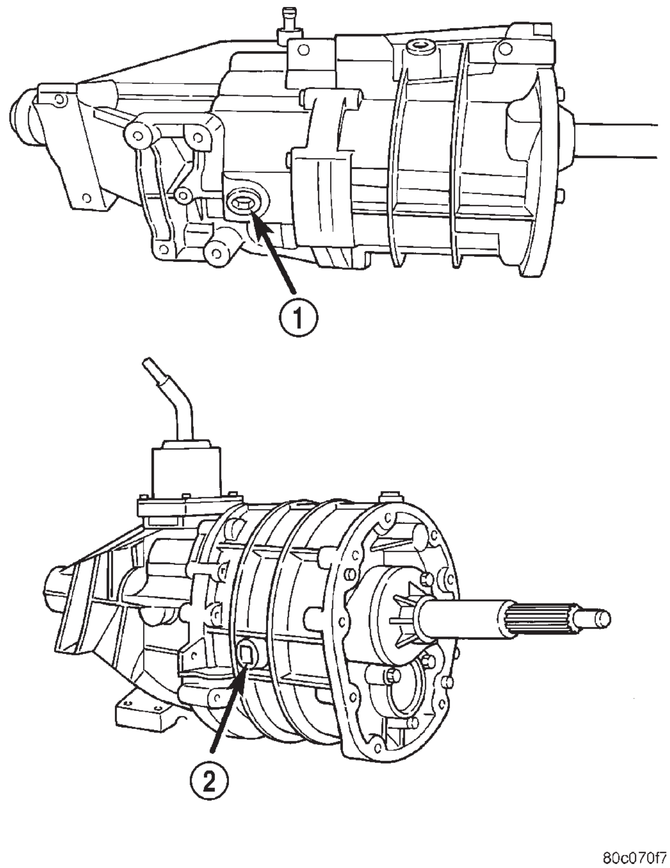


Fig. 3 Drain and Fill Plug Locations

1 – DRAIN PLUG
2 – FILL PLUG

Leaks can occur at the mating surfaces of the housings, or from the front/rear seals. A suspected leak could also be the result of an overfill condition.

Leaks at component mating surfaces will probably be the result of inadequate sealer, gaps in the sealer, incorrect bolt tightening, or use of a non–recommended sealer.

A leak at the front of the transmission will be from either a loose or damaged, front bearing retainer or retainer seal. Lubricant may also drip from the transmission clutch housing after extended operation. If the leak is severe, it will contaminate the clutch disc causing slip, grab and chatter.

Transmissions filled from air or electrically powered lubricant containers can be under filled. Always check the lubricant level after filling to avoid an under fill condition.

A correct lubricant level check can only be made when the vehicle is level; use a drive–on hoist to ensure this. Also allow the lubricant to settle for a minute or so before checking. These recommendations will ensure an accurate check and avoid an under-or-overfill condition.

HARD SHIFTING

Hard shifting is usually caused by a low lubricant level, improper or contaminated lubricants, transmission component damage, clutch linkage malfunction, or by a damaged clutch pressure plate or disc.

Substantial lubricant leaks can result in gear, shift component, synchro and bearing damage. If a leak goes undetected for an extended period, the first indications of a problem are usually hard shifting and noise.

Incorrect or contaminated lubricants can also contribute to hard shifting. The consequence of using non–recommended lubricants is noise, excessive wear, internal bind and hard shifting.

Improper clutch release is a frequent cause of hard shifting. Incorrect adjustment or a worn, damaged pressure plate or disc can cause incorrect release. If the clutch problem is advanced, gear clash during shifts can result.

Worn or damaged synchro rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing stiff and/or noisy shifts. In most cases, this condition will decline as the rings wear in.

TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears can generate a mild whine that may only be audible at extreme speeds.

Severe, obviously audible transmission noise is generally the result of a lubricant problem. Insufficient, improper, or contaminated lubricant can promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear breakage.

REMOVAL AND INSTALLATION

TRANSMISSION

REMOVAL

(1) Disconnect battery negative cable.

(2) Shift transmission into Neutral.

(3) Remove floor console. Refer to Group 23, Body, for proper procedures.

(4) Remove screws attaching shift boot to floorpan. Then slide boot upward on lever extension.

(5) Remove shift lever extension from the shift tower and lever assembly.

(6) Raise and support vehicle.

(7) Mark propeller shaft and axle companion flange for alignment reference. Use paint, scriber, or chalk to mark the flange.

REMOVAL AND INSTALLATION (Continued)

(8) Remove propeller shaft.
(9) Disconnect and remove exhaust system Y-pipe.
(10) Disconnect wires at backup light switch.
(11) Support engine with adjustable safety stand and wood block.
(12) If transmission is to be disassembled for repair, remove drain plug and drain lubricant from transmission.
(13) Remove bolts/nuts attaching transmission to rear mount.
(14) Support transmission with a transmission jack. Secure transmission to jack with safety chains.
(15) Remove rear crossmember.
(16) Remove bolts attaching clutch slave cylinder to clutch housing. Then move cylinder aside for working clearance.
(17) Remove starter.
(18) Remove transmission dust shield.
(19) Remove transmission harness wires from clips on transmission shift cover.
(20) Lower transmission slightly.
(21) Remove the bolts attaching the shift tower and lever assembly to the transmission housing. Then remove the shift tower and lever assembly.
(22) Remove bolts attaching transmission to engine.
(23) Slide transmission and jack rearward until input shaft clears clutch disc.
(24) Lower transmission jack and remove transmission from under vehicle.

INSTALLATION

NOTE: If a new transmission is being installed, be sure to use all components supplied with the new transmission. For example, if a new shift tower is supplied with the new transmission, do not re-use the original shift tower.

(1) Apply light coat of Mopar® high temperature bearing grease to contact surfaces of following components:
- input shaft splines.
- release bearing slide surface of front retainer.
- release bearing bore.
- release fork.
- release fork ball stud.
- propeller shaft slip yoke.

(2) Apply sealer to threads of drain plug and install plug in case.
(3) Mount transmission on jack and position transmission under vehicle.
(4) Raise transmission until input shaft is centered in clutch disc hub.
(5) Move transmission forward and start input shaft in clutch disc and pilot bushing.
(6) Work transmission forward until seated against engine. Do not allow transmission to remain unsupported after input shaft has entered clutch disc.
(7) Install and tighten transmission-to-engine bolts to 108 N·m (80 ft. lbs.) torque.
(8) Install clutch slave cylinder.
(9) Install transmission dust shield.
(10) Install starter.
(11) Connect backup light switch wires.
(12) Fill transmission with recommended lubricant. Correct fill level is bottom edge of fill plug hole.
(13) Shift the transmission into third gear.
(14) Install shift tower and lever assembly. Tighten shift tower bolts to 7-10 N·m (5-7 ft. lbs.) torque.
(15) Position transmission harness wires in clips on shift cover.
(16) Install transmission mount on transmission or rear crossmember.
(17) Install rear crossmember.
(18) Remove transmission jack and engine support fixture.
(19) Align and install propeller shaft.
(20) Lower vehicle.
(21) Install the shift lever extension onto the shift tower and lever assembly.
(22) Install shift boot.
(23) Install floor console. Refer to Group 23, Body, for proper procedures.
(24) Connect battery negative cable.

SHIFT TOWER

REMOVAL

(1) Shift transmission into Neutral.
(2) Unscrew and remove the shift lever extension from the shift
(3) Remove any floor console components necessary to access the transmission shift tower.
(4) Remove the bolts holding the shift tower to the isolator plate and transmission gear case.
(5) Remove the shift tower (Fig. 4) from the transmission.

INSTALLATION

(1) Shift transmission into third gear.
(2) Clean the mating surfaces of shift tower and transmission gear case with suitable wax and grease remover.
(3) Install the shift tower onto the transmission case. No sealant is necessary between the shift tower and transmission case.
(4) Install the bolts to hold the shift tower to the isolator plate and the transmission gear case. Tighten the shift tower bolts to 8.5 N·m (6.3 ft. lbs.).
(5) Install the shift lever extension and any floor console components previously removed.

REMOVAL AND INSTALLATION (Continued)

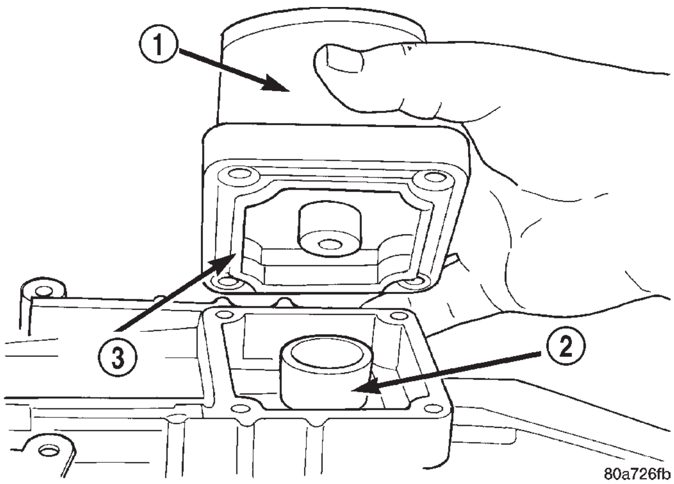


Fig. 4 Remove Shift Tower

1 – SHIFT TOWER AND LEVER ASSEMBLY
2 – SHIFT SOCKET
3 – SEAL

OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle.

(2) Mark propeller shaft and axle yoke for alignment reference.

(3) Disconnect and remove propeller shaft.

(4) Using a suitable pry tool or slide-hammer mounted screw, remove the output shaft seal.

INSTALLATION

(1) Place seal in position on transmission housing.

(2) Drive seal into transmission housing with Seal Installer C-3995–A (Fig. 5).

(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines.

(4) Align marks made at removal and connect propeller shaft to rear axle pinion yoke.

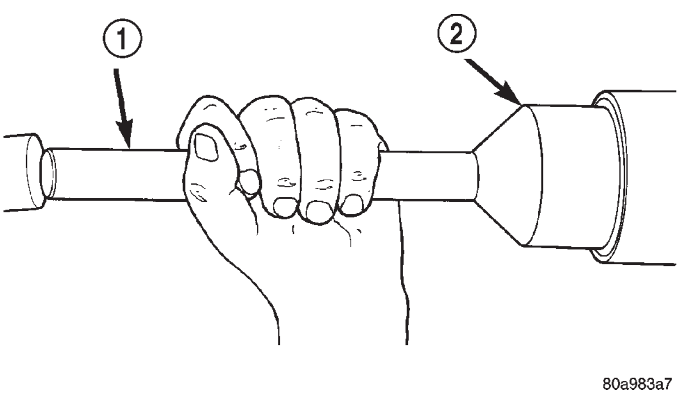


Fig. 5 Installing Transmission Output Shaft Seal

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3995-A

OUTPUT SHAFT BUSHING

REMOVAL

(1) Using a suitable pry tool or slide-hammer mounted screw, remove the output shaft seal.

(2) Insert Remover 6957 into rear housing. Tighten tool to bushing and remove bushing (Fig. 6).

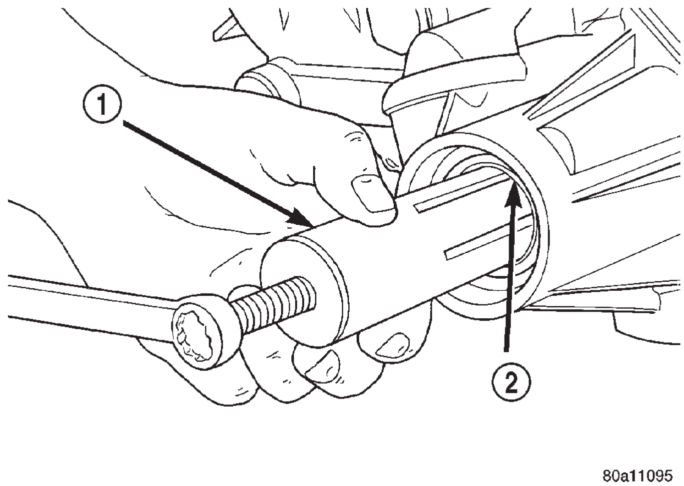


Fig. 6 Bushing Removal—Typical

1 – REMOVER 6957
2 – EXTENSION HOUSING BUSHING

INSTALLATION

(1) Align bushing oil hole with oil slot in rear housing.

(2) Tap bushing into place with Installer 8160 and Handle C-4171 (Fig. 7).

(3) Install new oil seal in housing using Seal Installer C-3995–A (Fig. 8).

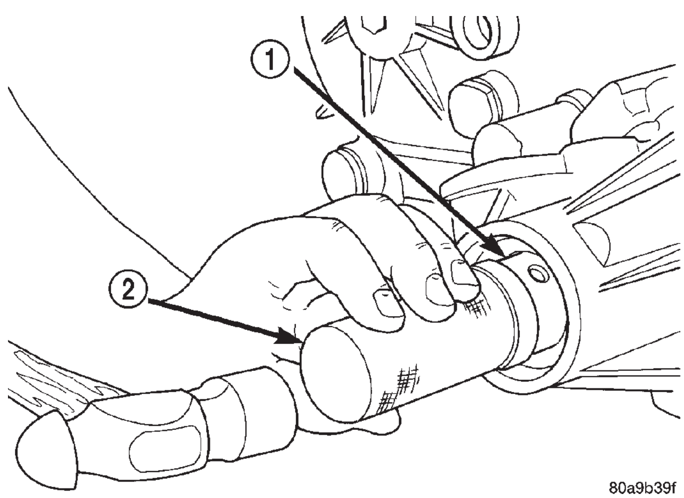


Fig. 7 Rear Housing Bushing Installation—Typical

1 – REAR RETAINER BUSHING
2 – INSTALLER 8160

REMOVAL AND INSTALLATION (Continued)

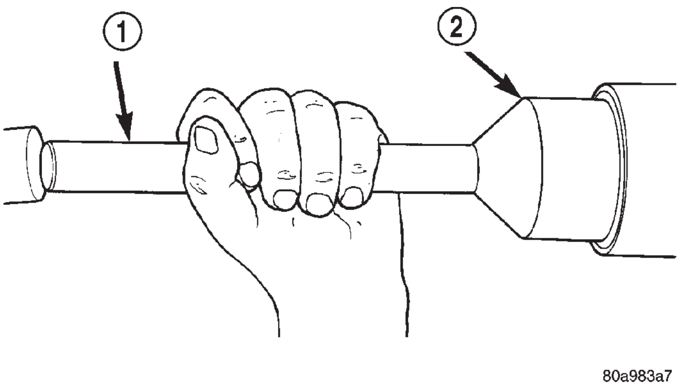


Fig. 8 Rear Housing Seal Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3995-A

(5) If necessary, remove shift tower bolts and remove tower and lever assembly (Fig. 10).

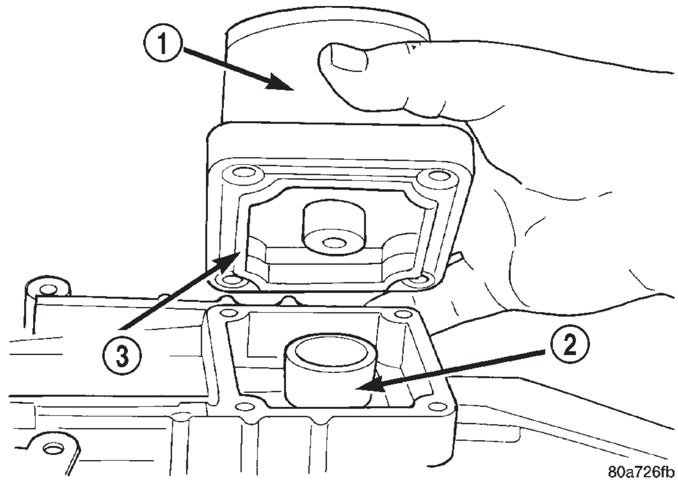


Fig. 10 Shift Tower Removal

1 – SHIFT TOWER AND LEVER ASSEMBLY
2 – SHIFT SOCKET
3 – SEAL

DISASSEMBLY AND ASSEMBLY

TRANSMISSION

DISASSEMBLY

FRONT HOUSING

(1) If necessary, temporarily reinstall shift lever assembly. Shift transmission into Neutral.

(2) If lubricant was not drained out of transmission during removal, remove drain plug and drain lubricant into container at this time.

(3) Inspect drain plug magnet for debris.

(4) Remove backup light switch. Switch is located on passenger side of rear housing (Fig. 9).

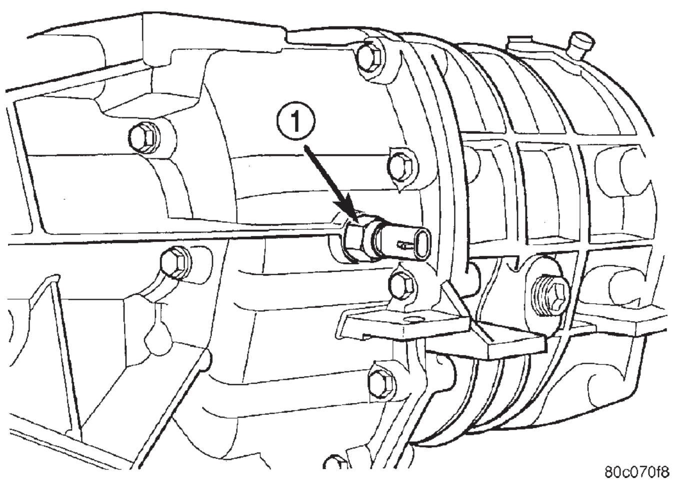


Fig. 9 Backup Light Switch Location

1 – BACKUP LAMP SWITCH

(6) Remove shift shaft lock bolt (Fig. 11). Bolt is located at top of front housing just forward of shift tower. Bolt is a shoulder bolt that secures the shift shaft bushing and lever.

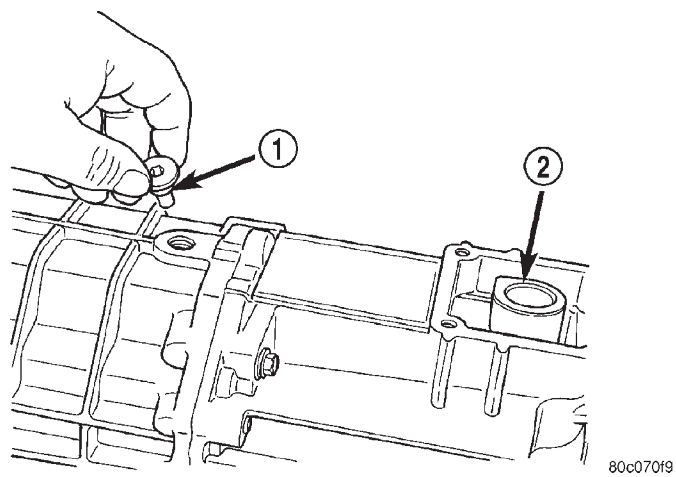


Fig. 11 Shift Shaft Lock Bolt Removal

1 – SHIFT SHAFT LOCK BOLT
2 – SHAFT SOCKET

(7) Use Remover 8117 and suitable slide hammer to remove shift shaft detent plug.

DISASSEMBLY AND ASSEMBLY (Continued)

(8) Remove shift shaft detent plunger and spring (Fig. 12). Use pencil magnet to remove spring then plunger, if necessary.

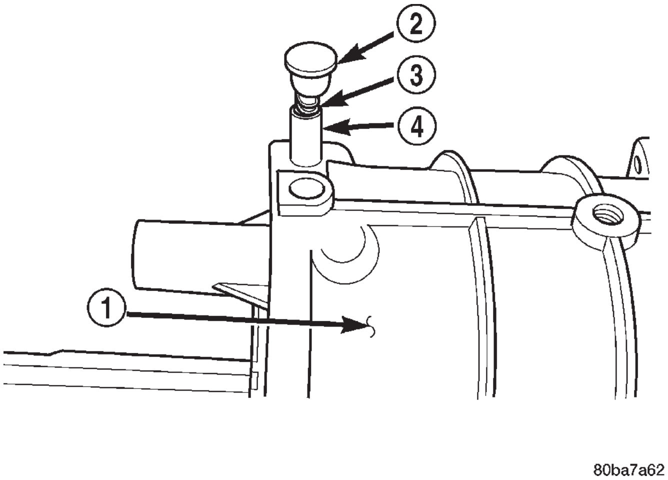


Fig. 12 Detent Plunger And Spring Removal

1 – FRONT HOUSING
2 – PLUG
3 – SPRING
4 – PLUNGER

(9) Remove bolts attaching input shaft bearing retainer to front housing (Fig. 13).

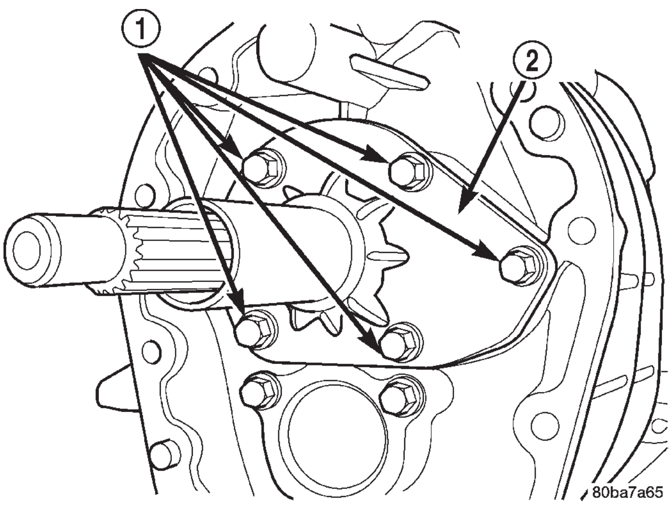


Fig. 13 Input Shaft Bearing Retainer Bolt Removal

1 – BOLTS (5)
2 – BEARING RETAINER

(10) Remove input shaft bearing retainer. Use pry tool to carefully lift retainer and

(11) Remove bearing retainer from input shaft (Fig. 14).

(12) Remove snap ring that secures input shaft in front bearing (Fig. 15).

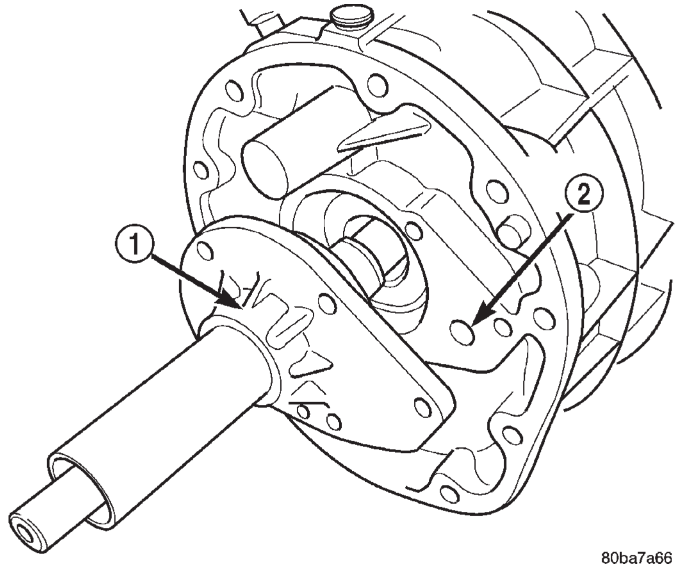


Fig. 14 Input Shaft Bearing Retainer Removal

1 – BEARING RETAINER
2 – OIL FEED

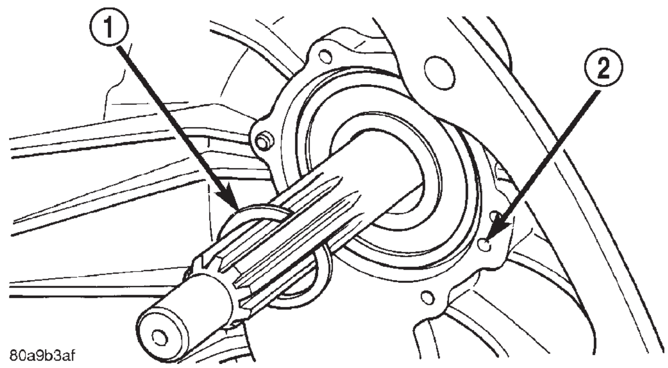


Fig. 15 Input Shaft Snap Ring Removal (Typical)

1 – INPUT SHAFT SNAP RING
2 – OIL FEED

(13) Remove bolts that attach front housing to rear housing (Fig. 16). Three bolts at extreme rear of housing are actually for the output shaft bearing retainer. It is not necessary to remove all three bolts at this time. Leave at least one bolt in place until geartrain is ready to be removed from case.

(14) Separate front housing from rear housing (Fig. 17). Use plastic mallet to tap front housing off alignment dowels.

(15) Remove and inspect input shaft bearing. Inspect countershaft front bearing race (Fig. 18).

(16) Note position of input shaft, shift shaft and forks, and geartrain components in housing (Fig. 19).

DISASSEMBLY AND ASSEMBLY (Continued)

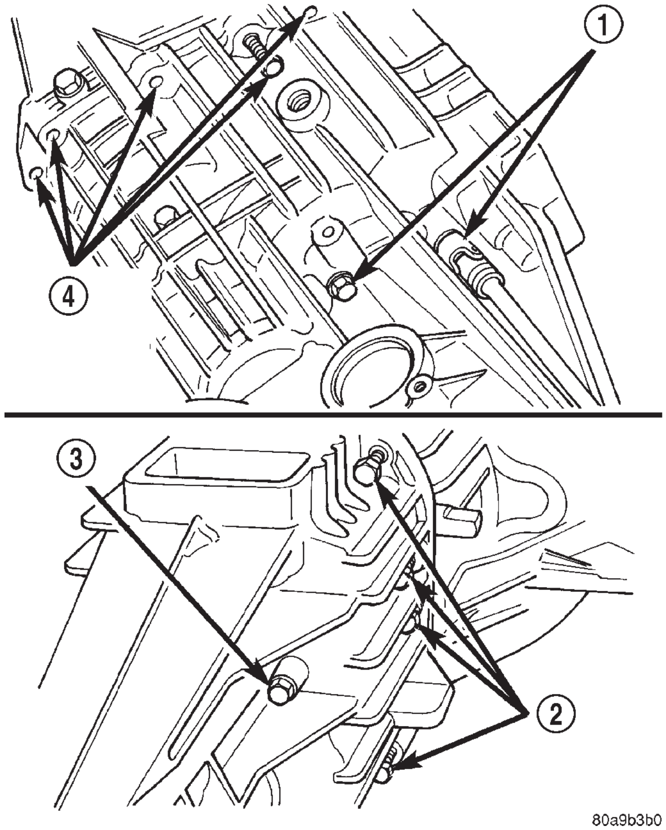


Fig. 16 Housing And Bearing Retainer Bolt Locations

1 – RETAINER BOLTS
2 – HOUSING BOLTS
3 – RETAINER BOLT
4 – HOUSING BOLT LOCATIONS

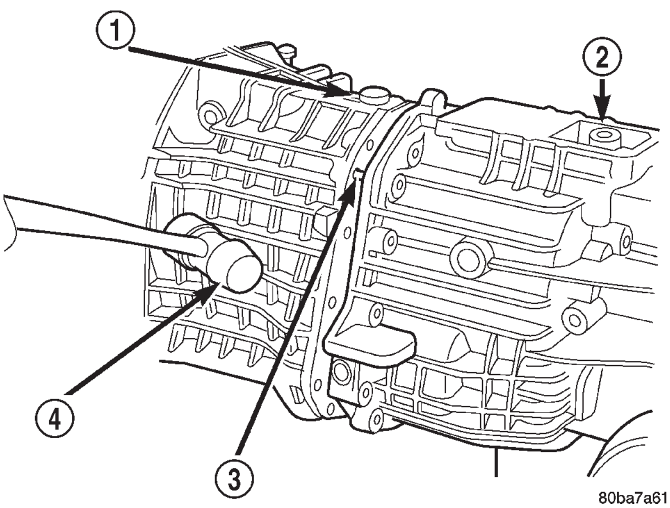


Fig. 17 Front Housing Removal

1 – FRONT HOUSING
2 – REAR HOUSING
3 – DOWELS (2)
4 – PLASTIC MALLET

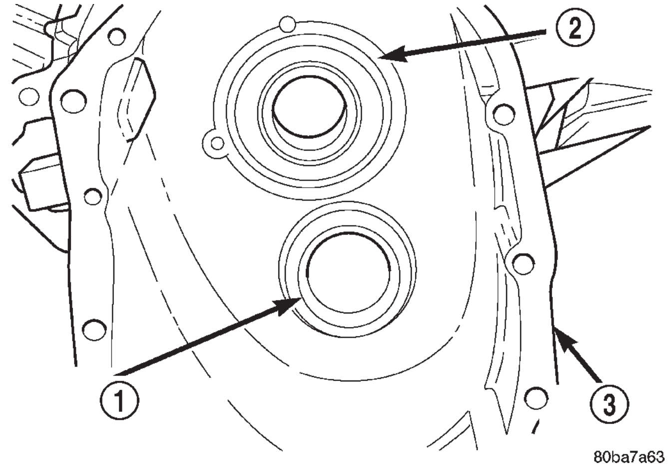


Fig. 18 Input Shaft Bearing and Countershaft Front Bearing Race Location

1 – COUNTERSHAFT FRONT BEARING RACE
2 – INPUT SHAFT BEARING
3 – FRONT HOUSING

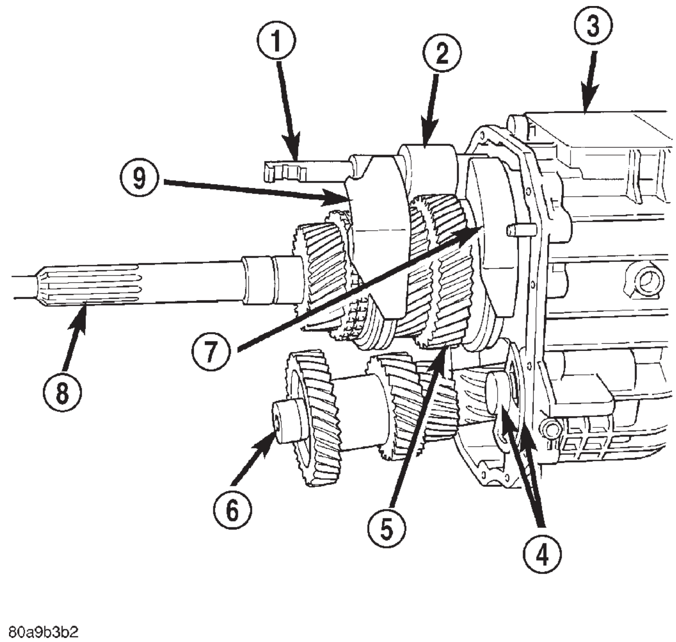


Fig. 19 Geartrain And Shift Component Identification

1 – SHIFT SHAFT
2 – BUSHING
3 – REAR HOUSING
4 – REVERSE IDLER AND SUPPORT
5 – OUTPUT SHAFT AND GEARS
6 – COUNTERSHAFT
7 – 1–2 FORK
8 – INPUT SHAFT
9 – 3–4 FORK

DISASSEMBLY AND ASSEMBLY (Continued)

SHIFT SHAFT, SHIFT FORKS AND REVERSE IDLER SEGMENT

(1) Using a hammer and suitable punch, drive out roll pin that secures shift bushing and lever to shift shaft (Fig. 20).

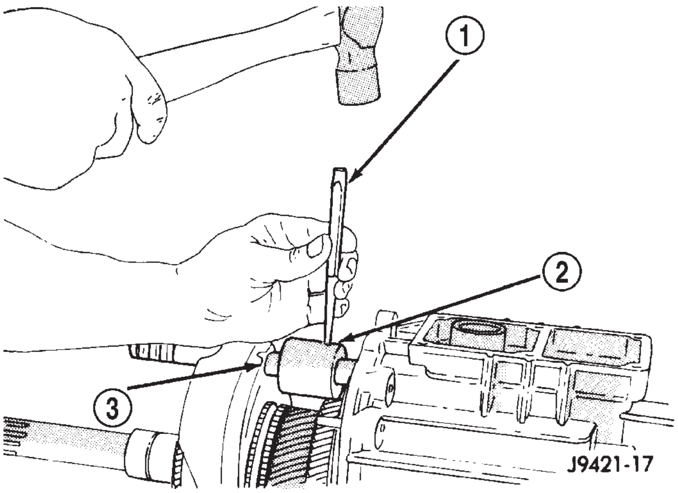


Fig. 20 Removing Shift Shaft Lever And Bushing Roll Pin

1 – PIN PUNCH
2 – BUSHING AND LEVER
3 – SHIFT SHAFT

(2) Position shift socket off to the side so that roll pin removal does not interfere with gears.

(3) Using a hammer and suitable punch, drive out shift socket roll pin to release shift socket from shaft. Roll pin will fall to bottom of rear housing and is easily retrieved.

NOTE: Be sure to use the proper size punch to prevent damage to the shift shaft.

(4) Pull shift shaft straight out of rear housing, shift socket, fifth-reverse fork, and 1-2 fork (Fig. 21).

(5) Remove shift socket from rear housing (Fig. 22).

(6) Remove lever and bushing (Fig. 23).

(7) Remove 3-4 fork. Rotate 3-4 fork around synchro sleeve until fork clears shift arms on 1-2 and fifth-reverse forks. Then remove 3-4 fork (Fig. 24).

(8) Remove the reverse idler shaft support bolt (front bolt) (Fig. 25).

(9) Loosen rear reverse idler shaft bolt (rear bolt) (Fig. 25).

(10) Remove reverse idler shaft support segment by sliding it straight out of housing.

(11) Remove reverse idler shaft bolt (rear bolt).

(12) Remove reverse idler shaft, idler gear, bearing, and thrust washer (Fig. 26).

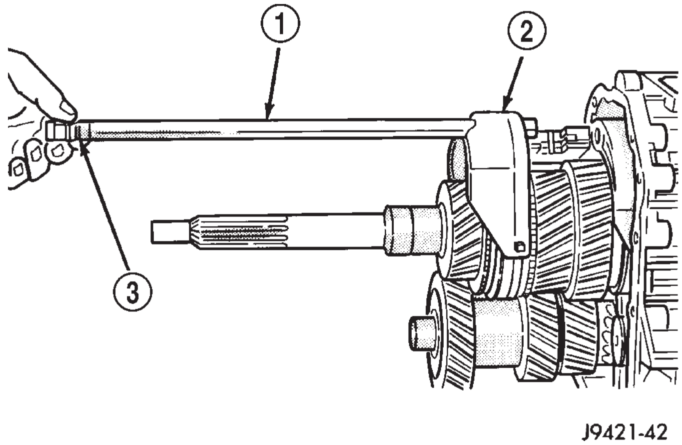


Fig. 21 Shift Shaft Removal

1 – SHIFT SHAFT
2 – 3–4 FORK
3 – SHAFT DETENT NOTCHES

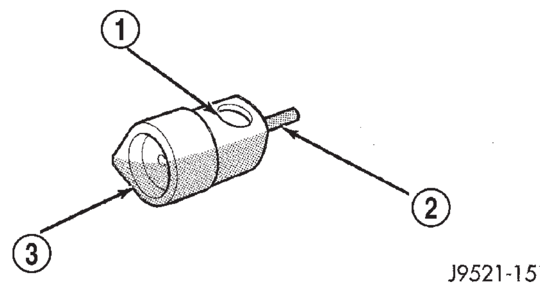


Fig. 22 Shift Socket And Roll Pin

1 – SHAFT BORE
2 – ROLL PIN
3 – SHIFT SOCKET

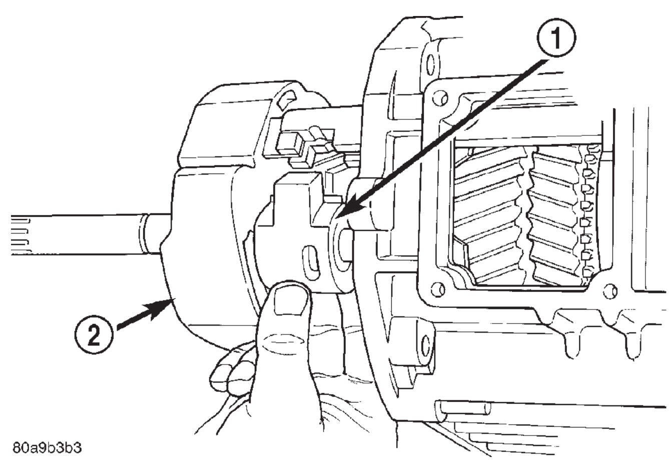


Fig. 23 Removing Shift Shaft Lever And Bushing

1 – SHAFT LEVER AND BUSHING
2 – 3–4 FORK

DISASSEMBLY AND ASSEMBLY (Continued)

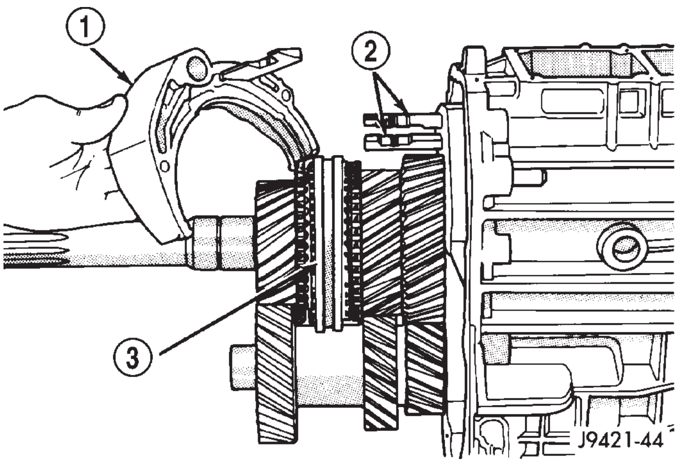


Fig. 24 Removing 3-4 Shift Fork

1 – 3–4 FORK
2 – 1–2 AND 5TH-REVERSE FORK ARMS
3 – 3–4 SYNCHRO SLEEVE

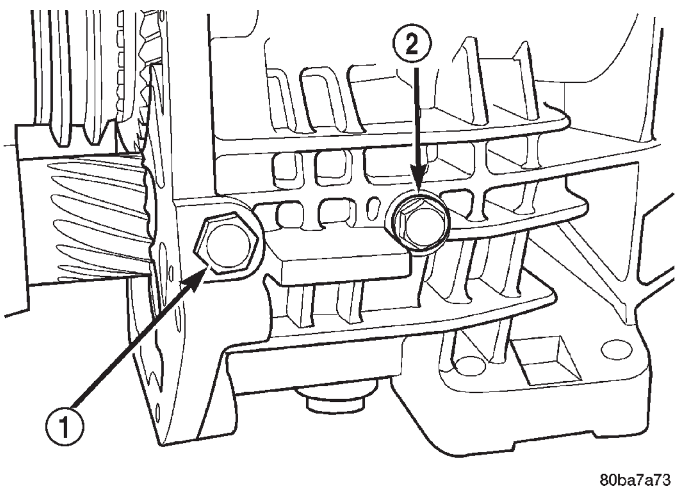


Fig. 25 Reverse Idler Shaft/Support Bolts

1 – SUPPORT BOLT
2 – SHAFT BOLT

GEARTRAIN

(1) Remove three bolts that attach output shaft bearing retainer to rear case (Fig. 27). Bolts are rear of shift tower opening.

(2) Grab hold of mainshaft and countershaft and remove geartrain from rear housing (Fig. 28).

(3) Examine condition of output shaft rear bearing bore and idler shaft notch in rear housing. Replace housing if any of these components are damaged. Inspect countershaft rear bearing race and replace if necessary.

PRELIMINARY GEARTRAIN

(1) Remove 1-2 and fifth-reverse forks from synchro sleeves.

(2) Separate countershaft from mainshaft.

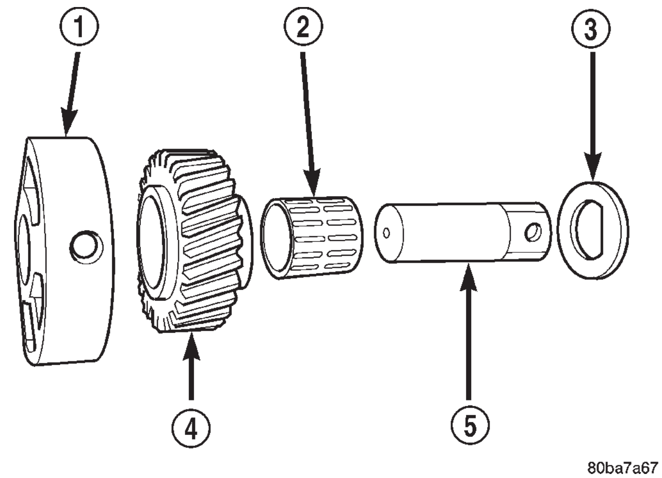


Fig. 26 Reverse Idler Assembly

1 – SUPPORT
2 – BEARING
3 – WASHER
4 – GEAR
5 – SHAFT

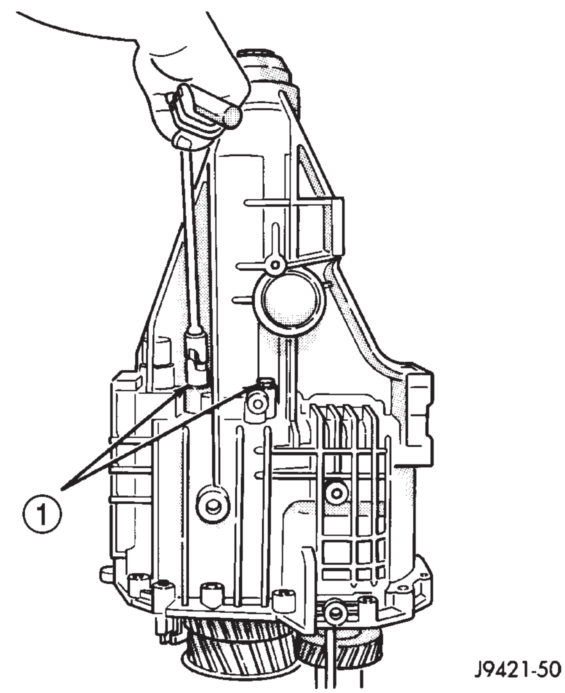


Fig. 27 Removing/Installing Output Shaft Bearing Retainer Bolts

1 – OUTPUT SHAFT BEARING RETAINER BOLTS (THIRD BOLT IS AT OPPOSITE SIDE OF CASE)

(3) Separate input shaft from output shaft.

(4) Inspect input/output shaft pilot bearing, input shaft pocket bore, and 4th gear synchro ring. Replace if necessary.

DISASSEMBLY AND ASSEMBLY (Continued)

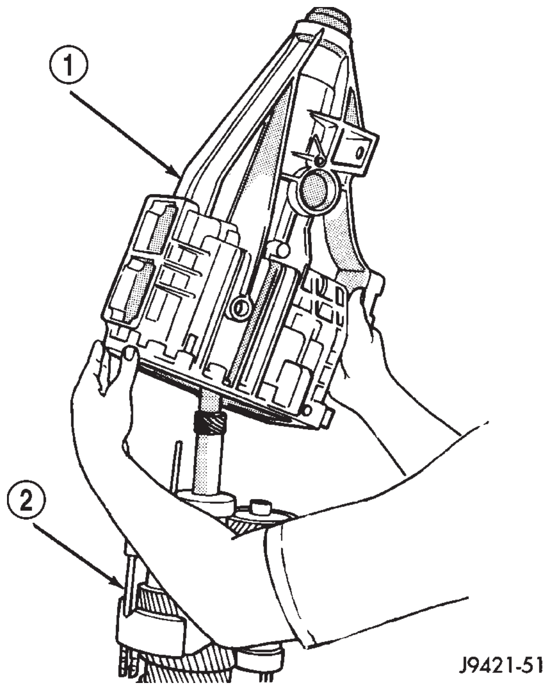


Fig. 28 Removing Geartrain from Rear Housing

1 – REAR HOUSING
2 – SHIFT FORKS AND GEARTRAIN

COUNTERSHAFT

(1) Remove countershaft front and rear bearing with Puller 8356.

(2) Remove rear bearing race (in rear housing) with Bearing Race Remover L-4454. Install new race with Race Driver C-4656 and Driver Handle C-4171.

(3) Remove bearing shim cap from front housing (below input shaft bearing retainer). Remove shim. Drive race through and out of housing with Race Driver C-4656 and Driver Handle C-4171. Install new race and drive into housing from outside. **Do not drive all the way into position. Tightening the shim cap will install the race to the proper position.** Install shim and shim cap and torque the shim cap bolts to 28.5 N·m (21 ft. lbs.).

OUTPUT SHAFT

NOTE: The synchronizer hubs and sleeves are different and must not be intermixed. It is recommended that each synchronizer unit be removed as an assembly to avoid intermixing parts. It is also recommended that each synchro hub and sleeve be marked with a scriber or paint for correct assembly reference.

(1) Remove snap ring that secures 3-4 synchro hub on output shaft.

(2) Remove 3-4 synchro assembly, third gear synchro ring, and third gear with shop press and Remover Tool 1130. Position Tool 1130 between second and third gears.

(3) Remove third gear needle bearing (Fig. 29).

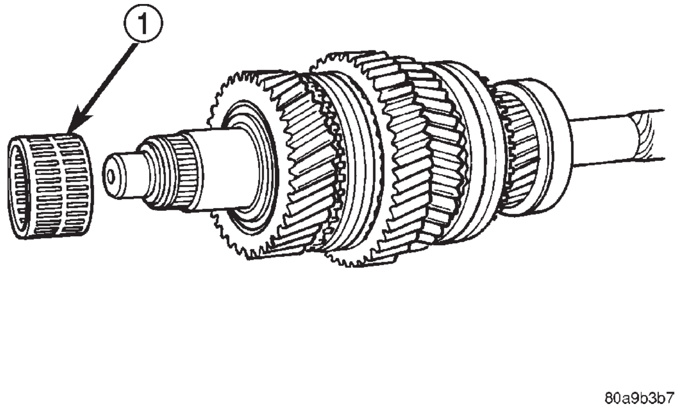


Fig. 29 Third Gear Needle Bearing Removal

1 – THIRD GEAR NEEDLE BEARING

(4) Remove retaining ring that secures two-piece thrust washer on shaft.

(5) Remove two-piece thrust washer (Fig. 30). Note position of washer locating lugs in shaft notches for installation reference.

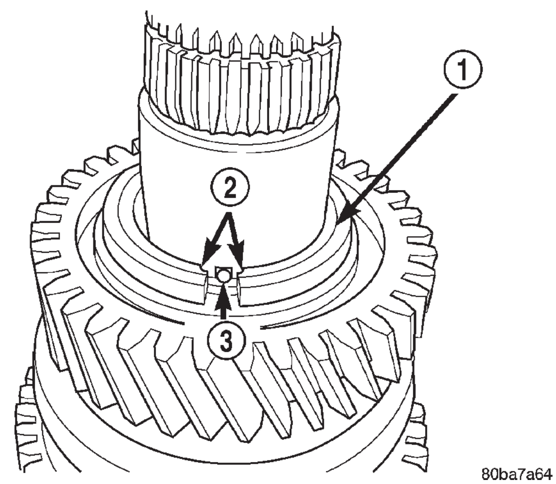


Fig. 30 Two-Piece Thrust Washer Removal

1 – WASHER (2 HALVES)
2 – PIN RELIEF
3 – PIN

(6) Remove second gear and needle bearing (Fig. 31).

(7) Remove 2nd–3rd gear thrust washer locating pin and store in a place where it can be found easily upon re-assembly.

DISASSEMBLY AND ASSEMBLY (Continued)

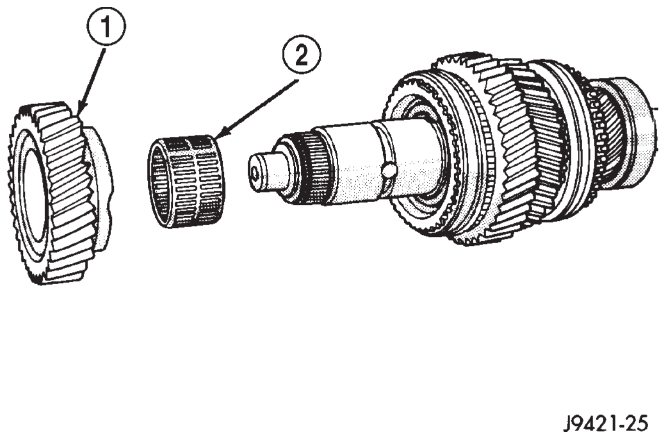


Fig. 31 Second Gear And Needle Bearing Removal

1 – SECOND GEAR
2 – SECOND GEAR NEEDLE BEARING

(8) Remove second gear synchro ring and synchro cone.

(9) Remove 1-2 synchro hub snap ring.

(10) Remove 1-2 synchro hub and sleeve and first gear from output shaft with shop press and Remover Tool 1130 (Fig. 32). Position Tool 1130 between first and reverse gears.

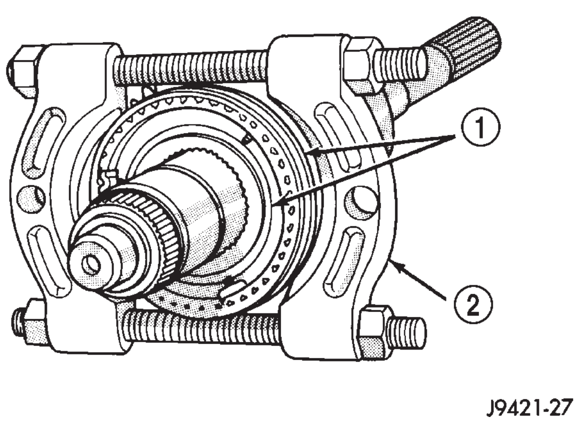


Fig. 32 Hub And Sleeve Removal—1-2 Synchro

1 – 1–2 SYNCHRO HUB AND SLEEVE
2 – SPECIAL TOOL 1130

(11) Remove first gear needle bearing (Fig. 33).

(12) Remove output shaft bearing snap ring (Fig. 34).

(13) Remove output shaft bearing from shaft with shop press and remover tool 1130. Position Tool 1130 between bearing and 5th gear.

(14) Remove fifth gear (Fig. 35).

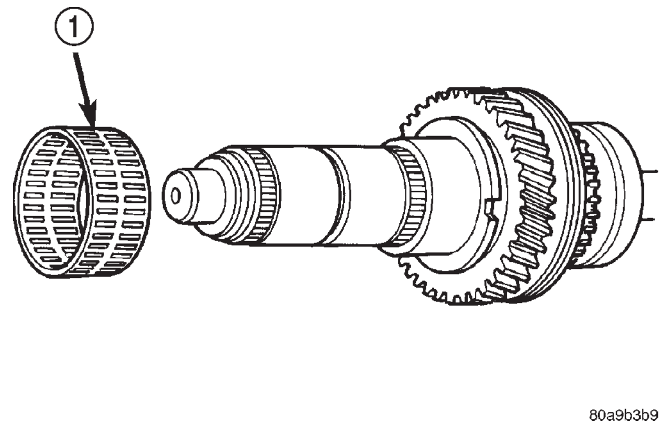


Fig. 33 First Gear Needle Bearing Removal

1 – FIRST GEAR NEEDLE BEARING

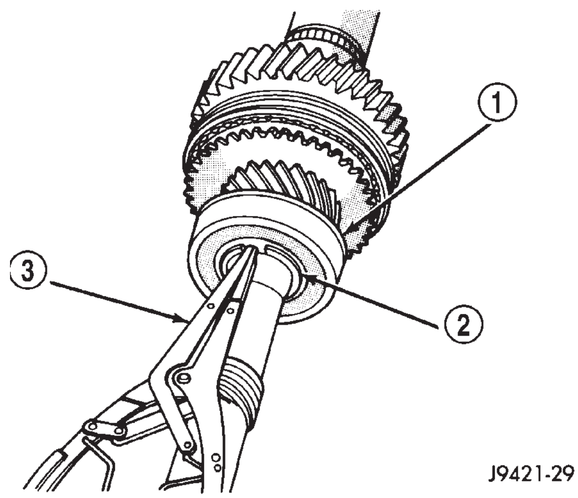


Fig. 34 Output Shaft Bearing Snap Ring Removal

1 – OUTPUT SHAFT BEARING
2 – BEARING SNAP RING
3 – SNAP RING PLIERS

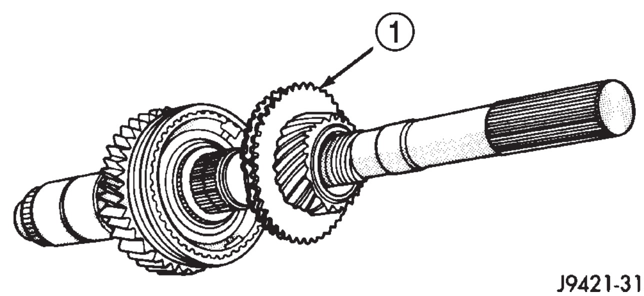


Fig. 35 Fifth Gear Removal

1 – FIFTH GEAR AND SYNCHRO RING

(15) Remove fifth gear needle bearing. Spread bearing apart just enough to clear shoulder on output shaft (Fig. 36).

DISASSEMBLY AND ASSEMBLY (Continued)

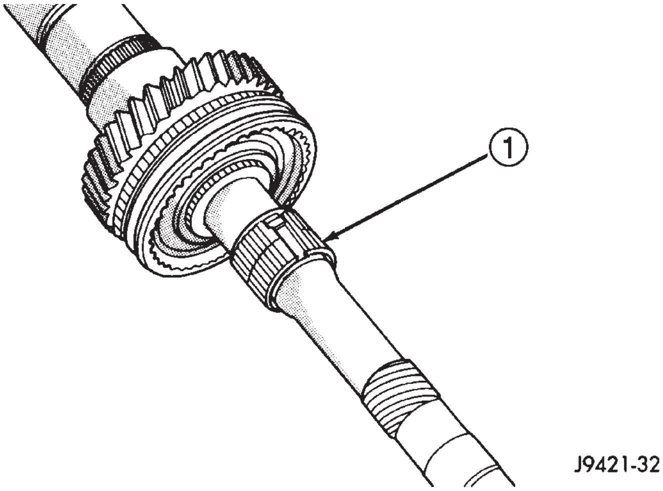


Fig. 36 Fifth Gear Needle Bearing Removal

1 – FIFTH GEAR NEEDLE BEARING (SPREAD BEARING TO CLEAR SHOULDER ON SHAFT)

(16) Remove fifth-reverse synchro hub snap ring (Fig. 37).

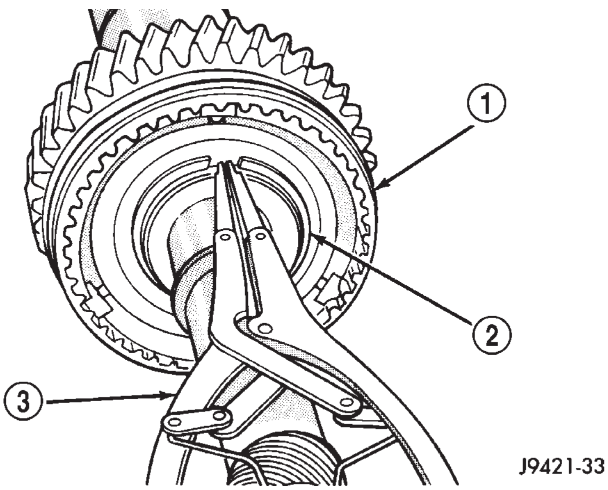


Fig. 37 Fifth-Reverse Synchro Hub Snap Ring Removal

1 – FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
2 – SYNCHRO HUB SNAP RING
3 – SNAP RING PLIERS

(17) Remove fifth-reverse synchro hub and sleeve with shop press (Fig. 38).

(18) Remove reverse gear and needle bearing (Fig. 39).

ASSEMBLY

COUNTERSHAFT

Examine condition of countershaft gears and bearings. Worn or broken gears require shaft replacement. Inspect bearings for excessive wear, damaged cage, or missing rollers. If replacing countershaft

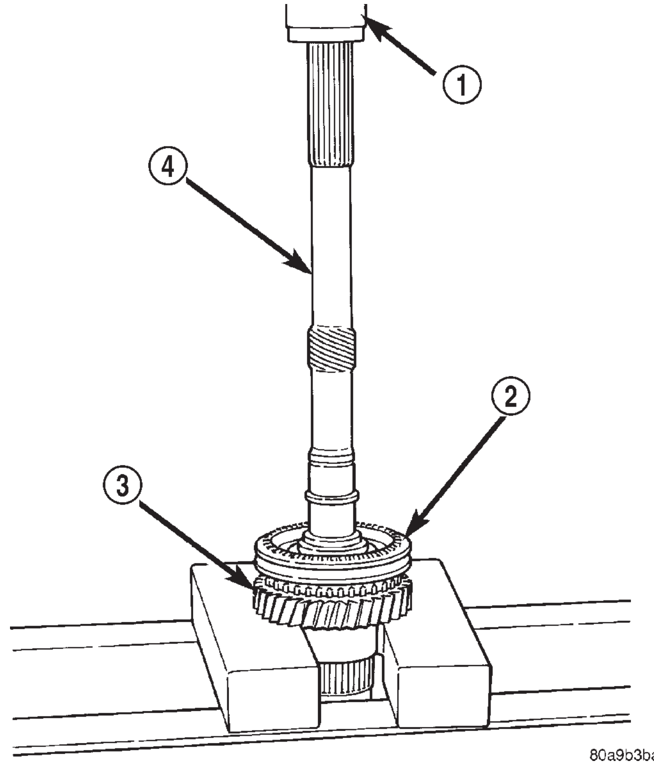


Fig. 38 Fifth-Reverse Synchro Hub And Sleeve Removal

1 – PRESS
2 – FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
3 – REVERSE GEAR
4 – OUTPUT SHAFT

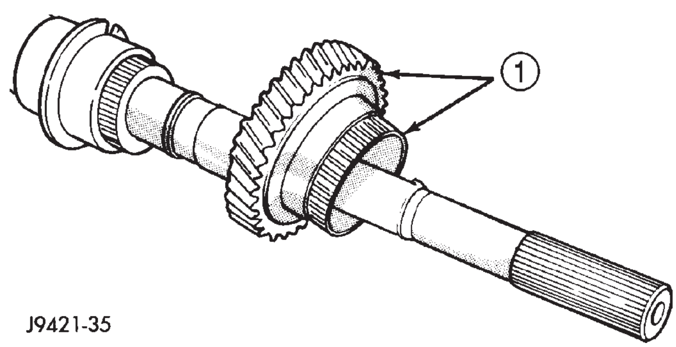


Fig. 39 Reverse Gear And Needle Bearing Removal

1 – REVERSE GEAR AND NEEDLE BEARING

bearings, the bearing race (located in front and rear housing) must be replaced also.

SYNCHRONIZER

The easiest method of assembling each synchro is to install the springs, struts and detent balls one at a time as follows:

(1) Slide the sleeve part way onto the hub. Leave enough room to install the spring in the hub and the strut in the hub groove.

DISASSEMBLY AND ASSEMBLY (Continued)

(2) Install the first spring in the hub. Then install a strut over the spring. Be sure the spring is seated in the spring bore in the strut.

(3) Slide the sleeve onto the hub just far enough to hold the first strut and spring in place.

(4) Place the detent ball in the top of the strut. Then carefully work the sleeve over the ball to hold it in place. A small flat blade screwdriver can be used to press the ball into place while moving the sleeve over it.

(5) Repeat the procedure for the remaining springs, struts and balls. Tape, or a rubber band can be used to temporarily secure each strut and ball as they are installed.

(6) Verify synchro assembly. Be sure the three springs, struts and detent balls are all in place (Fig. 40).

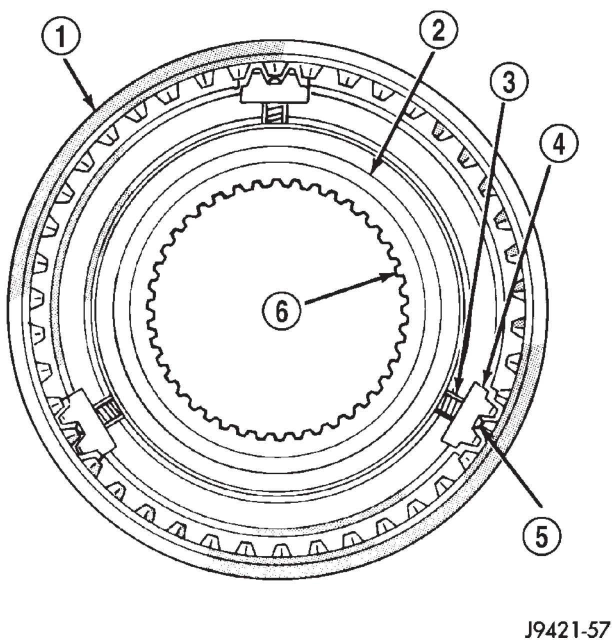


Fig. 40 Assembled View Of Synchro Components

1 – SLEEVE
2 – HUB SHOULDER
3 – SPRING (3)
4 – STRUT (3)
5 – DETENT BALL (3)
6 – HUB

OUTPUT SHAFT

NOTE: The synchronizer sleeves must be assembled with the grooves toward the first, third, and fifth gear. Additional sleeve identification is as follows:

- **First and second: one groove on the outer diameter toward the first gear. The 1–2 synchro sleeve may not have the identification groove readily visible. If the groove is not present, the smaller land on the side of synchro sleeve can be used for orientation. The small land goes toward first gear.**
- **Third and fourth: two grooves on the outer diameter toward the third gear.**
- **Fifth and reverse: two grooves on the outer diameter toward the fifth gear.**

(1) Lubricate shaft, gears and bearings with recommended lubricant during assembly. Petroleum jelly can be used to hold parts in place.

(2) Check bearing surfaces of output shaft for nicks or scratches. Smooth surfaces with 320/400 grit emery cloth if necessary. Apply oil to emery cloth and shaft surface before polishing.

(3) Inspect and replace any synchro ring that exhibits wear or damage. Completely immerse each synchro ring in lubricant before installation.

(4) Lubricate and install reverse gear needle bearing on shaft (Fig. 41). Slide bearing up against shoulder on output shaft.

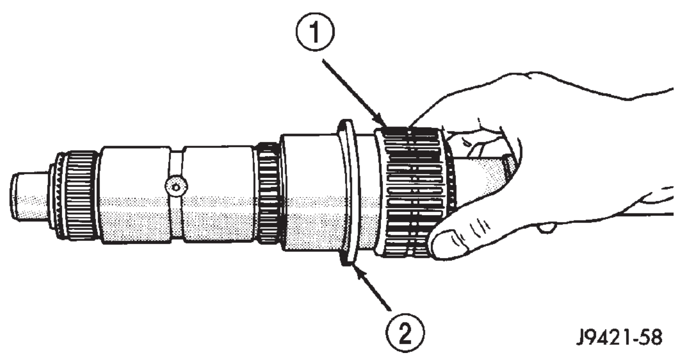


Fig. 41 Reverse Gear Bearing Installation

1 – REVERSE GEAR BEARING
2 – SHOULDER

(5) Install reverse gear over needle bearing (Fig. 42).

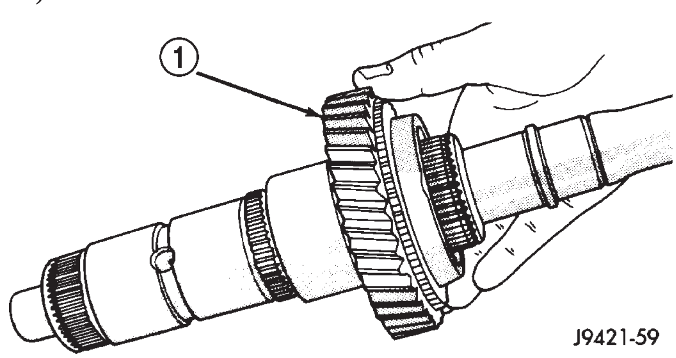


Fig. 42 Reverse Gear Installation

1 – REVERSE GEAR

(6) Install solid brass synchro ring on reverse gear (Fig. 43).

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: This synchro ring is different than all the rest. The angle on the friction face is 9° versus the 6.5° of all the other synchro rings. Check to be sure that the right one is used.

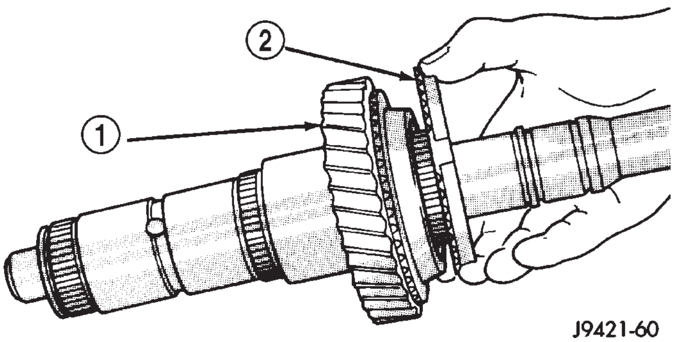


Fig. 43 Reverse Gear Synchro Ring Installation

1 – REVERSE GEAR
2 – SYNCHRO RING (SOLID BRASS)

(7) Assemble fifth-reverse synchro hub, sleeve, struts, springs and detent balls, if not previously done.

CAUTION: The fifth-reverse synchro hub and sleeve can be installed backwards if care is not exercised. One side of the sleeve has double grooves and offset teeth. This side is to be installed away from reverse gear (towards 5th).

(8) Start fifth-reverse synchro assembly on output shaft splines by hand. Then seat synchro onto shaft with shop press and Remover 6310-1 (Fig. 44).

NOTE: The synchro hub is designed such that the press should be necessary to install the synchro assembly onto the output shaft. There may be instances where the press is not necessary. As long as there is a snug fit between the hub and the shaft, the hub does not need to be replaced.

(9) Install new fifth-reverse hub snap ring (Fig. 45) as follows:

(a) Install thickest snap ring that will fit in shaft groove.

(b) Verify that snap ring is completely seated in groove before proceeding.

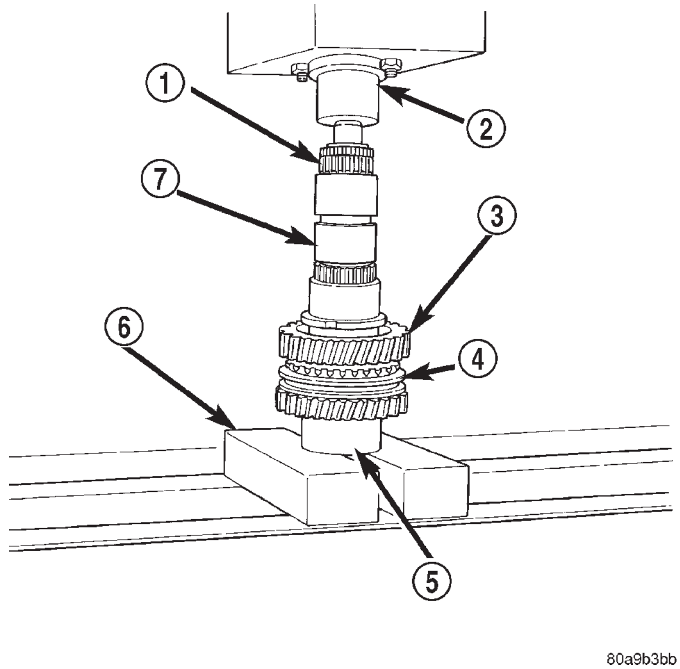


Fig. 44 Fifth-Reverse Synchro Assembly Installation

1 – SPACER
2 – PRESS RAM
3 – REVERSE GEAR
4 – FIFTH-REVERSE SYNCHRO ASSEMBLY
5 – SPECIAL TOOL 6310–1
6 – PRESS BLOCKS
7 – OUTPUT SHAFT

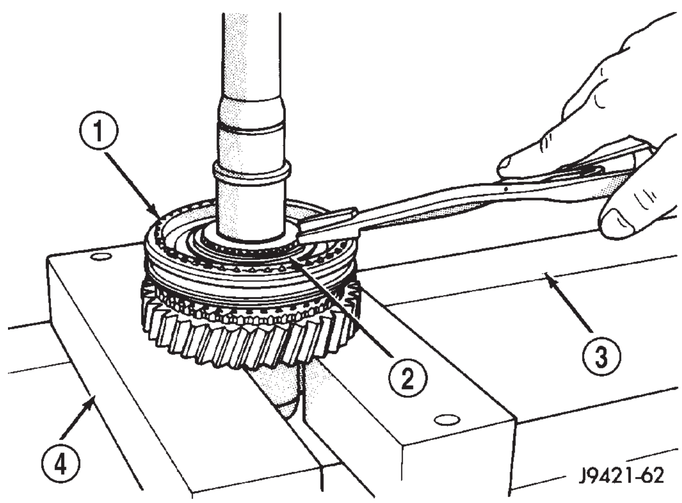


Fig. 45 Installing Fifth-Reverse Synchro Hub Snap Ring

1 – FIFTH-REVERSE SYNCHRO ASSEMBLY
2 – SNAP RING
3 – PRESS BED
4 – PRESS BLOCKS

DISASSEMBLY AND ASSEMBLY (Continued)

(10) Install fifth gear synchro ring in synchro hub and sleeve (Fig. 46).

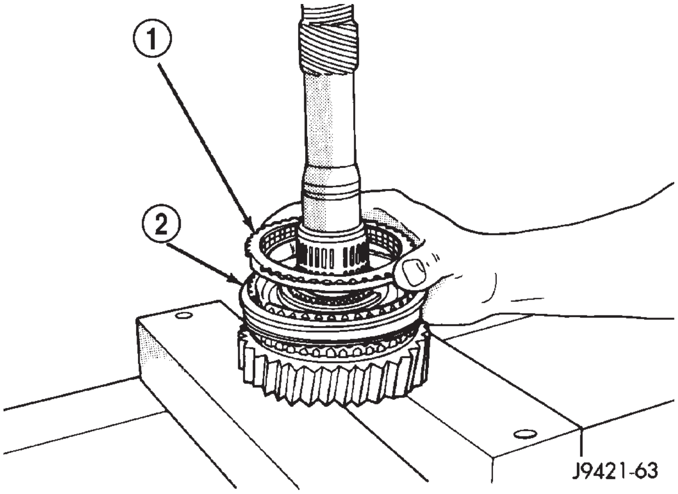


Fig. 46 Installing Fifth Gear Synchro Ring

1 – FIFTH-SPEED SYNCHRO RING
2 – FIFTH-REVERSE SYNCHRO ASSEMBLY

(11) Install fifth gear bearing. Spread bearing only enough to clear shoulder on output shaft (Fig. 47). Be sure bearing is properly seated after installation.

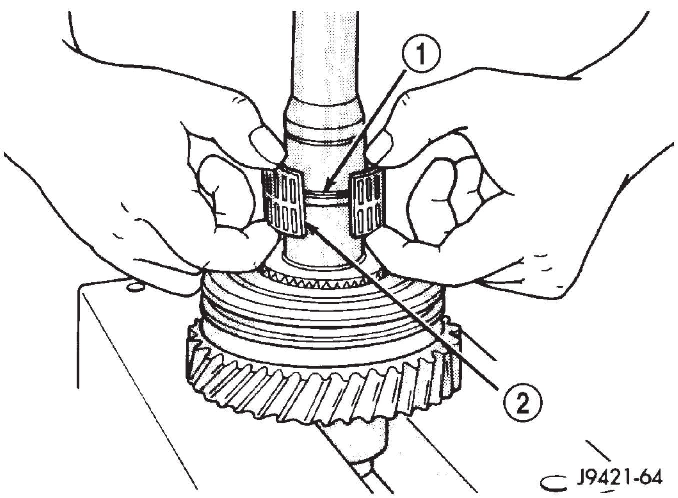


Fig. 47 Installing Fifth Gear Bearing

1 – SHAFT SHOULDER
2 – FIFTH GEAR BEARING

(12) Install fifth gear on shaft and onto bearing (Fig. 48).

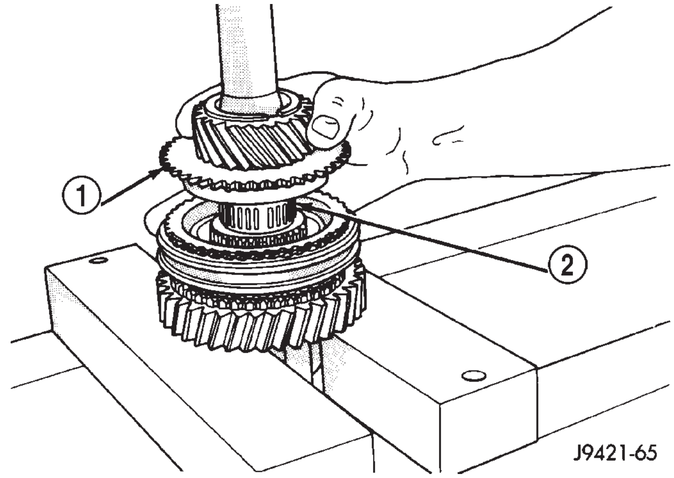


Fig. 48 Fifth Gear Installation

1 – FIFTH GEAR
2 – BEARING

(13) Install output shaft bearing.

(14) Install output shaft bearing snap ring (Fig. 49). Use heavy duty snap ring pliers and spread snap ring only enough to install it. Be sure snap ring is completely seated in shaft groove before proceeding.

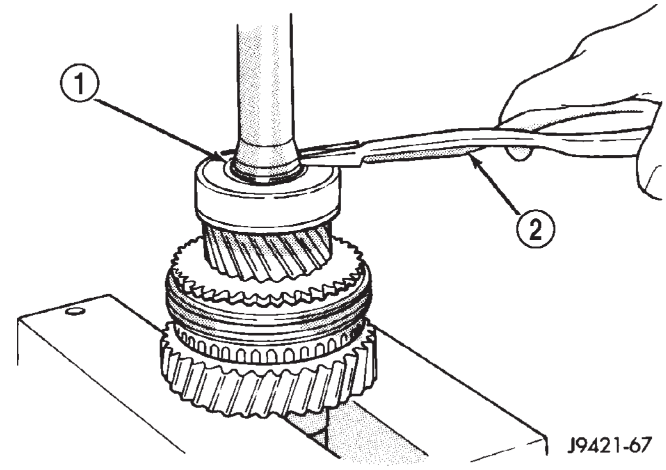


Fig. 49 Installing Output Shaft Bearing Snap Ring

1 – BEARING SNAP RING
2 – HEAVY DUTY SNAP RING PLIERS

(15) Invert output shaft and set the shaft in Remover 6310-1 so that fifth gear is seated on the tool (Fig. 50).

(16) Install first gear bearing on output shaft (Fig. 50). Be sure bearing is seated on shaft shoulder and is properly joined.

(17) Install the synchro cone onto first gear. Verify the locating tabs on the synchro cone are properly located to the recesses in first gear.

DISASSEMBLY AND ASSEMBLY (Continued)

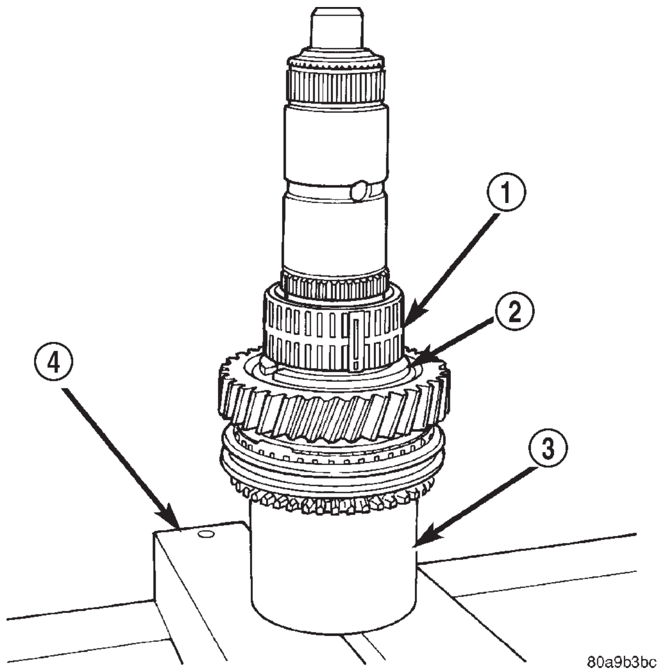


Fig. 50 First Gear Bearing Installation

1 – FIRST GEAR BEARING
2 – SHAFT SHOULDER
3 – SPECIAL TOOL 6310–1
4 – PRESS BLOCKS

(18) Install first gear on shaft and over bearing (Fig. 51). Make sure bearing synchro cone is facing up as shown.

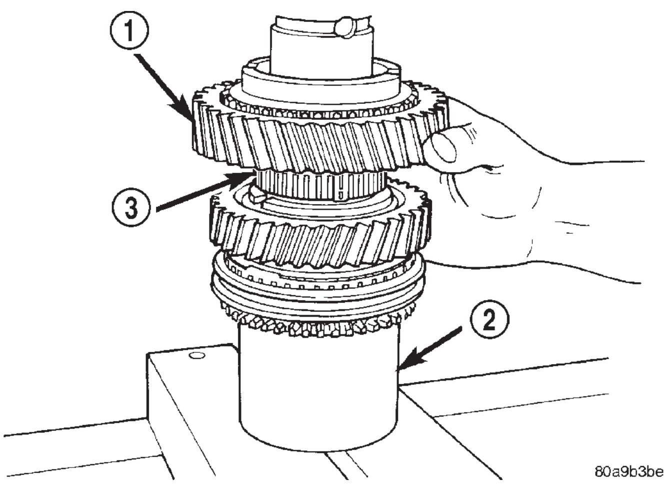


Fig. 51 First Gear Installation

1 – FIRST GEAR
2 – SPECIAL TOOL 6310–1
3 – BEARING

(19) Install first gear synchro ring (Fig. 52).

(20) Assemble 1-2 synchro hub sleeve, springs, struts and detent balls.

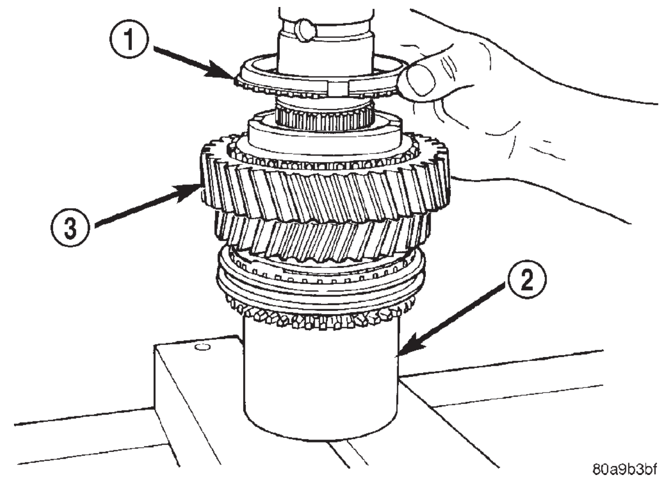


Fig. 52 First Gear Synchro Ring Installation

1 – FIRST GEAR SYNCHRO RING
2 – SPECIAL TOOL 6310–1
3 – FIRST GEAR

CAUTION: The 1–2 synchro hub and sleeve can be installed backwards if care is not exercised. One side of the sleeve has a groove and offset teeth. This side is to be installed towards 1st gear (away from 2nd gear).

(21) Start 1-2 synchro assembly on shaft by hand (Fig. 53). Be sure synchro sleeve is properly positioned.

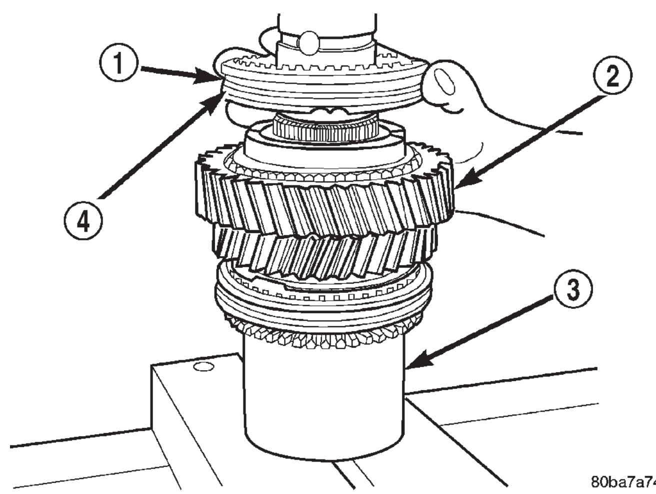


Fig. 53 Starting 1-2 Synchro On Shaft

1 – 1–2 SYNCHRO ASSEMBLY
2 – 1ST GEAR
3 – SPECIAL TOOL 6310–1
4 – BE SURE THIS IS SINGLE GROOVE SIDE OF SYNCHRO SLEEVE

(22) Press 1-2 synchro onto output shaft using suitable size pipe tool and shop press (Fig. 54).

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: The synchro hub is designed such that the press should be necessary to install the synchro assembly onto the output shaft. There may be instances where the press is not necessary. As long as there is a snug fit between the hub and the shaft, the hub does not need to be replaced.

CAUTION: Take time to align the synchro ring and sleeve as hub the is being pressed onto the shaft. The synchro ring can be cracked if it becomes mis-aligned.

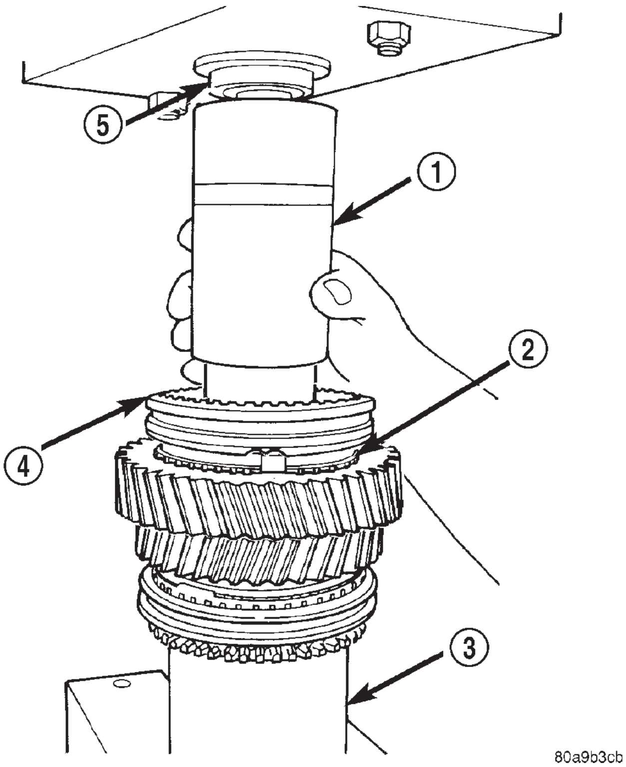


Fig. 54 Pressing 1-2 Synchro Assembly Onto Output Shaft

1 – SUITABLE SIZE PIPE TOOL
2 – SYNCHRO RING
3 – SPECIAL TOOL 6310–1
4 – 1–2 SYNCHRO ASSEMBLY
5 – PRESS RAM

(23) Install new 1-2 synchro hub snap ring (Fig. 55) as follows:

(a) Install thickest snap ring that will fit in shaft groove.

(b) Verify that snap ring is completely seated in groove before proceeding.

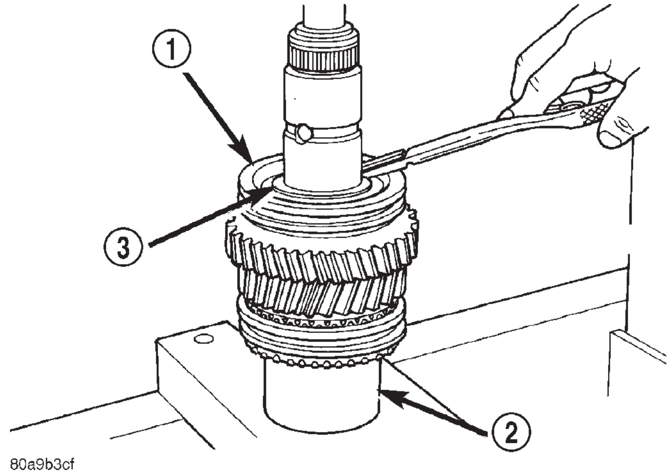


Fig. 55 Installing 1-2 Synchro Hub Snap Ring

1 – 1–2 SYNCHRO
2 – SPECIAL TOOL 6310–1
3 – SYNCHRO SNAP RING

(24) Install second gear synchro ring in 1-2 synchro hub and sleeve (Fig. 56). Be sure synchro ring is properly seated in sleeve.

(25) Install synchro cone into the synchro ring.

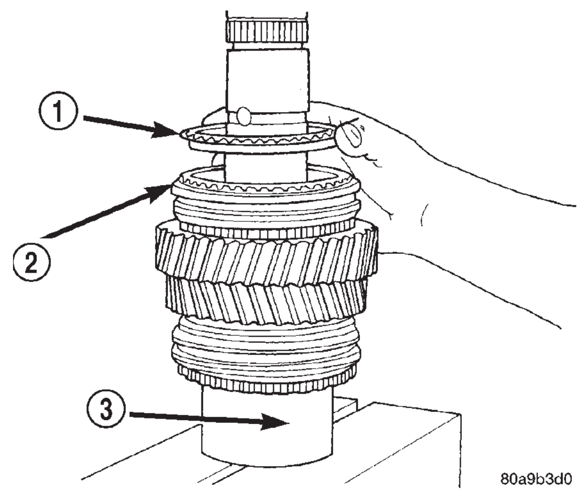


Fig. 56 Second Gear Synchro Ring Installation

1 – SECOND GEAR SYNCHRO RING
2 – 1–2 SYNCHRO
3 – SPECIAL TOOL 6310–1

DISASSEMBLY AND ASSEMBLY (Continued)

(26) Install second gear needle bearing on shaft (Fig. 57).

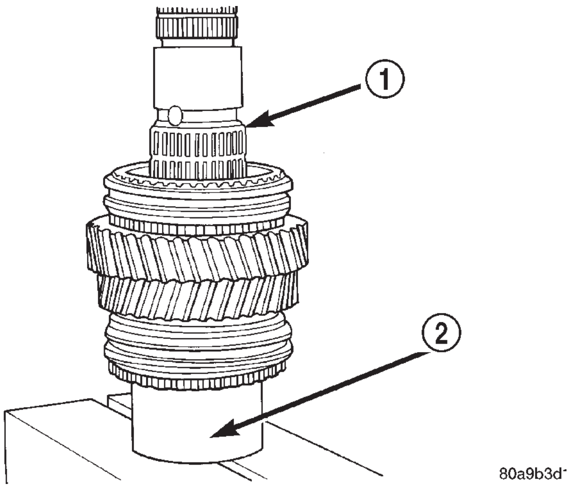


Fig. 57 Second Gear Bearing Installation

1 – SECOND GEAR BEARING
2 – SPECIAL TOOL 6310–1

(27) Install second gear onto shaft and bearing (Fig. 58). Make sure that second gear is fully seated on synchro components.

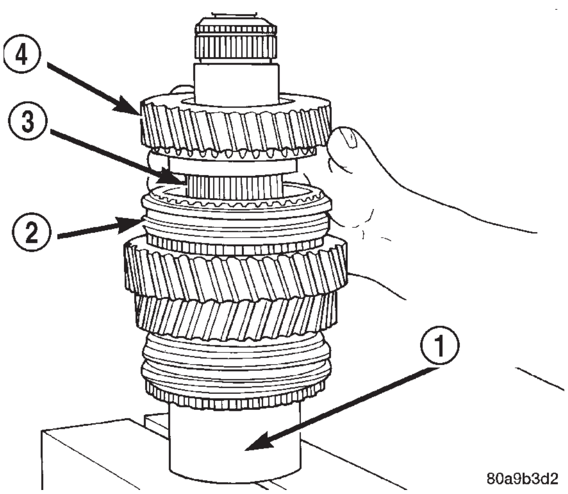


Fig. 58 Second Gear Installation

1 – SPECIAL TOOL 6310–1
2 – 1–2 SYNCHRO ASSEMBLY
3 – BEARING
4 – SECOND GEAR

(28) Install thrust washer pin to shaft. Install two-piece thrust washer (Fig. 59). Be sure washer halves are seated in shaft groove and that pin reliefs are positioned at washer locating pin.

(29) Seat retaining ring around two-piece thrust washer.

(30) Install third gear needle bearing on shaft (Fig. 60).

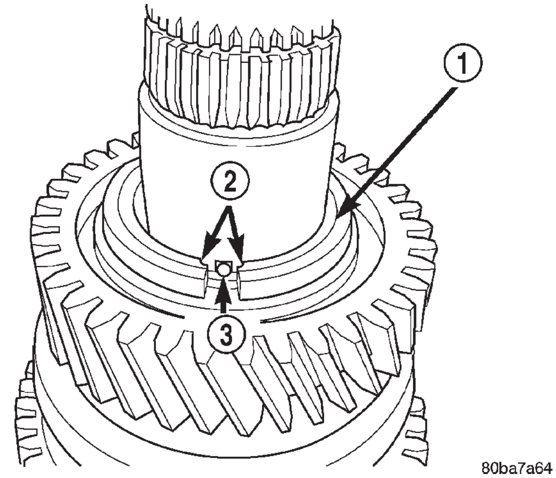


Fig. 59 Installing Two-Piece Thrust Washer

1 – WASHER (2 HALVES)
2 – PIN RELIEF
3 – PIN

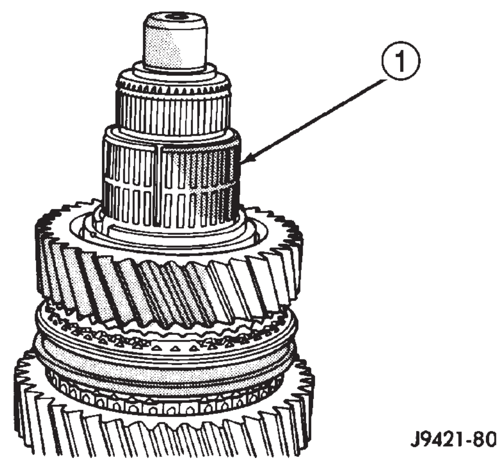


Fig. 60 Third Gear Bearing Installation

1 – THIRD GEAR BEARING

(31) Install third gear on shaft and bearing (Fig. 61).

(32) Install third speed synchro ring on third gear (Fig. 62).

(33) Assemble 3-4 synchro hub, sleeve, springs, struts and detent balls.

CAUTION: The 3–4 synchro hub and sleeve can be installed backwards if care is not exercised. One side of the sleeve has two grooves and offset teeth. This side is to be installed towards 3rd gear (away from 4th gear).

(34) Start 3-4 synchro hub on output shaft splines by hand (Fig. 63).

DISASSEMBLY AND ASSEMBLY (Continued)

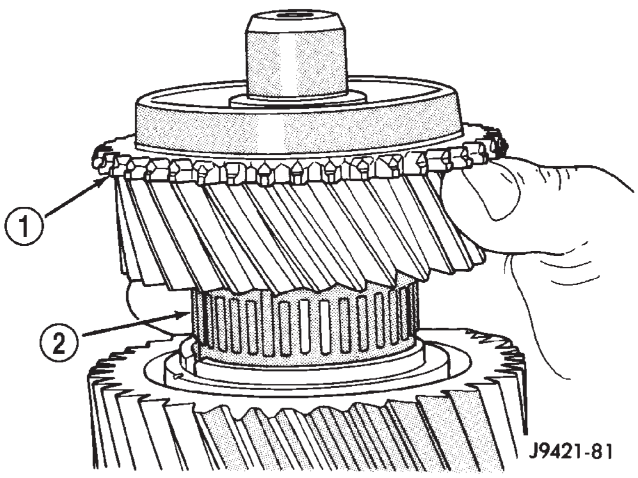


Fig. 61 Installing Third Gear

1 – THIRD GEAR
2 – BEARING

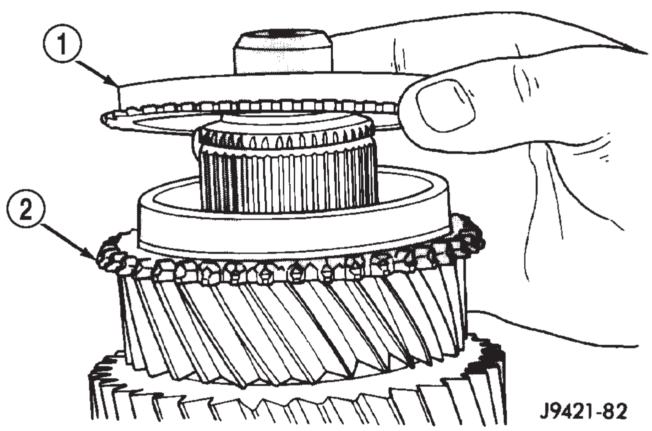


Fig. 62 Third Speed Synchro Ring Installation

1 – THIRD SPEED SYNCHRO RING
2 – THIRD GEAR

(35) Press 3-4 synchro assembly onto output shaft with shop press and suitable size pipe tool (Fig. 64). Make sure that the tool presses on hub as close to output shaft as possible but does not contact the shaft splines.

NOTE: The synchro hub is designed such that the press should be necessary to install the synchro assembly onto the output shaft. There may be instances where the press is not necessary. As long as there is a snug fit between the hub and the shaft, the hub does not need to be replaced.

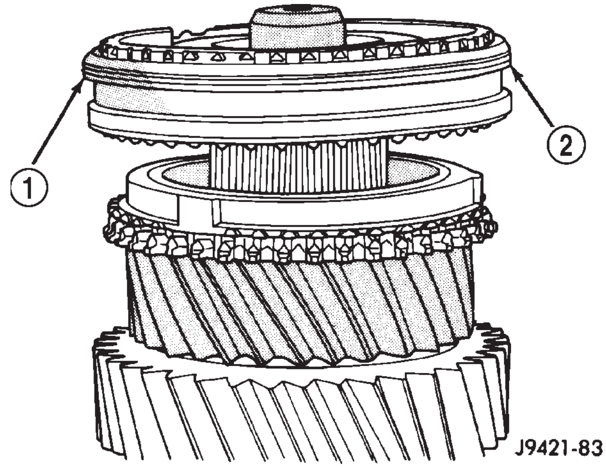


Fig. 63 Starting 3-4 Synchro Hub On Output Shaft

1 – GROOVED SIDE OF SLEEVE (TO FRONT)
2 – 3–4 SYNCHRO ASSEMBLY

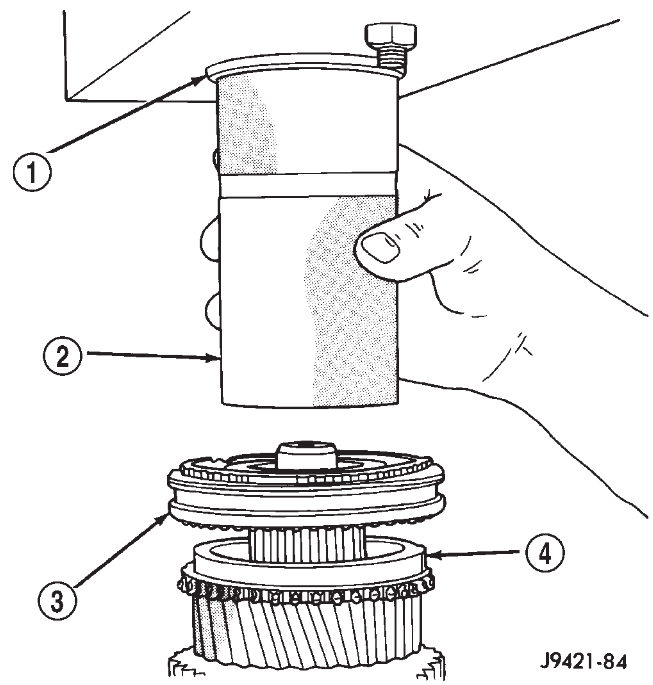


Fig. 64 Pressing 3-4 Synchro Assembly On Output Shaft

1 – PRESS RAM
2 – PIPE TOOL
3 – 3–4 SYNCHRO
4 – THIRD SPEED SYNCHRO RING

(36) Install 3-4 synchro hub snap ring (Fig. 65) as follows:

(a) Install thickest snap ring that will fit in shaft groove. Use heavy duty snap ring pliers to install new ring.

(b) Verify that snap ring is completely seated in groove before proceeding.

DISASSEMBLY AND ASSEMBLY (Continued)

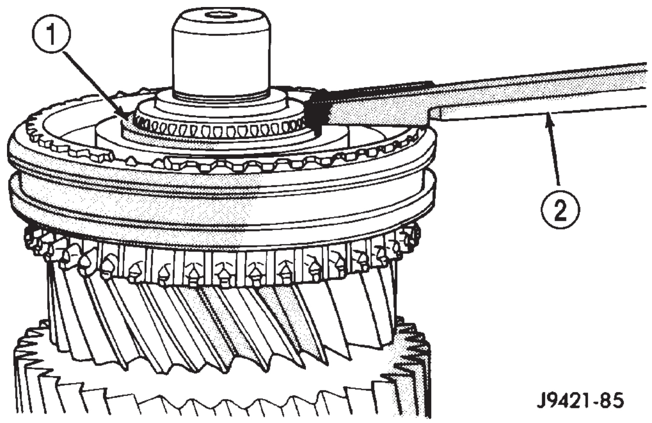


Fig. 65 Installing 3-4 Synchro Hub Snap Ring

1 – 3–4 SYNCHRO HUB SNAP RING
2 – HEAVY DUTY SNAP RING PLIERS

(37) Verify correct position of synchro sleeves before proceeding with assembly operations (Fig. 66). Grooved side of 3-4 sleeve should be facing rearward toward third gear. First gear side of 1-2 sleeve should be facing first gear. Tapered side of fifth-reverse sleeve with two grooves should be facing rearward toward fifth gear.

GEARTRAIN ASSEMBLY

(1) Install input shaft into Support Stand 8355 (Fig. 67).

(2) Install pilot bearing in input shaft (Fig. 67).

NOTE: There is a correct and an incorrect way to install the pilot bearing into the input shaft. The side of the pilot bearing with the small diameter goes toward the input shaft.

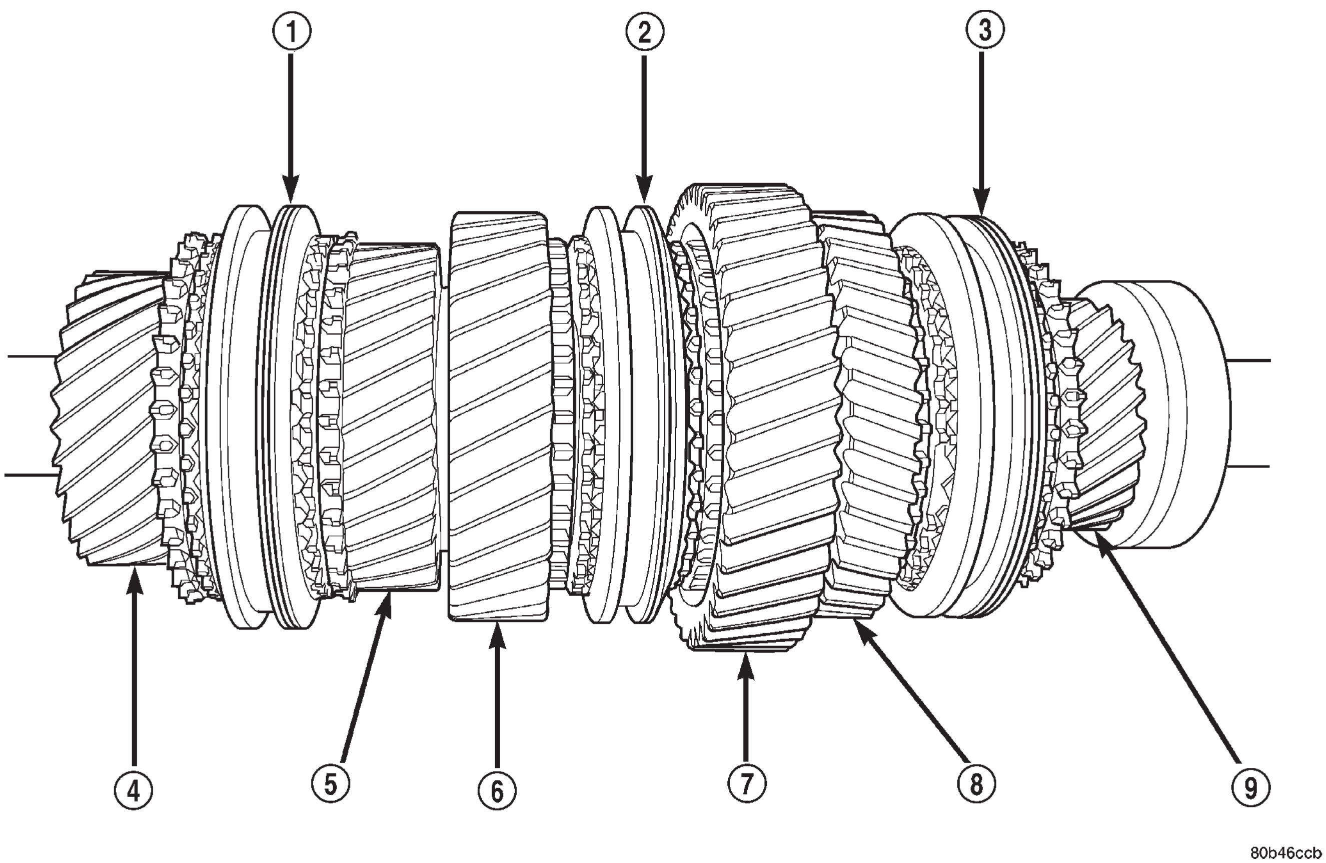


Fig. 66 Correct Synchro Sleeve Position

1 – 2 GROOVES
2 – 1 GROOVE
3 – 2 GROOVES
4 – 4TH GEAR
5 – 3RD GEAR
6 – 2ND GEAR
7 – 1ST GEAR
8 – REVERSE GEAR
9 – 5TH GEAR

DISASSEMBLY AND ASSEMBLY (Continued)

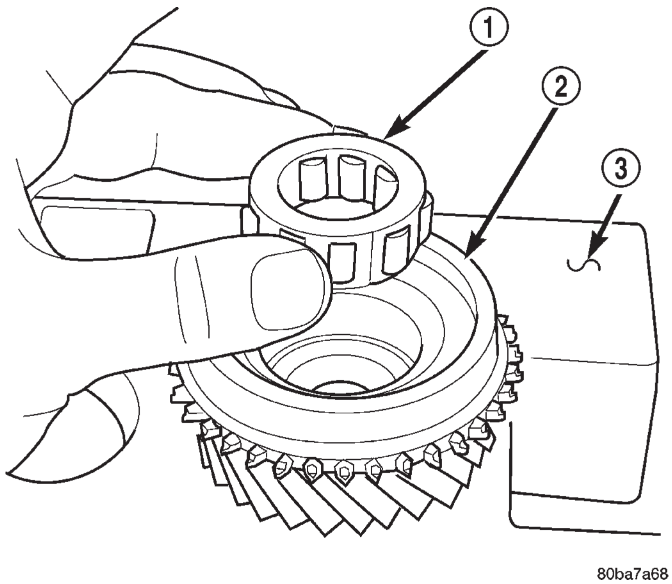


Fig. 67 Input Shaft and Pilot Bearing

1 – PILOT BEARING
2 – INPUT SHAFT
3 – STAND 8355

(3) Install fourth gear synchro ring on input shaft (Fig. 68).

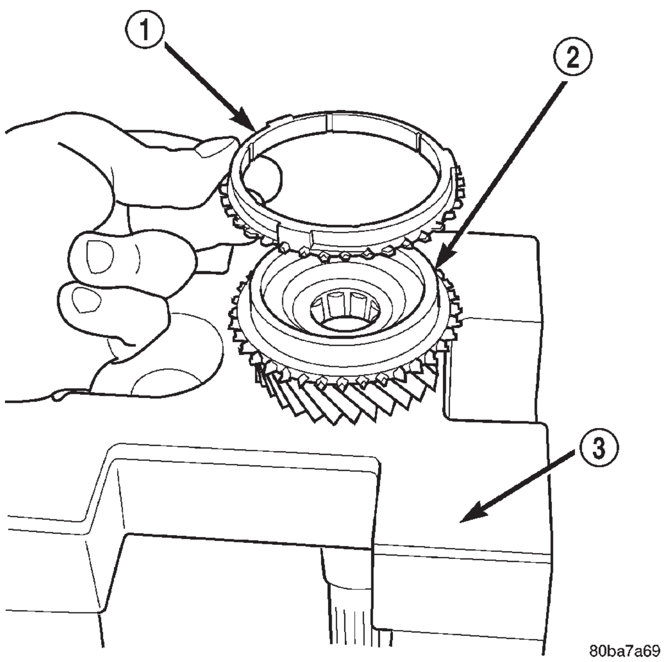


Fig. 68 Installing Fourth Gear Synchro Ring On Input Shaft

1 – 4TH GEAR SYNCHRO RING
2 – INPUT SHAFT
3 – STAND 8355

(4) Install assembled output shaft and geartrain in input shaft (Fig. 69). Carefully rotate output shaft until the 3–4 synchro ring seats in synchro hub and sleeve.

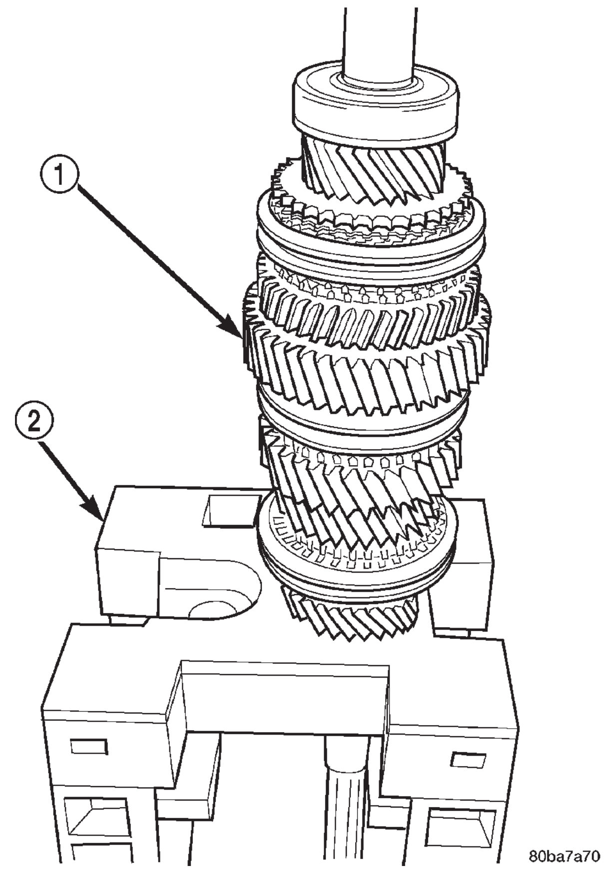


Fig. 69 Assembled Mainshaft on Support Stand 8355

1 – MAIN SHAFT
2 – SUPPORT STAND 8355

(5) Slide countershaft into fixture slot. Verify that countershaft and output shaft gears are fully meshed with the mainshaft gears before proceeding (Fig. 70).

(6) Thread one Pilot Stud 8120 in center or passenger side hole of output shaft bearing retainer. Then position retainer on fifth gear as shown.

(7) Assemble 1-2 and fifth reverse-shift forks (Fig. 71). Arm of fifth-reverse fork goes through slot in 1-2 fork.

(8) Install assembled shift forks in synchro sleeves (Fig. 72). Be sure forks are properly seated in sleeves.

DISASSEMBLY AND ASSEMBLY (Continued)

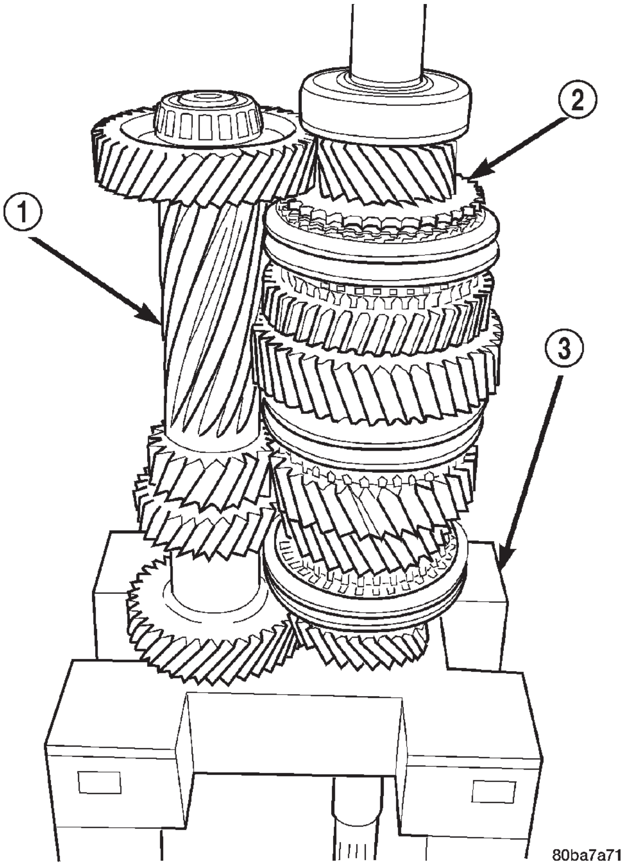


Fig. 70 Countershaft Installed On Support Stand 8355

1 – COUNTER SHAFT
2 – MAIN SHAFT
3 – SUPPORT STAND 8355

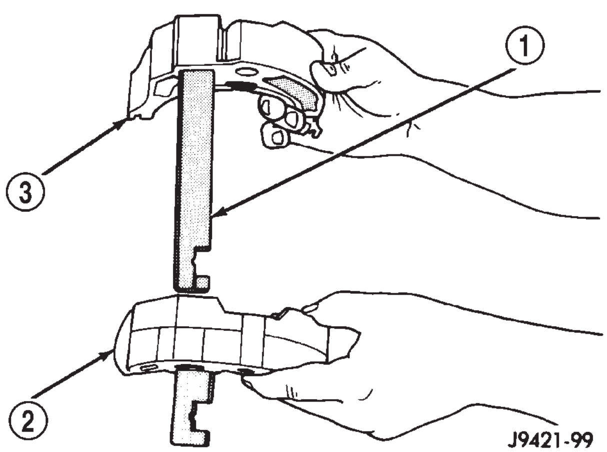


Fig. 71 Assembling 1-2 And Fifth-Reverse Shift Forks

1 – INSERT ARM THROUGH 1–2 FORK
2 – 1–2 FORK
3 – FIFTH-REVERSE FORK

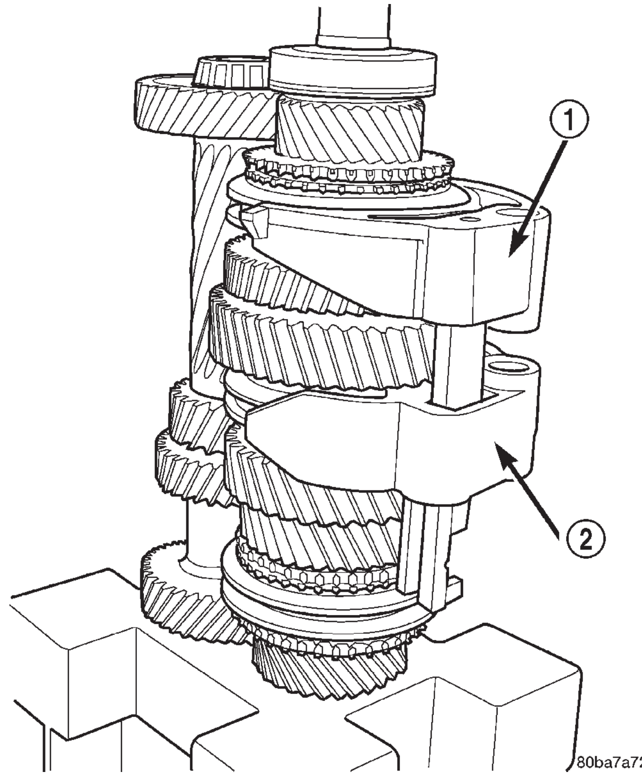


Fig. 72 Shift Forks Installed In Synchro Sleeves

1 – 5TH REVERSE SHIFT FORK
2 – 1–2 SHIFT FORK

REAR HOUSING

(1) Lubricate countershaft rear bearing race.

(2) Install rear housing onto geartrain (Fig. 73). Be sure bearing retainer pilot stud is in correct bolt hole in housing. Also be sure countershaft and output shaft bearings are aligned in housing and on countershaft.

(3) Seat rear housing on output shaft rear bearing and countershaft. Use plastic or rawhide mallet to tap housing into place.

(4) Install the three bolts that secure rear bearing retainer to rear housing as follows:

(a) Apply Mopar® Gasket Maker, or equivalent, to bolt threads, bolt shanks and under bolt heads (Fig. 74).

(b) Start first two bolts in retainer (Fig. 75). It may be necessary to move retainer rearward (with pilot stud) in order to start bolts in retainer.

(c) Remove Pilot Stud 8120 and install last retainer bolt (Fig. 75).

(d) Tighten all three retainer bolts to 22 N·m (16 ft. lbs.) torque.

NOTE: All the bolts used on the NV1500 except the reverse idler shaft bolts have o-rings to seal the bolts to the transmission case. Inspect the o-rings to ensure that they are correctly installed and are in good condition.

DISASSEMBLY AND ASSEMBLY (Continued)

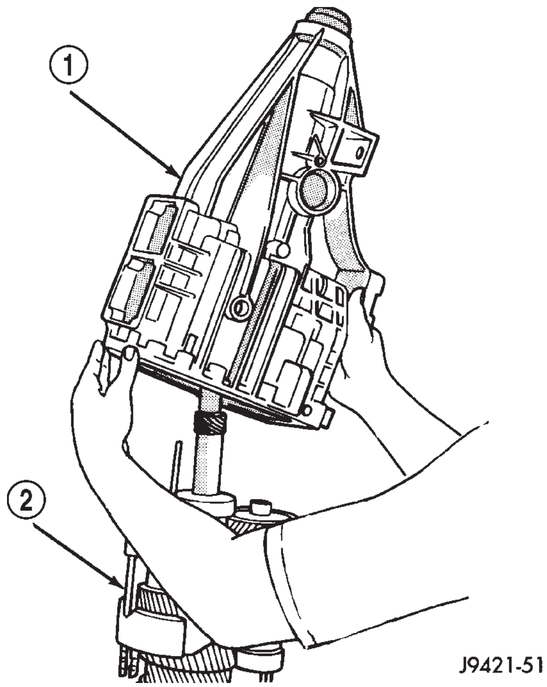


Fig. 73 Rear Housing Installation

1 – REAR HOUSING
2 – SHIFT FORKS AND GEARTRAIN

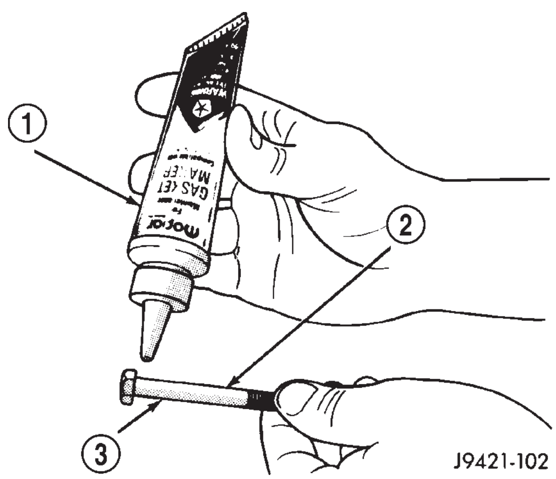


Fig. 74 Applying Sealer To Retainer And Housing Bolts

1 – MOPAR GASKET MAKER (OR LOCTITE 518)
2 – RETAINER AND HOUSING BOLTS
3 – APPLY SEALER TO UNDERSIDE OF BOLT HEAD, SHANK AND THREADS

REVERSE IDLER

(1) Remove geartrain and housing assembly from support stand with aid of helper.

(2) Assemble shaft, gear, and washer (without bearing or support) and install into housing (Fig. 76).

NOTE: The small shoulder on the reverse idler gear goes toward the front of the transmission.

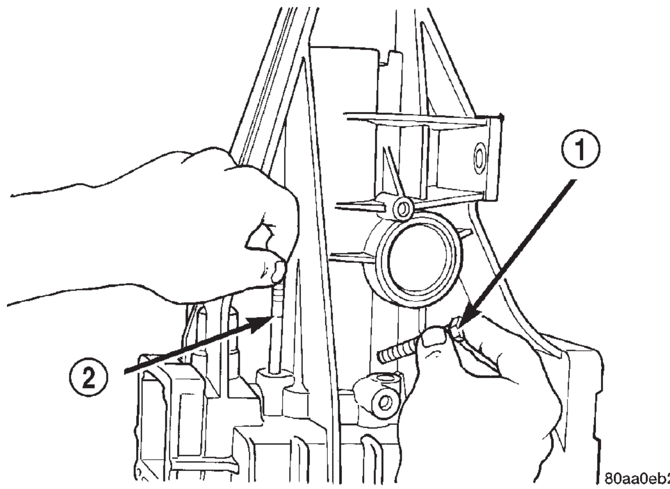


Fig. 75 Removing Pilot Stud Tool And Installing Retainer Bolts

1 – BEARING RETAINER BOLT
2 – SPECIAL TOOL 8120

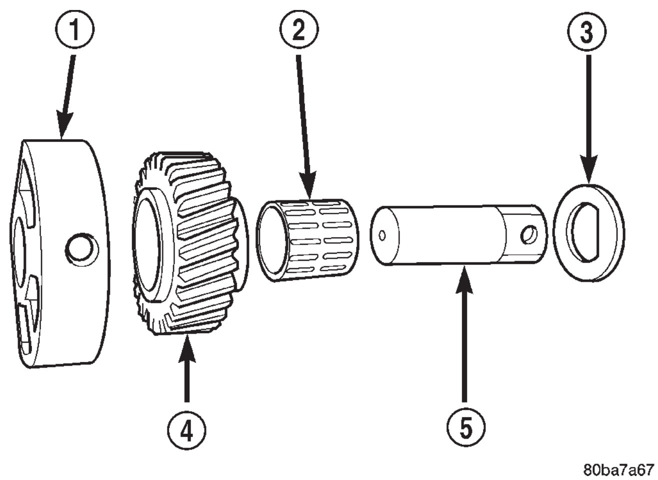


Fig. 76 Reverse Idler Assembly

1 – SUPPORT
2 – BEARING
3 – WASHER
4 – GEAR
5 – SHAFT

(3) Apply Mopar® Gasket Maker, or equivalent, sealer to underside of idler shaft and support bolt heads, bolt shanks and bolt threads (Fig. 74).

(4) Align hole in housing with threaded hole in shaft and start shaft rear bolt a few threads.

(5) Install bearing into position.

(6) Install segment (Fig. 76), align housing hole with segment threaded hole, and start support bolt a few threads.

(7) Tighten large idler shaft bolt to 43 N·m (31.7 ft. lbs.) torque. Tighten small idler shaft bolt to 22 N·m (16.2 ft. lbs.) torque.

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: Make sure the idler shaft and support segment are properly seated and held firmly in place while tightening the shaft bolts. The segment, housing or shaft threads can be damaged if the idler shaft is allowed to shift out of position in the housing.

SHIFT SHAFT, SHAFT LEVER AND BUSHING AND SHIFT SOCKET

(1) Before proceeding, verify that all synchro sleeves are in Neutral position (centered on hub). Move sleeves into neutral if necessary.

CAUTION: The transmission synchros must all be in Neutral position for proper reassembly. Otherwise, the housings, shift forks and gears can be damaged during installation of the two housings.

(2) Install 3-4 shift fork in synchro sleeve (Fig. 77). Verify that groove in fork arm is aligned with grooves in 1-2 and fifth-reverse fork arms as shown.

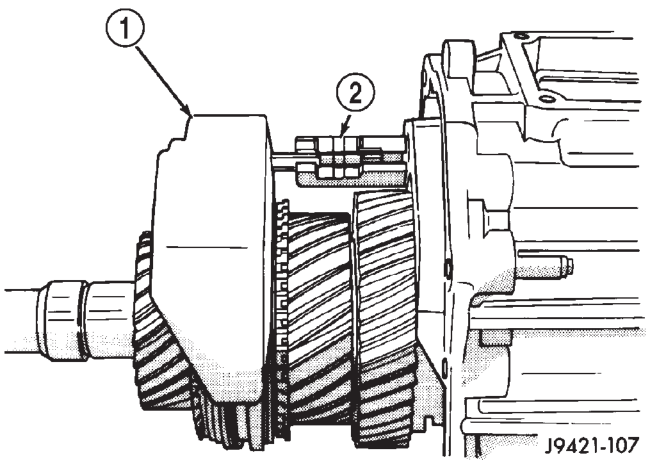


Fig. 77 Installing 3-4 Shift Fork

1 – 3–4 FORK
2 – ALIGN GROOVES IN FORK ARMS

(3) Slide shift shaft through 3-4 shift fork (Fig. 78). Be sure shaft detent notches are to front.

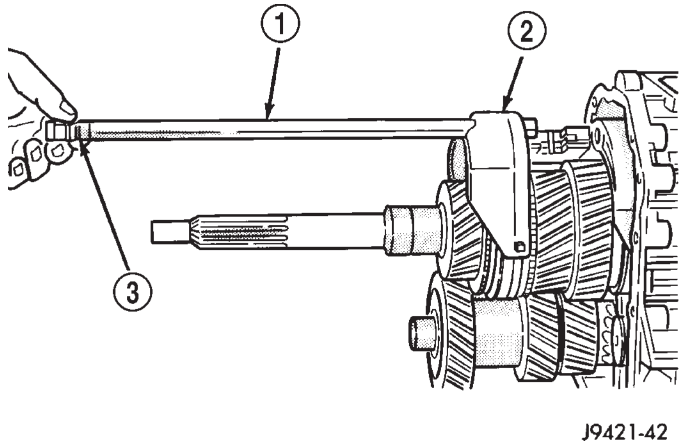


Fig. 78 Shift Shaft Installation

1 – SHIFT SHAFT
2 – 3–4 FORK
3 – SHAFT DETENT NOTCHES

(4) Assemble shift shaft shift lever and bushing (Fig. 79). Be sure slot in bushing is facing up and roll pin hole for lever is aligned with hole in shaft.

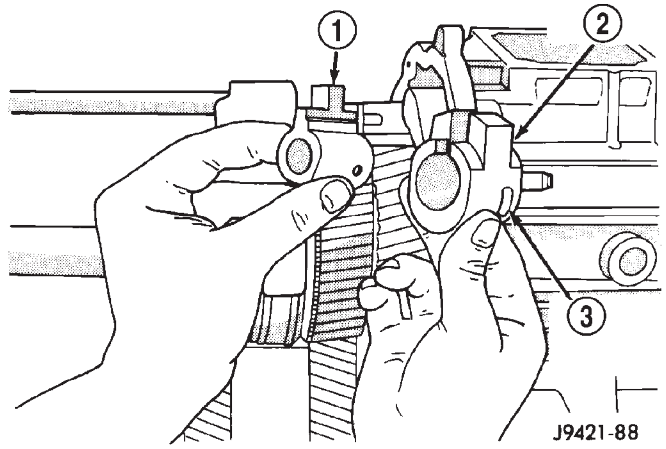


Fig. 79 Assembling Shift Shaft Lever And Bushing

1 – SHAFT LEVER
2 – LEVER BUSHING
3 – BUSHING LOCK PIN SLOT

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Install assembled lever and bushing on shift shaft (Fig. 80).

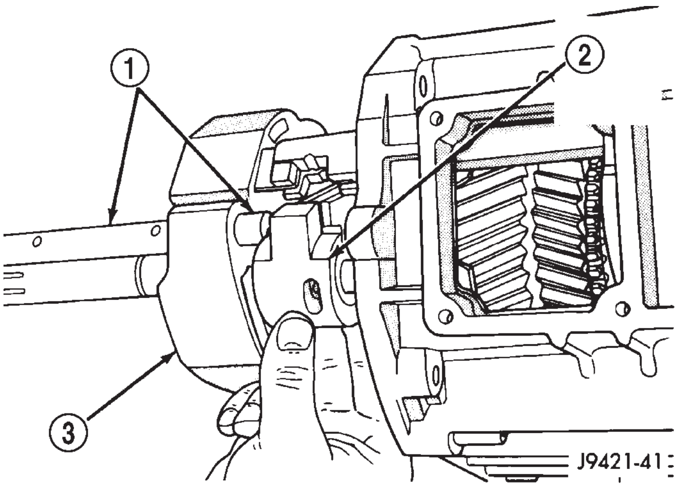


Fig. 80 Installing Shift Shaft Lever And Bushing

1 – SHIFT SHAFT
2 – SHAFT LEVER AND BUSHING
3 – 3–4 FORK

(6) Slide shift shaft through 1-2 and fifth-reverse fork and into shift lever opening in rear housing (Fig. 81).

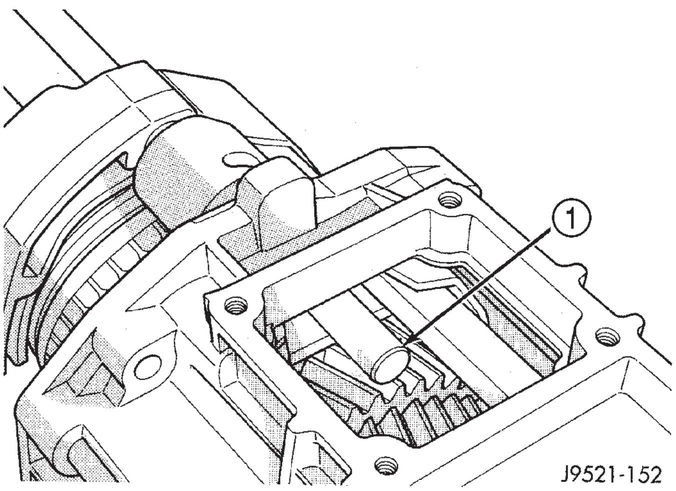


Fig. 81 Inserting Shaft Into Lever Opening In Housing

1 – SHIFT SHAFT

(7) Align shift socket with shaft and slide shaft through socket and into shift shaft bearing in rear housing (Fig. 82).

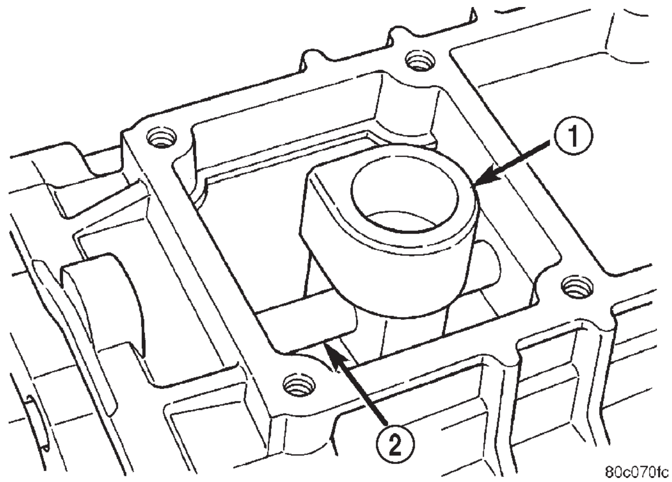


Fig. 82 Shift Socket Installation

1 – SHIFT SOCKET
2 – SHIFT SHAFT

(8) Rotate shift shaft so detent notches in shaft are facing the TOP of the transmission housing.

CAUTION: Correct positioning of the shift shaft detent notch is important. Both of the shaft roll pins can be installed even when the shaft is 180° off. If this occurs, the transmission will have to be disassembled again to correct shaft alignment.

(9) Select correct new roll pin for shift shaft lever (Fig. 83). Shaft lever roll pin is approximately 22 mm (7/8 in.) long. Shift socket roll pin is approximately 33 mm (1-1/4 in.) long.

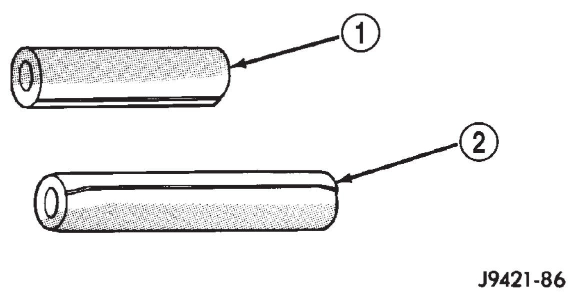


Fig. 83 Roll Pin Identification—Shaft Lever And Shift Socket

1 – SHAFT LEVER ROLL PIN
2 – SHIFT SOCKET ROLL PIN

DISASSEMBLY AND ASSEMBLY (Continued)

(10) Align roll pin holes in shift shaft, lever and bushing. Then start roll pin into shaft lever by hand (Fig. 84).

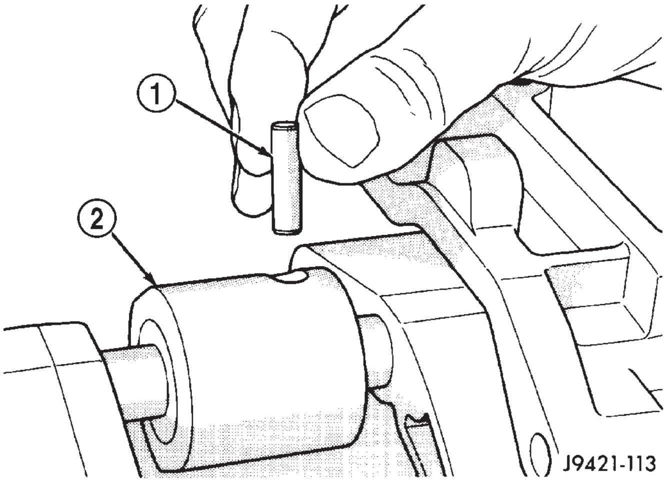


Fig. 84 Starting Roll Pin In Shift Shaft Lever

1 – SHAFT LEVER ROLL PIN (7⁄8" LONG)
2 – LEVER AND BUSHING

(11) Seat shaft lever roll pin with pin punch (Fig. 85).

CAUTION: The shaft lever roll pin must be flush with the surface of the lever. The lever bushing will bind on the roll pin if the pin is not seated flush.

(12) Before proceeding, verify that lock pin slot in lever bushing is positioned as shown (Fig. 85).

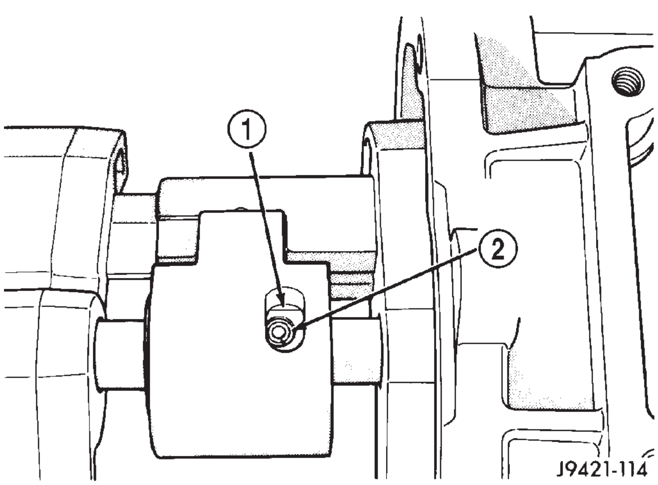


Fig. 85 Correct Seating Of Shift Shaft Lever Roll Pin

1 – BUSHING LOCK PIN SLOT
2 – SEAT ROLL PIN FLUSH WITH LEVER

(13) Align roll pin holes in shift socket and shift shaft. Then start roll pin into shift shaft by hand (Fig. 86).

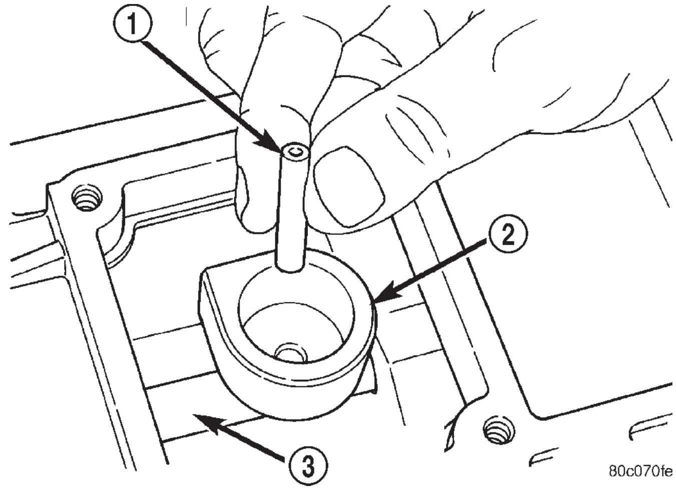


Fig. 86 Starting Roll Pin In Shift Socket

1 – ROLL PIN
2 – SHIFT SOCKET
3 – SHIFT SHAFT

(14) Seat roll pin in shift socket with pin punch. Roll pin must be flush with socket after installation (Fig. 87).

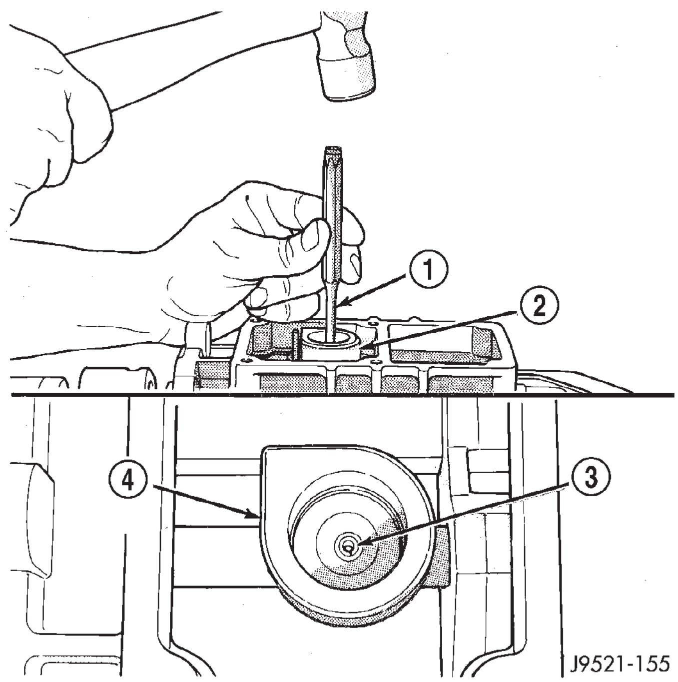


Fig. 87 Seating Shift Socket Roll Pin

1 – PIN PUNCH
2 – SHIFT SOCKET
3 – SEAT ROLL PIN FLUSH
4 – SHIFT SOCKET

(15) Verify that notches in shift fork arms are aligned. Realign arms if necessary.

DISASSEMBLY AND ASSEMBLY (Continued)

FRONT HOUSING AND INPUT SHAFT BEARING RETAINER

(1) If previously removed, install input shaft bearing in front housing bore (Fig. 88). Install snap ring and use plastic mallet to seat bearing. Bearing goes in from front side of housing only.

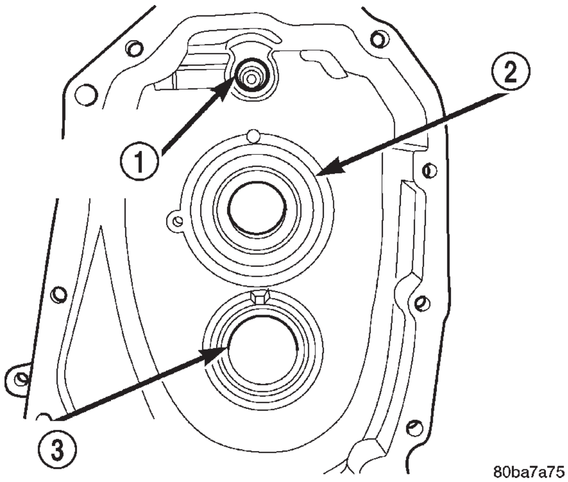


Fig. 88 Input Shaft Bearing And Countershaft Front Bearing Identification

1 – SHIFT SHAFT BUSHING
2 – INPUT SHAFT BEARING
3 – COUNTERSHAFT FRONT BEARING RACE

(2) Apply small amount of petroleum jelly to shift shaft bushing in front housing (Fig. 89).

(3) Apply 1/8 in. wide bead of Mopar® Gasket Maker, or equivalent, to mating surfaces of front and rear housings (Fig. 89).

(4) Have helper hold rear housing and geartrain in upright position. Then install front housing on rear housing and geartrain.

(5) Work front housing downward onto geartrain until seated on rear housing.

CAUTION: If the front housing will not seat on the rear housing, either the shift components are not in Neutral, or one or more components are misaligned. Do not force the front housing into place. This will only result in damaged components.

(6) Place transmission in horizontal position.

(7) Apply Mopar® Gasket Maker, or equivalent, to housing attaching bolts. Apply sealer material sealer to underside of bolt heads and to bolt shanks and threads (Fig. 90).

(8) Install and start housing attaching bolts by hand (Fig. 90). Then tighten bolts to 34 N·m (25 ft. lbs.) torque.

(9) Install shift shaft bushing lock bolt (Fig. 91). Apply Mopar® Gasket Maker, or equivalent, to bolt threads, shank and underside of bolt head before installation.

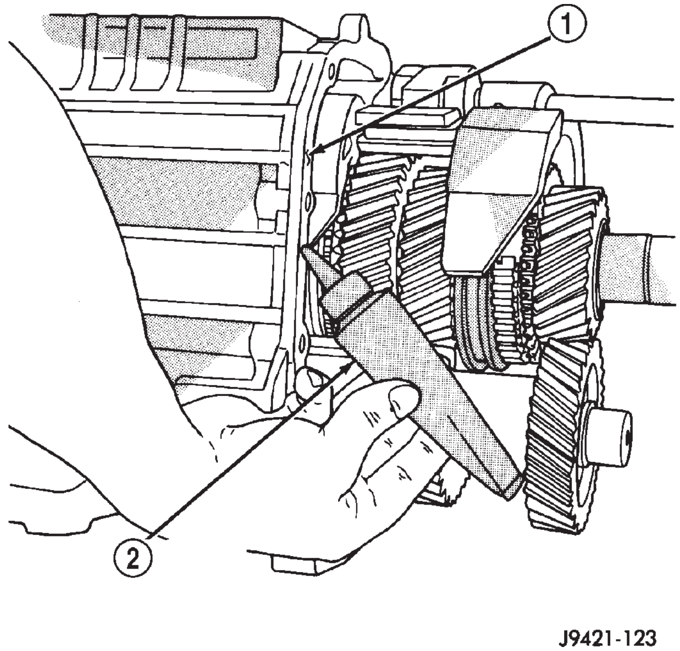


Fig. 89 Applying Sealer To Front/Rear Housings

1 – HOUSING FLANGE SURFACE
2 – MOPAR GASKET MAKER (OR LOCTITE 518)

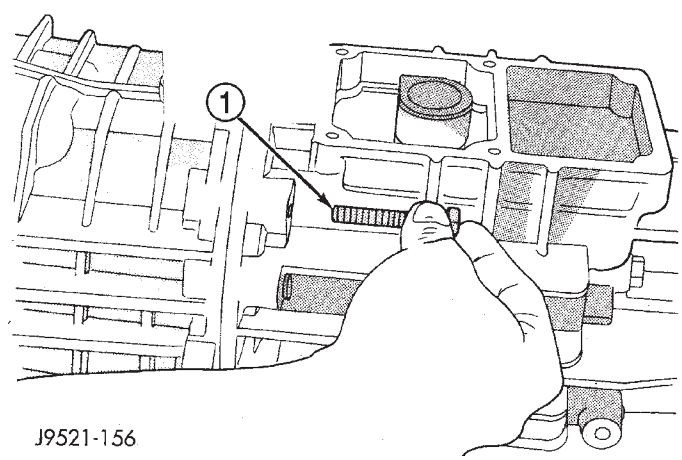


Fig. 90 Installing Housing Attaching Bolts

1 – HOUSING ATTACHING BOLTS (APPLY SEALER BEFOREHAND)

CAUTION: If the lock bolt cannot be fully installed, do not try to force it into place. Either the shift shaft is not in Neutral, or the shaft bushing (or lever) is misaligned.

(10) Remove countershaft bearing shim cap and shim. Attach a dial indicator and move countershaft front and back to measure shaft end play. The required countershaft pre-load 0.001–0.003 inches. Add this amount to the measured amount of countershaft end-play. This gives the amount of shims nec-

DISASSEMBLY AND ASSEMBLY (Continued)

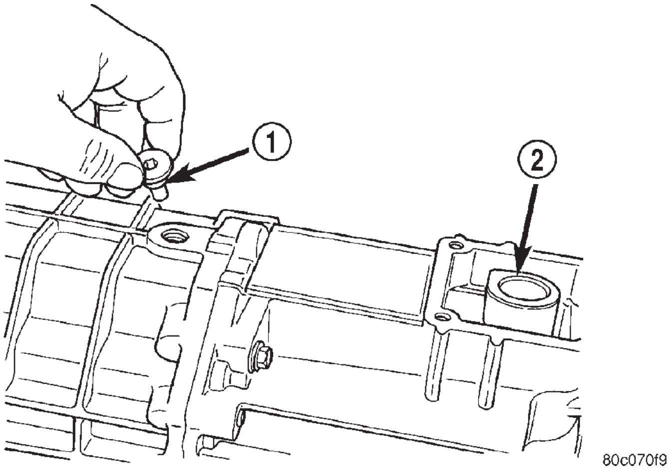


Fig. 91 Installing Shift Shaft Bushing Lock Bolt

1 – SHIFT SHAFT LOCK BOLT
2 – SHAFT SOCKET

essary to correctly pre-load the front and rear countershaft bearings.

(11) Install the selected shims and the shim cap. Tighten shim cap bolts to 29 N·m (21.4 ft. lbs.). Verify the shim selection by rotating the input shaft by hand with the transmission in neutral. The proper torque required to rotate the input shaft and the countershaft is approximately 5–7 in.lbs.. The input shaft should therefore be easily rotated by hand. If the input shaft cannot be rotated by hand or is not smooth through several rotations, re-check the countershaft pre-load.

(12) Lubricate then install shift shaft detent plunger in housing bore (Fig. 92). Lubricate plunger with petroleum jelly or gear lubricant. **Be sure plunger is fully seated in detent notch in shift shaft.**

(13) Install detent spring inside plunger (Fig. 92).

(14) Install detent plug as follows:

(a) Install detent plug in end of Installer 8123.

(b) Position plug on detent spring and compress spring until detent plug pilots in detent plunger bore.

(c) Drive detent plug into transmission case until plug seats.

(15) Install backup light switch (Fig. 93).

(16) Install input shaft snap ring (Fig. 94).

(17) Install new oil seal in front bearing retainer with Installer Tool 6448 (Fig. 95).

(18) Apply bead of Mopar® Silicone Sealer, or equivalent, to flange surface of front bearing retainer.

(19) Align and install front bearing retainer over input shaft and onto housing mounting surface (Fig. 96). Although retainer is one-way fit on housing, be sure bolt holes are aligned before seating retainer.

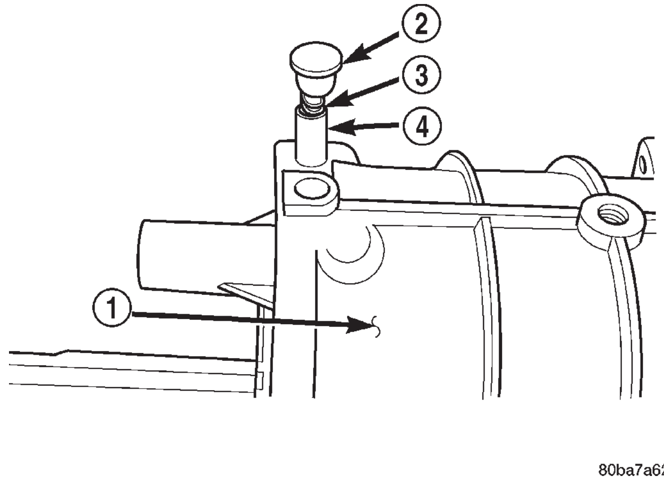


Fig. 92 Installing Shift Shaft Detent Plunger, Spring, and Plug

1 – FRONT HOUSING
2 – PLUG
3 – SPRING
4 – PLUNGER

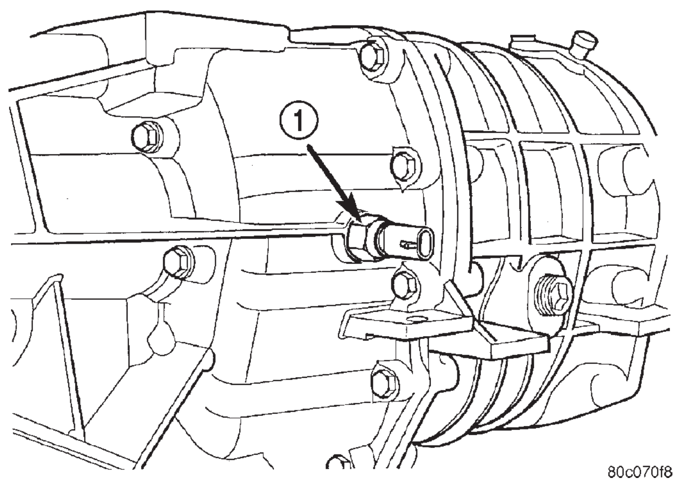


Fig. 93 Installing Backup Light Switch

1 – BACKUP LAMP SWITCH

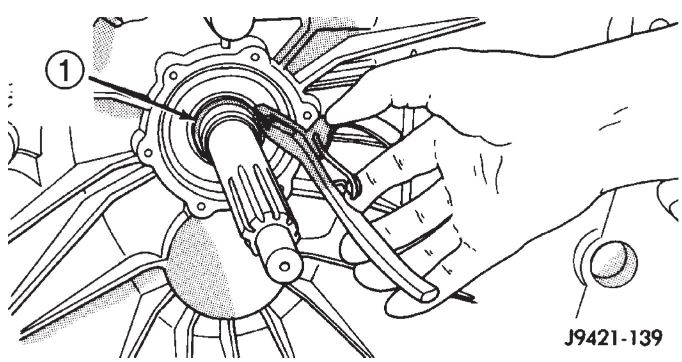


Fig. 94 Installing Input Shaft Snap Ring

1 – INPUT SHAFT SNAP RING

DISASSEMBLY AND ASSEMBLY (Continued)

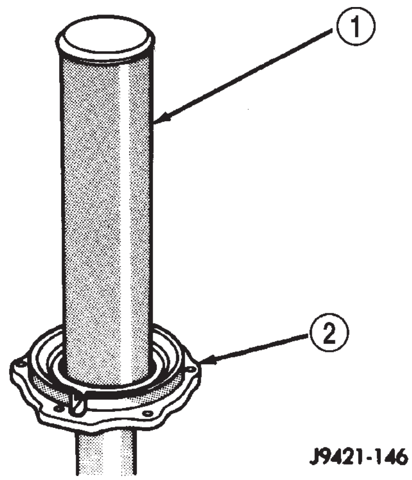


Fig. 95 Installing Oil Seal In Front Bearing Retainer (Typical)

1 – SPECIAL TOOL 6448
2 – FRONT BEARING RETAINER

NOTE: Be sure that no sealer gets into the oil feed hole in the transmission case or bearing retainer.

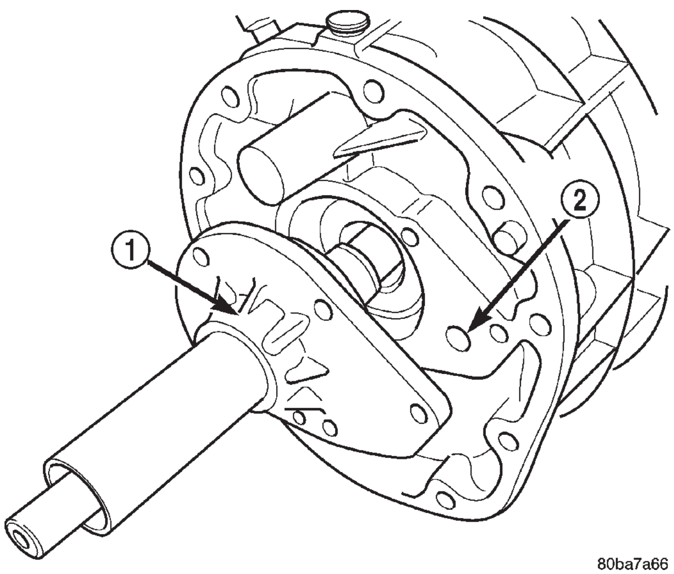


Fig. 96 Installing Input Shaft Bearing Retainer

1 – BEARING RETAINER
2 – OIL FEED

(20) Install and tighten bearing retainer bolts to 29 N·m (21.4 ft. lbs.) torque (Fig. 97).

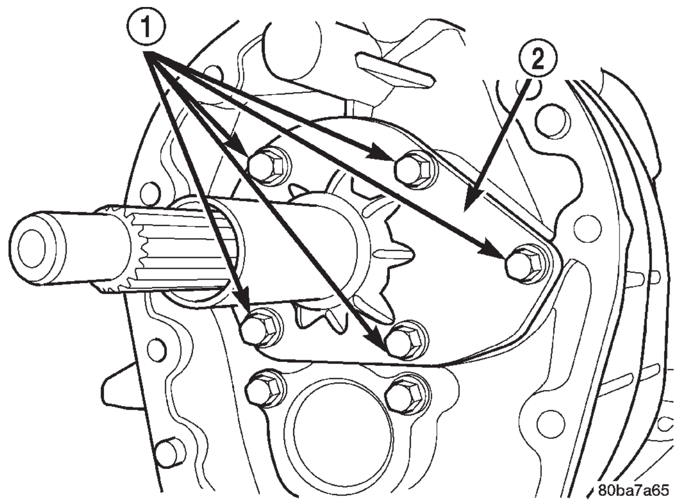


Fig. 97 Installing Input Shaft Bearing Retainer Bolts

1 – BOLTS (5)
2 – BEARING RETAINER

SHIFT TOWER AND LEVER ASSEMBLY

(1) Apply petroleum jelly to ball end of shift lever and interior of shift socket.

(2) Shift the transmission into third gear.

(3) Align and install shift tower and lever assembly (Fig. 98). Be sure shift ball is seated in socket and the offset in the tower is toward the passenger side of the vehicle before installing tower bolts.

(4) Install shift tower bolts (Fig. 99). Tighten bolts to 8.5 N·m (75.2 in. lbs.) torque.

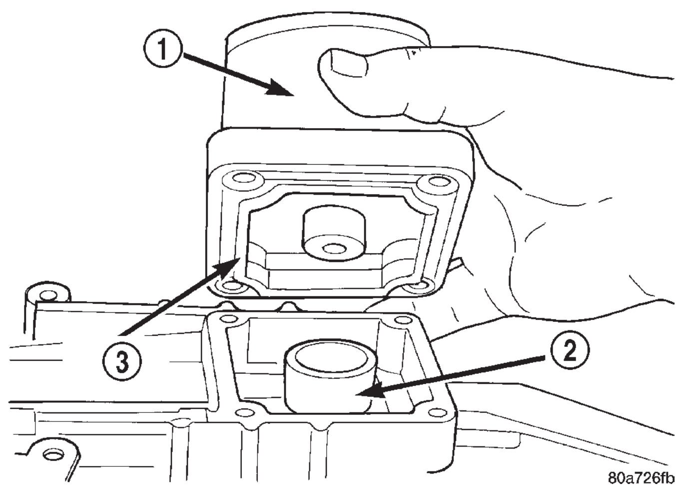


Fig. 98 Shift Tower Installation

1 – SHIFT TOWER AND LEVER ASSEMBLY
2 – SHIFT SOCKET
3 – SEAL

DISASSEMBLY AND ASSEMBLY (Continued)

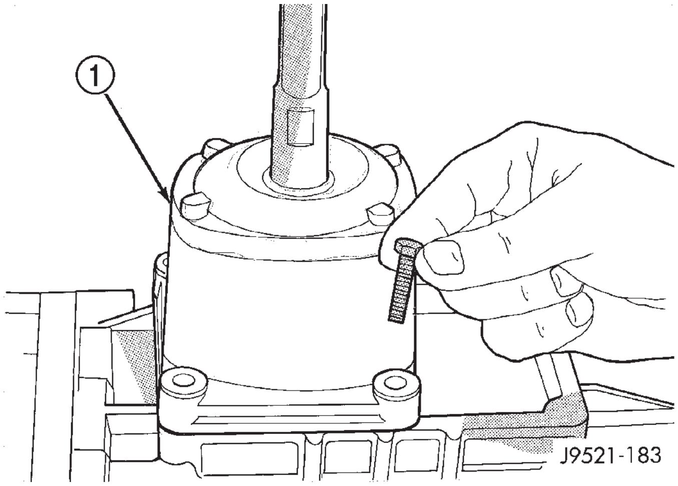


Fig. 99 Shift Tower Bolt Installation

1 – SHIFT TOWER AND LEVER ASSEMBLY

(5) Fill transmission to bottom edge of fill plug hole with Mopar® Transmission Lubricant, P/N 4761526.

(6) Install and tighten fill plug to 34 N·m (25 ft. lbs.) torque.

(7) Check transmission vent. Be sure vent is open and not restricted.

CLEANING AND INSPECTION

TRANSMISSION COMPONENTS

Clean the gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean the shaft bearings with a mild solvent such as Mopar® degreasing solvent, Gunk, or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry, or wipe them dry with clean shop towels.

SHIFT LEVER ASSEMBLY

The shift lever assembly is not serviceable. Replace the lever and shift tower as an assembly if the tower, lever, lever ball, or internal components are worn, or damaged.

SHIFT SHAFT AND FORKS

Inspect the shift fork interlock arms and synchro sleeve contact surfaces (Fig. 100). Replace any fork exhibiting wear or damage in these areas. Do not attempt to salvage shift forks.

Check condition of the shift shaft detent plunger and spring. The plunger should be smooth and free of nicks, or scores. The plunger spring should be straight and not collapsed, or distorted. Minor scratches, or nicks on the plunger can be smoothed with 320/400 grit emery soaked in oil. Replace the plunger and spring if in doubt about condition. Check condition of detent plunger bushings. Replace if damaged.

Inspect the shift shaft, shift shaft bushing and bearing, the shaft lever, and the lever bushing that fits over the lever. Replace the shaft if bent, cracked, or severely scored. Minor burrs, nicks, or scratches can be smoothed off with 320/400 grit emery cloth followed by polishing with crocus cloth. Replace the shift shaft bushing or bearing if damaged.

Replace the shaft lever and bushing if either part is deformed, or worn. Do not attempt to salvage these parts as shift fork binding will occur. Replace the small detent ball and spring that goes in the lever if the ball is worn, or if the spring is bent or collapsed. Replace the roll pin that secures the lever to the shaft.

FRONT/REAR HOUSINGS AND BEARING RETAINERS

Inspect the housings carefully. Look for cracks, stripped threads, scored mating surfaces, damaged bearing bores, or worn dowel pin holes. Minor nicks on mating surfaces can be dressed off with a fine file, or emery cloth. Damaged threads can be renewed by either re-tapping or installing Helicoil inserts.

NOTE: The front housing contains the countershaft front bearing race. The rear housing contains the countershaft rear bearing race. If a countershaft bearing failure results, the bearing races must be replaced also. Refer to countershaft service for proper service procedures.

Inspect the input shaft bearing retainer. Be sure the release bearing slide surface of the retainer is in good condition. Minor nicks on the surface can be smoothed off with 320/420 grit emery cloth and final polished with oil coated crocus cloth. Replace the retainer seal if necessary.

Inspect the output shaft bearing retainer. Be sure the U-shaped retainer is flat and free of distortion. Replace the retainer if the threads are damaged, or if the retainer is bent, or cracked.

COUNTERSHAFT BEARINGS AND RACES

The countershaft bearings are standard tapered roller bearings, with matching races. The races are pressed into the front and rear housings. Inspect the countershaft bearings AND races for abnormal wear or damage. Refer to countershaft bearing service for proper service procedures.

CLEANING AND INSPECTION (Continued)

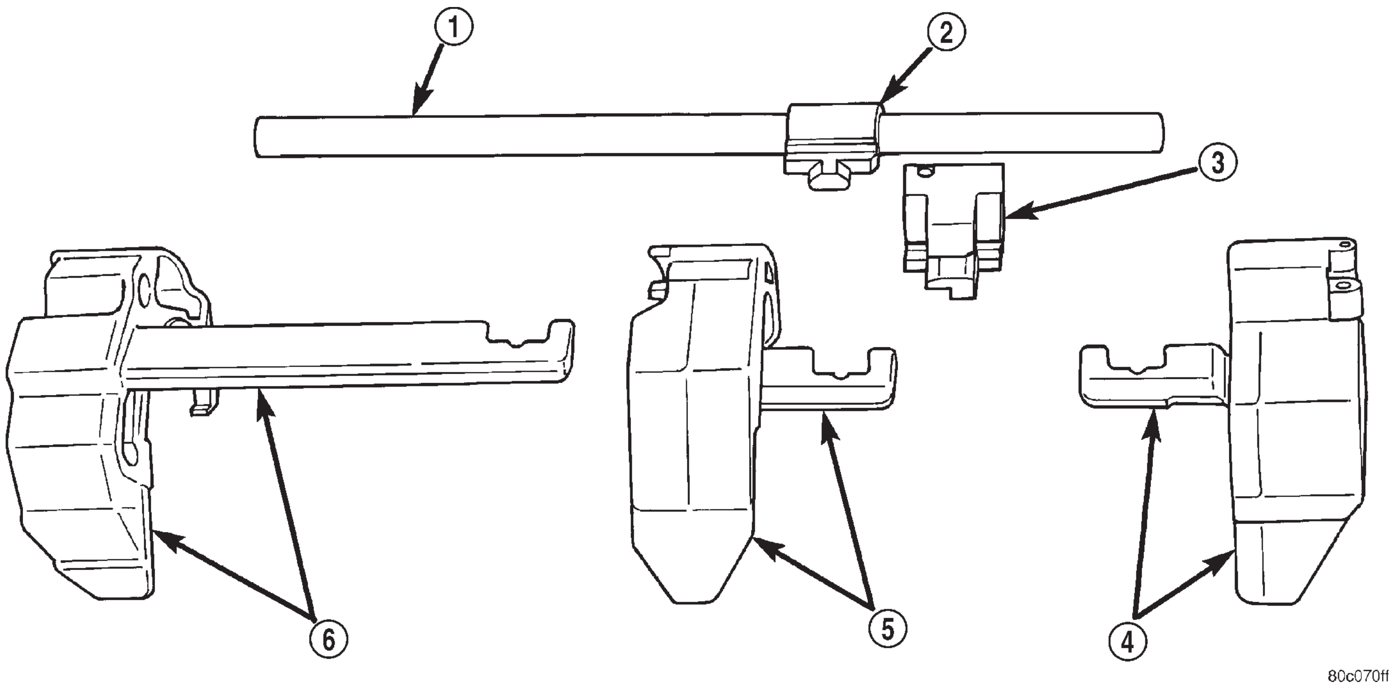


Fig. 100 Shift Forks And Shaft

1 – SHIFT SHAFT
2 – SHAFT LEVER
3 – SHAFT LEVER BUSHING
4 – 3–4 SHIFT FORK
5 – 1–2 SHIFT FORK
6 – FIFTH-REVERSE SHIFT FORK

REVERSE IDLER COMPONENTS

Inspect the idler gear, bearing, shaft, thrust washer, and support for excessive wear or failure (Fig. 101). Replace the bearing if any of the needle bearing rollers are worn, chipped, cracked, flat-spotted, or brinnelled. Also replace the bearing if the plastic bearing cage is damaged or distorted.

Replace the thrust washer, if cracked, chipped, or worn. Replace the idler gear if the teeth are chipped, cracked or worn thin. Replace the shaft if worn, scored, or the bolt threads are damaged beyond repair. Replace the support segment if cracked, or chipped and replace the idler attaching bolts if the threads are damaged.

SHIFT SOCKET

Inspect the shift socket for wear or damage. replace the socket if the roll pin, or shift shaft bores are damaged. Minor nicks in the shift lever ball seat in the socket can be smoothed down with 400 grit emery or wet/dry paper. Replace the socket if the ball seat is worn, or cracked. Do not reuse the original shift socket roll pin. Install a new pin during reassembly. The socket roll pin is approximately is approximately 33 mm (1-1/4 in.) long.

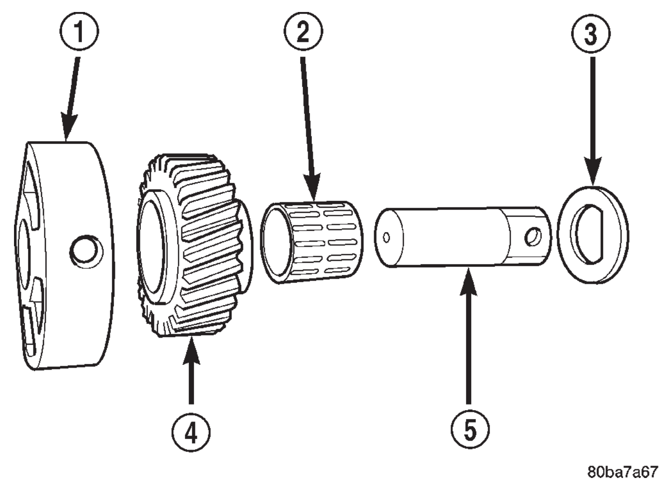


Fig. 101 Reverse Idler Assembly

1 – SUPPORT
2 – BEARING
3 – WASHER
4 – GEAR
5 – SHAFT

OUTPUT SHAFT AND GEARTRAIN

Inspect all of the gears for worn, cracked, chipped, or broken teeth. Also check condition of the bearing bore in each gear. The bores should be smooth and free of surface damage. Discoloration of the gear

CLEANING AND INSPECTION (Continued)

bores is a normal occurrence and is not a reason for replacement. Replace gears only when tooth damage has occurred, or if the bores are brinnelled or severely scored.

Inspect the shaft splines and bearings surfaces. Minor nicks on the bearing surfaces can be smoothed with 320/420 grit emery and final polished with crocus cloth. Replace the shaft if the splines are damaged or bearing surfaces are deeply scored, worn, or brinnelled.

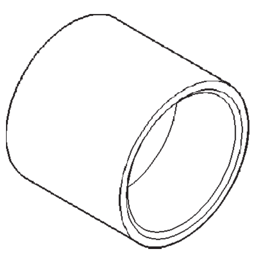
SPECIFICATIONS

TORQUE

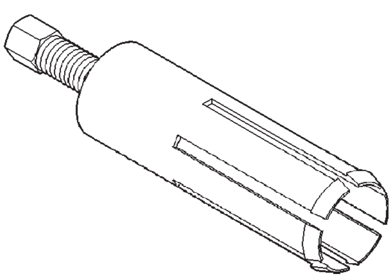
DESCRIPTION	TORQUE
Back up Lamp Switch	41 N·m (30 ft. lbs.)
Bearing Shim Cap (countershaft)	41 N·m (30 ft. lbs.)
Bearing Retainer (front)	41 N·m (30 ft. lbs.)
Bearing Retainer (rear)	34 N·m (25 ft. lbs.)
Drain/Fill Plug	34 N·m (25 ft. lbs.)
Shift Shaft Lock Bolt	27 N·m (20 ft. lbs.)
Shift Tower Bolts	14 N·m (120 in. lbs.)
Idler Shaft Bolt (M8 x 1.25 x 70)	27 N·m (20 ft. lbs.)
Idler Shaft Bolt (M10 x 1.5 x 35)	52 N·m (40 ft. lbs.)

SPECIAL TOOLS

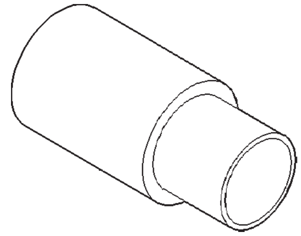
NV1500 MANUAL TRANSMISSION



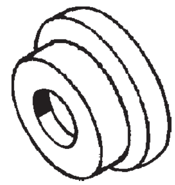
Installer, Seal—C-3995-A



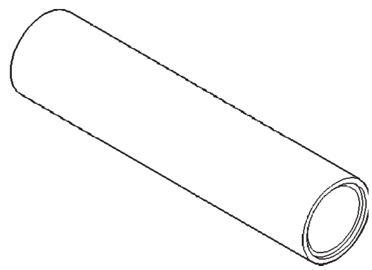
Remover, Bushing—6957



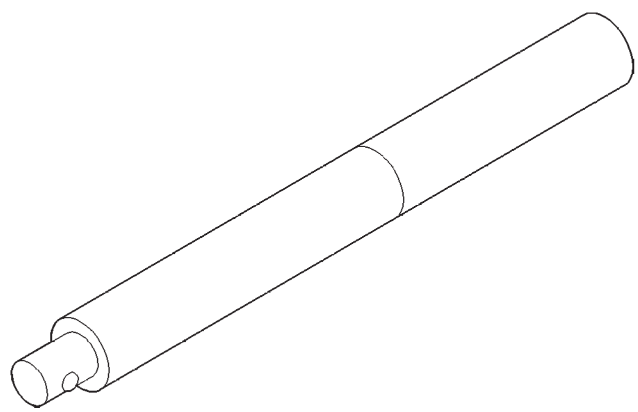
Installer, Bushing—8160



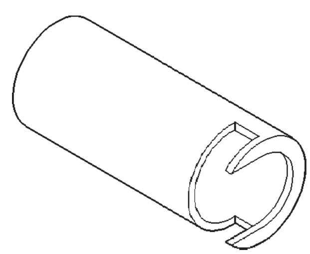
Driver, Bearing Race—C-4656



Installer, Seal—6448

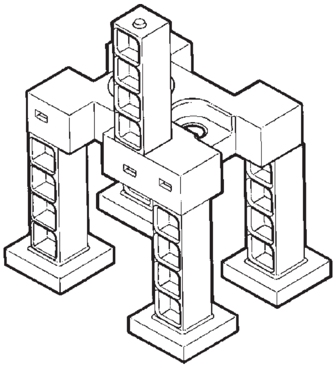


Handle—C-4171

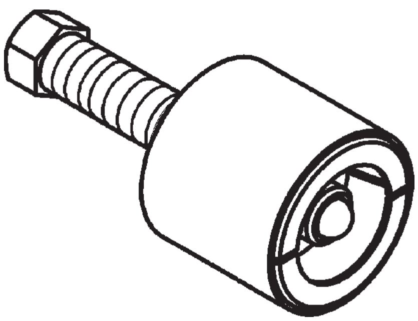


Remover—8117

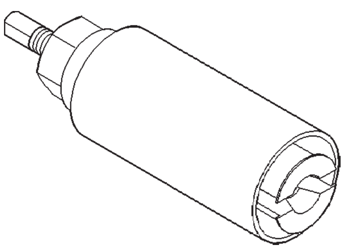
SPECIAL TOOLS (Continued)



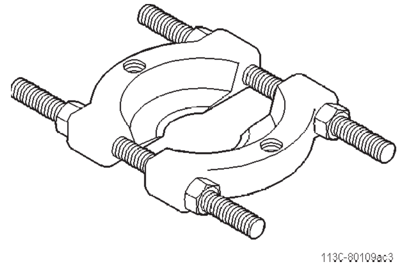
Support Stand, NV1500—8355



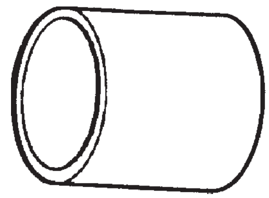
Remover, Bearing—8356



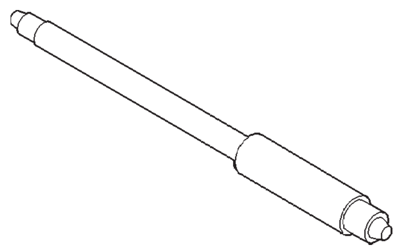
Remover, Bearing Race—L-4454



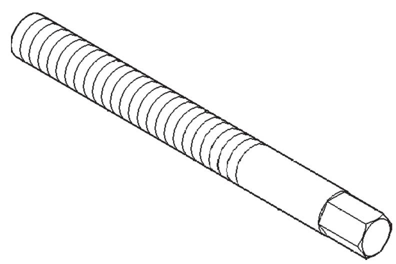
Splitter, Bearing—1130



Tube—6310-1



Remover/Installer—8119



Stud, Alignment—8120

NV3500 MANUAL TRANSMISSION

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
NV3500 MANUAL TRANSMISSION 36
LUBRICANT 39
DIAGNOSIS AND TESTING
LOW LUBRICANT LEVEL 39
HARD SHIFTING 39
TRANSMISSION NOISE 40
REMOVAL AND INSTALLATION
TRANSMISSION—2WD 40
TRANSMISSION—4WD 41
SHIFT TOWER 42
YOKE SEAL—2WD 43
REAR HOUSING YOKE BUSHING 43
DISASSEMBLY AND ASSEMBLY
TRANSMISSION 44
CLEANING AND INSPECTION
TRANSMISSION COMPONENTS 78
SPECIFICATIONS
TORQUE 81
SPECIAL TOOLS
NV3500 MANUAL TRANSMISSION 81

DESCRIPTION AND OPERATION

NV3500 MANUAL TRANSMISSION

DESCRIPTION

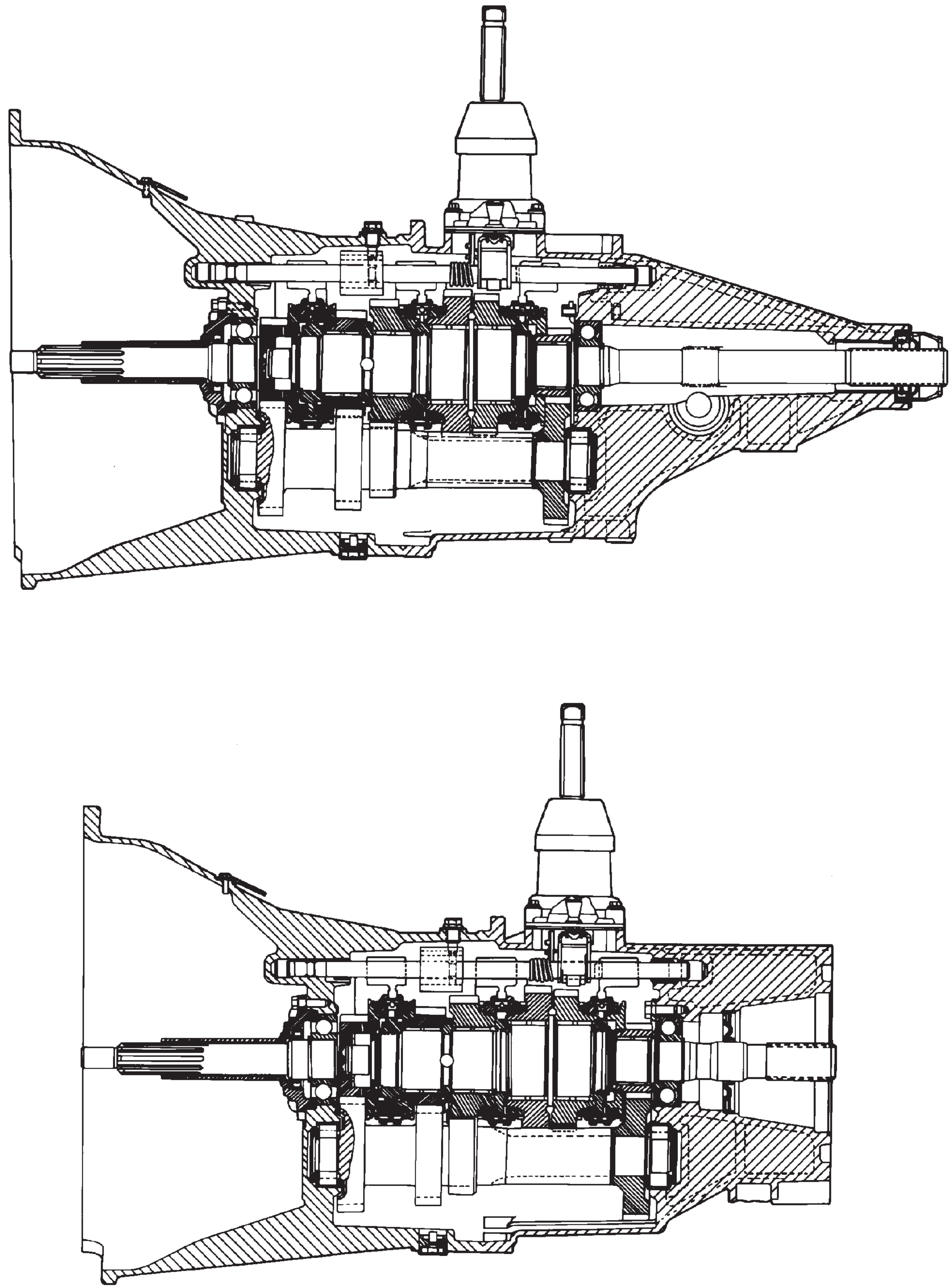
The NV3500 is a medium-duty, 5-speed, constant mesh, fully synchronized manual transmission. Fifth gear is an overdrive range with a ratio of 0.73:1. The NV3500 is available in two and four–wheel drive configurations.

The transmission gear case consists of two aluminum housings (Fig. 1). The clutch housing is not a removable component. It is an integral part of the transmission front housing.

A combination of roller and ball bearings are used to support the transmission shafts in the two housings. The transmission gears all rotate on caged type needle bearings. A roller bearing is used between the input and output shaft.

The NV3500 has a single shaft shift mechanism with three shift forks all mounted on the shaft. The shaft is supported in the front and rear housings by bushings and one linear ball bearing. Internal shift components consist of the forks, shaft, shift lever socket, and detent components (Fig. 2).

DESCRIPTION AND OPERATION (Continued)



J9421-1

Fig. 1 NV3500 Manual Transmission

DESCRIPTION AND OPERATION (Continued)

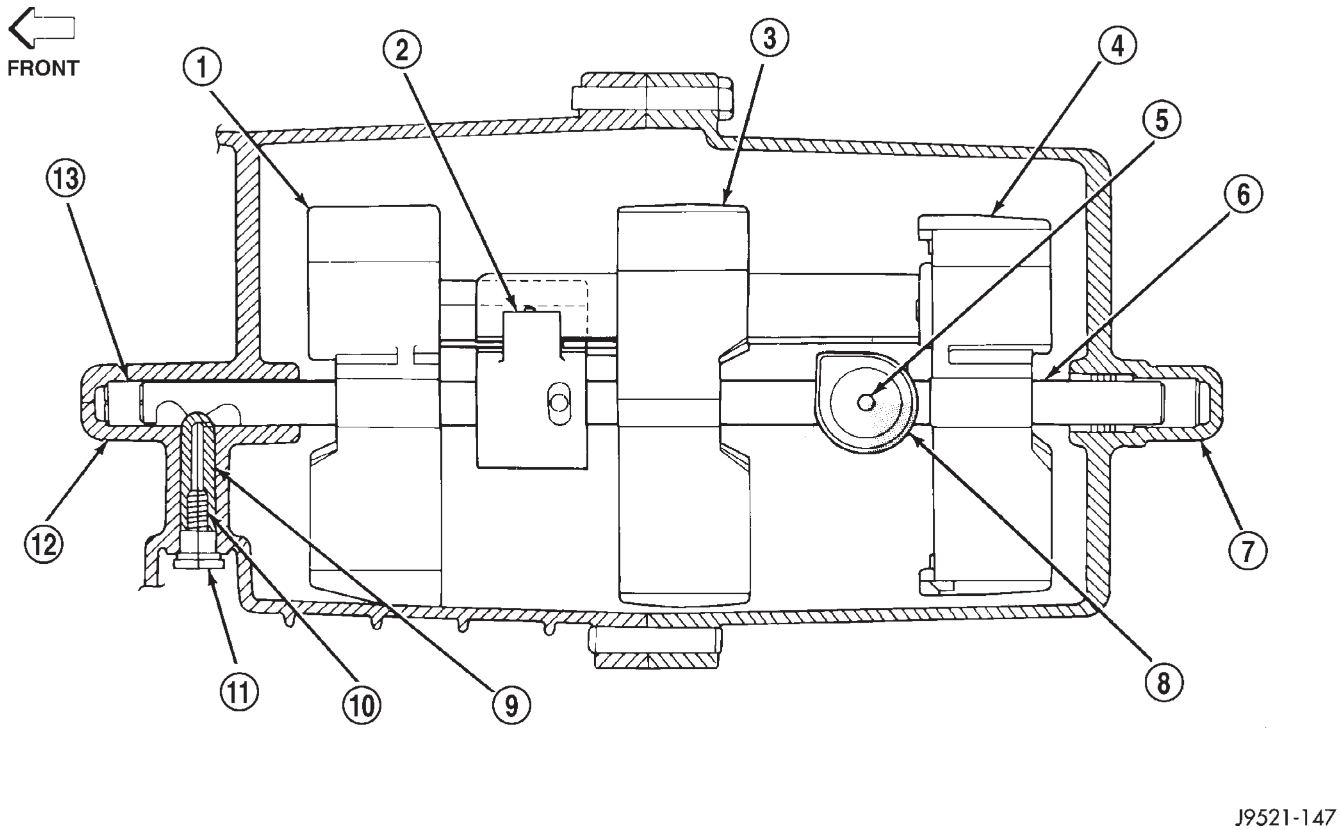


Fig. 2 NV3500 Shift Mechanism

1 – 3–4 FORK
2 – SHIFT SHAFT LEVER AND BUSHING
3 – 1–2 FORK
4 – FIFTH-REVERSE FORK
5 – ROLL PIN
6 – SHIFT SHAFT
7 – REAR HOUSING
8 – SHIFT LEVER SOCKET
9 – DETENT PLUNGER
10 – DETENT SPRING
11 – DETENT PLUG
12 – FRONT HOUSING
13 – SHIFT SHAFT

GEAR RATIOS

Two versions of the NV3500 are available. The wide ratio version has a 4.01 first gear and 2.32 second gear. The close ratio NV3500 has a 3.48 first gear and 2.16 second gear.

WIDE RATIO VERSION

RANGE	RATIO
FIRST	4.01:1
SECOND	2.32:1
THIRD	1.40:1
FOURTH	1:1
FIFTH	0.73:1
REVERSE	3.55:1

CLOSE RATIO VERSION

RANGE	RATIO
FIRST	3.48:1
SECOND	2.16:1
THIRD	1.40:1
FOURTH	1:1
FIFTH	0.73:1
REVERSE	3.55:1

OPERATION

The manual transmission receives power through the clutch assembly from the engine. The clutch disc is splined to the transmission input shaft and is turned at engine speed at all times that the clutch is engaged. The input shaft is connected to the transmission countershaft through the mesh of fourth

DESCRIPTION AND OPERATION (Continued)

speed gear on the input shaft and the fourth countershaft gear. At this point, all the transmission gears are spinning.

The driver selects a particular gear by moving the shift lever to the desired gear position. This movement moves the internal transmission shift components to begin the shift sequence. As the shift lever moves the selected shift rail, the shift fork attached to that rail begins to move. The fork is positioned in a groove in the outer circumference of the synchronizer sleeve. As the shift fork moves the synchronizer sleeve, the synchronizer begins to speed-up or slow down the selected gear (depending on whether we are up-shifting or down-shifting). The synchronizer does this by having the synchronizer hub splined to the mainshaft, or the countershaft in some cases, and moving the blocker ring into contact with the gear's friction cone. As the blocker ring and friction cone come together, the gear speed is brought up or down to the speed of the synchronizer. As the two speeds match, the splines on the inside of the synchronizer sleeve become aligned with the teeth on the blocker ring and the friction cone and eventually will slide over the teeth, locking the gear to the mainshaft, or countershaft, through the synchronizer.

LUBRICANT

DESCRIPTION

Required lubricant for the NV3500 is Mopar® Manual Transmission Lubricant, P/N 4874464. This is the **only** lubricant to be used in NV3500 transmissions. No other lubricants are acceptable, or recommended.

The correct transmission lubricant level is to the bottom edge of the fill plug hole (Fig. 3).

The transmission must be level to obtain an accurate lubricant level check. A drive–on type of hoist is recommended for this purpose.

Lubricant capacity of the NV3500 is approximately 2.28 liters (4.8 pints). This represents the approximate quantity needed to refill the transmission after a lubricant change or overhaul.

DRAIN AND FILL PLUG LOCATIONS

The NV3500 fill and drain plugs are both located in the front housing. The fill plug is at the passenger side of the housing. The drain plug is at the bottom of the housing (Fig. 3).

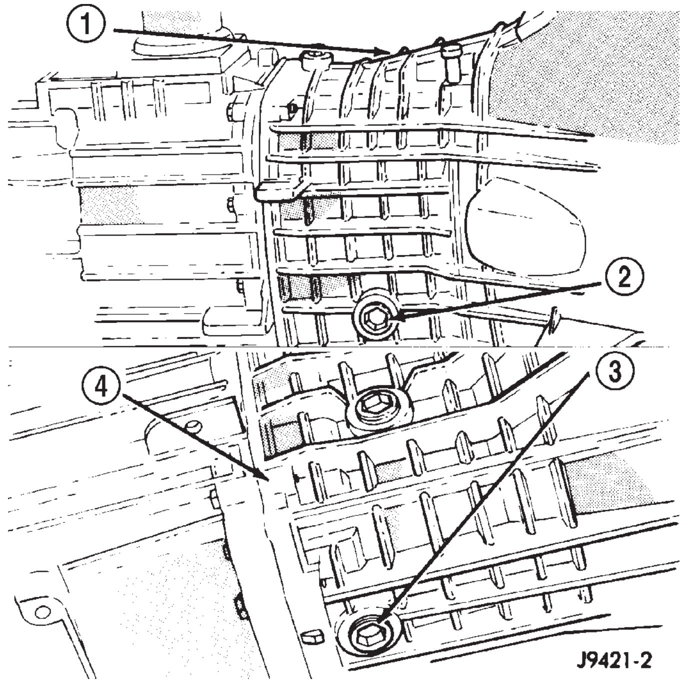


Fig. 3 Drain and Fill Plug Locations

1 – FRONT HOUSING
2 – FILL PLUG
3 – DRAIN PLUG
4 – FRONT HOUSING

DIAGNOSIS AND TESTING

LOW LUBRICANT LEVEL

A low transmission lubricant level is generally the result of a leak, inadequate lubricant fill, or an incorrect lubricant level check.

Leaks can occur at the mating surfaces of the housings, or from the front/rear seals. A suspected leak could also be the result of an overfill condition.

Leaks at component mating surfaces will probably be the result of inadequate sealer, gaps in the sealer, incorrect bolt tightening, or use of a non–recommended sealer.

A leak at the front of the transmission will be from either a loose or damaged, front bearing retainer or retainer seal. Lubricant may also drip from the transmission clutch housing after extended operation. If the leak is severe, it will contaminate the clutch disc causing slip, grab and chatter.

Transmissions filled from air or electrically powered lubricant containers can be under filled. Always check the lubricant level after filling to avoid an under fill condition.

A correct lubricant level check can only be made when the vehicle is level; use a drive–on hoist to ensure this. Also allow the lubricant to settle for a minute or so before checking. These recommendations will ensure an accurate check and avoid an under-or-overfill condition.

HARD SHIFTING

Hard shifting is usually caused by a low lubricant level, improper or contaminated lubricants, transmis-

DIAGNOSIS AND TESTING (Continued)

sion component damage, clutch linkage malfunction, or by a damaged clutch pressure plate or disc.

Substantial lubricant leaks can result in gear, shift component, synchro and bearing damage. If a leak goes undetected for an extended period, the first indications of a problem are usually hard shifting and noise.

Incorrect or contaminated lubricants can also contribute to hard shifting. The consequence of using non–recommended lubricants is noise, excessive wear, internal bind and hard shifting.

Improper clutch release is a frequent cause of hard shifting. Malfunctioning clutch linkage, a worn or damaged pilot bearing, a worn or damaged pressure plate or disc can cause incorrect release. If the clutch problem is advanced, gear clash during shifts can result.

Worn or damaged synchro rings can cause gear clash when shifting into any forward gear. In some new or rebuilt transmissions, new synchro rings may tend to stick slightly causing stiff and/or noisy shifts. In most cases, this condition will decline as the rings wear in.

TRANSMISSION NOISE

Most manual transmissions make some noise during normal operation. Rotating gears can generate a mild whine that may only be audible at extreme speeds.

Severe, obviously audible transmission noise is generally the result of a lubricant problem. Insufficient, improper, or contaminated lubricant can promote rapid wear of gears, synchros, shift rails, forks and bearings. The overheating caused by a lubricant problem, can also lead to gear breakage.

REMOVAL AND INSTALLATION

TRANSMISSION—2WD

REMOVAL

(1) Disconnect battery negative cable.

(2) Shift transmission into Neutral.

(3) Remove floor console. Refer to Group 23, Body, for proper procedures.

(4) Remove screws attaching shift boot to floorpan. Then slide boot upward on lever extension.

(5) Remove shift lever extension from the shift tower and lever assembly.

(6) Raise and support vehicle.

(7) Mark propeller shaft and axle companion flange for alignment reference. Use paint, scriber, or chalk to mark the flange.

(8) Remove propeller shaft.

(9) Disconnect and remove exhaust system Y-pipe.

(10) Disconnect wires at backup light switch.

(11) Support engine with adjustable safety stand and wood block.

(12) If transmission is to be disassembled for repair, remove drain plug and drain lubricant from transmission.

(13) Remove bolts/nuts attaching transmission to rear mount.

(14) Support transmission with a transmission jack. Secure transmission to jack with safety chains.

(15) Remove rear crossmember.

(16) Remove bolts attaching clutch slave cylinder to clutch housing. Then move cylinder aside for working clearance.

(17) Remove starter.

(18) Remove transmission dust shield.

(19) Remove transmission harness wires from clips on transmission shift cover.

(20) Lower transmission slightly.

(21) Remove the bolts attaching the shift tower and lever assembly to the transmission housing. Then remove the shift tower and lever assembly.

(22) Remove bolts attaching transmission to engine.

(23) Slide transmission and jack rearward until input shaft clears clutch disc.

(24) Lower transmission jack and remove transmission from under vehicle.

INSTALLATION

NOTE: If a new transmission is being installed, be sure to use all components supplied with the new transmission. For example, if a new shift tower is supplied with the new transmission, do not re-use the original shift tower.

(1) Apply light coat of Mopar® high temperature bearing grease to contact surfaces of following components:

- input shaft splines.
- release bearing slide surface of front retainer.
- release bearing bore.
- release fork.
- release fork ball stud.
- propeller shaft slip yoke.

(2) Apply sealer to threads of drain plug and install plug in case.

(3) Mount transmission on jack and position transmission under vehicle.

(4) Raise transmission until input shaft is centered in clutch disc hub.

(5) Move transmission forward and start input shaft in clutch disc and pilot bushing.

(6) Work transmission forward until seated against engine. Do not allow transmission to remain unsupported after input shaft has entered clutch disc.

REMOVAL AND INSTALLATION (Continued)

(7) Install and tighten transmission-to-engine bolts to 108 N·m (80 ft. lbs.) torque.
(8) Install clutch slave cylinder.
(9) Install transmission dust shield.
(10) Install starter.
(11) Connect backup light switch wires.
(12) Fill transmission with recommended lubricant. Correct fill level is bottom edge of fill plug hole.
(13) Install shift tower and lever assembly. Tighten shift tower bolts to 7-10 N·m (5-7 ft. lbs.) torque.
(14) Position transmission harness wires in clips on shift cover.
(15) Install transmission mount on transmission or rear crossmember.
(16) Install rear crossmember.
(17) Remove transmission jack and engine support fixture.
(18) Align and install propeller shaft.
(19) Lower vehicle.
(20) Install the shift lever extension onto the shift tower and lever assembly.
(21) Install shift boot.
(22) Install floor console. Refer to Group 23, Body, for proper procedures.
(23) Connect battery negative cable.

TRANSMISSION—4WD

REMOVAL

(1) Disconnect battery negative cable.
(2) Shift transmission into Neutral.
(3) Remove floor console. Refer to Group 23, Body, for proper procedures.
(4) Remove shift lever boot.
(5) Remove the shift lever extension from the shift tower and lever assembly.
(6) Raise vehicle.
(7) Remove skid plate, if equipped.
(8) If transmission will be disassembled for repair, remove drain plug and drain lubricant from transmission.
(9) Mark propeller shafts and companion flange for assembly reference.
(10) Disconnect and remove propeller shafts.
(11) Disconnect and remove exhaust system Y-pipe. Then disconnect and lower remaining exhaust pipes for clearance as necessary.
(12) Support engine with adjustable safety stand.
(13) Disconnect backup light switch wires.
(14) Disconnect transfer case shift linkage at transfer case range lever.
(15) Remove transfer case shift lever from transmission.
(16) Remove bolts/nuts attaching transmission to rear support.
(17) Remove crossmember bolts/nuts and remove crossmember.
(18) Support transfer case with transmission jack. Secure transfer case to jack with safety chains.
(19) Remove transfer case attaching nuts.
(20) Move transfer case rearward until input gear clears transmission output shaft.
(21) Lower transfer case assembly and move it from under vehicle.
(22) Support transmission with transmission jack. Secure transmission to jack with safety chains.
(23) Remove transmission harness from retaining clips on transmission shift cover.
(24) Remove clutch slave cylinder splash shield, if equipped.
(25) Remove clutch slave cylinder attaching nuts. Move cylinder aside for working clearance.
(26) Remove starter.
(27) Remove transmission splash shield.
(28) Lower transmission slightly.
(29) Remove bolts attaching shift tower and lever assembly to rear case. Then remove shift tower and lever as an assembly.
(30) Remove bolts attaching transmission to engine.
(31) Move transmission rearward until input shaft clears clutch disc.
(32) Lower transmission and remove it from under vehicle.

INSTALLATION

NOTE: If a new transmission is being installed, be sure to use all components supplied with the new transmission. For example, if a new shift tower is supplied with the new transmission, do not re-use the original shift tower.

(1) Apply light coat of Mopar® high temperature bearing grease to contact surfaces of following components:
- input shaft splines.
- release bearing slide surface of front retainer.
- release bearing bore.
- release fork.
- release fork ball stud.
- propeller shaft slip yoke.

(2) Apply sealer to threads of drain plug, then install plug in case.
(3) Mount transmission on jack and position transmission under vehicle. Secure transmission to jack with safety chains.
(4) Raise transmission until input shaft is centered in clutch disc hub.
(5) Move transmission forward and start input shaft in clutch disc.

REMOVAL AND INSTALLATION (Continued)

(6) Work transmission forward until seated against engine. Do not allow transmission to remain unsupported after input shaft has entered clutch disc.

(7) Install and tighten transmission to engine bolts to 108 N·m (80 ft. lbs.) torque.

(8) Position transmission harness wires in clips on shift cover.

(9) Install slave cylinder and shield, if equipped.

(10) Install shift tower and lever assembly. Tighten shift tower bolts to 7-10 N·m (5-7 ft. lbs.) torque.

(11) Install transmission mount on transmission or rear crossmember.

(12) Install transfer case shift lever on transmission.

(13) Install rear crossmember.

(14) Remove transmission jack and engine support fixture.

(15) Install transfer case on transmission jack. Secure transfer case to jack with safety chains.

(16) Raise jack and align transfer case input gear with transmission output shaft.

(17) Move transfer case forward and seat it on transmission.

(18) Install and tighten transfer case attaching nuts. Tighten nuts to 41-47 N·m (30-35 ft. lbs.) if case has 3/8 studs, or 30-41 N·m (22-30 ft. lbs.) if case has 5/16 studs.

(19) Connect backup light switch wires.

(20) Install transmission dust cover.

(21) Install starter.

(22) Install transfer case shift lever to side of transfer case.

(23) Connect transfer case shift lever to range lever on transfer case.

(24) Align and connect propeller shafts.

(25) Fill transmission with required lubricant. Check lubricant level in transfer case and add lubricant if necessary.

(26) Install transfer case skid plate, if equipped, and crossmember. Tighten attaching bolts/nuts to 41 N·m (30 ft. lbs.) torque.

(27) Install exhaust system components.

(28) Lower vehicle.

(29) Install the shift lever extension onto the shift tower and lever assembly.

(30) Install shift lever boot.

(31) Install floor console. Refer to Group 23, Body, for proper procedures.

(32) Connect battery negative cable.

SHIFT TOWER

REMOVAL

(1) Shift transmission into Neutral.

(2) Unscrew and remove the shift lever extension from the shift

(3) Remove any floor console components necessary to access the transmission shift tower.

(4) Remove the bolts holding the shift tower to the isolator plate and transmission gear case.

(5) Remove the shift tower (Fig. 4) from the transmission.

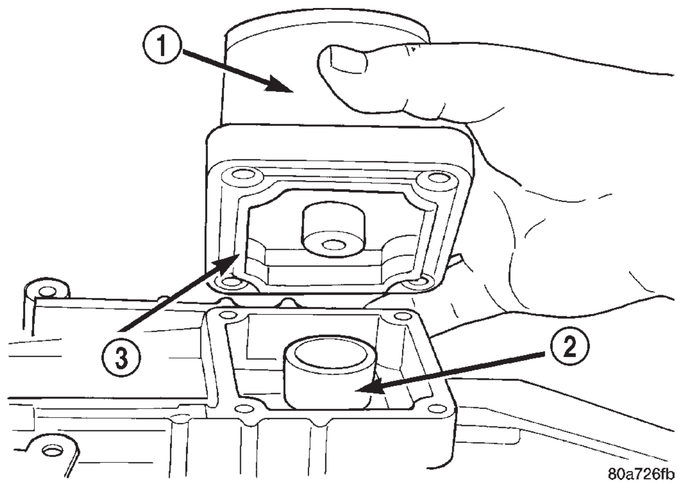


Fig. 4 Remove Shift Tower

1 – SHIFT TOWER AND LEVER ASSEMBLY
2 – SHIFT SOCKET
3 – SEAL

INSTALLATION

(1) Shift transmission into third gear.

(2) Clean the mating surfaces of shift tower and transmission gear case with suitable wax and grease remover.

(3) Install the shift tower onto the transmission case. No sealant is necessary between the shift tower and transmission case.

(4) Install the bolts to hold the shift tower to the isolator plate and the transmission gear case. Tighten the shift tower bolts to 8.5 N·m (6.3 ft. lbs.).

(5) Install the shift lever extension and any floor console components previously removed.

REMOVAL AND INSTALLATION (Continued)

YOKE SEAL—2WD

REMOVAL

(1) Raise vehicle.

(2) Mark propeller shaft and axle companion flange for alignment reference.

(3) Disconnect and remove propeller shaft.

(4) Remove old seal with Seal Remover C-3985-B (Fig. 5) from transmission housing.

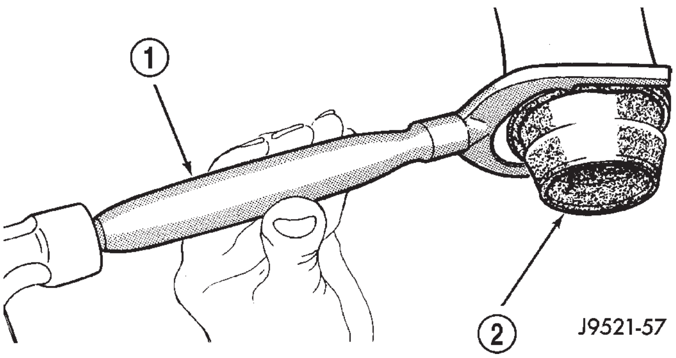


Fig. 5 Removing Transmission Housing Yoke Seal

1 – SPECIAL TOOL C-3985–B
2 – SEAL

INSTALLATION

(1) Place seal in position on transmission housing.

(2) Drive seal into transmission housing with Seal Installer C-3972-A (Fig. 6).

(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines.

(4) Align marks made at removal and connect propeller shaft to rear axle companion flange.

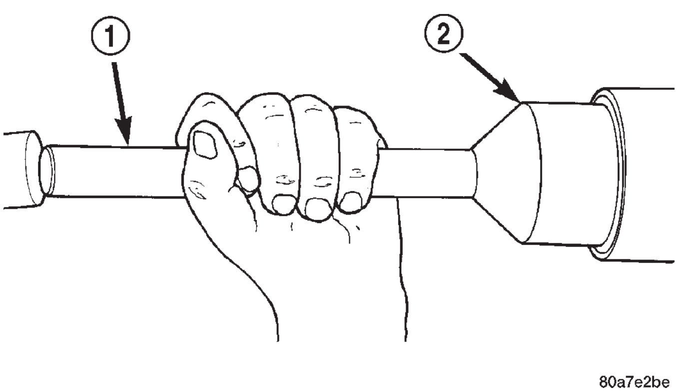


Fig. 6 Installing Transmission Housing Yoke Seal

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3972–A

REAR HOUSING YOKE BUSHING

REMOVAL

(1) Remove housing yoke seal.

(2) Insert Remover 6957 into rear housing. Tighten tool to bushing and remove bushing (Fig. 7).

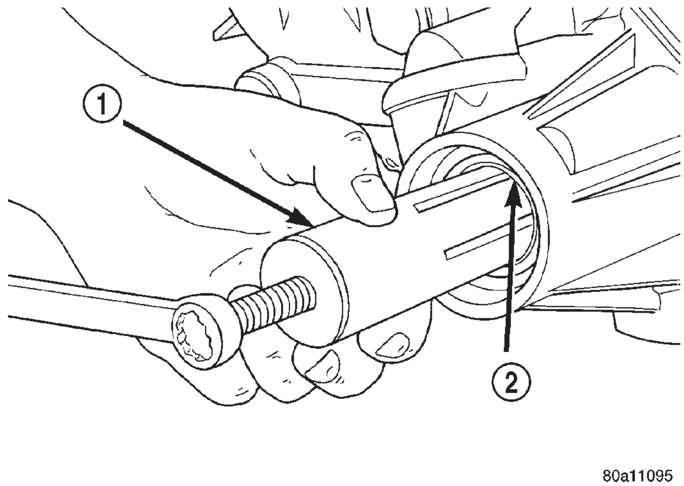


Fig. 7 Bushing Removal—Typical

1 – REMOVER 6957
2 – EXTENSION HOUSING BUSHING

INSTALLATION

(1) Align bushing oil hole with oil slot in rear housing.

(2) Tap bushing into place with Installer 6951 and Handle C-4171.

(3) Install new oil seal in housing using Seal Installer C-3972–A (Fig. 8).

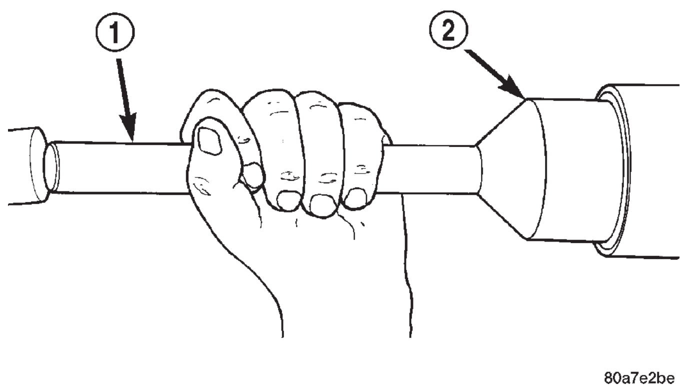


Fig. 8 Rear Housing Seal Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3972–A

DISASSEMBLY AND ASSEMBLY

TRANSMISSION

FRONT HOUSING REMOVAL

(1) If necessary, temporarily reinstall shift lever assembly. Shift transmission into Neutral.

(2) If lubricant was not drained out of transmission during removal, remove drain plug and drain lubricant into container at this time.

(3) Inspect drain plug magnet for debris.

(4) Remove backup light switch. Switch is located on driver side of rear housing (Fig. 9).

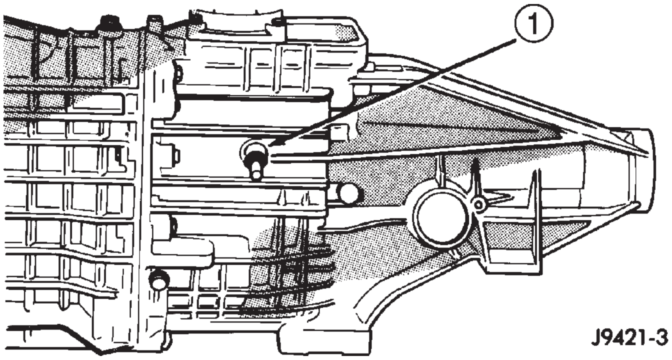


Fig. 9 Backup Light Switch Location

1 – BACKUP LIGHT SWITCH

(5) If necessary, remove shift tower bolts and remove tower and lever assembly (Fig. 10).

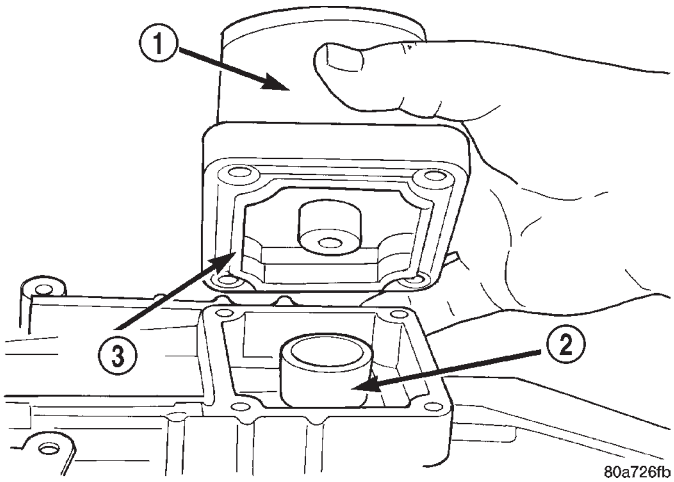


Fig. 10 Shift Tower Removal

1 – SHIFT TOWER AND LEVER ASSEMBLY
2 – SHIFT SOCKET
3 – SEAL

(6) Remove shift shaft lock bolt (Fig. 11). Bolt is located at top of front housing just forward of shift tower. Bolt is a shoulder bolt that secures the shift shaft bushing and lever.

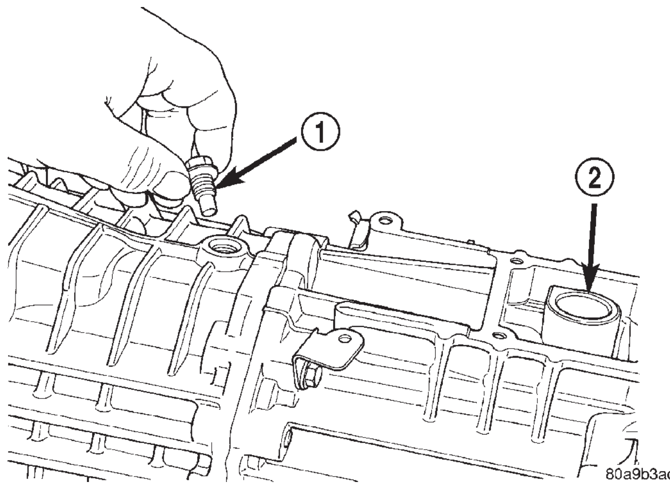


Fig. 11 Shift Shaft Lock Bolt Removal

1 – SHIFT SHAFT LOCK BOLT
2 – SHAFT SOCKET

(7) Remove bolts attaching input shaft bearing retainer in front housing (Fig. 12). Note location of oil feed formation on retainer for installation reference.

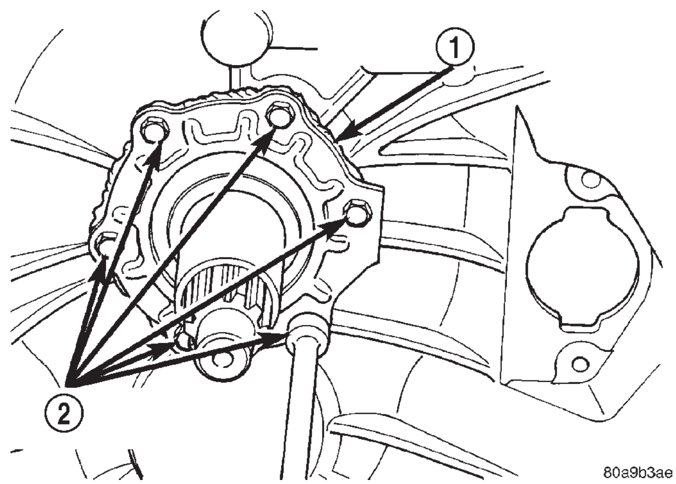


Fig. 12 Input Shaft Bearing Retainer Bolt Removal

1 – INPUT SHAFT BEARING RETAINER
2 – RETAINER BOLTS

(8) Remove input shaft bearing retainer. Use pry tool to carefully lift retainer and break sealer bead (Fig. 13).

(9) Remove bearing retainer from input shaft (Fig. 14).

(10) Remove snap ring that secures input shaft in front bearing (Fig. 15).

(11) Use Remover 8117 and suitable slide hammer to remove shift shaft detent plug.

(12) Remove shift shaft detent plunger and spring (Fig. 16). Use pencil magnet to remove spring then plunger, if necessary.

DISASSEMBLY AND ASSEMBLY (Continued)

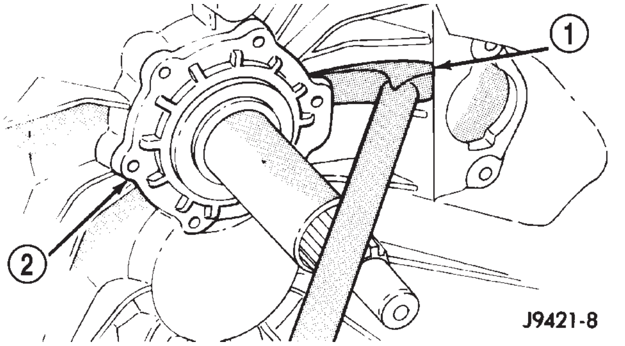


Fig. 13 Loosening Bearing Retainer Sealer Bead

1 – PRY TOOL
2 – INPUT SHAFT BEARING RETAINER

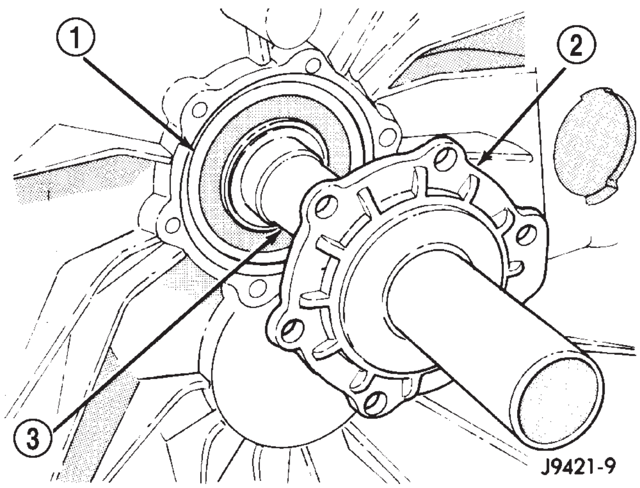


Fig. 14 Input Shaft Bearing Retainer Removal

1 – SHAFT BEARING
2 – BEARING RETAINER
3 – INPUT SHAFT

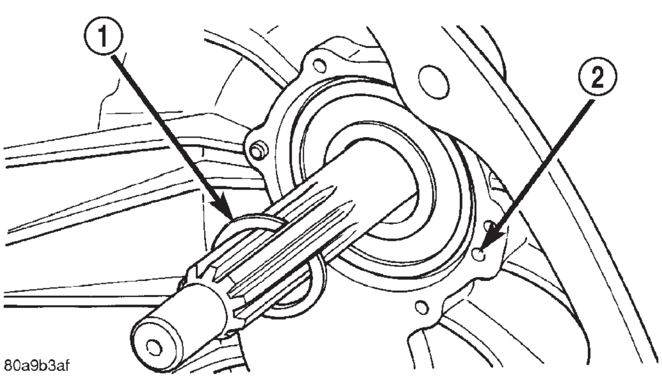


Fig. 15 Input Shaft Snap Ring Removal

1 – INPUT SHAFT SNAP RING
2 – OIL FEED

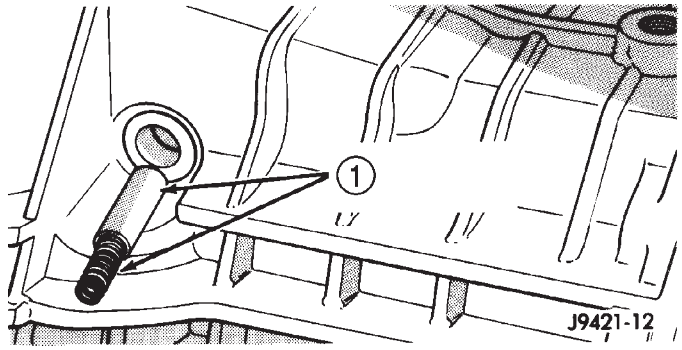


Fig. 16 Detent Plunger And Spring Removal

1 – SHIFT SHAFT DETENT PLUNGER AND SPRING

(13) Remove bolts that attach front housing to rear housing (Fig. 17). Three bolts at extreme rear of housing are actually for the output shaft bearing retainer. It is not necessary to remove all three bolts at this time. Leave at least one bolt in place until rear case is ready to be removed.

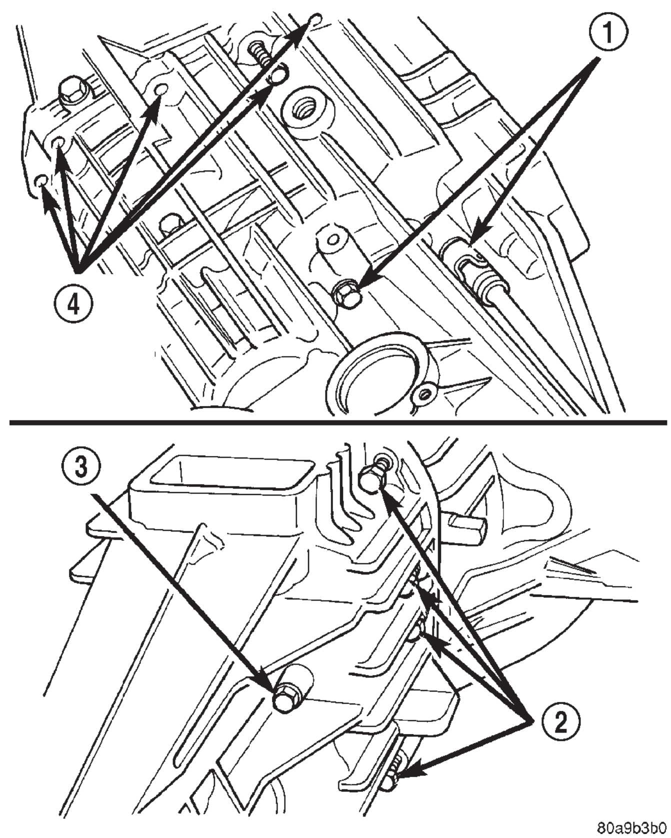


Fig. 17 Housing And Bearing Retainer Bolt Locations

1 – RETAINER BOLTS
2 – HOUSING BOLTS
3 – RETAINER BOLT
4 – HOUSING BOLT LOCATIONS

DISASSEMBLY AND ASSEMBLY (Continued)

(14) Separate front housing from rear housing (Fig. 18). Use plastic mallet to tap front housing off alignment dowels.

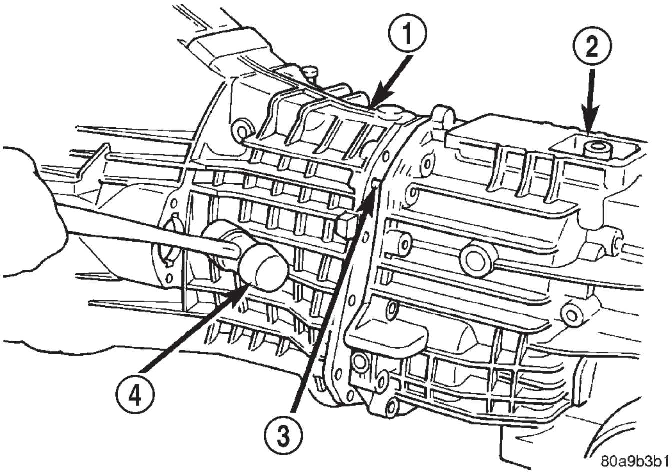


Fig. 18 Front Housing Removal

1 – FRONT HOUSING
2 – REAR HOUSING
3 – DOWELS (2)
4 – PLASTIC MALLET

(15) Remove input shaft bearing and countershaft front bearing from front case (Fig. 19). Countershaft bearing can be removed by hand.

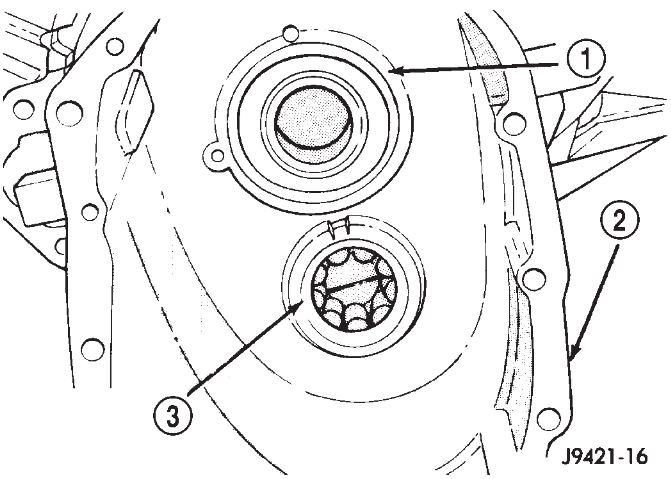


Fig. 19 Input Shaft And Countershaft Front Bearing Location

1 – INPUT SHAFT BEARING
2 – FRONT HOUSING
3 – COUNTERSHAFT FRONT BEARING

(16) Note position of input shaft, shift shaft and forks, and geartrain components in housing (Fig. 20).

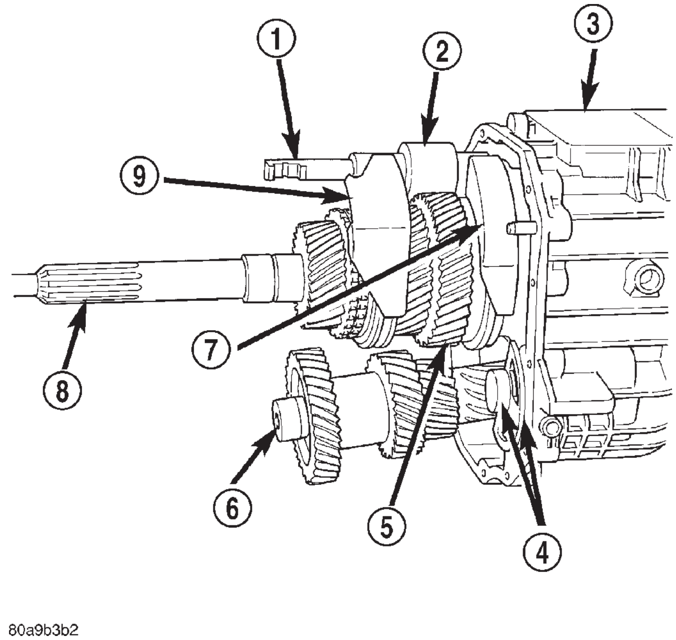


Fig. 20 Geartrain And Shift Component Identification

1 – SHIFT SHAFT
2 – BUSHING
3 – REAR HOUSING
4 – REVERSE IDLER AND SUPPORT
5 – OUTPUT SHAFT AND GEARS
6 – COUNTERSHAFT
7 – 1–2 FORK
8 – INPUT SHAFT
9 – 3–4 FORK

SHIFT SHAFT, SHIFT FORKS AND REVERSE IDLER SEGMENT REMOVAL

(1) Unseat roll pin that secures shift socket to shift shaft with Special Tool 6858 as follows:

(a) Position Tool 6858 on shift socket. Then center tool over roll pin. Be sure tool legs are firmly seated on shift socket (Fig. 21).

(b) Tilt socket toward side of case. This places roll pin at slight angle to avoid trapping pin between gear teeth.

(c) Tighten tool punch to press roll pin downward and out of shift socket (Fig. 21). Roll pin does not have to come completely out of shift shaft; it only has to clear shift socket. Be careful not to drive roll pin out of shaft far enough to jam into the geartrain.

DISASSEMBLY AND ASSEMBLY (Continued)

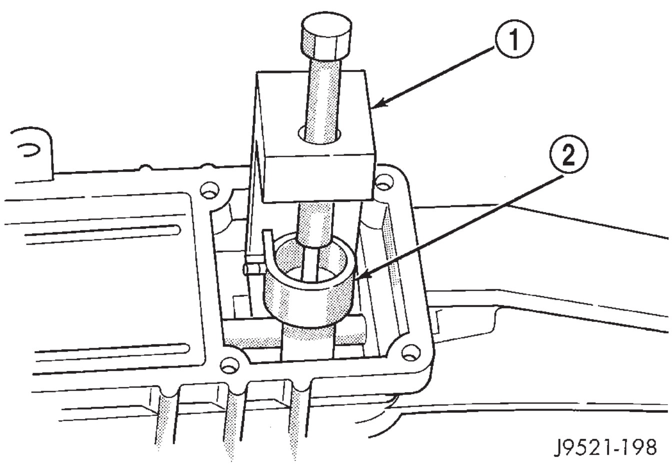


Fig. 21 Unseating Shift Socket Roll Pin With Tool 6858

1 – SPECIAL TOOL 6858
2 – SHIFT SOCKET

(2) Drive out roll pin that secures shift bushing and lever to shift shaft (Fig. 22).

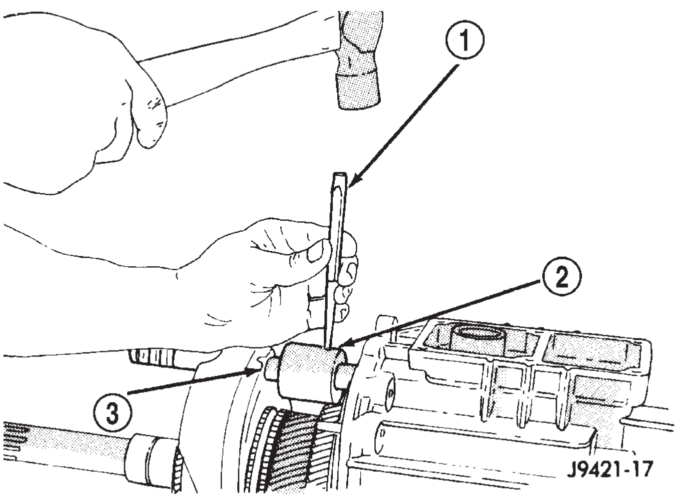


Fig. 22 Removing Shift Shaft Lever And Bushing Roll Pin

1 – PIN PUNCH
2 – BUSHING AND LEVER
3 – SHIFT SHAFT

(3) Pull shift shaft straight out of rear housing, shift socket, fifth-reverse fork, and 1-2 fork (Fig. 23).

(4) Remove shift socket from rear housing (Fig. 24).

(5) Remove lever and bushing (Fig. 25).

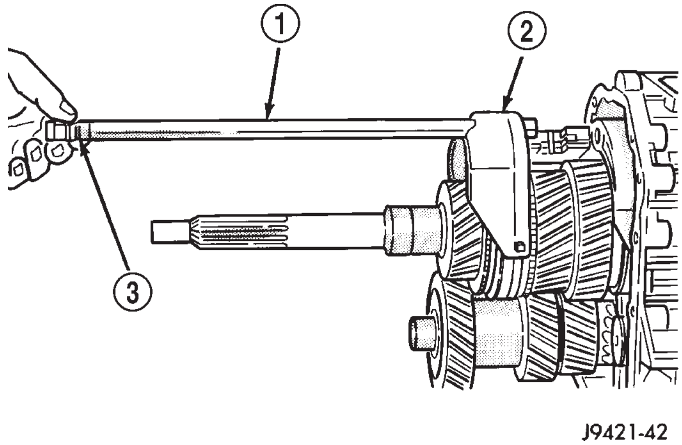


Fig. 23 Shift Shaft Removal

1 – SHIFT SHAFT
2 – 3–4 FORK
3 – SHAFT DETENT NOTCHES

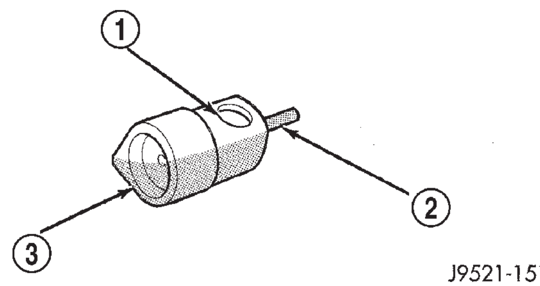


Fig. 24 Shift Socket And Roll Pin

1 – SHAFT BORE
2 – ROLL PIN
3 – SHIFT SOCKET

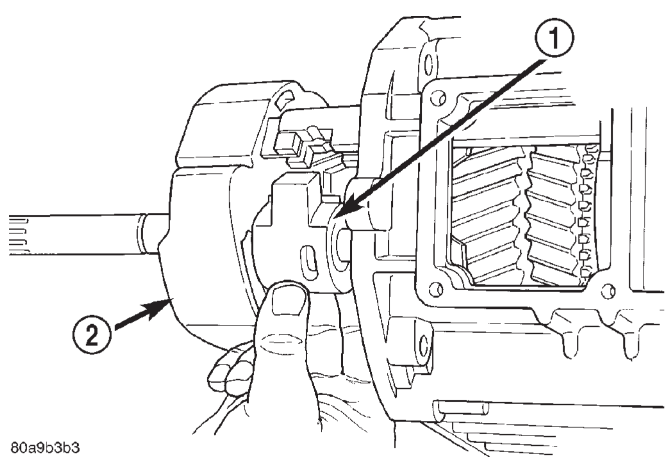


Fig. 25 Removing Shift Shaft Lever And Bushing

1 – SHAFT LEVER AND BUSHING
2 – 3–4 FORK

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Remove 3-4 fork. Rotate 3-4 fork around synchro sleeve until fork clears shift arms on 1-2 and fifth-reverse forks. Then remove 3-4 fork (Fig. 26).

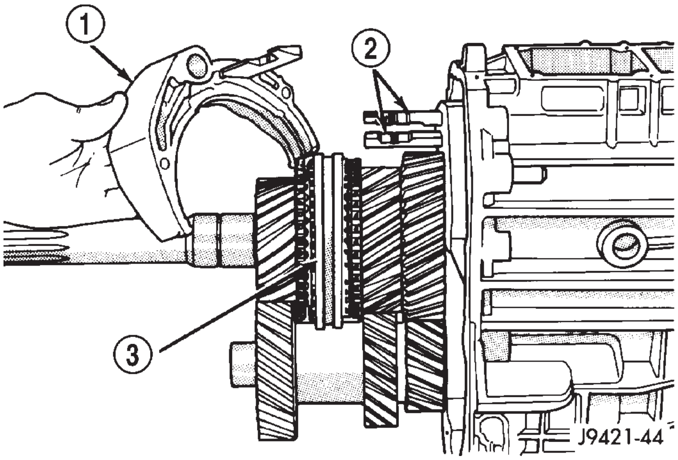


Fig. 26 Removing 3-4 Shift Fork

1 – 3–4 FORK
2 – 1–2 AND 5TH-REVERSE FORK ARMS
3 – 3–4 SYNCHRO SLEEVE

(7) Remove the front reverse idler shaft bolt.

(8) Loosen rear reverse idler shaft bolt.

(9) Remove reverse idler shaft support segment by sliding it straight out of housing.

(10) Support geartrain and rear housing on Assembly Fixture Tool 6747 as follows:

(a) Adjust height of reverse idler pedestal rod until the reverse idle shaft bottoms in Cup 8115.

(b) Position Adapters 6747-1A and 6747-2A on Assembly Fixture 6747.

(c) Slide fixture tool onto input shaft, countershaft and idler gear (Fig. 27).

(d) Stand geartrain and rear housing upright on fixture (Fig. 28). Have helper hold fixture tool in place while housing and geartrain is being rotated into upright position.

(11) Remove rear bolt holding reverse idler shaft in housing.

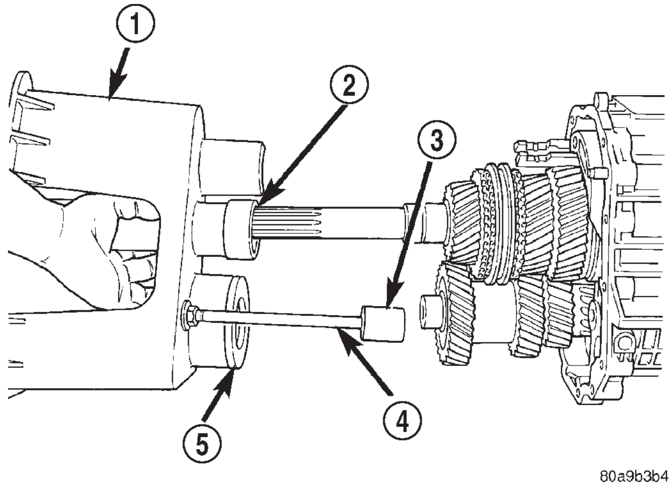


Fig. 27 Installing Assembly Fixture On Geartrain

1 – SPECIAL TOOL 6747
2 – SPECIAL TOOL 6747–1A
3 – SPECIAL TOOL 8115
4 – REVERSE IDLER PEDESTAL
5 – SPECIAL TOOL 6747–2A

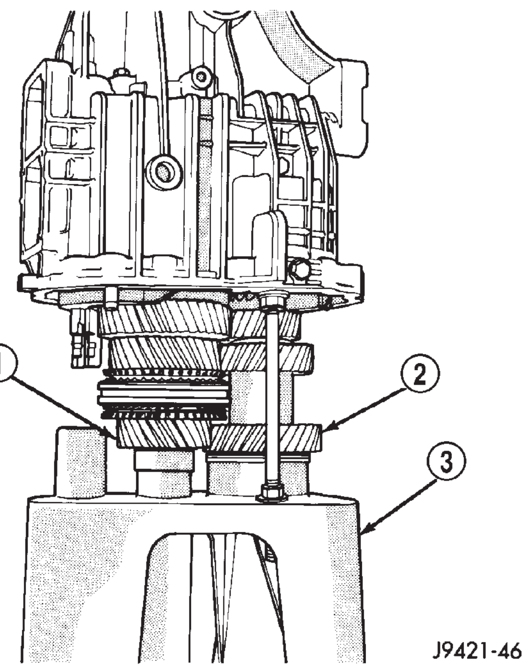


Fig. 28 Geartrain And Housing Mounted On Fixture Tool

1 – INPUT SHAFT
2 – COUNTERSHAFT
3 – SPECIAL TOOL 6747

DISASSEMBLY AND ASSEMBLY (Continued)

REAR HOUSING REMOVAL—2WD

(1) On 2-wheel drive transmission, remove three bolts that attach output shaft bearing retainer to rear case (Fig. 29). Bolts are rear of shift tower opening.

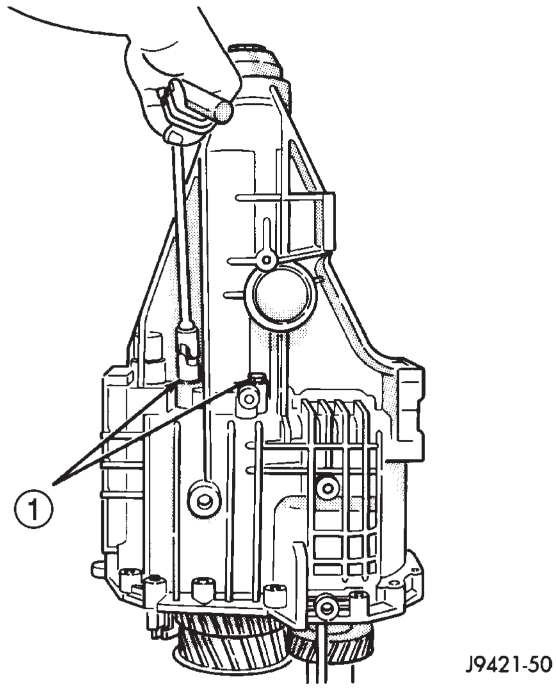


Fig. 29 Removing/Installing Output Shaft Bearing Retainer Bolts—2WD

1 – OUTPUT SHAFT BEARING RETAINER BOLTS (THIRD BOLT IS AT OPPOSITE SIDE OF CASE)

(2) Unseat output shaft bearing from bearing bore in rear housing. Use plastic or rawhide mallet to tap rear housing upward and off output shaft bearing as shown (Fig. 30).

(3) Lift rear housing up and off geartrain (Fig. 31).

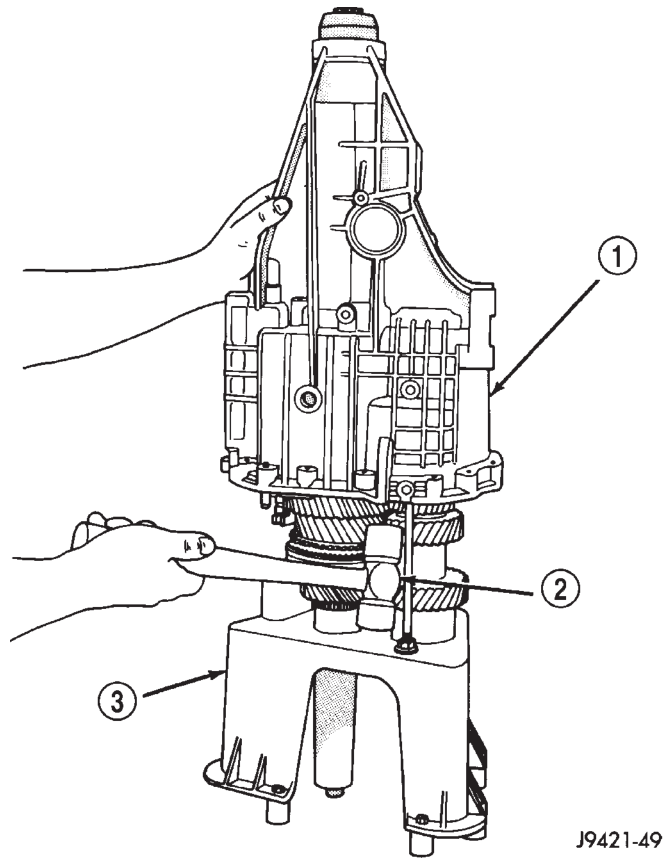


Fig. 30 Unseating Rear Housing From Output Shaft Bearing—2WD

1 – REAR HOUSING
2 – PLASTIC OR RAWHIDE MALLET
3 – FIXTURE TOOL

(4) Remove countershaft rear bearing from countershaft (Fig. 32).

(5) Examine condition of bearing bore and idler shaft notch in rear housing. Replace housing if any of these components are damaged.

DISASSEMBLY AND ASSEMBLY (Continued)

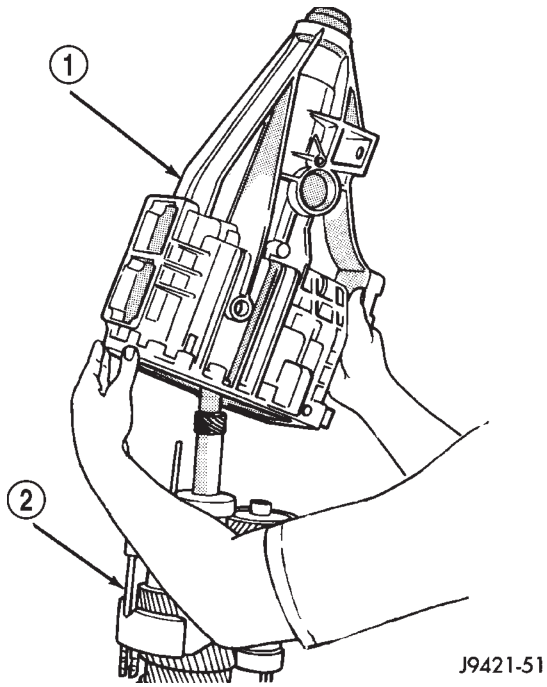


Fig. 31 Rear Housing Removal—2WD

1 – REAR HOUSING
2 – SHIFT FORKS AND GEARTRAIN

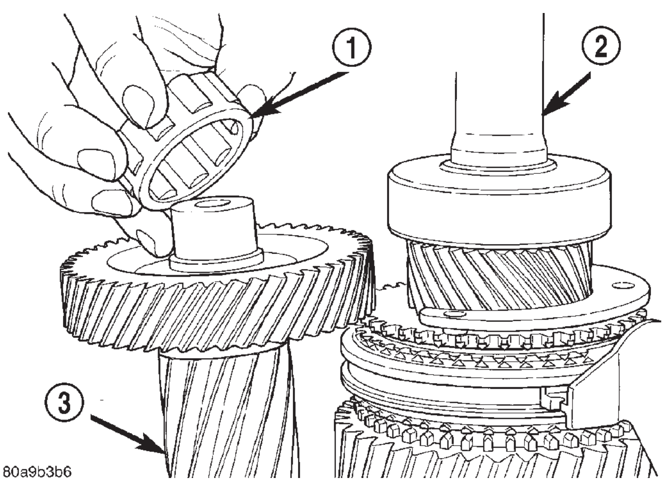


Fig. 32 Remove Countershaft Rear Bearing

1 – COUNTERSHAFT REAR BEARING
2 – OUTPUT SHAFT
3 – COUNTER SHAFT

REAR ADAPTER HOUSING REMOVAL—4WD

(1) Locate dimples in face of rear seal (Fig. 33). Use a suitable slide hammer mounted screw to remove seal by inserting screw into seal at dimple locations (Fig. 34).

(2) Remove rear bearing snap ring from output shaft with heavy duty snap ring pliers (Fig. 35).

(3) Lift rear adapter housing upward and off geartrain (Fig. 36).

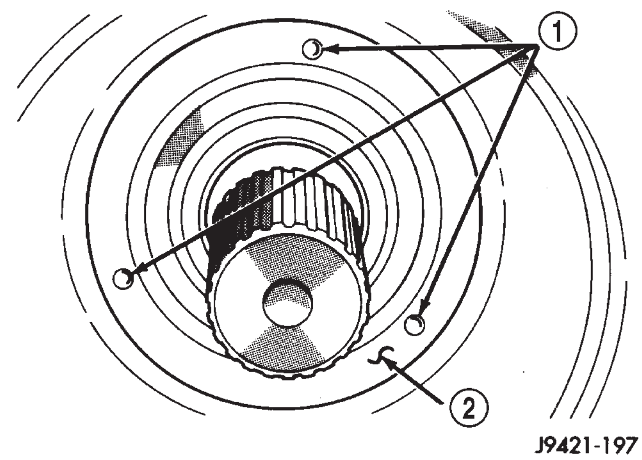


Fig. 33 Location Of Dimples In Seal Face—4WD

1 – LOCATION OF DIMPLES
2 – SEAL FACE

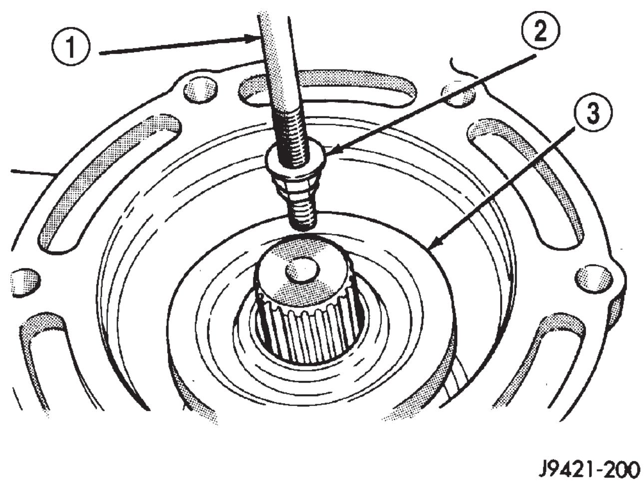


Fig. 34 Rear Seal Removal—4WD

1 – SLIDE HAMMER
2 – REMOVER TOOL
3 – REAR SEAL

(4) Remove bearing retainer bolts and remove rear bearing retainer and rear bearing (Fig. 37). Use hammer handle to push or tap bearing out of housing if needed.

(5) Examine condition of bearing bore, countershaft rear bearing race and idler shaft notch in rear housing. Replace housing if race, bore or notch are worn or damaged.

GEARTRAIN DISASSEMBLY FROM FIXTURE

(1) Remove reverse idler gear assembly from assembly fixture cup.

(2) Remove 1-2 and fifth-reverse forks from synchro sleeves.

(3) Slide countershaft out of fixture tool.

DISASSEMBLY AND ASSEMBLY (Continued)

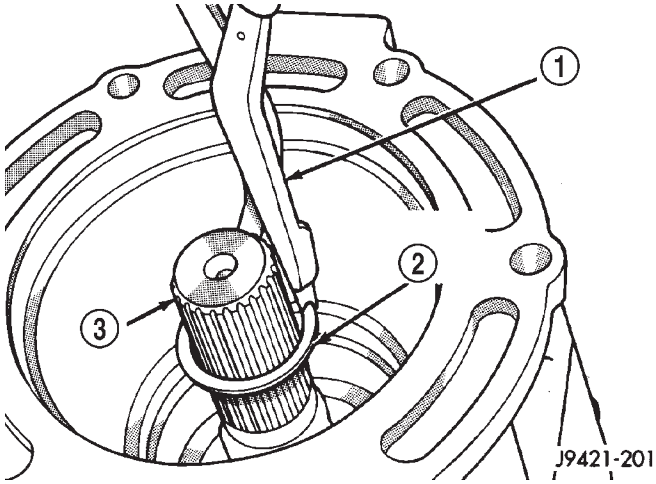


Fig. 35 Rear Bearing Snap Ring Removal—4WD

1 – HEAVY DUTY SNAP RING PLIERS
2 – REAR BEARING SNAP RING
3 – OUTPUT SHAFT

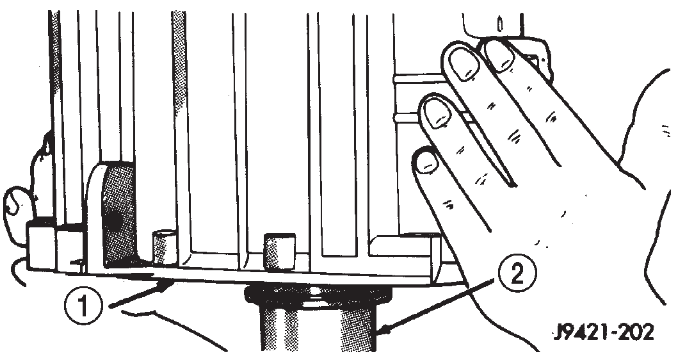


Fig. 36 Rear Adapter Housing Removal

1 – REAR ADAPTER HOUSING
2 – OUTPUT SHAFT

(4) Remove output shaft bearing retainer from rear surface of fifth gear (retainer will drop onto gear after bolts are removed).

(5) Lift and remove output shaft and gears off input shaft.

(6) Lift and remove input shaft, pilot bearing and fourth gear synchro ring from assembly fixture tool.

OUTPUT SHAFT DISASSEMBLY

NOTE: The synchronizer hubs and sleeves are different and must not be intermixed. It is recommended that each synchronizer unit be removed as an assembly to avoid intermixing parts. It is also recommended that each synchro hub and sleeve be marked with a scriber or paint for correct assembly reference.

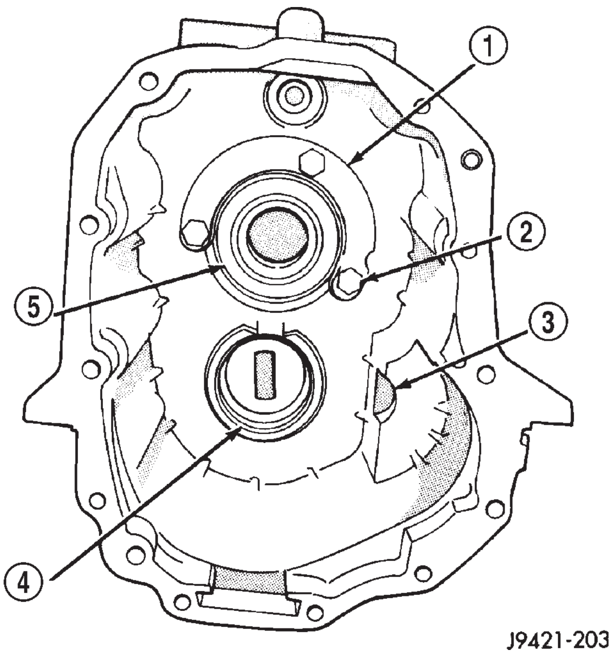


Fig. 37 Rear Adapter Housing Components

1 – BEARING RETAINER
2 – RETAINER BOLTS (3)
3 – IDLER SHAFT NOTCH
4 – COUNTERSHAFT REAR BEARING RACE
5 – REAR BEARING

(1) Remove snap ring that secures 3-4 synchro hub on output shaft.

(2) Remove 3-4 synchro assembly, third gear synchro ring, and third gear with shop press and Remover Tool 1130. Position Tool 1130 between second and third gears.

(3) Remove third gear needle bearing (Fig. 38).

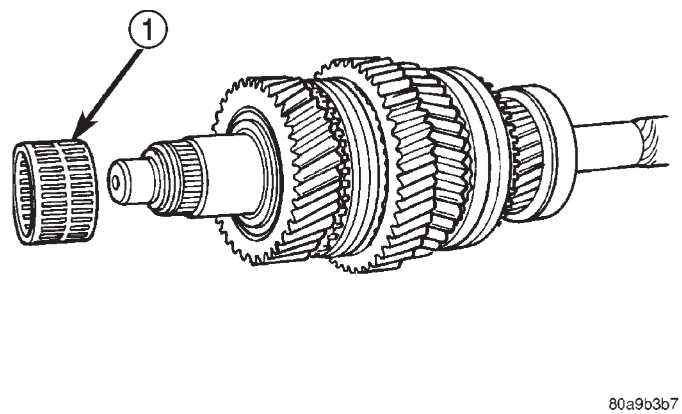


Fig. 38 Third Gear Needle Bearing Removal

1 – THIRD GEAR NEEDLE BEARING

(4) Remove retaining ring that secures two-piece thrust washer on shaft (Fig. 39). Use small pry tool to remove retaining ring.

DISASSEMBLY AND ASSEMBLY (Continued)

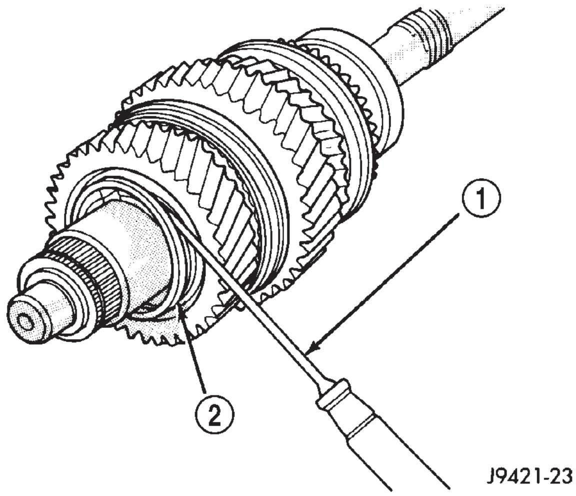


Fig. 39 Thrust Washer Retaining Ring Removal

1 – PRY TOOL
2 – THRUST WASHER RETAINING RING

(5) Remove two-piece thrust washer (Fig. 40). Note position of washer locating lugs in shaft notches for installation reference. The diamond shaped marks on the washer surface should be facing the front of the shaft.

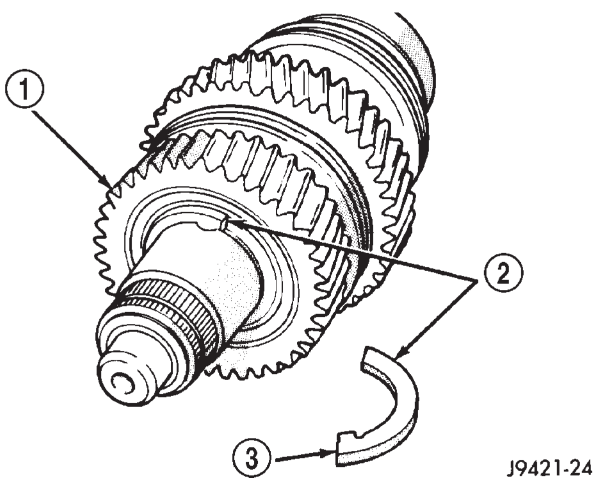


Fig. 40 Two-Piece Thrust Washer Removal

1 – SECOND GEAR
2 – THRUST WASHER (2–PIECE)
3 – WASHER LOCATING LUG

(6) Remove second gear and needle bearing (Fig. 41).

(7) Remove second gear synchro ring, synchro friction cone, and synchro cone (Fig. 42).

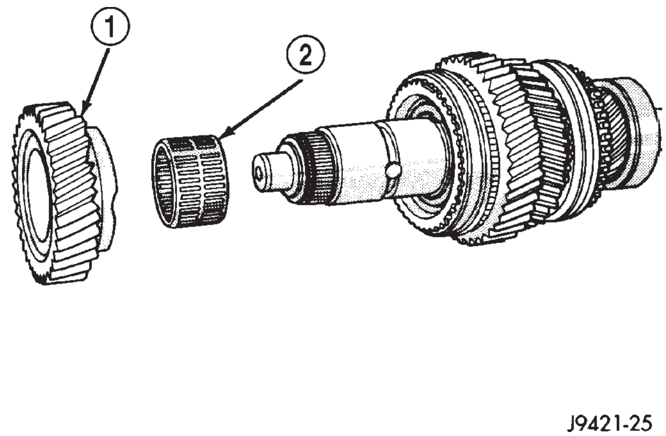


Fig. 41 Second Gear And Needle Bearing Removal

1 – SECOND GEAR
2 – SECOND GEAR NEEDLE BEARING

(8) Remove interm ring.

(9) Remove 1-2 synchro hub snap ring.

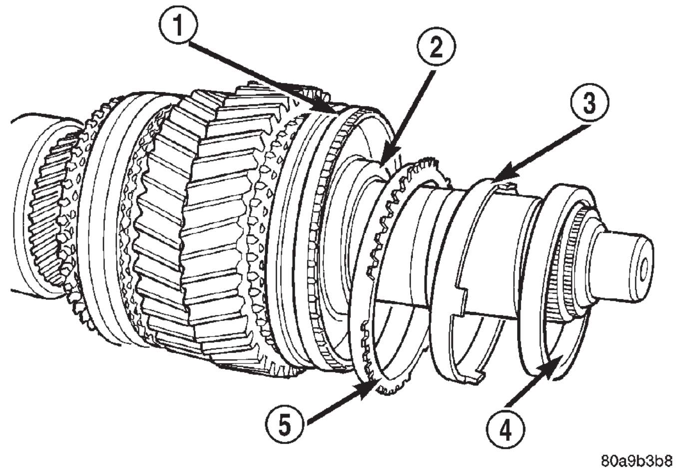


Fig. 42 Second Gear Synchro Ring And Cones Removal

1 – 1–2 SYNCHRO HUB AND SLEEVE
2 – INTERM RING
3 – SYNCHRO FRICTION CONE
4 – SYNCHRO CONE
5 – SYNCHRO RING

(10) Remove 1-2 synchro hub and sleeve and first gear from output shaft with shop press and Remover Tool 1130 (Fig. 43). Position Tool 1130 between first and reverse gears.

DISASSEMBLY AND ASSEMBLY (Continued)

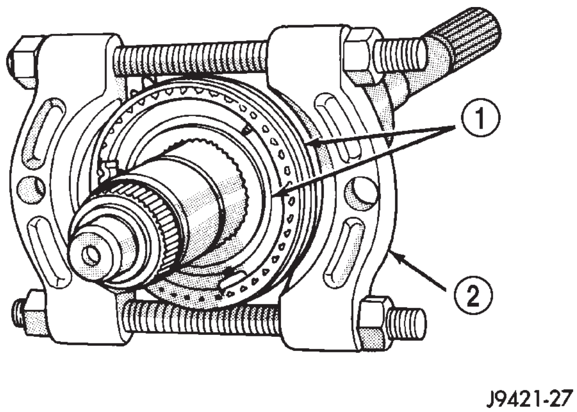


Fig. 43 Hub And Sleeve Removal—1-2 Synchro

1 – 1–2 SYNCHRO HUB AND SLEEVE
2 – SPECIAL TOOL 1130

(11) Remove first gear needle bearing (Fig. 44).

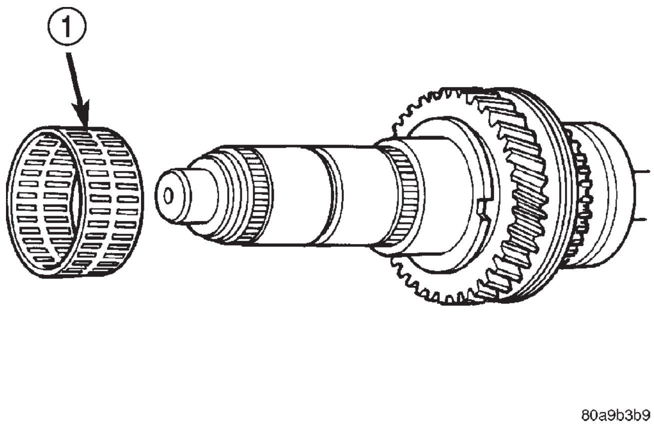


Fig. 44 First Gear Needle Bearing Removal

1 – FIRST GEAR NEEDLE BEARING

(12) Remove output shaft bearing snap ring (Fig. 45).

(13) On 2-wheel drive models, remove output shaft bearing.

(14) Remove fifth gear (Fig. 46).

(15) Remove fifth gear needle bearing. Spread bearing apart just enough to clear shoulder on output shaft (Fig. 47).

(16) Remove fifth-reverse synchro hub snap ring (Fig. 48).

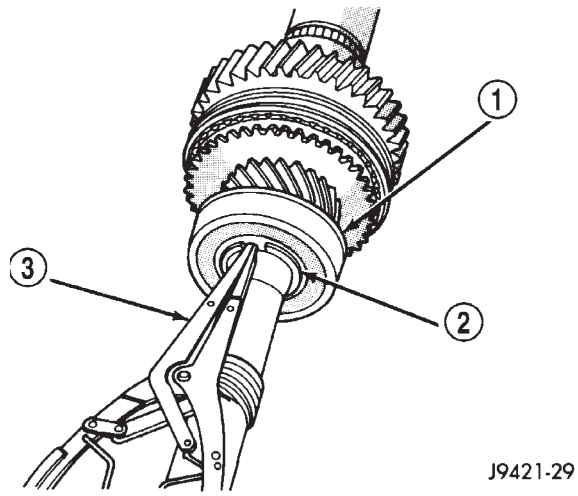


Fig. 45 Output Shaft Bearing Snap Ring Removal

1 – OUTPUT SHAFT BEARING
2 – BEARING SNAP RING
3 – SNAP RING PLIERS

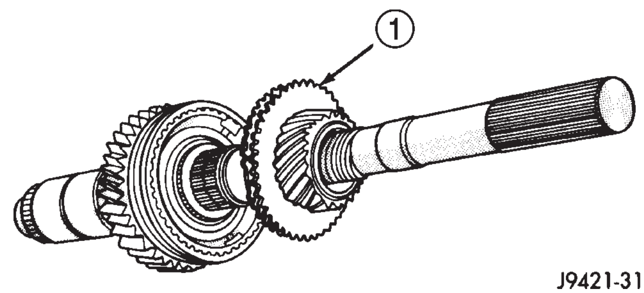


Fig. 46 Fifth Gear Removal

1 – FIFTH GEAR AND SYNCHRO RING

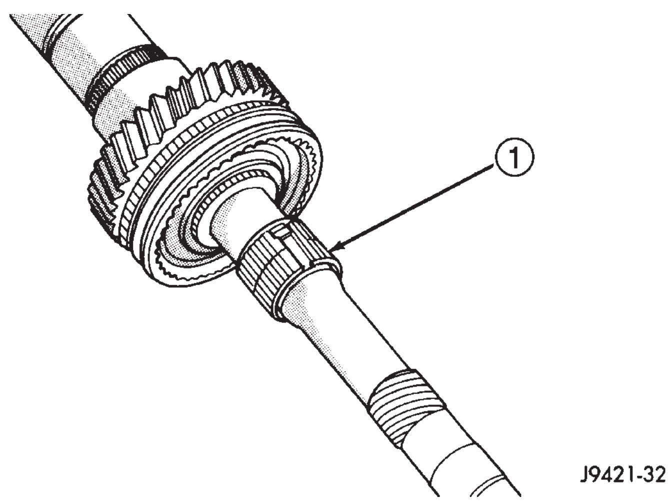


Fig. 47 Fifth Gear Needle Bearing Removal

1 – FIFTH GEAR NEEDLE BEARING (SPREAD BEARING TO CLEAR SHOULDER ON SHAFT)

DISASSEMBLY AND ASSEMBLY (Continued)

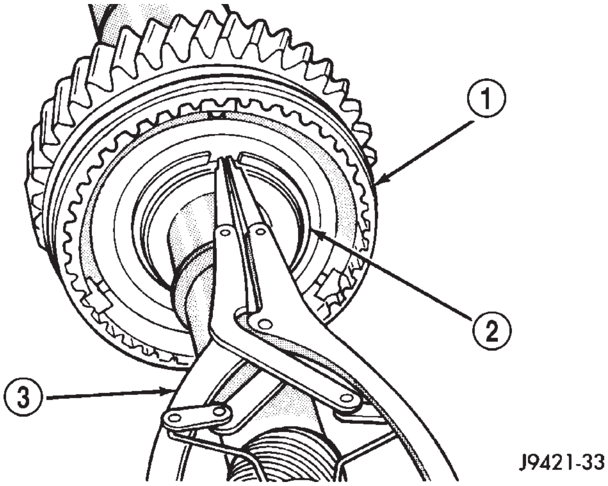


Fig. 48 Fifth-Reverse Synchro Hub Snap Ring Removal

1 – FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
2 – SYNCHRO HUB SNAP RING
3 – SNAP RING PLIERS

(17) Remove fifth-reverse synchro hub and sleeve with shop (Fig. 49).

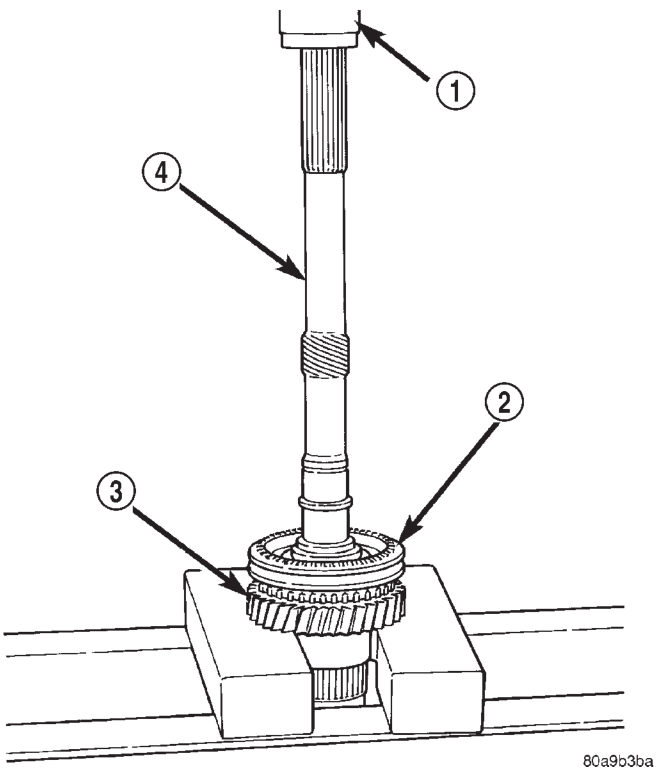


Fig. 49 Fifth-Reverse Synchro Hub And Sleeve Removal

1 – PRESS
2 – FIFTH-REVERSE SYNCHRO HUB AND SLEEVE
3 – REVERSE GEAR
4 – OUTPUT SHAFT

(18) Remove reverse gear and needle bearing (Fig. 50).

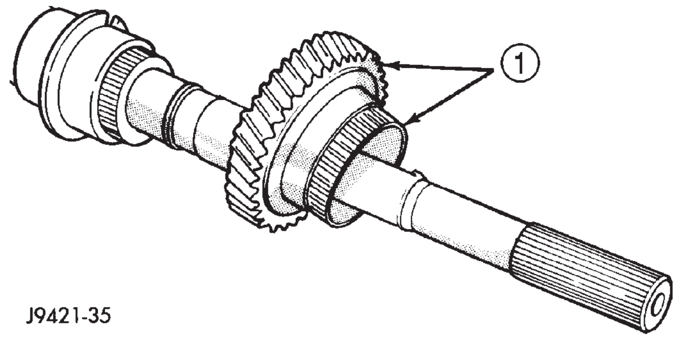


Fig. 50 Reverse Gear And Needle Bearing Removal

1 – REVERSE GEAR AND NEEDLE BEARING

REVERSE IDLER DISASSEMBLY

(1) Remove idler gear snap rings (Fig. 51).

(2) Remove thrust washer, wave washer, thrust plate and idler gear from shaft.

(3) Remove idler gear needle bearing from shaft.

ASSEMBLY

Gaskets are not used in the NV3500 transmission. Sealers are used at all case joints. The recommended sealer is Mopar® Silicone Sealer, or equivalent, for all case joints. Apply these products as indicated in the assembly procedures.

NOTE: It is very important that the transmission shift components be in Neutral position during assembly. This is necessary to prevent damaging synchro and shift components when the housings are installed.

The 3-4, 1-2 and fifth-reverse synchro hub snap rings can be fitted selectively. New snap rings are available in 0.05 mm (0.0019 in.) thickness increments. Use the thickest snap ring that will fit in each snap ring groove.

SYNCHRO COMPONENT ASSEMBLY

The easiest method of assembling each synchro is to install the springs, struts and detent balls one at a time as follows:

(1) Slide the sleeve part way onto the hub. Leave enough room to install the spring in the hub and the strut in the hub groove.

(2) Install the first spring in the hub. Then install a strut over the spring. Be sure the spring is seated in the spring bore in the strut.

(3) Slide the sleeve onto the hub just far enough to hold the first strut and spring in place.

(4) Place the detent ball in the top of the strut. Then carefully work the sleeve over the ball to hold it in place. A small flat blade screwdriver can be used

DISASSEMBLY AND ASSEMBLY (Continued)

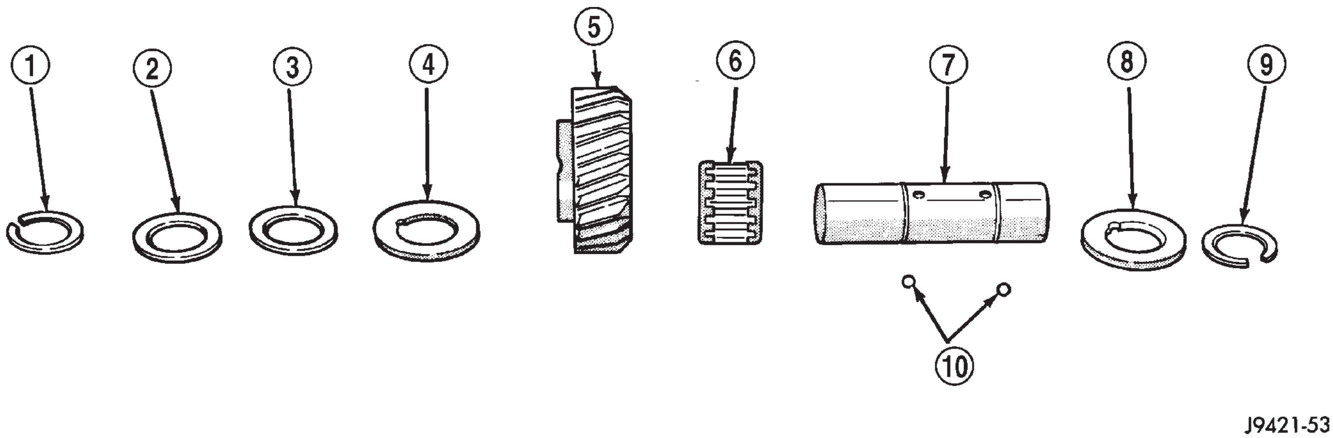


Fig. 51 Reverse Idler Components

1 – SNAP RING
2 – FLAT WASHER
3 – WAVE WASHER
4 – THRUST WASHER
5 – REVERSE IDLER GEAR
6 – IDLER GEAR BEARING
7 – IDLER SHAFT
8 – THRUST WASHER
9 – SNAP RING
10 – THRUST WASHER LOCK BALLS

to press the ball into place while moving the sleeve over it.

(5) Repeat the procedure for the remaining springs, struts and balls. Tape, or a rubber band can be used to temporarily secure each strut and ball as they are installed.

(6) Verify synchro assembly. Be sure the three springs, struts and detent balls are all in place (Fig. 52).

OUTPUT SHAFT ASSEMBLY

(1) Lubricate shaft, gears and bearings with recommended lubricant during assembly. Petroleum jelly can be used to hold parts in place.

(2) Check bearing surfaces of output shaft for nicks or scratches. Smooth surfaces with 320/400 grit emery cloth if necessary. Apply oil to emery cloth and shaft surface before polishing.

(3) Inspect and replace any synchro ring that exhibits wear or damage. Completely immerse each synchro ring in lubricant before installation.

(4) Lubricate and install reverse gear needle bearing on shaft (Fig. 53). Slide bearing up against shoulder on output shaft.

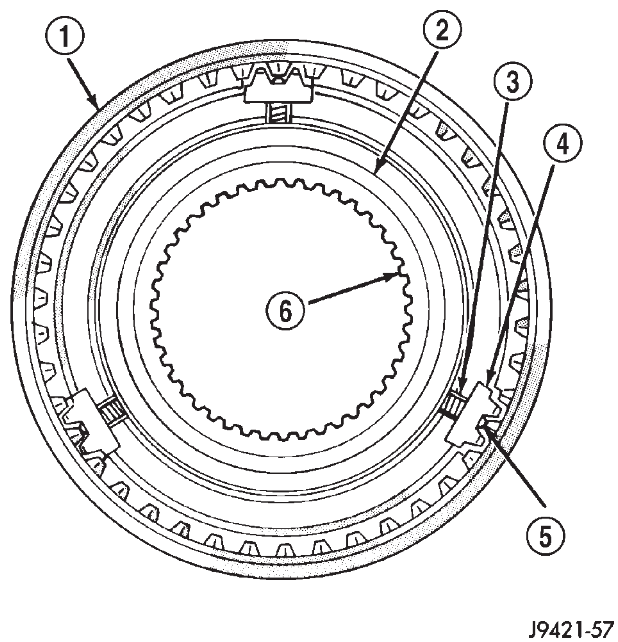


Fig. 52 Assembled View Of Synchro Components

1 – SLEEVE
2 – HUB SHOULDER
3 – SPRING (3)
4 – STRUT (3)
5 – DETENT BALL (3)
6 – HUB

DISASSEMBLY AND ASSEMBLY (Continued)

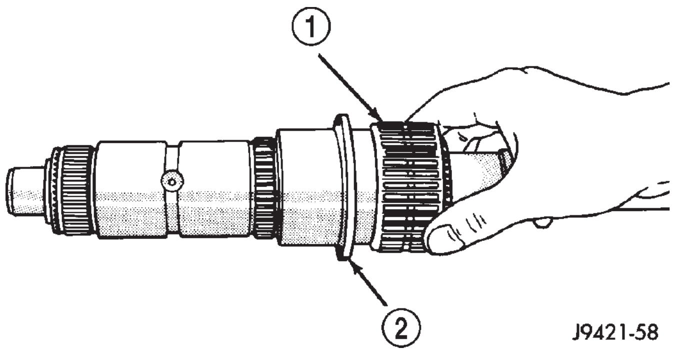


Fig. 53 Reverse Gear Bearing Installation

1 – REVERSE GEAR BEARING
2 – SHOULDER

(5) Install reverse gear over needle bearing (Fig. 54).

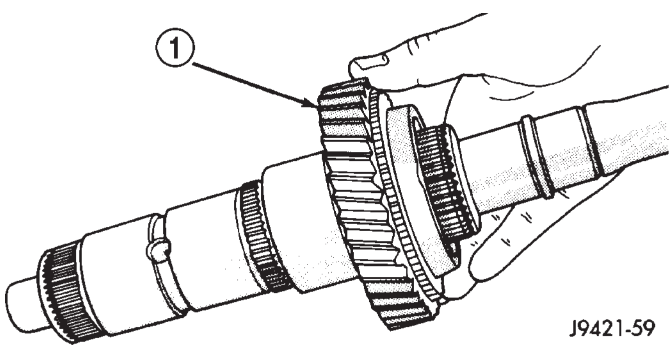


Fig. 54 Reverse Gear Installation

1 – REVERSE GEAR

(6) Install solid brass synchro ring on reverse gear (Fig. 55).

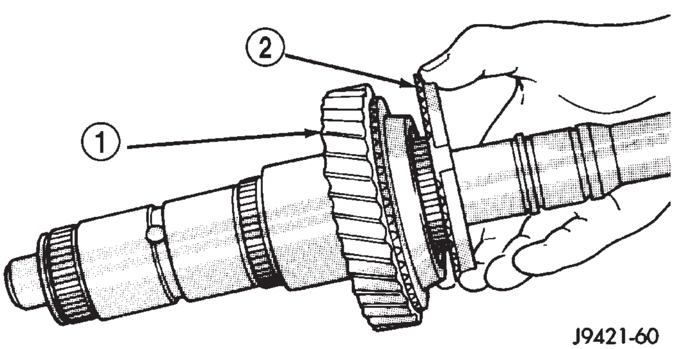


Fig. 55 Reverse Gear Synchro Ring Installation

1 – REVERSE GEAR
2 – SYNCHRO RING (SOLID BRASS)

(7) Assemble fifth-reverse synchro hub, sleeve, struts, springs and detent balls, if not previously done.

CAUTION: The fifth-reverse synchro hub and sleeve can be installed backwards if care is not exercised. One side of the hub has shoulders around the hub bore. Make sure this side of the hub is facing the front of the shaft. In addition, one side of the sleeve is tapered. Be sure the sleeve is installed so the tapered side will be facing the front of the shaft.

(8) Start fifth-reverse synchro assembly on output shaft splines by hand. Then seat synchro onto shaft with shop press and Remover 6310-1 (Fig. 56).

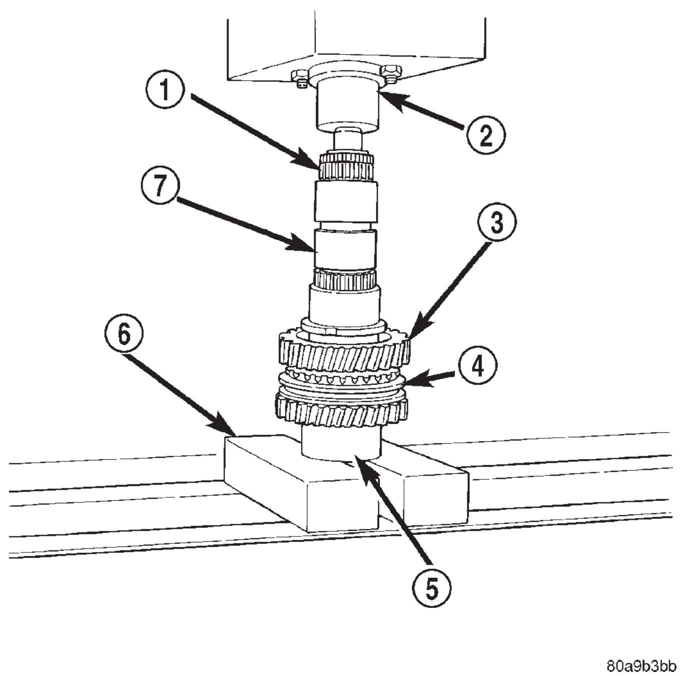


Fig. 56 Fifth-Reverse Synchro Assembly Installation

1 – SPACER
2 – PRESS RAM
3 – REVERSE GEAR
4 – FIFTH-REVERSE SYNCHRO ASSEMBLY
5 – SPECIAL TOOL 6310–1
6 – PRESS BLOCKS
7 – OUTPUT SHAFT

(9) Install new fifth-reverse hub snap ring (Fig. 57) as follows:

(a) Snap rings are available in thicknesses from 2.00 mm to 2.20 mm (0.078 to 0.086 in.).

(b) Install thickest snap ring that will fit in shaft groove.

DISASSEMBLY AND ASSEMBLY (Continued)

(c) Verify that snap ring is completely seated in groove before proceeding.

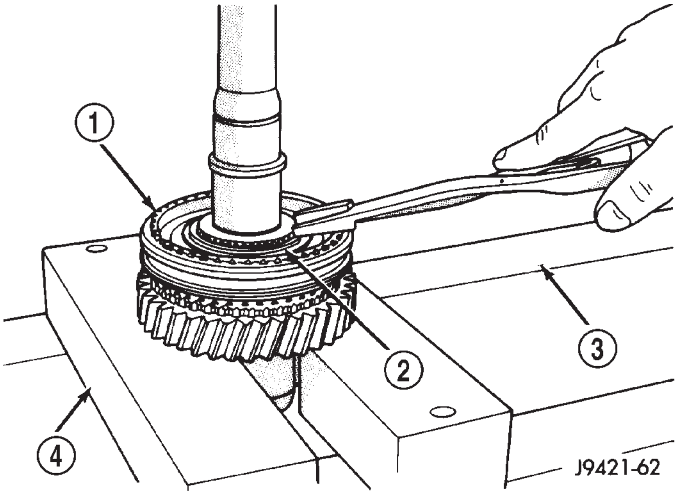


Fig. 57 Installing Fifth-Reverse Synchro Hub Snap Ring

1 – FIFTH-REVERSE SYNCHRO ASSEMBLY
2 – SNAP RING
3 – PRESS BED
4 – PRESS BLOCKS

(10) Install fifth gear synchro ring in synchro hub and sleeve (Fig. 58).

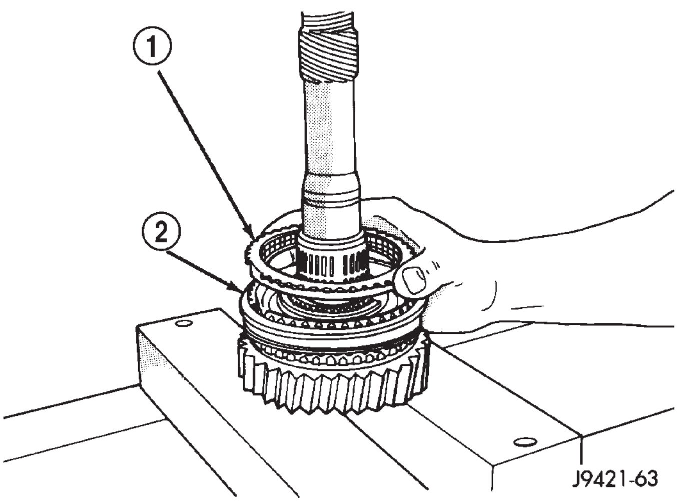


Fig. 58 Installing Fifth Gear Synchro Ring

1 – FIFTH-SPEED SYNCHRO RING
2 – FIFTH-REVERSE SYNCHRO ASSEMBLY

(11) Install fifth gear bearing. Spread bearing only enough to clear shoulder on output shaft (Fig. 59). Be sure bearing is properly seated after installation.

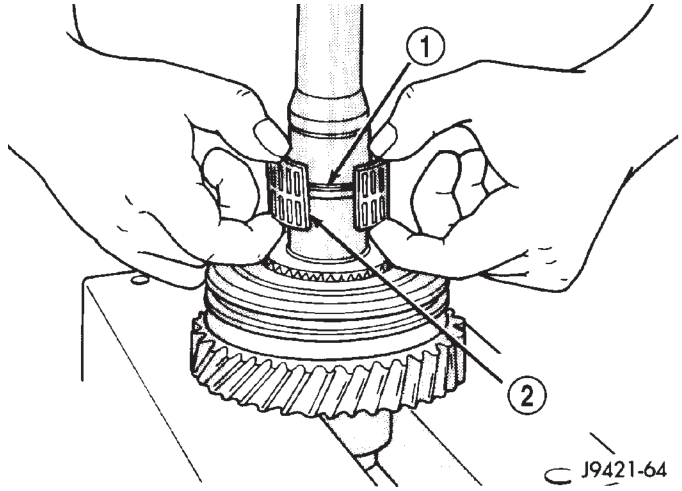


Fig. 59 Installing Fifth Gear Bearing

1 – SHAFT SHOULDER
2 – FIFTH GEAR BEARING

(12) Install fifth gear on shaft and onto bearing (Fig. 60).

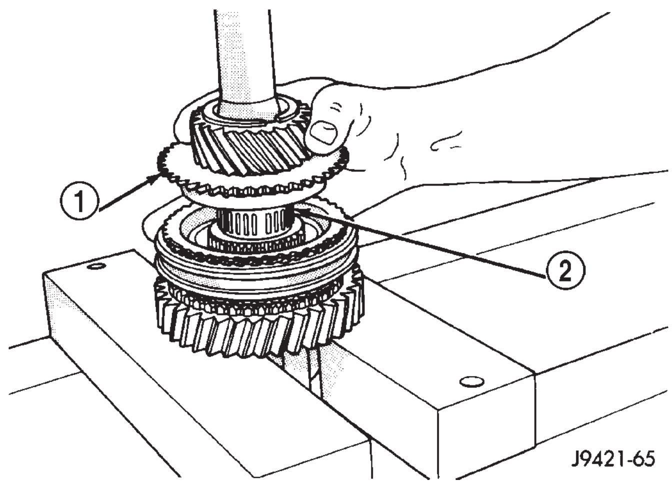


Fig. 60 Fifth Gear Installation

1 – FIFTH GEAR
2 – BEARING

(13) Invert output shaft and set the shaft in Remover 6310-1 so that fifth gear is seated on the tool (Fig. 61).

(14) Install first gear bearing on output shaft (Fig. 61). Be sure bearing is seated on shaft shoulder and is properly joined.

(15) Install the first gear inner blocker ring onto first gear.

DISASSEMBLY AND ASSEMBLY (Continued)

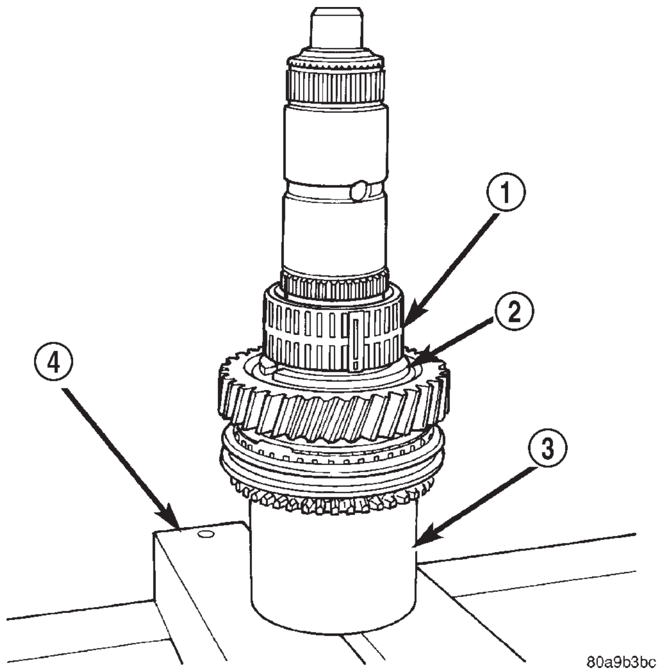


Fig. 61 First Gear Bearing Installation

1 – FIRST GEAR BEARING
2 – SHAFT SHOULDER
3 – SPECIAL TOOL 6310–1
4 – PRESS BLOCKS

(16) Install first gear on shaft and over bearing (Fig. 62).

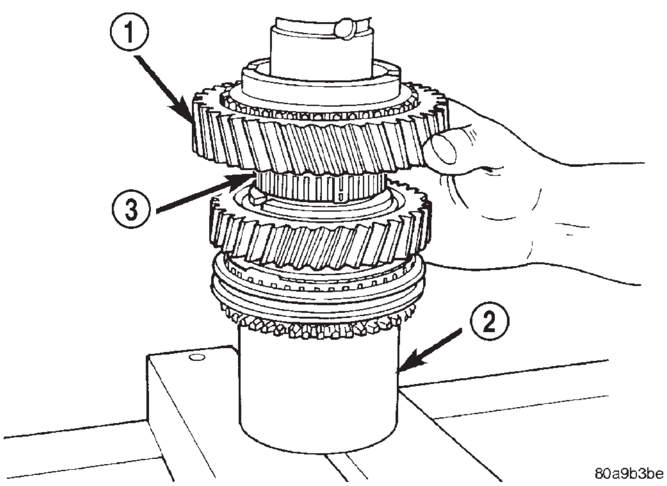


Fig. 62 First Gear Installation

1 – FIRST GEAR
2 – SPECIAL TOOL 6310–1
3 – BEARING

(17) Install the first gear friction cone over the inner blocker ring.

(18) Install first gear synchro/outer blocker ring (Fig. 63) (Fig. 63) over the first gear friction cone.

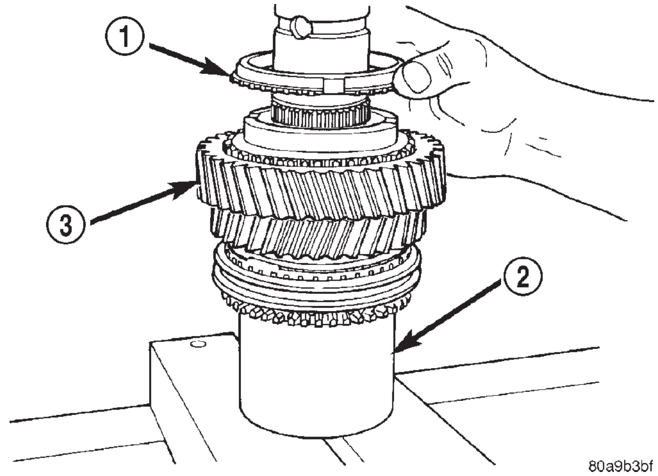


Fig. 63 First Gear Synchro Ring Installation

1 – FIRST GEAR SYNCHRO RING
2 – SPECIAL TOOL 6310–1
3 – FIRST GEAR

(19) Assemble 1-2 synchro hub sleeve, springs, struts and detent balls.

CAUTION: The 1-2 synchro hub and sleeve can be installed backwards if care is not exercised. One side of the synchro sleeve is marked First Gear Side. Be sure this side of the sleeve will face first gear after installation.

(20) Start 1-2 synchro assembly on shaft by hand (Fig. 64). Be sure synchro sleeve is properly positioned. Side marked first side must be facing first gear.

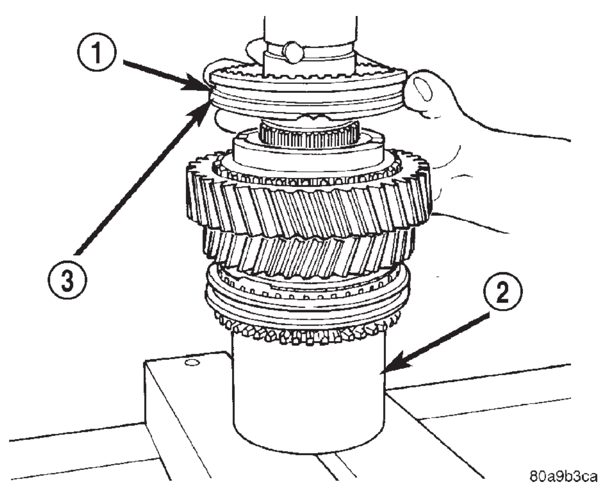


Fig. 64 Starting 1-2 Synchro On Shaft

1 – 1–2 SYNCHRO ASSEMBLY
2 – SPECIAL TOOL 6310–1
3 – BE SURE THIS IS “FIRST GEAR SIDE” OF SYNCHRO SLEEVE

DISASSEMBLY AND ASSEMBLY (Continued)

(21) Press 1-2 synchro onto output shaft using suitable size pipe tool and shop press (Fig. 65).

CAUTION: Take time to align the synchro ring and sleeve as hub the is being pressed onto the shaft. The synchro ring can be cracked if it becomes mis-aligned.

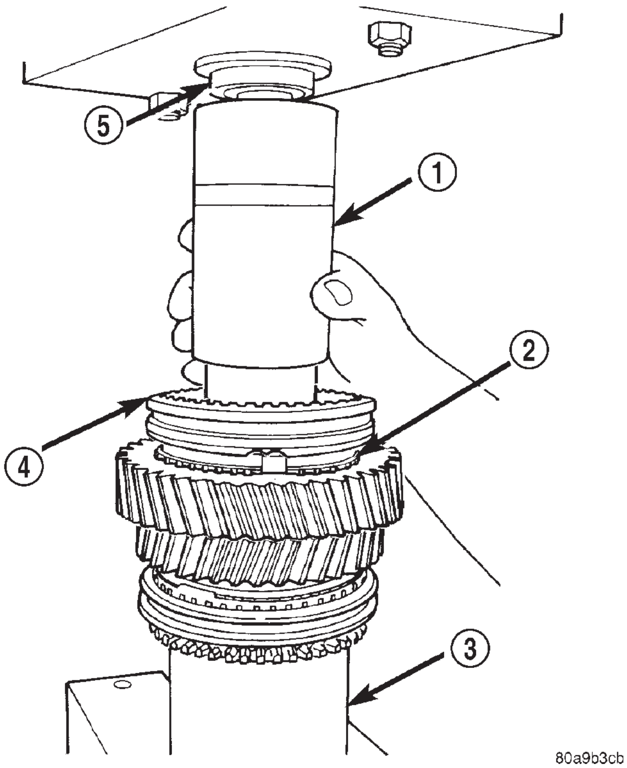


Fig. 65 Pressing 1-2 Synchro Assembly Onto Output Shaft

1 – SUITABLE SIZE PIPE TOOL
2 – SYNCHRO RING
3 – SPECIAL TOOL 6310–1
4 – 1–2 SYNCHRO ASSEMBLY
5 – PRESS RAM

(22) Install interm ring.

(23) Install new 1-2 synchro hub snap ring (Fig. 66) as follows:

(a) Snap rings are available in thicknesses from 1.80 mm to 2.00 mm (0.070 to 0.078 in.).

(b) Install thickest snap ring that will fit in shaft groove.

(c) Verify that snap ring is completely seated in groove before proceeding.

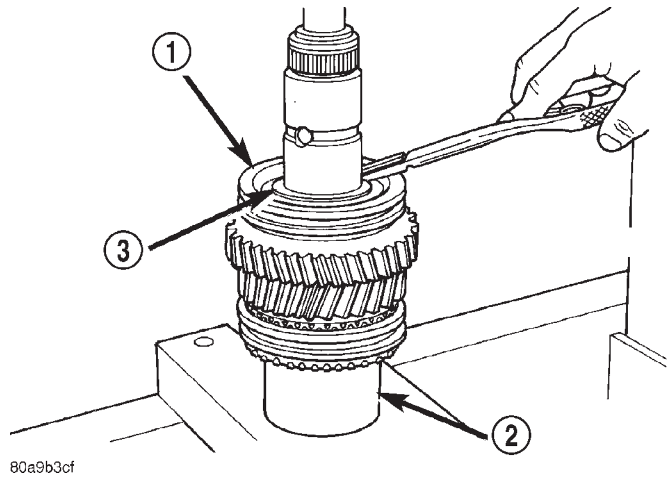


Fig. 66 Installing 1-2 Synchro Hub Snap Ring

1 – 1–2 SYNCHRO
2 – SPECIAL TOOL 6310–1
3 – SYNCHRO SNAP RING

(24) Install second gear synchro/outer blocker ring in 1-2 synchro hub and sleeve (Fig. 67). Be sure synchro ring is properly seated in sleeve.

(25) Install the second gear friction cone into the second gear synchro/outer blocker ring.

(26) Install the second gear inner blocker ring into the friction cone.

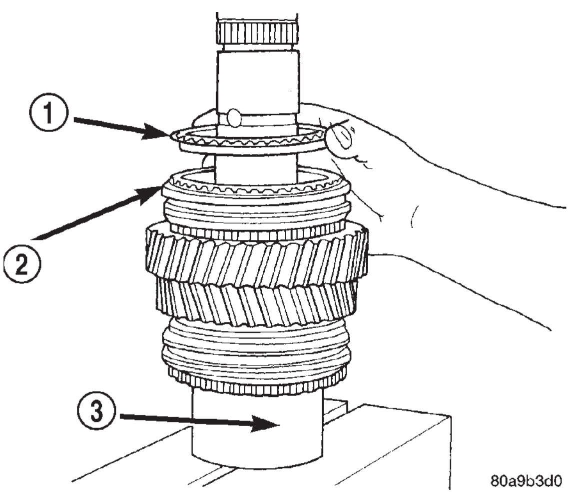


Fig. 67 Second Gear Synchro Ring Installation

1 – SECOND GEAR SYNCHRO RING
2 – 1–2 SYNCHRO
3 – SPECIAL TOOL 6310–1

DISASSEMBLY AND ASSEMBLY (Continued)

(27) Install second gear needle bearing on shaft (Fig. 68).

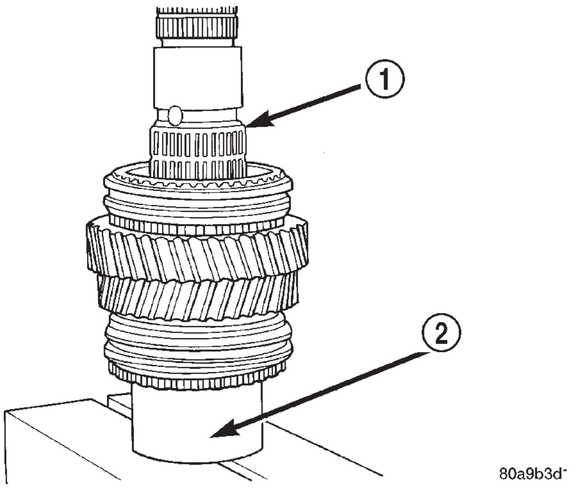


Fig. 68 Second Gear Bearing Installation

1 – SECOND GEAR BEARING
2 – SPECIAL TOOL 6310–1

(28) Install second gear onto shaft and bearing (Fig. 69). Make sure that second gear is fully seated on synchro components.

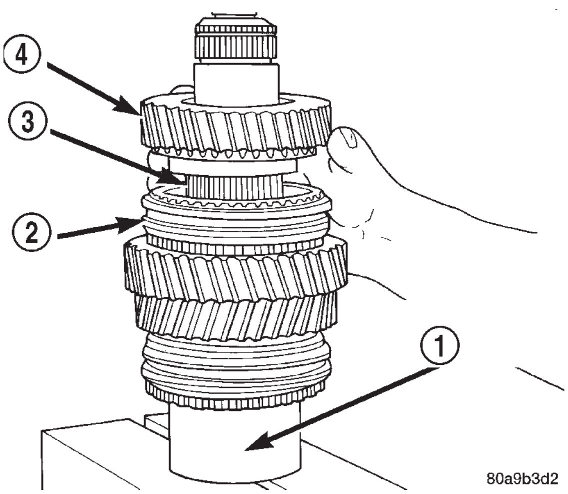


Fig. 69 Second Gear Installation

1 – SPECIAL TOOL 6310–1
2 – 1–2 SYNCHRO ASSEMBLY
3 – BEARING
4 – SECOND GEAR

(29) Install two-piece thrust washer (Fig. 70). Be sure washer halves are seated in shaft groove and that washer lugs are seated in shaft lug bores. Also, ensure that the i.d. grooves and markings noted during removal are facing the correct direction. The diamond shaped marks on the face of the washer must face the front of the shaft.

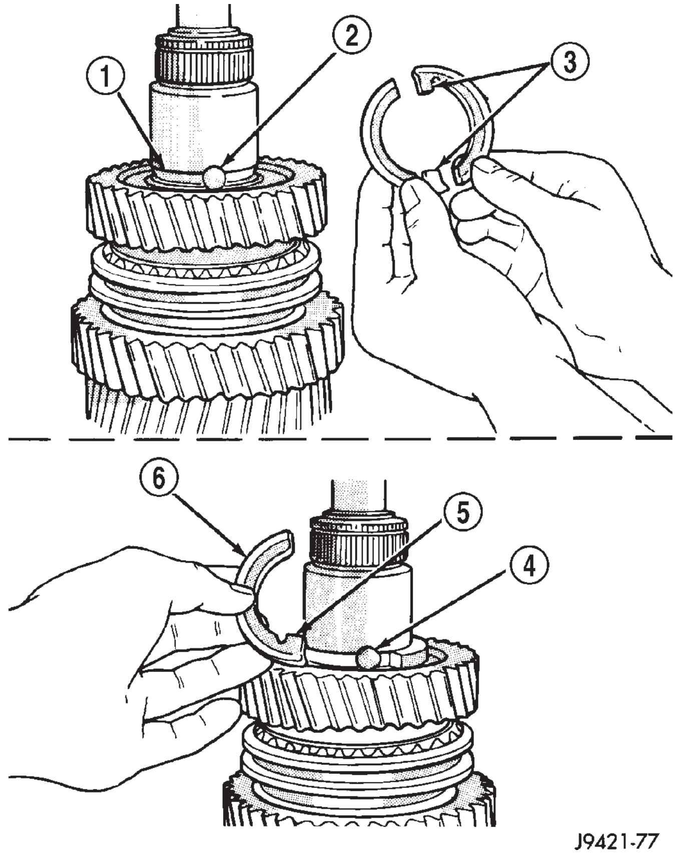


Fig. 70 Installing Two-Piece Thrust Washer

1 – WASHER GROOVE IN SHAFT
2 – LUG BORE
3 – THRUST WASHER LUGS
4 – LUG BORE
5 – LUG
6 – WASHER HALF

(30) Start retaining ring around two-piece thrust washer (Fig. 71). Make sure that the locating dimple is between the thrust washer halves.

DISASSEMBLY AND ASSEMBLY (Continued)

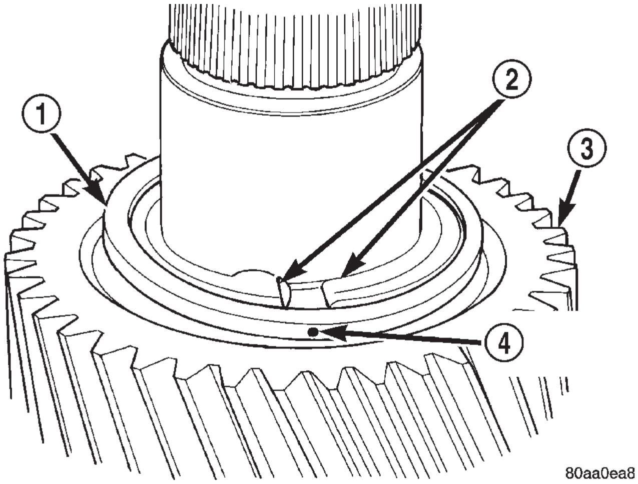


Fig. 71 Starting Retaining Ring Over Two-Piece Thrust Washer

1 – THRUST WASHER RETAINING RING
2 – THRUST WASHER HALVES
3 – SECOND GEAR
4 – LOCATING DIMPLE

(31) Seat thrust washer retaining ring with plastic mallet (Fig. 72).

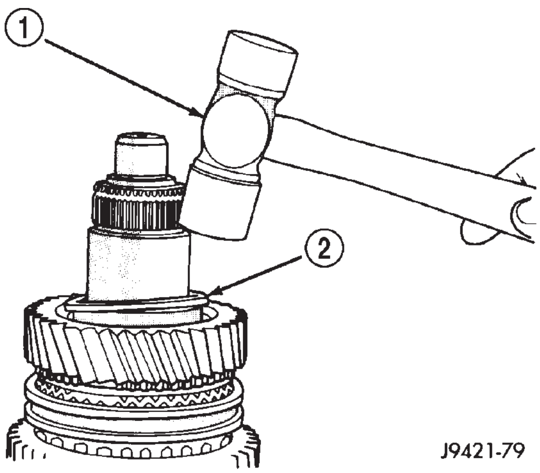


Fig. 72 Seating Thrust Washer Retaining Ring

1 – PLASTIC MALLET
2 – THRUST WASHER RETAINING RING

(32) Install third gear needle bearing on shaft (Fig. 73).

(33) Install third gear on shaft and bearing (Fig. 74).

(34) Install third speed synchro ring on third gear (Fig. 75).

(35) Assemble 3-4 synchro hub, sleeve, springs, struts and detent balls.

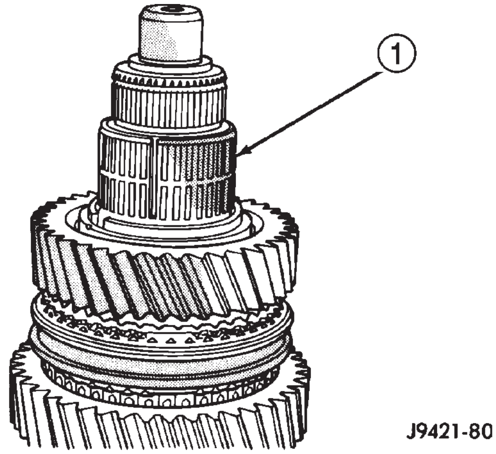


Fig. 73 Third Gear Bearing Installation

1 – THIRD GEAR BEARING

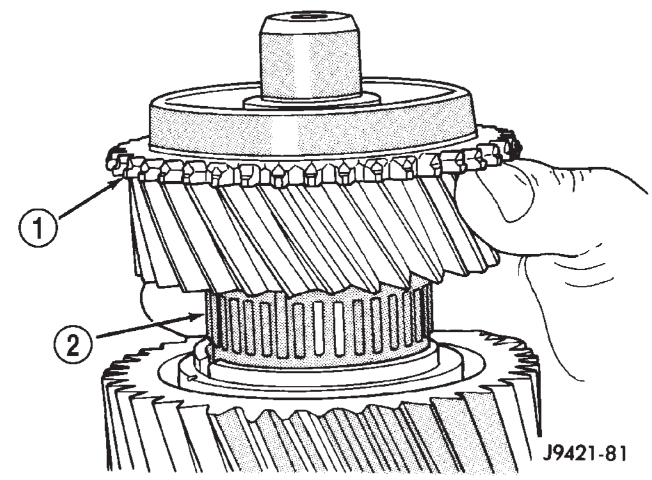


Fig. 74 Installing Third Gear

1 – THIRD GEAR
2 – BEARING

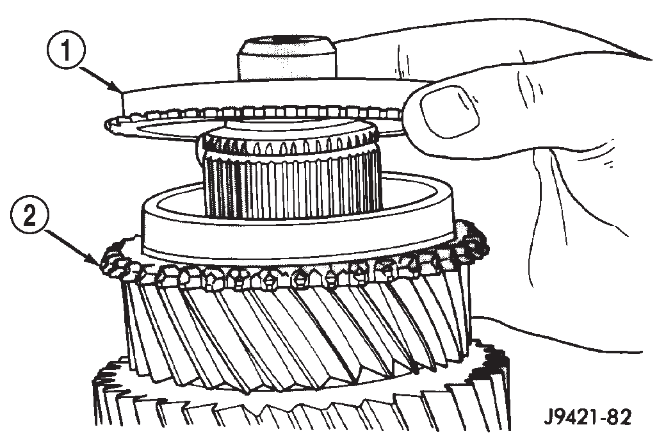


Fig. 75 Third Speed Synchro Ring Installation

1 – THIRD SPEED SYNCHRO RING
2 – THIRD GEAR

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: The 3-4 synchro hub and sleeve can be installed backwards if care is not exercised. One side of the sleeve has grooves in it. Be sure this side of sleeve is also facing the front of the shaft.

(36) Start 3-4 synchro hub on output shaft splines by hand (Fig. 76).

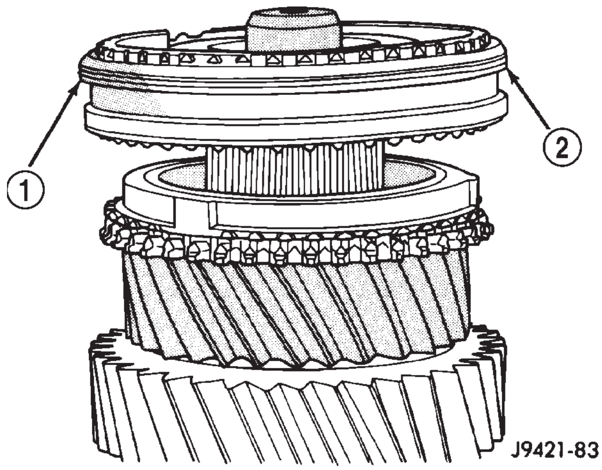


Fig. 76 Starting 3-4 Synchro Hub On Output Shaft

1 – GROOVED SIDE OF SLEEVE (TO FRONT)
2 – 3–4 SYNCHRO ASSEMBLY

(37) Press 3-4 synchro assembly onto output shaft with shop press and suitable size pipe tool (Fig. 77). Make sure that the tool presses on hub as close to output shaft as possible but does not contact the shaft splines.

(38) Install 3-4 synchro hub snap ring (Fig. 78) as follows:

(a) Snap rings are available in thicknesses from 2.00 mm to 2.30 mm (0.078 to 0.090 in.).

(b) Install thickest snap ring that will fit in shaft groove. Use heavy duty snap ring pliers to install new ring.

(c) Verify that snap ring is completely seated in groove before proceeding.

(39) Install output shaft bearing.

(40) Install output shaft bearing snap ring (Fig. 79). Use heavy duty snap ring pliers and spread snap ring only enough to install it. Be sure snap ring is completely seated in shaft groove before proceeding.

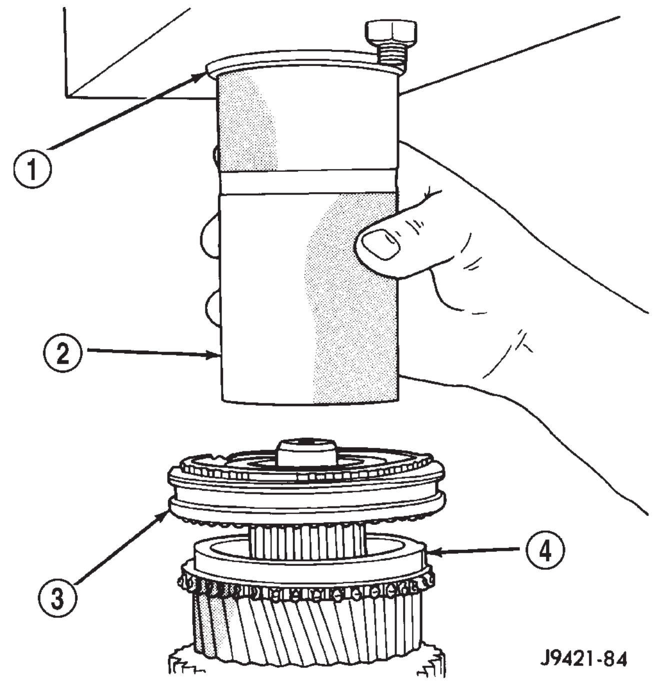


Fig. 77 Pressing 3-4 Synchro Assembly On Output Shaft

1 – PRESS RAM
2 – PIPE TOOL
3 – 3–4 SYNCHRO
4 – THIRD SPEED SYNCHRO RING

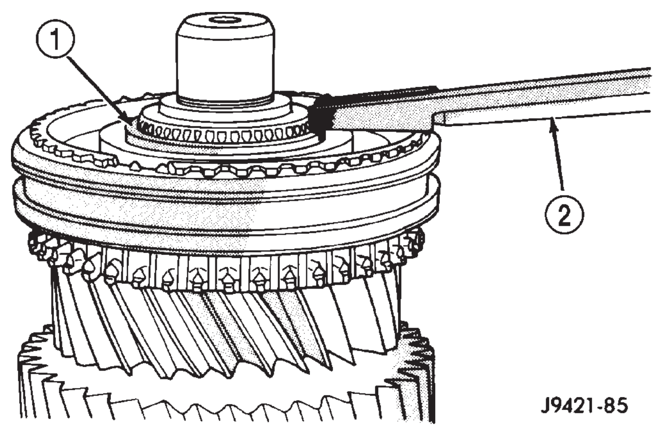


Fig. 78 Installing 3-4 Synchro Hub Snap Ring

1 – 3–4 SYNCHRO HUB SNAP RING
2 – HEAVY DUTY SNAP RING PLIERS

DISASSEMBLY AND ASSEMBLY (Continued)

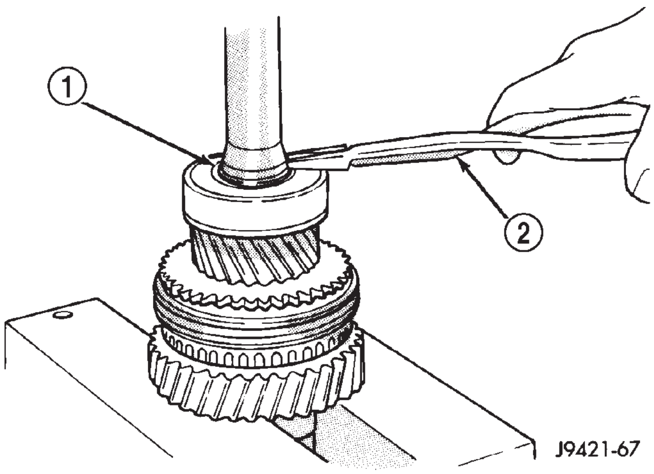


Fig. 79 Installing Output Shaft Bearing Snap Ring

1 – BEARING SNAP RING
2 – HEAVY DUTY SNAP RING PLIERS

(41) Verify correct position of synchro sleeves before proceeding with assembly operations (Fig. 80). Grooved side of 3-4 sleeve should be facing forward. First gear side of 1-2 sleeve should be facing first gear. Tapered side of fifth-reverse sleeve should be facing forward.

REVERSE IDLER ASSEMBLY

(1) Lubricate idler components with gear lube.

(2) Slide idler gear bearing on shaft (Fig. 81). Bearing fits either way on shaft.

(3) Slide gear onto shaft. Side of gear with recess goes to rear (Fig. 81).

(4) Place first lock ball in dimple at rear end of idler shaft (Fig. 81). Petroleum jelly can be used to hold ball in place if desired.

(5) Slide thrust rear thrust washer onto shaft and over lock ball (Fig. 82).

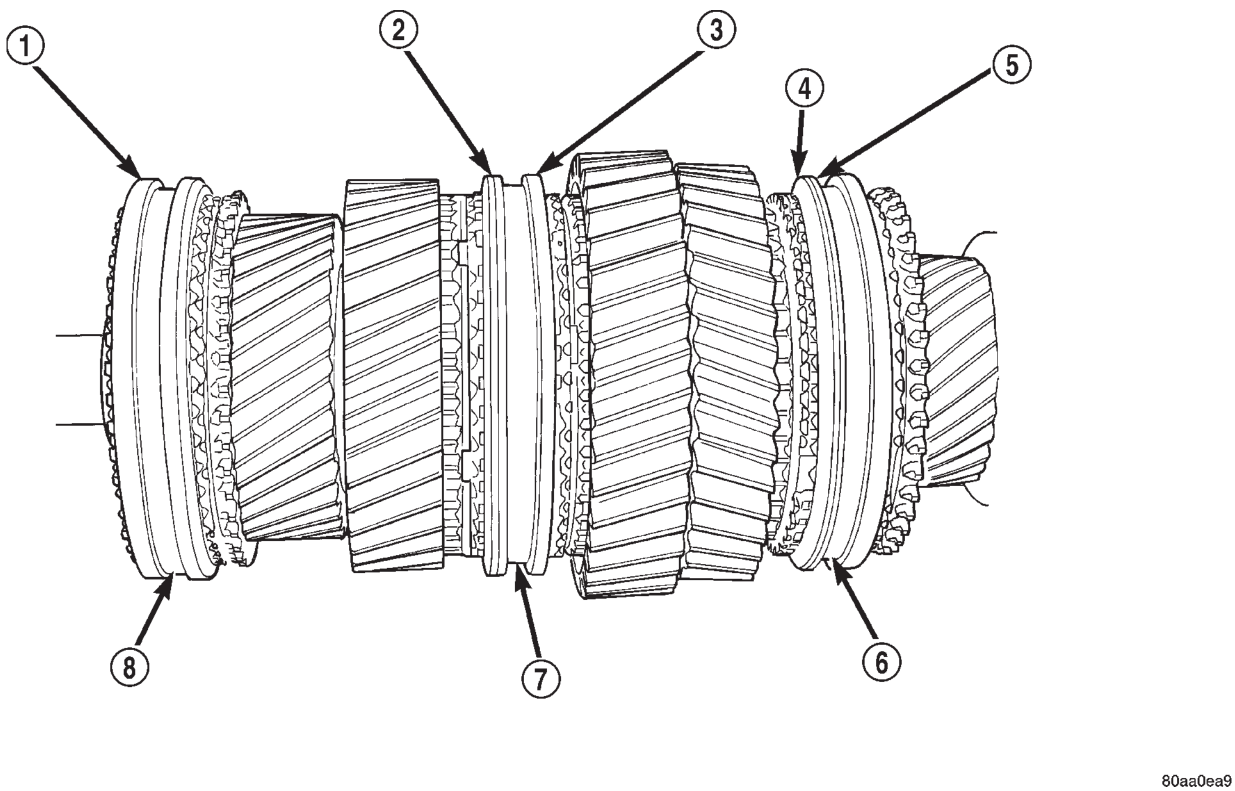


Fig. 80 Correct Synchro Sleeve Position

1 – DOUBLE GROOVE FORWARD
2 – GROOVE FORWARD
3 – FIRST GEAR SIDE MARKING TOWARD FIRST GEAR
4 – TAPER FORWARD
5 – GROOVE FORWARD
6 – 5TH-REV SYNCHRO SLEEVE
7 – 1–2 SYNCHRO SLEEVE
8 – 3–4 SYNCHRO SLEEVE

DISASSEMBLY AND ASSEMBLY (Continued)

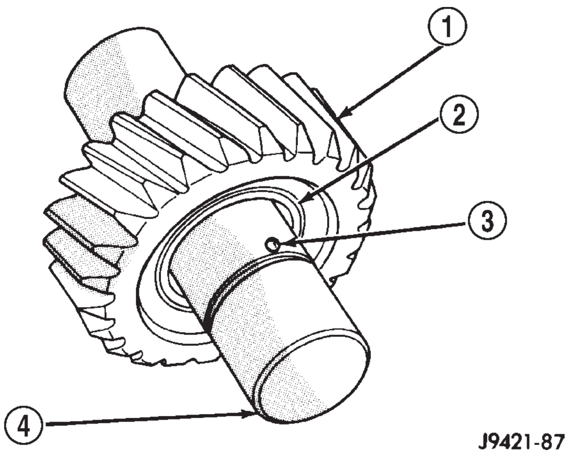


Fig. 81 Idler Gear And Bearing Installation

1 – IDLER GEAR
2 – BEARING
3 – LOCK BALL
4 – REAR OF SHAFT

(6) Install snap ring in groove at rear of shaft (Fig. 82).

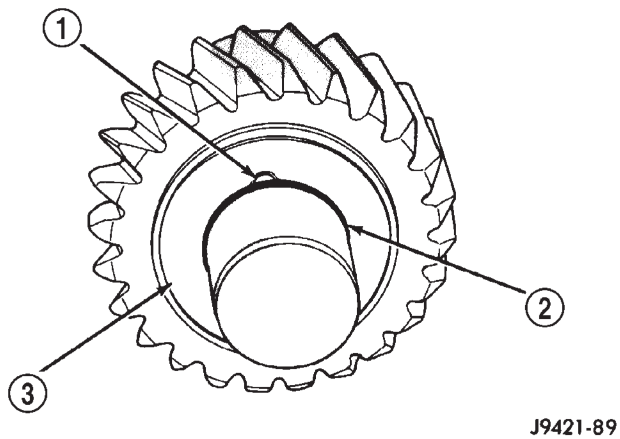


Fig. 82 Idler Gear Rear Thrust Washer Installation

1 – LOCK BALL
2 – SNAP RING GROOVE
3 – THRUST WASHER

(7) Install lock ball in dimple at front of shaft. Hold ball in place with petroleum jelly if desired.

(8) Install front thrust washer on shaft and slide washer up against gear and over lock ball (Fig. 83).

(9) Install wave washer, flat washer and remaining snap ring on idler shaft (Fig. 83). Be sure snap ring is fully seated.

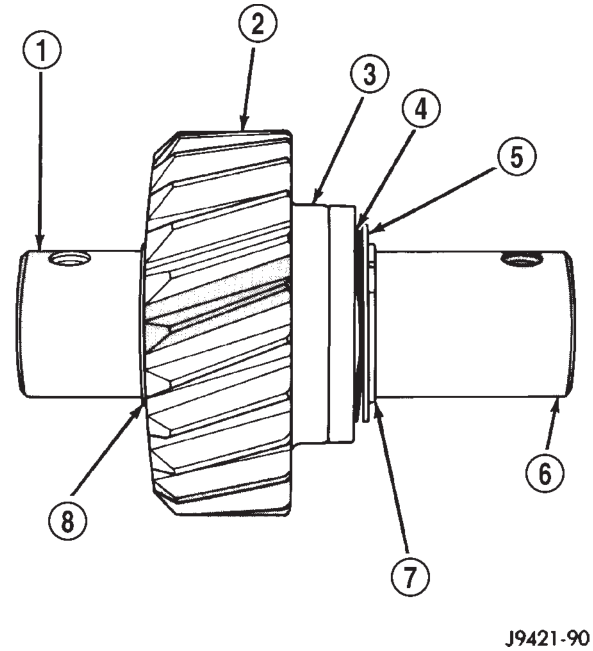


Fig. 83 Idler Gear And Shaft Assembly

1 – REAR OF SHAFT
2 – GEAR
3 – THRUST WASHER AND BALL
4 – WAVE WASHER
5 – FLAT WASHER
6 – FRONT OF SHAFT
7 – SNAP RING
8 – SNAP RING

SHIFT SHAFT AND DETENT PLUNGER BUSHINGS/ BEARINGS

(1) Inspect shift shaft bushing and bearing for damage.

(2) If necessary, the shift shaft bushing can be replaced as follows:

(a) Locate a bolt that will thread into the bushing without great effort.

(b) Thread the bolt into the bushing, allowing the bolt to make its own threads in the bushing.

(c) Attach a slide hammer or suitable puller to the bolt and remove bushing.

(d) Use the short end of Installer 8119 to install the new bushing.

(e) The bushing is correctly installed if the bushing is flush with the transmission case.

(3) If necessary, the shift shaft bearing can be replaced as follows:

(a) Locate a bolt that will thread into the bearing without great effort.

(b) Thread the bolt into the bearing as much as possible.

(c) Attach a slide hammer or suitable puller to the bolt and remove the bearing.

DISASSEMBLY AND ASSEMBLY (Continued)

(d) Use the short end of Installer 8119 to install the new bearing.

(e) The bearing is correctly installed if the bearing is flush with the transmission case.

(4) Inspect detent plunger bushings for damage.

NOTE: The detent plunger bushings are installed to a specific depth. The space between the two bushings when correctly installed contain an oil feed hole. Do not attempt to install the bushings with anything other than the specified tool or this oil hole may become restricted.

(5) If necessary, the detent plunger bushings can be replaced as follows:

(a) Using the long end of Installer 8119, drive the detent bushings through the outer case and into the shift shaft bore.

(b) Remove the bushings from the shift shaft bore.

(c) Install a new detent plunger bushing on the long end of Installer 8118.

(d) Start the bushing in the detent plunger bore in the case.

(e) Drive the bushing into the bore until the tool contacts the transmission case.

(f) Install a new detent plunger bushing on the short end of Installer 8118.

(g) Start the bushing in the detent plunger bore in the case.

(h) Drive the bushing into the bore until the tool contacts the transmission case.

GEARTRAIN ASSEMBLY IN FIXTURE

(1) Install Adapter 6747-1A on input shaft hub of fixture tool (Fig. 84). Then install Adapter 6747-2A on front bearing hub of countershaft. Adapter 6747-2A has a raised shoulder on one side. Be sure the shoulder is seated against the countershaft.

(2) Install input shaft in fixture tool. Make sure Adapter Tool 6747-1A is positioned under shaft as shown (Fig. 85).

(3) Install pilot bearing in input shaft (Fig. 85).

NOTE: The pilot bearing can be installed backwards if care is not exercised. Be sure the large diameter side of the roller retainer faces the output shaft and the small diameter side faces the input shaft.

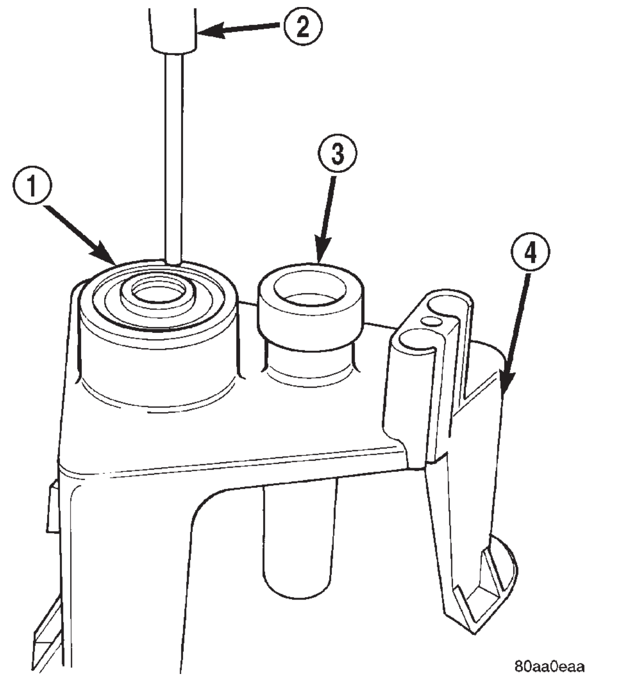


Fig. 84 Preparing Assembly Fixture For Geartrain Build-up

1 – SPECIAL TOOL 6747–2A (INSTALL ON COUNTERSHAFT FRONT HUB)
2 – SPECIAL TOOL 8115
3 – SPECIAL TOOL 6747–1A
4 – SPECIAL TOOL 6747

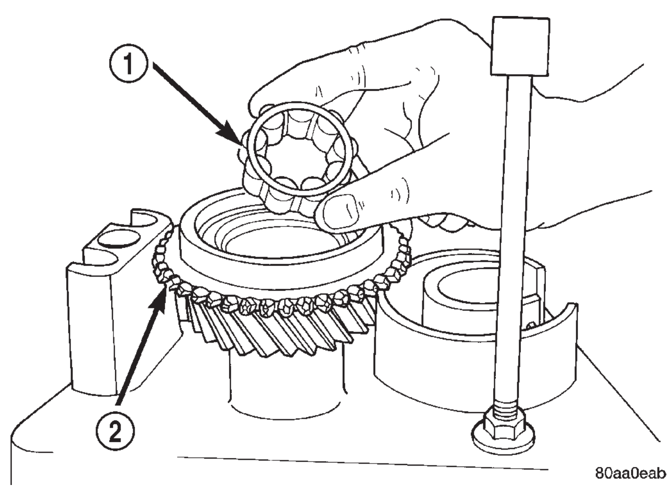


Fig. 85 Installing Pilot Bearing In Input Shaft

1 – PILOT BEARING
2 – INPUT SHAFT

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Install fourth gear synchro ring on input shaft (Fig. 86).

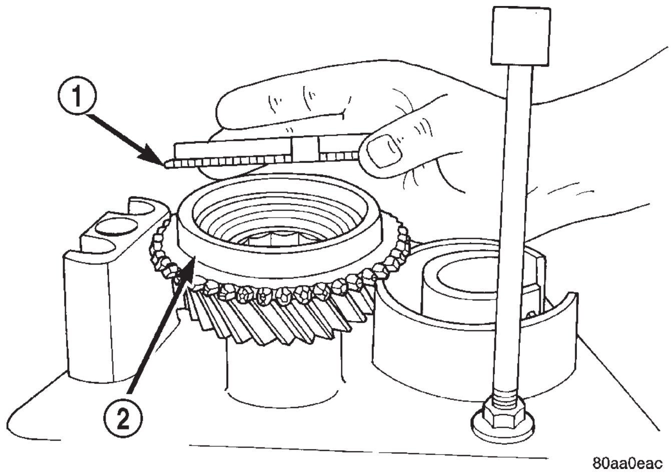


Fig. 86 Installing Fourth Gear Synchro Ring On Input Shaft

1 – FOURTH GEAR SYNCHRO RING
2 – INPUT SHAFT

(5) Adjust height of idler gear pedestal on assembly fixture (Fig. 87). Start with a basic height of 18.4 cm (7-1/4 in.). Final adjustment can be made after gear is positioned on pedestal.

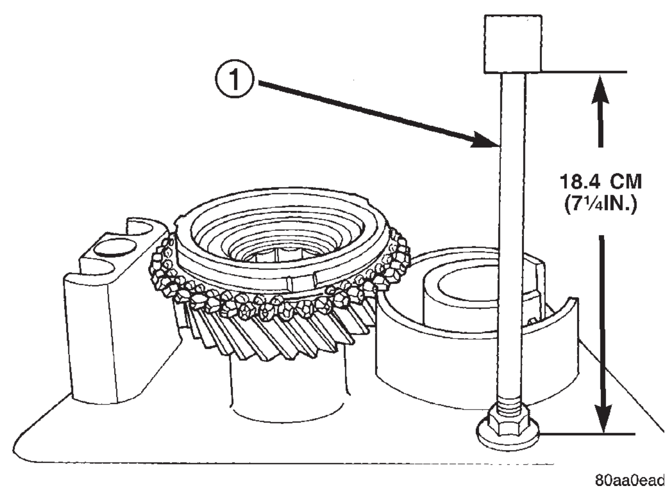


Fig. 87 Idler Pedestal Basic Height Adjustment

1 – REVERSE IDLER PEDESTAL

(6) Install assembled output shaft and geartrain in input shaft (Fig. 88). Carefully rotate output shaft until the 3–4 synchro ring seats in synchro hub and sleeve.

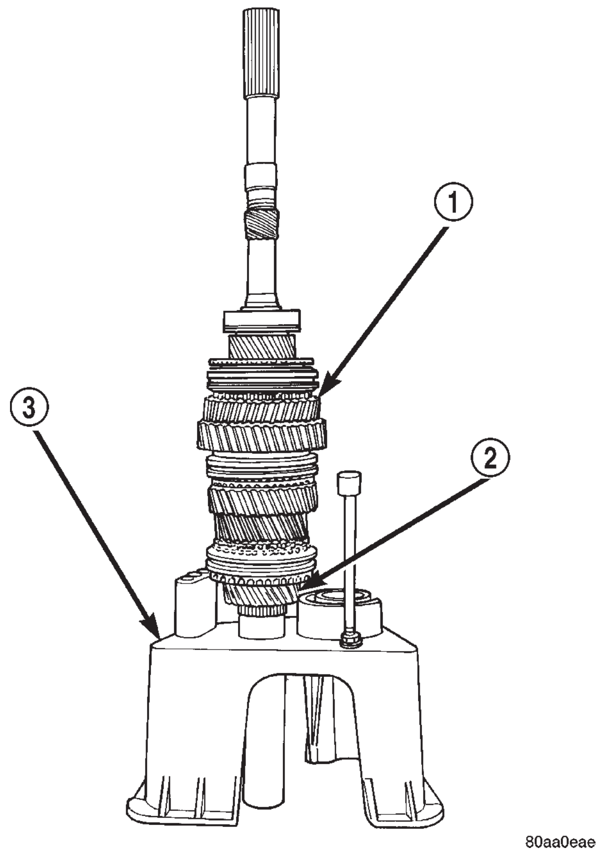


Fig. 88 Output Shaft And Geartrain Installed In Input Shaft

1 – OUTPUT SHAFT AND GEARTRAIN
2 – INPUT SHAFT
3 – SPECIAL TOOL 6747

(7) Install Adapter 6747-2A on front bearing hub of countershaft, if not previously done. The adapter has a shoulder on one side. The shoulder goes toward the countershaft.

(8) Slide countershaft (and adapter) into fixture slot. Verify that countershaft and output shaft gears are fully meshed with the mainshaft gears before proceeding (Fig. 89).

DISASSEMBLY AND ASSEMBLY (Continued)

(9) Check alignment of countershaft and output shaft gear teeth. Note that gears may not align perfectly. A difference in height of 1.57 to 3.18 mm (1/16 to 1/8 in.) will probably exist. This difference will not interfere with assembly. However, if the difference is greater than this, the countershaft adapter tool is probably upside down. Remove countershaft, reverse adapter tool, reinstall countershaft and check alignment again.

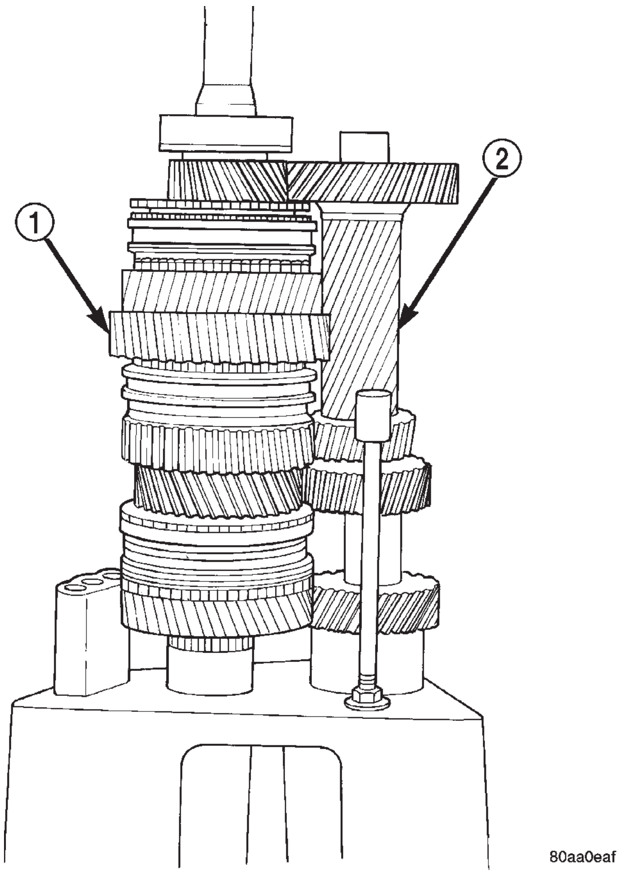


Fig. 89 Countershaft Installed On Fixture Tool

1 – OUTPUT SHAFT AND GEARTRAIN
2 – COUNTERSHAFT (SLIDE INTO PLACE ON FIXTURE TOOL)

(10) Position reverse idler in support cup of assembly fixture (Fig. 90). Be sure idler gear is properly meshed and aligned with shaft gear teeth and that bolt holes are facing out and not toward geartrain. Adjust pedestal up or down if necessary. Also be sure that short end of idler shaft is facing up as shown.

(11) On 2-wheel drive transmission, thread one Pilot Stud 8120 in center or passenger side hole of output shaft bearing retainer. Then position retainer on fifth gear as shown (Fig. 91).

(12) Assemble 1-2 and fifth reverse-shift forks (Fig. 92). Arm of fifth-reverse fork goes through slot in 1-2 fork.

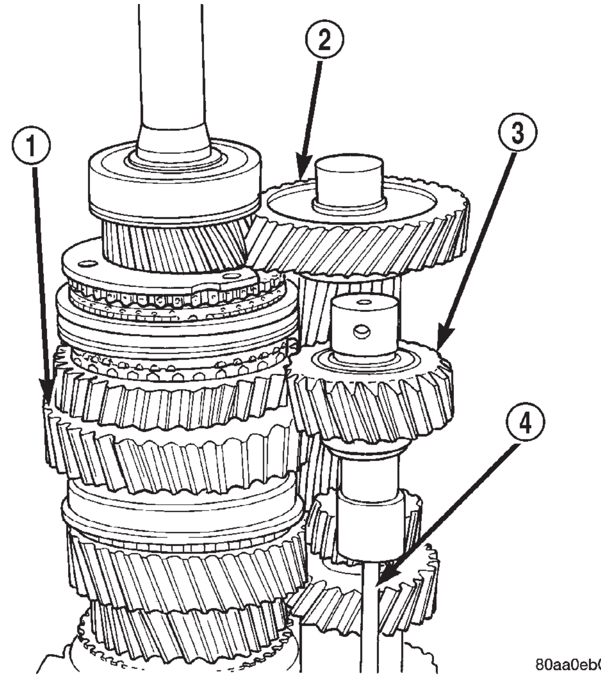


Fig. 90 Reverse Idler Assembly Positioned On Assembly Fixture Pedestal

1 – OUTPUT SHAFT AND GEARTRAIN
2 – COUNTERSHAFT
3 – REVERSE IDLER ASSEMBLY
4 – TOOL PEDESTAL

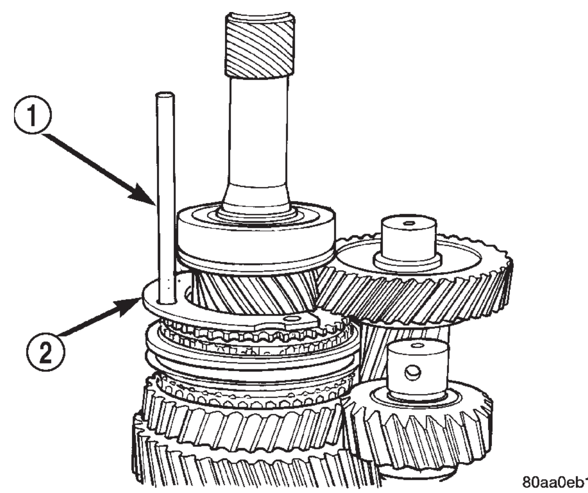


Fig. 91 Positioning Output Shaft Bearing Retainer For Rear Housing Installation

1 – SPECIAL TOOL 8120
2 – OUTPUT SHAFT BEARING RETAINER

(13) Install assembled shift forks in synchro sleeves (Fig. 93). Be sure forks are properly seated in sleeves.

DISASSEMBLY AND ASSEMBLY (Continued)

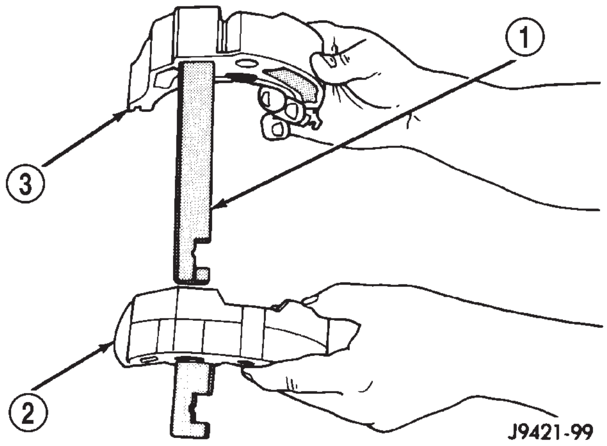


Fig. 92 Assembling 1-2 And Fifth-Reverse Shift Forks

1 – INSERT ARM THROUGH 1–2 FORK
2 – 1–2 FORK
3 – FIFTH-REVERSE FORK

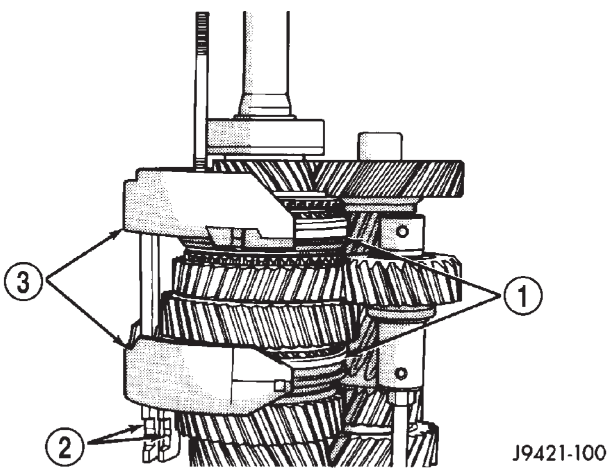


Fig. 93 Shift Forks Installed In Synchro Sleeves

1 – SYNCHRO SLEEVES
2 – FORK ARMS
3 – SHIFT FORKS

REAR HOUSING INSTALLATION—2WD

(1) Drive adapter housing alignment dowels back into housing until dowels are flush with mounting surface (Fig. 94).

(2) Apply liberal quantity of petroleum jelly to countershaft rear bearing and bearing race.

(3) Install countershaft rear bearing in bearing race (Fig. 95).

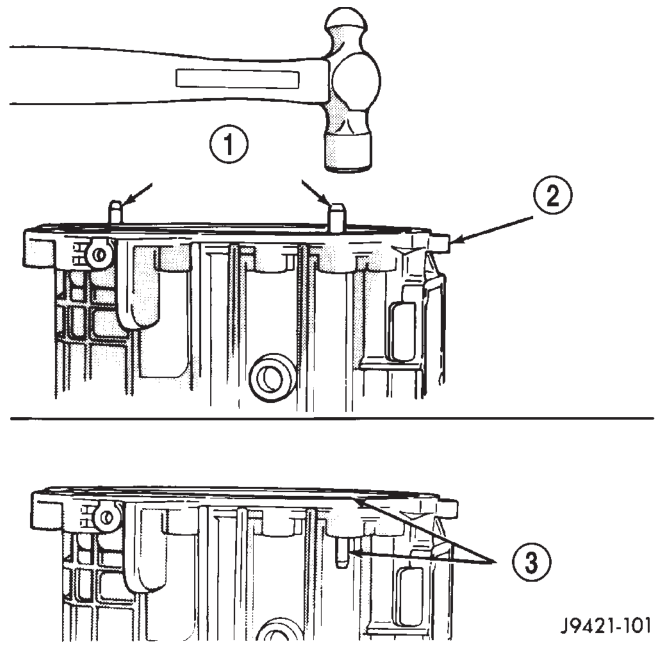


Fig. 94 Preparing Rear Housing Dowels For Installation

1 – HOUSING ALIGNMENT DOWELS
2 – REAR HOUSING
3 – DOWEL FLUSH WITH SURFACE

CAUTION: The countershaft bearings can be installed backwards if care is not exercised. Be sure the large diameter side of the roller retainer faces the countershaft and the small diameter side faces the race and housing (Fig. 96).

(4) Apply extra petroleum jelly to hold countershaft rear bearing in place when housing is installed.

(5) Apply light coat of petroleum jelly to shift shaft bushing/bearing in rear housing (Fig. 96).

(6) Reach into countershaft rear bearing with finger, and push each bearing roller outward against race. Then apply extra petroleum jelly to hold rollers in place. This avoids having rollers becoming displaced during housing installation. This will result in misalignment between bearing and countershaft bearing hub.

(7) Install rear housing onto geartrain (Fig. 97). Be sure bearing retainer pilot stud is in correct bolt hole in housing. Also be sure countershaft and output shaft bearings are aligned in housing and on countershaft. It may be necessary to lift upward on countershaft slightly to ensure that the countershaft rear bearing engages to the countershaft before the rear output shaft bearing engages the housing.

(8) Seat rear housing on output shaft rear bearing and countershaft. Use plastic or rawhide mallet to tap housing into place.

DISASSEMBLY AND ASSEMBLY (Continued)

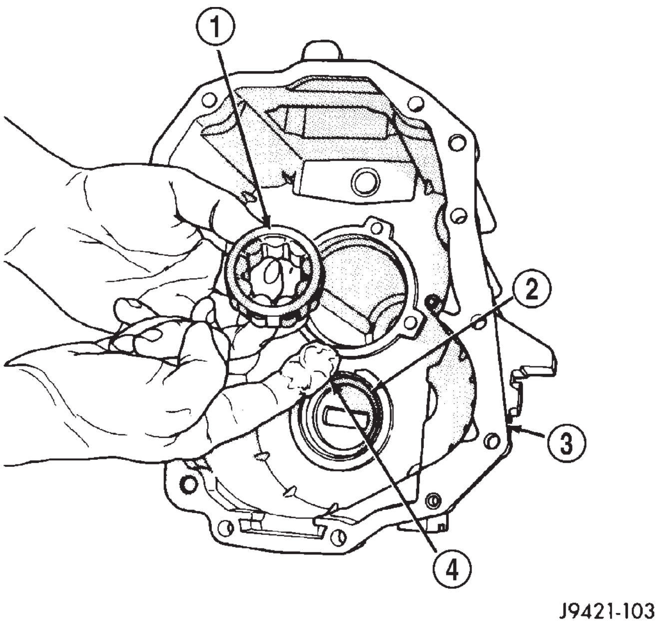


Fig. 95 Lubricating Countershaft Rear Bearing

1 – COUNTERSHAFT REAR BEARING
2 – REAR BEARING RACE
3 – REAR HOUSING
4 – PETROLEUM JELLY (APPLY TO BEARING AND RACE)

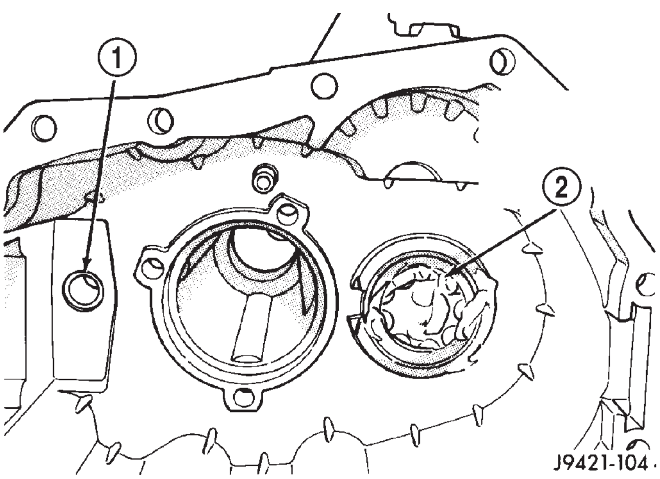


Fig. 96 Countershaft Rear Bearing Seated In Seated in Race

1 – SHIFT SHAFT BUSHING/BEARING
2 – COUNTERSHAFT REAR BEARING (SEATED IN RACE)

(9) Install the three bolts that secure rear bearing retainer to rear housing as follows:

(a) Apply Mopar® Gasket Maker, or equivalent, to bolt threads, bolt shanks and under bolt heads (Fig. 98).

(b) Start first two bolts in retainer (Fig. 99). It may be necessary to move retainer rearward (with pilot stud) in order to start bolts in retainer.

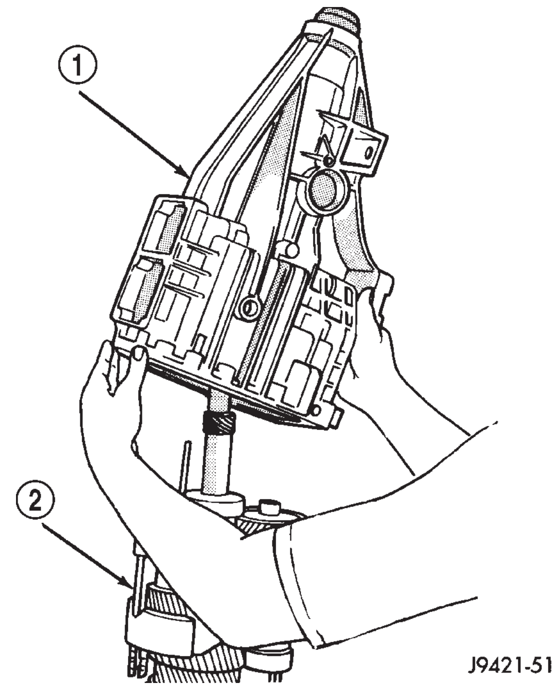


Fig. 97 Rear Housing Installation—2WD

1 – REAR HOUSING
2 – SHIFT FORKS AND GEARTRAIN

(c) Remove Pilot Stud 8120 and install last retainer bolt (Fig. 99).

(d) Tighten all three retainer bolts to 30-35 N·m (22-26 ft. lbs.) torque.

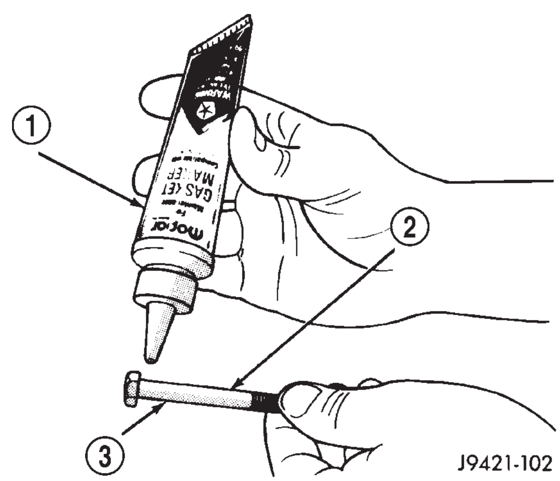


Fig. 98 Applying Sealer To Retainer And Housing Bolts

1 – MOPAR GASKET MAKER (OR LOCTITE 518)
2 – RETAINER AND HOUSING BOLTS
3 – APPLY SEALER TO UNDERSIDE OF BOLT HEAD, SHANK AND THREADS

DISASSEMBLY AND ASSEMBLY (Continued)

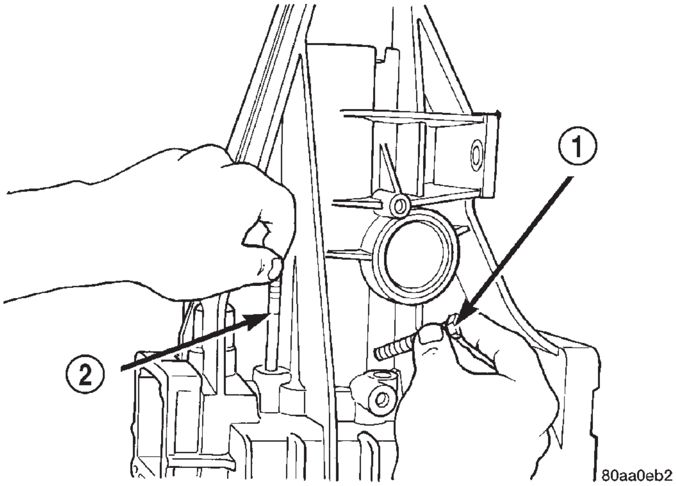


Fig. 99 Removing Pilot Stud Tool And Installing Retainer Bolts—2WD

1 – BEARING RETAINER BOLT
2 – SPECIAL TOOL 8120

ADAPTER HOUSING INSTALLATION—4WD

(1) Install rear bearing in adapter housing. Use wood hammer handle or wood dowel to tap bearing into place.

(2) Position rear bearing retainer in adapter housing (Fig. 100).

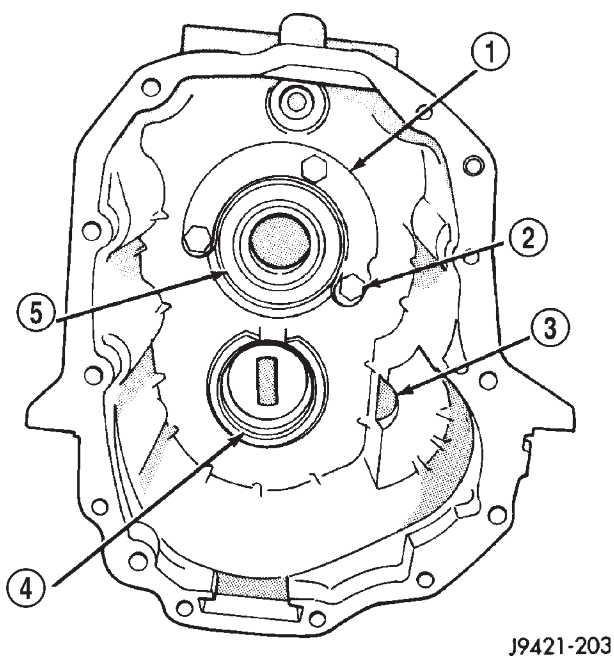


Fig. 100 Preparing Adapter Housing For Installation—4WD

1 – BEARING RETAINER
2 – RETAINER BOLTS (3)
3 – IDLER SHAFT NOTCH
4 – COUNTERSHAFT REAR BEARING RACE
5 – REAR BEARING

(3) Apply Mopar® Gasket Maker, or equivalent, to threads, bolt shanks and under hex heads of bearing retainer bolts (Fig. 101).

(4) Apply liberal quantity of petroleum jelly to countershaft rear bearing and bearing race.

(5) Install countershaft rear bearing in bearing race (Fig. 96).

CAUTION: The countershaft bearings can be installed backwards if care is not exercised. Be sure the large diameter side of the roller retainer faces the countershaft and the small diameter side faces the race and housing (Fig. 96).

(6) Apply extra petroleum jelly to hold countershaft rear bearing in place when housing is installed.

(7) Apply light coat of petroleum jelly to shift shaft bushing/bearing in adapter housing (Fig. 96).

(8) Install adapter housing on geartrain.

(9) Install rear bearing snap ring on output shaft (Fig. 101).

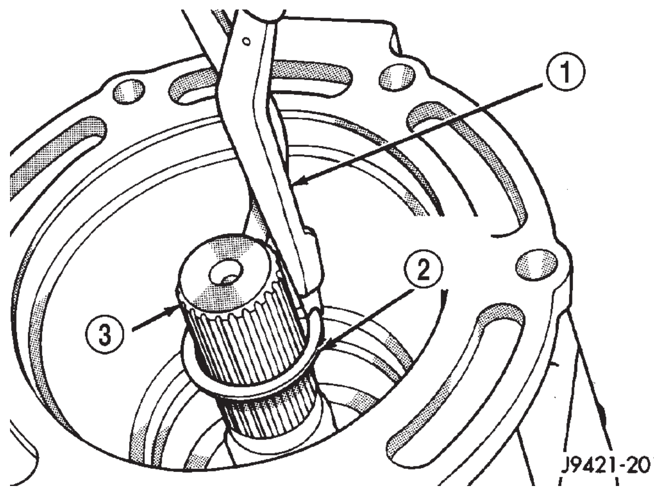


Fig. 101 Installing Rear Bearing Snap Ring—4WD

1 – HEAVY DUTY SNAP RING PLIERS
2 – REAR BEARING SNAP RING
3 – OUTPUT SHAFT

(10) Lubricate lip of new rear seal (Fig. 102) with Mopar® Door Ease, or transmission fluid.

(11) Install new rear seal in adapter housing bore with Installer C-3860-A. Be sure seal is fully seated in housing bore (Fig. 102).

DISASSEMBLY AND ASSEMBLY (Continued)

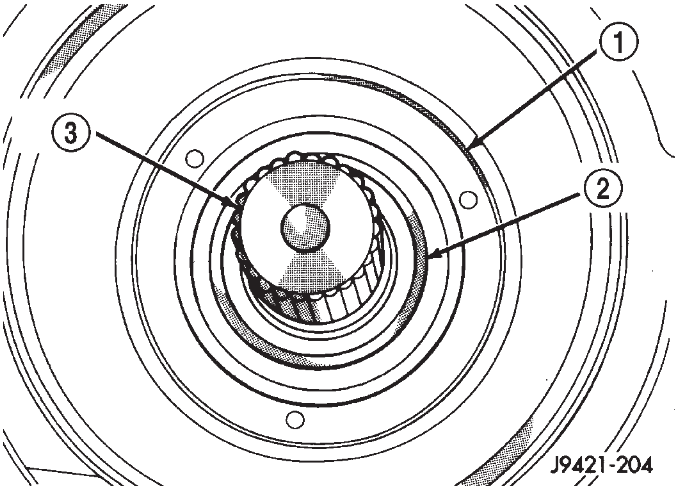


Fig. 102 Rear Seal Installation—4WD

1 – REAR SEAL
2 – SEAL LIP
3 – OUTPUT SHAFT

REVERSE IDLER SEGMENT INSTALLATION

(1) Remove geartrain and housing assembly from fixture with aid of helper.

(2) Apply Mopar® Gasket Maker, or equivalent, sealer to underside of idler shaft bolt heads, bolt shanks and bolt threads (Fig. 98).

(3) Align idler shaft and rear housing bolt holes with drift, pin punch, or Phillips screwdriver.

(4) Work segment upward into housing and onto idler shaft.

(5) Verify that idler shaft is seated in housing notch before proceeding. Segment and housing can be damaged if idler shaft is misaligned.

(6) Insert idler shaft retaining bolts through housing and segment and into shaft. Long bolt goes through segment and short bolt goes through housing and directly into rear of shaft.

(7) Tighten idler shaft bolts to 19-25 N·m (14-18 ft. lbs.) torque.

CAUTION: Make sure the idler shaft and support segment are properly seated and held firmly in place while tightening the shaft bolts. The segment, housing or shaft threads can be damaged if the idler shaft is allowed to shift out of position in the housing.

SHIFT SHAFT, SHAFT LEVER AND BUSHING AND SHIFT SOCKET INSTALLATION

(1) Before proceeding, verify that all synchro sleeves are in Neutral position (centered on hub). Move sleeves into neutral if necessary.

CAUTION: The transmission synchros must all be in Neutral position for proper reassembly. Otherwise, the housings, shift forks and gears can be damaged during installation of the two housings.

(2) Install 3-4 shift fork in synchro sleeve (Fig. 103). Verify that groove in fork arm is aligned with grooves in 1-2 and fifth-reverse fork arms as shown.

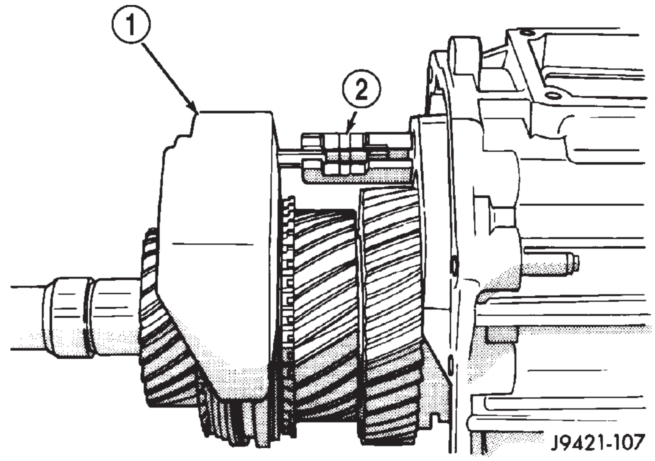


Fig. 103 Installing 3-4 Shift Fork

1 – 3–4 FORK
2 – ALIGN GROOVES IN FORK ARMS

(3) Slide shift shaft through 3-4 shift fork (Fig. 104). Be sure shaft detent notches are to front.

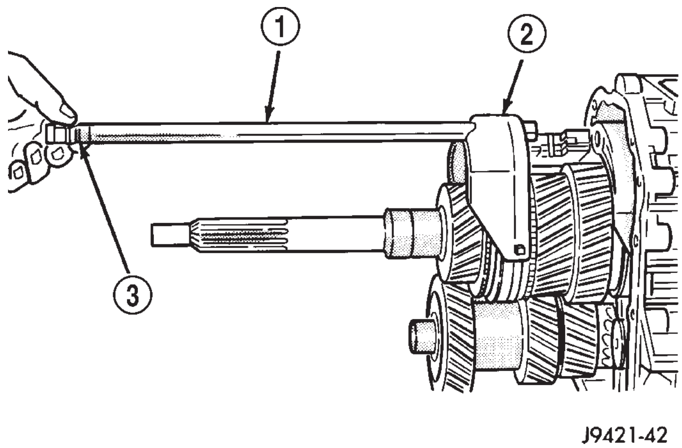


Fig. 104 Shift Shaft Installation

1 – SHIFT SHAFT
2 – 3–4 FORK
3 – SHAFT DETENT NOTCHES

(4) Assemble shift shaft shift lever and bushing (Fig. 105). Be sure slot in bushing is facing up and roll pin hole for lever is aligned with hole in shaft.

(5) Install assembled lever and bushing on shift shaft (Fig. 106).

DISASSEMBLY AND ASSEMBLY (Continued)

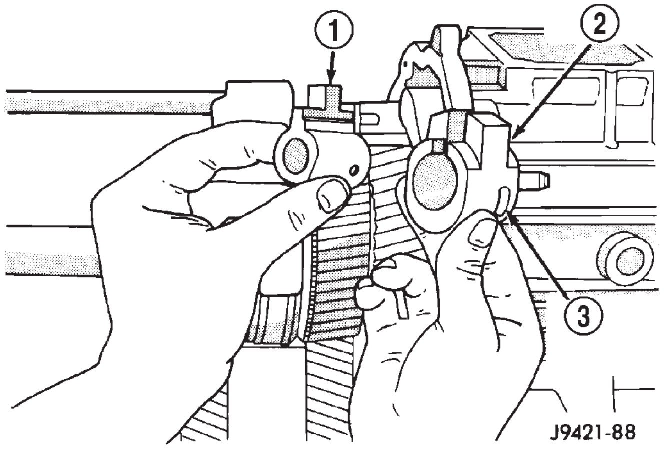


Fig. 105 Assembling Shift Shaft Lever And Bushing

1 – SHAFT LEVER
2 – LEVER BUSHING
3 – BUSHING LOCK PIN SLOT

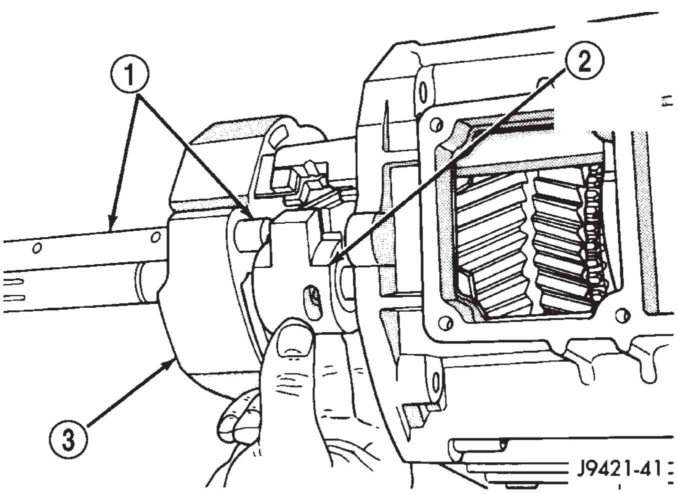


Fig. 106 Installing Shift Shaft Lever And Bushing

1 – SHIFT SHAFT
2 – SHAFT LEVER AND BUSHING
3 – 3–4 FORK

(6) Slide shift shaft through 1-2 and fifth-reverse fork and into shift lever opening in rear housing (Fig. 107).

(7) Align shift socket with shaft and slide shaft through socket and into shift shaft bearing in rear housing (Fig. 108).

(8) Rotate shift shaft so detent notches in shaft are facing driver side of housing.

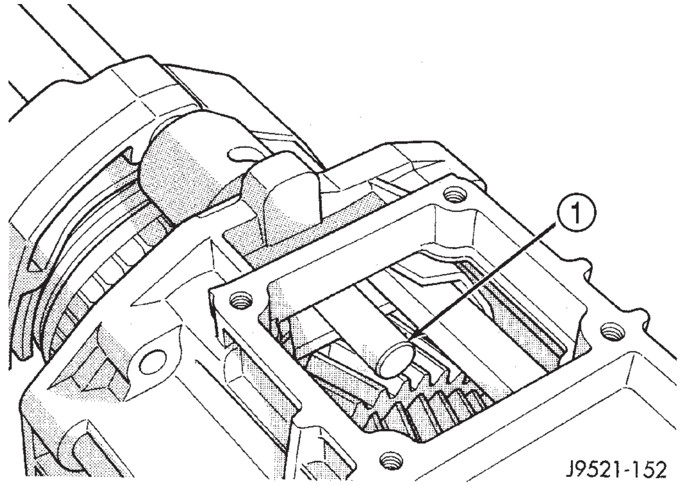


Fig. 107 Inserting Shaft Into Lever Opening In Housing

1 – SHIFT SHAFT

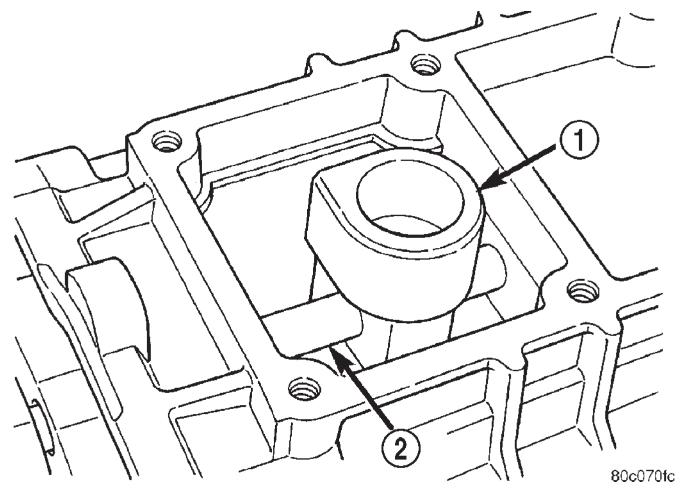


Fig. 108 Shift Socket Installation

1 – SHIFT SOCKET
2 – SHIFT SHAFT

CAUTION: Correct positioning of the shift shaft detent notch is important. Both of the shaft roll pins can be installed even when the shaft is 180° off. If this occurs, the transmission will have to be disassembled again to correct shaft alignment.

(9) Select correct new roll pin for shift shaft lever (Fig. 109). Shaft lever roll pin is approximately 22 mm (7/8 in.) long. Shift socket roll pin is approximately 33 mm (1-1/4 in.) long.

DISASSEMBLY AND ASSEMBLY (Continued)

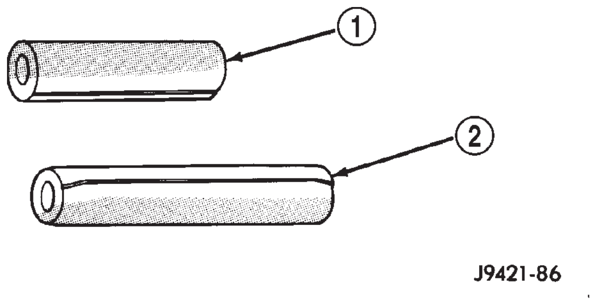


Fig. 109 Roll Pin Identification—Shaft Lever And Shift Socket

1 – SHAFT LEVER ROLL PIN
2 – SHIFT SOCKET ROLL PIN

(10) Align roll pin holes in shift shaft, lever and bushing. Then start roll pin into shaft lever by hand (Fig. 110).

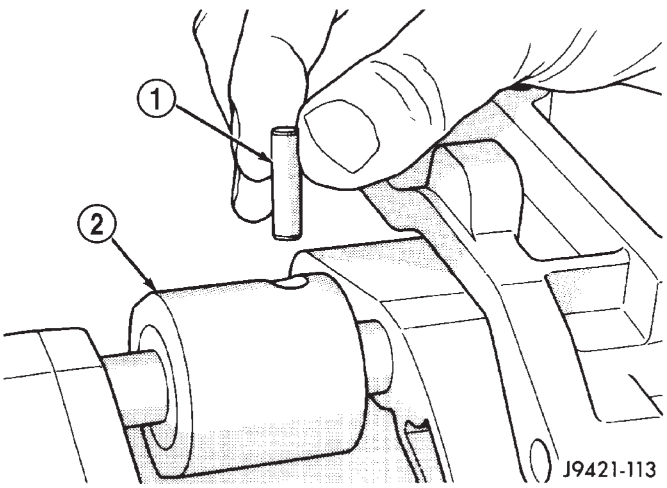


Fig. 110 Starting Roll Pin In Shift Shaft Lever

1 – SHAFT LEVER ROLL PIN (7⁄8" LONG)
2 – LEVER AND BUSHING

(11) Seat shaft lever roll pin with pin punch (Fig. 111).

CAUTION: The shaft lever roll pin must be flush with the surface of the lever. The lever bushing will bind on the roll pin if the pin is not seated flush.

(12) Before proceeding, verify that lock pin slot in lever bushing is positioned as shown (Fig. 111).

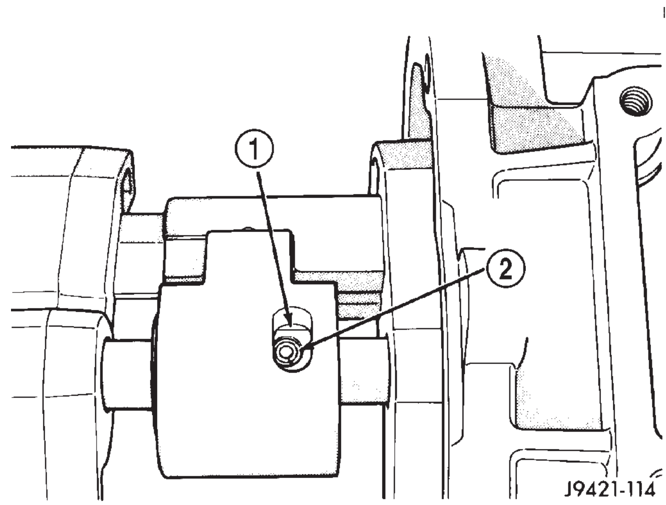


Fig. 111 Correct Seating Of Shift Shaft Lever Roll Pin

1 – BUSHING LOCK PIN SLOT
2 – SEAT ROLL PIN FLUSH WITH LEVER

(13) Align roll pin holes in shift socket and shift shaft. Then start roll pin into shift shaft by hand (Fig. 112).

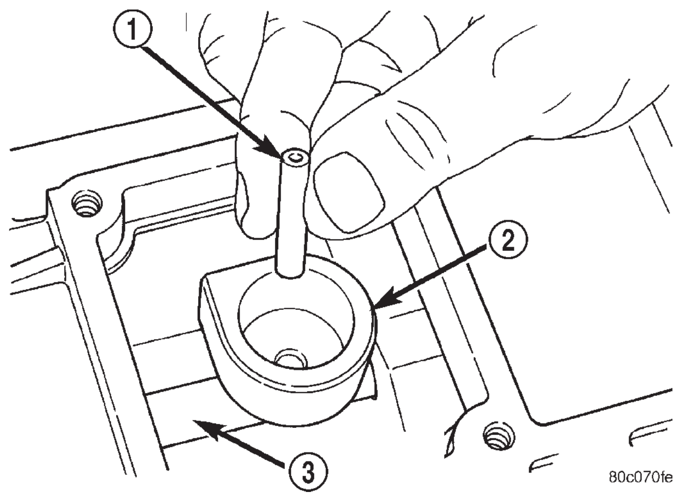


Fig. 112 Starting Roll Pin In Shift Socket

1 – ROLL PIN
2 – SHIFT SOCKET
3 – SHIFT SHAFT

DISASSEMBLY AND ASSEMBLY (Continued)

(14) Seat roll pin in shift socket with pin punch. Roll pin must be flush with socket after installation (Fig. 113).

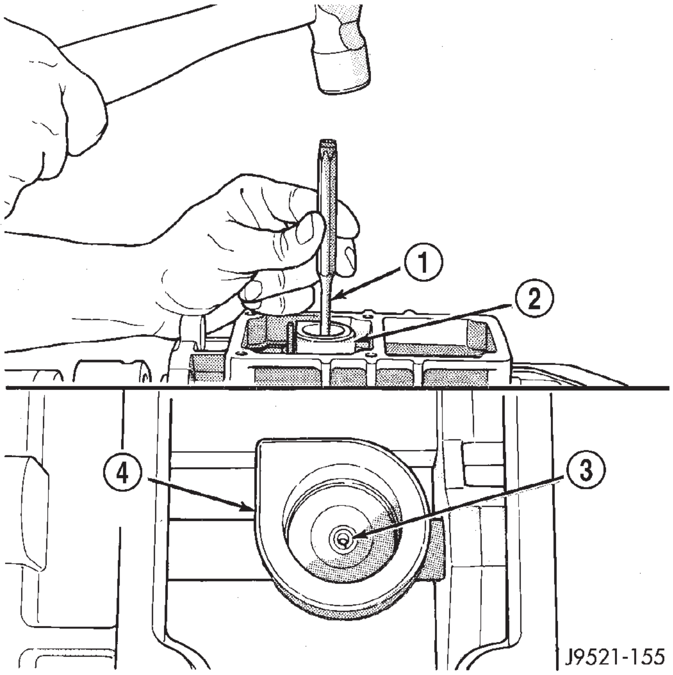


Fig. 113 Seating Shift Socket Roll Pin

1 – PIN PUNCH
2 – SHIFT SOCKET
3 – SEAT ROLL PIN FLUSH
4 – SHIFT SOCKET

(15) Verify that notches in shift fork arms are aligned. Realign arms if necessary.

FRONT HOUSING AND INPUT SHAFT BEARING RETAINER INSTALLATION

(1) Install input shaft bearing in front housing bore (Fig. 114). Use plastic mallet to seat bearing. Bearing goes in from front side of housing only.

(2) Apply liberal quantity of petroleum jelly to countershaft front bearing. Then insert bearing in front housing race (Fig. 115). Large diameter side of bearing cage goes toward countershaft (Fig. 114). Small diameter side goes toward bearing race in housing.

(3) Reach into countershaft front bearing with finger, and push each bearing roller outward against race. Then apply extra petroleum jelly to hold rollers in place. This avoids having rollers becoming displaced during housing installation. This will result in misalignment between bearing and countershaft bearing hub.

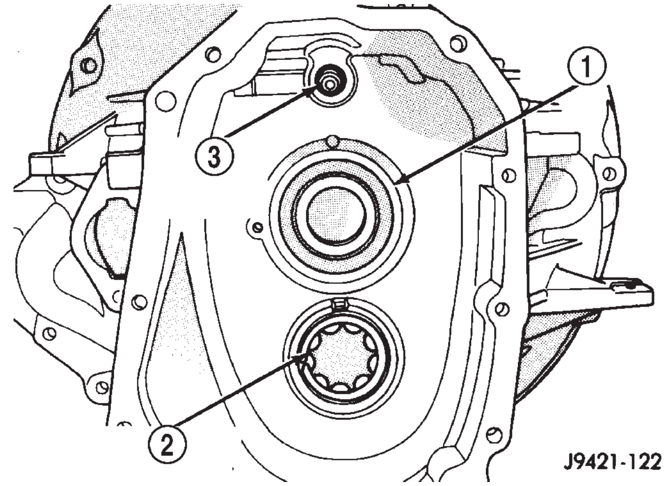


Fig. 114 Input Shaft Bearing And Countershaft Front Bearing Installation

1 – INPUT SHAFT BEARING
2 – COUNTERSHAFT FRONT BEARING
3 – SHIFT SHAFT BUSHING

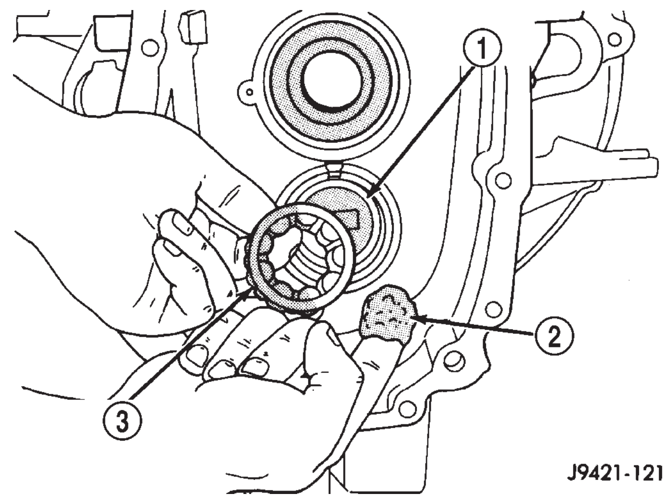


Fig. 115 Lubricating/Positioning Countershaft Front Bearing

1 – BEARING RACE
2 – PETROLEUM JELLY
3 – COUNTERSHAFT FRONT BEARING

(4) Apply small amount of petroleum jelly to shift shaft bushing in front housing.

(5) Apply 1/8 in. wide bead of Mopar® Silicone Sealer, or equivalent, to mating surfaces of front and rear housings.

(6) Have helper hold rear housing and geartrain in upright position. Then install front housing on rear housing and geartrain (Fig. 116).

DISASSEMBLY AND ASSEMBLY (Continued)

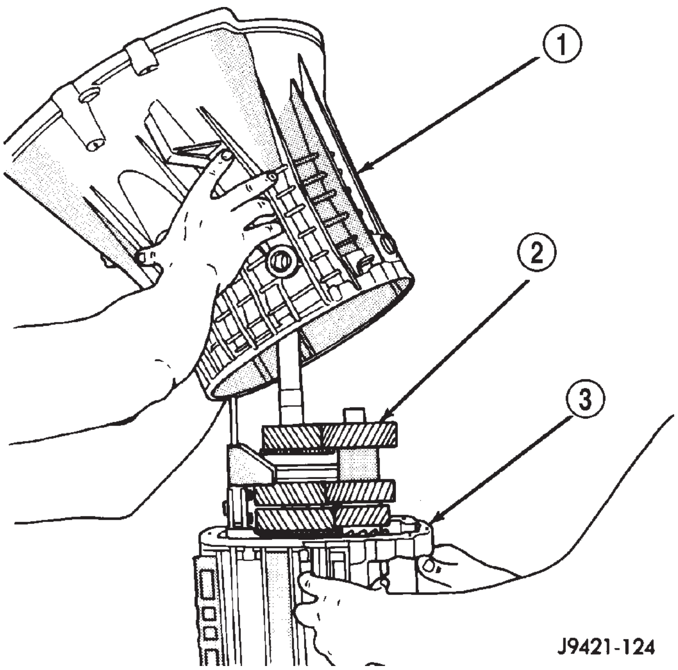


Fig. 116 Front Housing Installation

1 – FRONT HOUSING
2 – GEARTRAIN
3 – REAR HOUSING

(7) Work front housing downward onto geartrain until seated on rear housing.

CAUTION: If the front housing will not seat on the rear housing, either the shift components are not in Neutral, or one or more components are mis-aligned. Do not force the front housing into place. This will only result in damaged components.

(8) Tap rear housing alignment dowels back into place with hammer and pin punch (Fig. 117). Both dowels should be flush fit in each housing. Have helper hold transmission upright while dowels are tapped back into place.

(9) Place transmission in horizontal position.

(10) Apply Mopar® Gasket Maker, or equivalent, to housing attaching bolts. Apply sealer material sealer to underside of bolt heads and to bolt shanks and threads (Fig. 118).

(11) Install and start housing attaching bolts by hand (Fig. 118). Then tighten bolts to 30-35 N·m (22-26 ft. lbs.) torque.

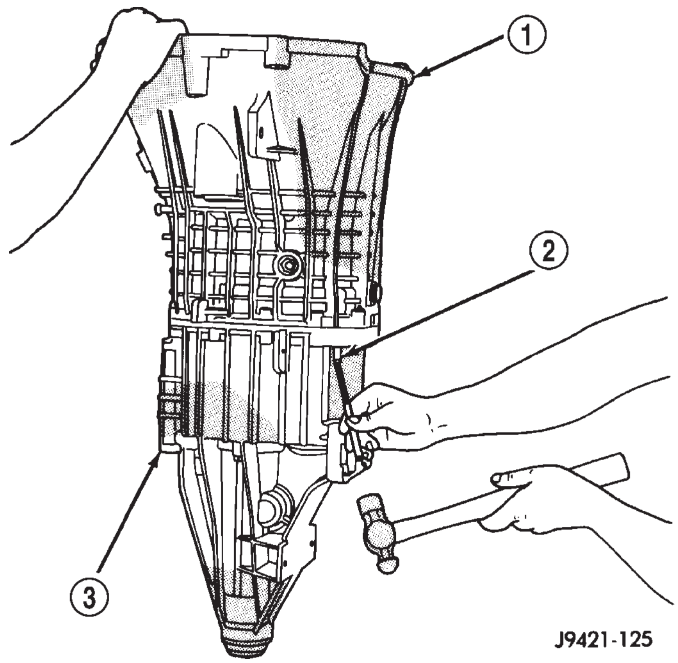


Fig. 117 Reseating Housing Alignment Dowels

1 – FRONT HOUSING
2 – ALIGNMENT DOWELS (2)
3 – REAR HOUSING

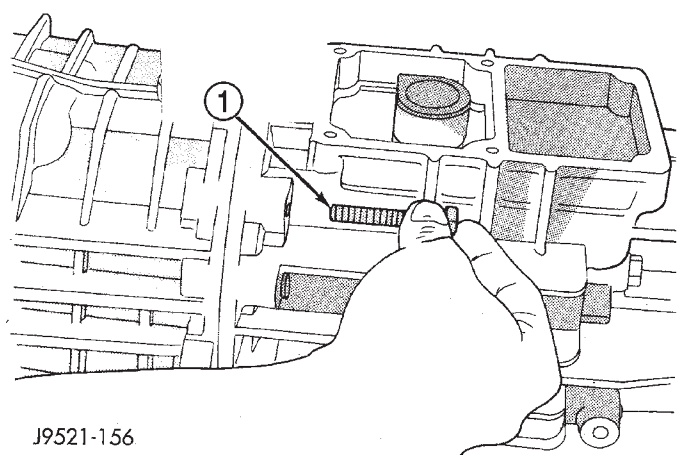


Fig. 118 Installing Housing Attaching Bolts

1 – HOUSING ATTACHING BOLTS (APPLY SEALER BEFOREHAND)

(12) Install shift shaft bushing lock bolt (Fig. 119). Apply Mopar® Gasket Maker, or equivalent, to bolt threads, shank and underside of bolt head before installation.

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: If the lock bolt cannot be fully installed, do not try to force it into place. Either the shift shaft is not in Neutral, or the shaft bushing (or lever) is misaligned (Fig. 120).

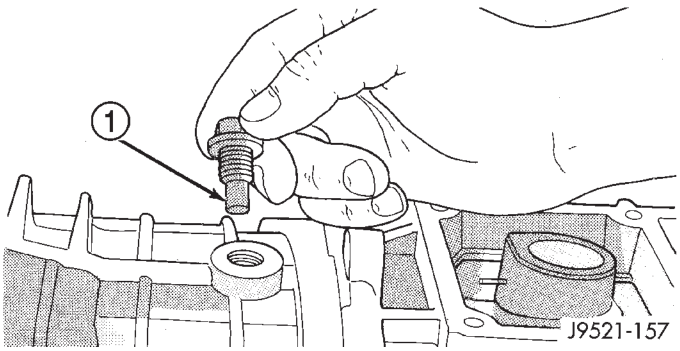


Fig. 119 Installing Shift Shaft Bushing Lock Bolt

1 – SHIFT SHAFT BUSHING LOCK BOLT

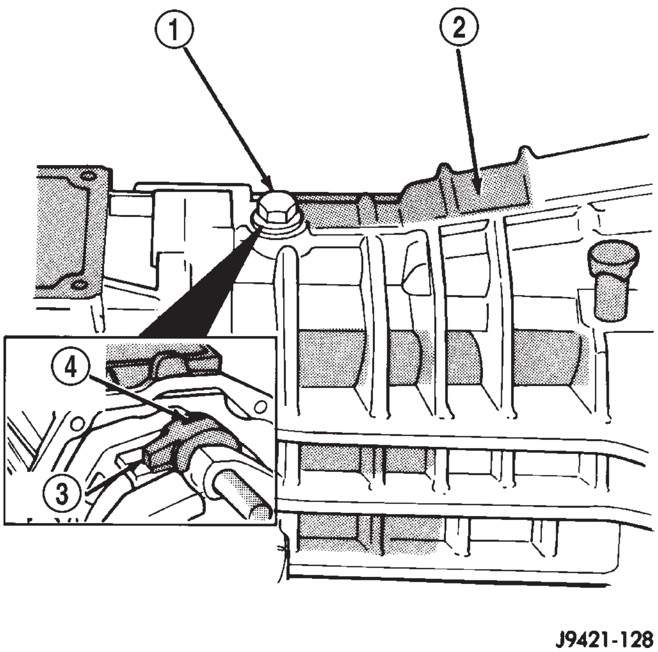


Fig. 120 Correct Alignment Of Lock Bolt And Shaft Bushing

1 – LOCK BOLT
2 – FRONT HOUSING
3 – SHAFT LEVER
4 – LOCK BOLT GROOVE

(13) Lubricate then install shift shaft detent plunger in housing bore (Fig. 121). Lubricate plunger with petroleum jelly or gear lubricant. **Be sure plunger is fully seated in detent notch in shift shaft.**

(14) Install detent spring inside plunger (Fig. 122).

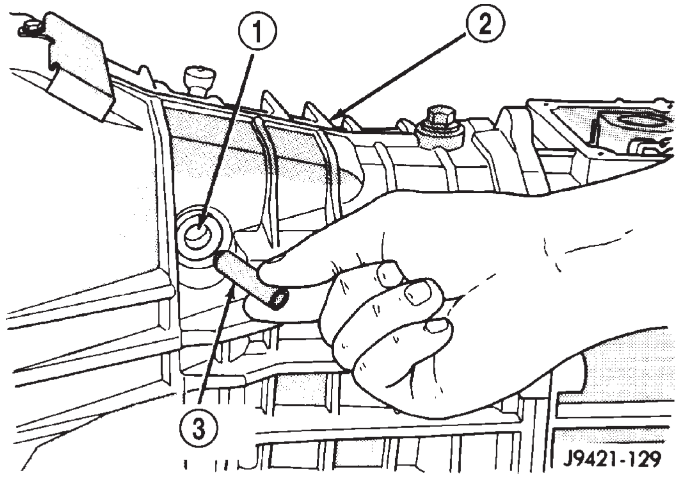


Fig. 121 Installing Shift Shaft Detent Plunger

1 – DETENT BORE
2 – FRONT HOUSING
3 – DETENT PLUNGER

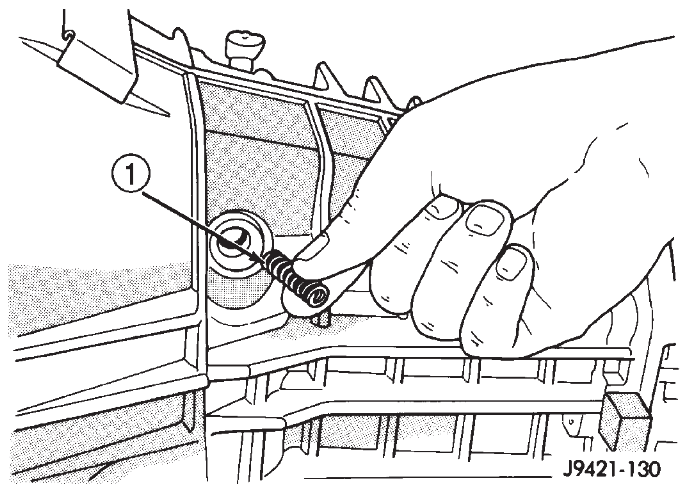


Fig. 122 Installing Detent Plunger Spring

1 – DETENT SPRING (GOES INSIDE PLUNGER)

(15) Install detent plug as follows:

(a) Install detent plug in end of Installer 8123.

(b) Position plug on detent spring and compress spring until detent plug pilots in detent plunger bore.

(c) Drive detent plug into transmission case until plug seats.

(16) Install backup light switch (Fig. 123).

(17) Install input shaft snap ring (Fig. 124).

(18) Install new oil seal in front bearing retainer with Installer Tool 6448 (Fig. 125).

DISASSEMBLY AND ASSEMBLY (Continued)

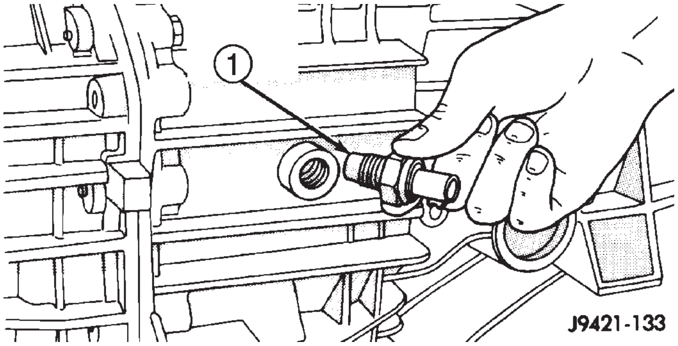


Fig. 123 Installing Backup Light Switch

1 – BACKUP LIGHT SWITCH

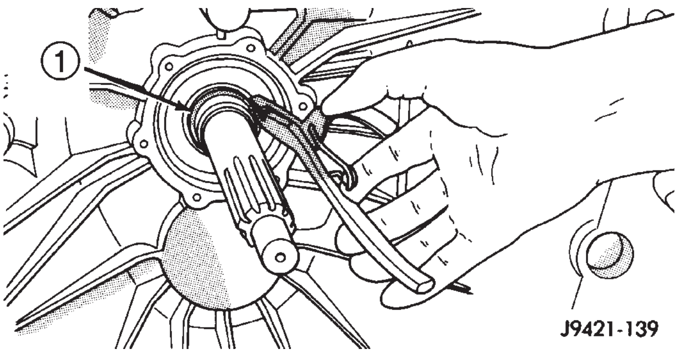


Fig. 124 Installing Input Shaft Snap Ring

1 – INPUT SHAFT SNAP RING

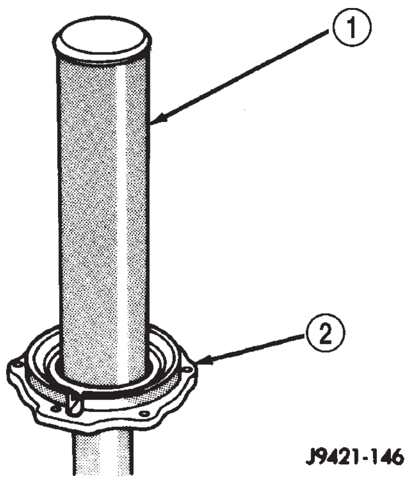


Fig. 125 Installing Oil Seal In Front Bearing Retainer

1 – SPECIAL TOOL 6448
2 – FRONT BEARING RETAINER

(19) Apply bead of Mopar® silicone sealer, or equivalent, to flange surface of front bearing retainer (Fig. 126).

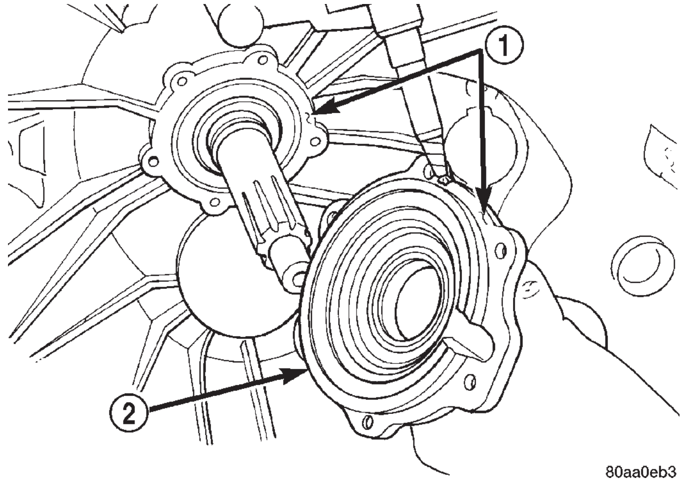


Fig. 126 Applying Sealer To Bearing Retainer And Housing

1 – APPLY SEALER BEAD
2 – INPUT SHAFT BEARING RETAINER

(20) Align and install front bearing retainer over input shaft and onto housing mounting surface (Fig. 127). Although retainer is one-way fit on housing, be sure bolt holes are aligned before seating retainer. Be sure that no sealer gets into the oil feed hole in the transmission case or bearing retainer.

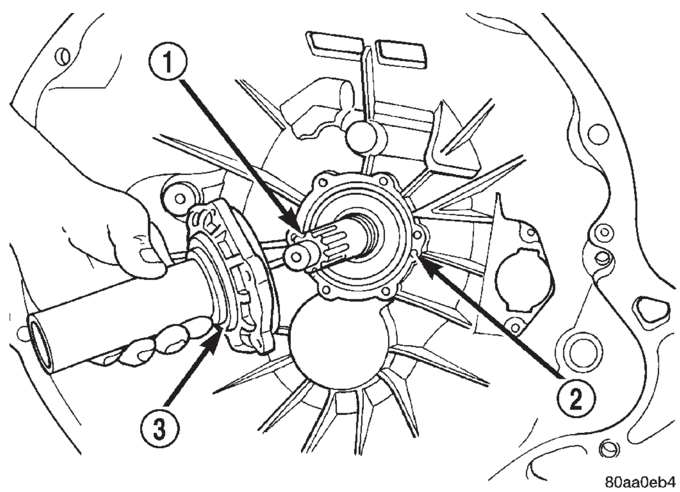


Fig. 127 Installing Input Shaft Bearing Retainer

1 – INPUT SHAFT
2 – OIL FEED
3 – BEARING RETAINER

(21) Install and tighten bearing retainer bolts to 7-10 N·m (5-7 ft. lbs.) torque (Fig. 128).

DISASSEMBLY AND ASSEMBLY (Continued)

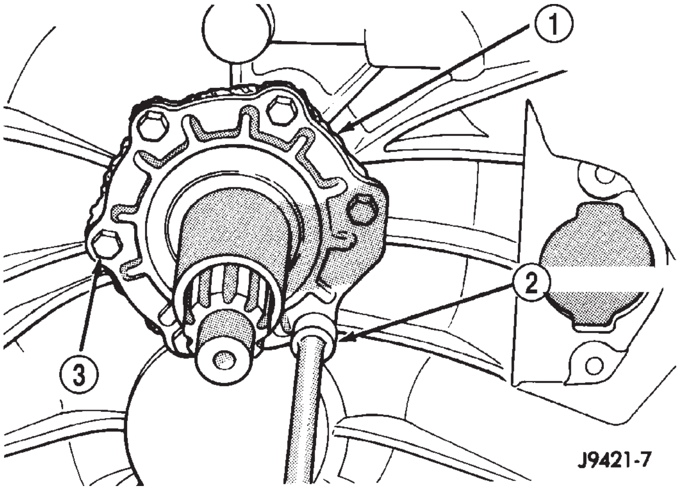


Fig. 128 Installing Input Shaft Bearing Retainer Bolts

1 – INPUT SHAFT BEARING RETAINER
2 – 10mm SOCKET
3 – RETAINER BOLTS (6)

SHIFT TOWER AND LEVER ASSEMBLY INSTALLATION

(1) Apply petroleum jelly to ball end of shift lever and interior of shift socket.

(2) Align and install shift tower and lever assembly (Fig. 129). Be sure shift ball is seated in socket and the offset in the tower is toward the passenger side of the vehicle before installing tower bolts.

(3) Install shift tower bolts (Fig. 130). Tighten bolts to 7-10 N·m (5-7 ft. lbs.) torque.

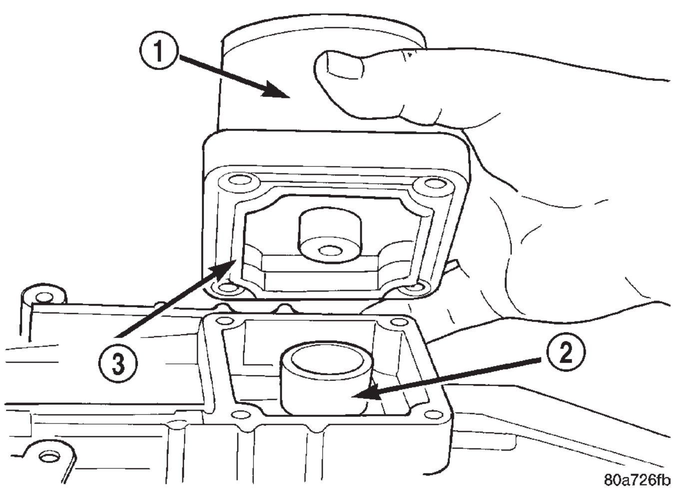


Fig. 129 Shift Tower Installation

1 – SHIFT TOWER AND LEVER ASSEMBLY
2 – SHIFT SOCKET
3 – SEAL

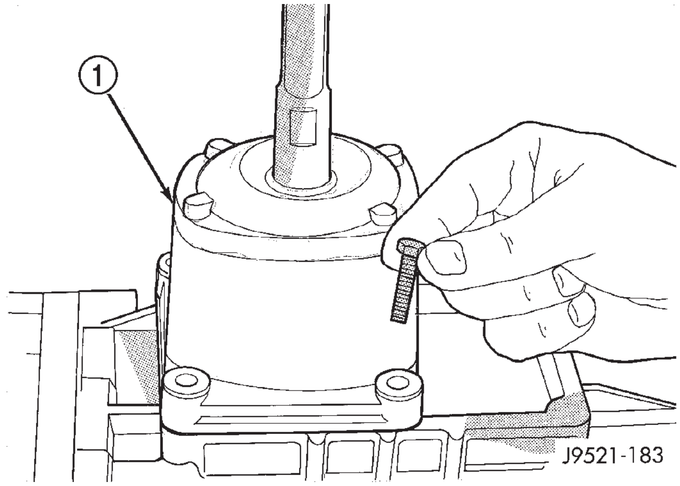


Fig. 130 Shift Tower Bolt Installation

1 – SHIFT TOWER AND LEVER ASSEMBLY

(4) Fill transmission to bottom edge of fill plug hole with Mopar® Transmission Lubricant, P/N 4874464.

(5) Install and tighten fill plug to 19-27 N·m (14-20 ft. lbs.) torque.

(6) Check transmission vent (Fig. 131). Be sure vent is open and not restricted.

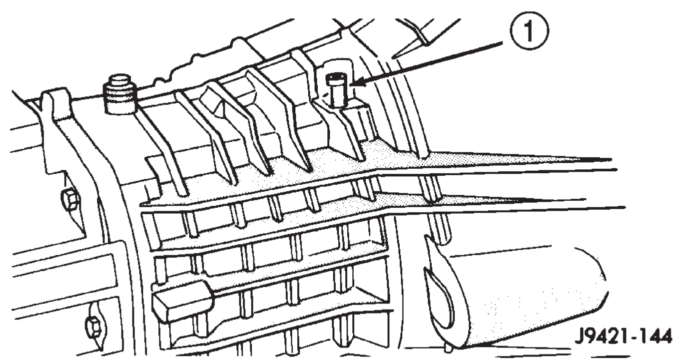


Fig. 131 Vent Location

1 – TRANSMISSION VENT

CLEANING AND INSPECTION

TRANSMISSION COMPONENTS

Clean the gears, shafts, shift components and transmission housings with a standard parts cleaning solvent. Do not use acid or corrosive base solvents. Dry all parts except bearings with compressed air.

Clean the shaft bearings with a mild solvent such as Mopar® degreasing solvent, Gunk, or similar solvents. Do not dry the bearings with compressed air. Allow the bearings to either air dry, or wipe them dry with clean shop towels.

CLEANING AND INSPECTION (Continued)

SHIFT TOWER AND LEVER ASSEMBLY

The shift tower and lever assembly is not serviceable. Replace the lever and shift tower as an assembly if the tower, lever, lever ball, or internal components are worn, or damaged.

SHIFT SHAFT AND FORKS

Inspect the shift fork interlock arms and synchro sleeve contact surfaces (Fig. 132). Replace any fork exhibiting wear or damage in these areas. Do not attempt to salvage shift forks.

Check condition of the shift shaft detent plunger and spring. The plunger should be smooth and free of nicks, or scores. The plunger spring should be straight and not collapsed, or distorted. Minor scratches, or nicks on the plunger can be smoothed with 320/400 grit emery soaked in oil. Replace the plunger and spring if in doubt about condition. Check condition of detent plunger bushings. Replace if damaged.

Inspect the shift shaft, shift shaft bushing and bearing, the shaft lever, and the lever bushing that fits over the lever. Replace the shaft if bent, cracked, or severely scored. Minor burrs, nicks, or scratches can be smoothed off with 320/400 grit emery cloth followed by polishing with crocus cloth. Replace the shift shaft bushing or bearing if damaged.

Replace the shaft lever and bushing if either part is deformed, or worn. Do not attempt to salvage these parts as shift fork binding will occur. Replace the roll pin that secures the lever to the shaft.

FRONT/REAR HOUSINGS AND BEARING RETAINERS

Inspect the housings carefully. Look for cracks, stripped threads, scored mating surfaces, damaged bearing bores, or worn dowel pin holes. Minor nicks on mating surfaces can be dressed off with a fine file, or emery cloth. Damaged threads can be renewed by either re-tapping or installing Helicoil inserts.

NOTE: The front housing contains the countershaft front bearing race. The rear housing contains the countershaft rear bearing race. Be advised that these components are NOT serviceable items. The front housing will have to be replaced if the countershaft bearing race is loose, worn, or damaged. The rear housing will have to be replaced if the countershaft rear bearing race is loose, worn, or damaged.

Inspect the input shaft bearing retainer. Be sure the release bearing slide surface of the retainer is in good condition. Minor nicks on the surface can be smoothed off with 320/420 grit emery cloth and final

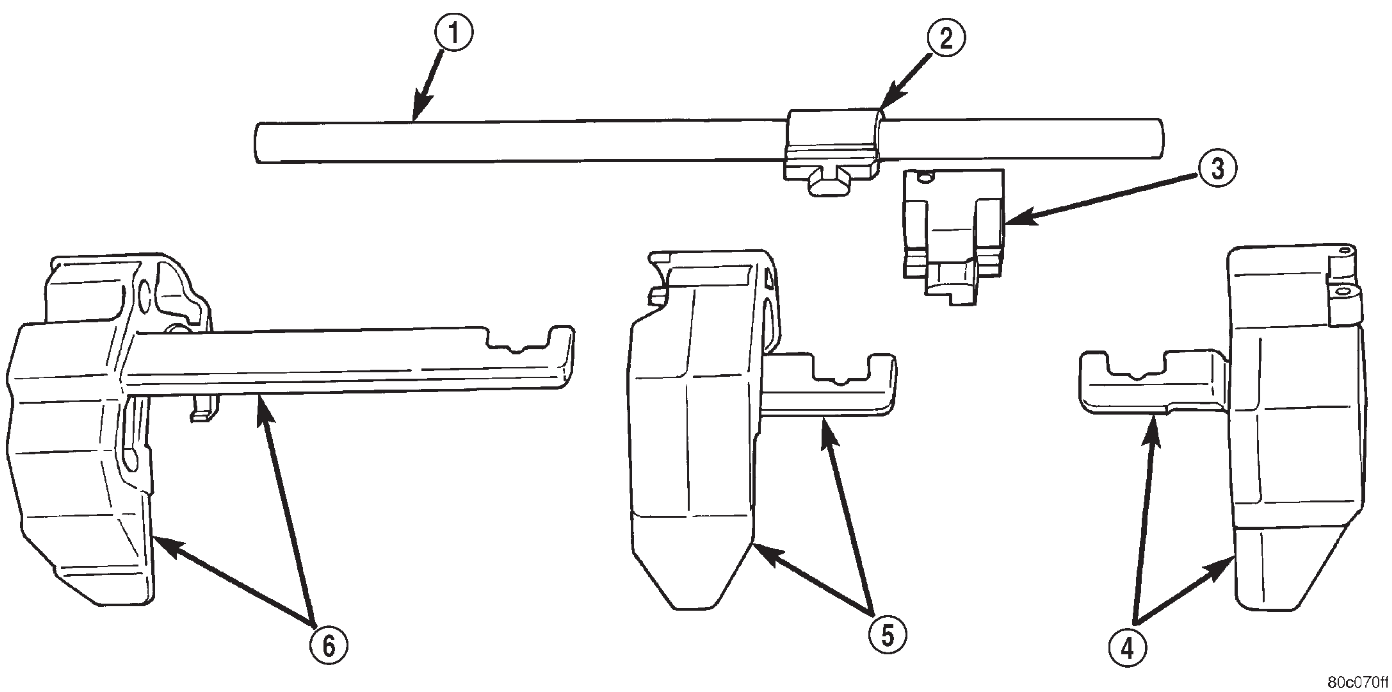


Fig. 132 Shift Forks And Shaft

1 – SHIFT SHAFT
2 – SHAFT LEVER
3 – SHAFT LEVER BUSHING
4 – 3–4 SHIFT FORK
5 – 1–2 SHIFT FORK
6 – FIFTH-REVERSE SHIFT FORK

CLEANING AND INSPECTION (Continued)

polished with oil coated crocus cloth. Replace the retainer seal if necessary.

Inspect the output shaft bearing retainer. Be sure the U-shaped retainer is flat and free of distortion. Replace the retainer if the threads are damaged, or if the retainer is bent, or cracked.

COUNTERSHAFT BEARINGS AND RACES

The countershaft bearings and races are machine lapped during manufacture to form matched sets. The bearings and races should not be interchanged.

NOTE: The bearing races are a permanent press fit in the housings and are NOT serviceable. If a bearing race becomes damaged, it will be necessary to replace the front or rear housing as necessary. A new countershaft bearing will be supplied with each new housing for service use.

The countershaft bearings can be installed backwards if care is not exercised. The bearing roller cage is a different diameter on each side. Be sure the bearing is installed so the large diameter side of the cage is facing the countershaft gear (Fig. 133). The small diameter side goes in the bearing race.

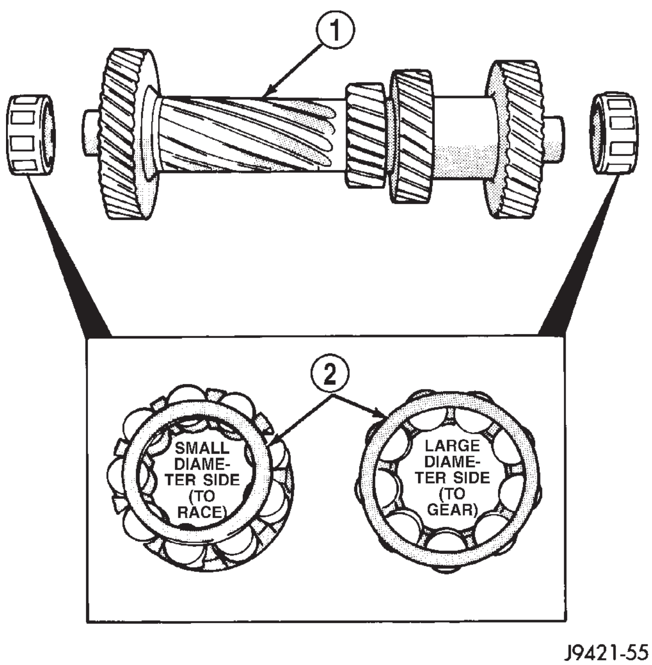


Fig. 133 Correct Countershaft Bearing Installation

1 – COUNTERSHAFT
2 – BEARING CAGE

REVERSE IDLER COMPONENTS

Inspect the idler gear, bearing, shaft, thrust washer, wave washer and thrust plate. Replace the bearing if any of the needle bearing rollers are worn, chipped, cracked, flat-spotted, or brinnelled. Also replace the bearing if the plastic bearing cage is damaged or distorted.

Replace the thrust washer, wave washer, or thrust plate if cracked, chipped, or worn. Replace the idler gear if the teeth are chipped, cracked or worn thin. Replace the shaft if worn, scored, or the bolt threads are damaged beyond repair. Replace the support segment if cracked, or chipped and replace the idler attaching bolts if the threads are damaged.

Shift Socket

Inspect the shift socket for wear or damage. replace the socket if the roll pin, or shift shaft bores are damaged. Minor nicks in the shift lever ball seat in the socket can be smoothed down with 400 grit emery or wet/dry paper. Replace the socket if the ball seat is worn, or cracked. Do not reuse the original shift socket roll pin. Install a new pin during reassembly. The socket roll pin is approximately is approximately 33 mm (1-1/4 in.) long.

Output Shaft And Geartrain

Inspect all of the gears for worn, cracked, chipped, or broken teeth. Also check condition of the bearing bore in each gear. The bores should be smooth and free of surface damage. Discoloration of the gear bores is a normal occurrence and is not a reason for replacement. Replace gears only when tooth damage has occurred, or if the bores are brinnelled or severely scored.

Inspect the shaft splines and bearings surfaces. Minor nicks on the bearing surfaces can be smoothed with 320/420 grit emery and final polished with crocus cloth. Replace the shaft if the splines are damaged or bearing surfaces are deeply scored, worn, or brinnelled.

SPECIFICATIONS

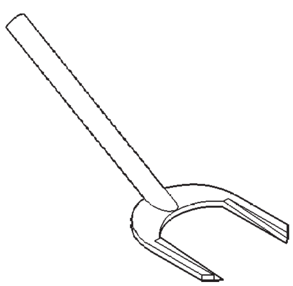
TORQUE

Description	Torque
Clutch Housing Bolts	54–61 N•m (40–45 ft. lbs.)
Crossmember-To-Frame Bolts	61–75 N•m (44–55 ft. lbs.)
Crossmember-To-Insulator Nuts	54–61 N•m (40–45 ft. lbs.)
Drain/Fill Plug	9–27 N•m (14–20 ft. lbs.)
Front-To-Rear Housing Bolts	30–35 N•m (22–26 ft. lbs.)
Front Bearing Retainer Bolts	7–10 N•m (5–7 ft. lbs.)
Idler Shaft Bolts	19–25 N•m (14–18 ft. lbs.)
Rear Bearing Retainer Bolts	30–35 N•m (22–26 ft. lbs.)
Shift Tower Bolts	7–10 N•m (5–7 ft. lbs.)
Slave Cylinder Attaching Nuts	23 N•m (200 in. lbs.)
Transfer Case Attaching Nuts	47 N•m (35 ft. lbs.)
U-Joint Clamp Bolts	19 N•m (170 in. lbs.)

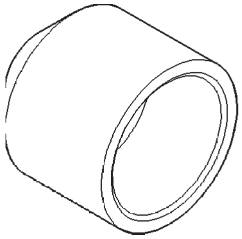
J9421-212

SPECIAL TOOLS

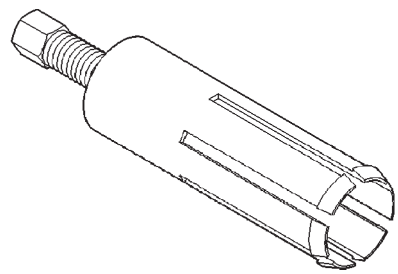
NV3500 MANUAL TRANSMISSION



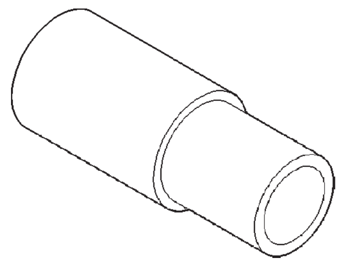
Remover, Seal—C-3985-B



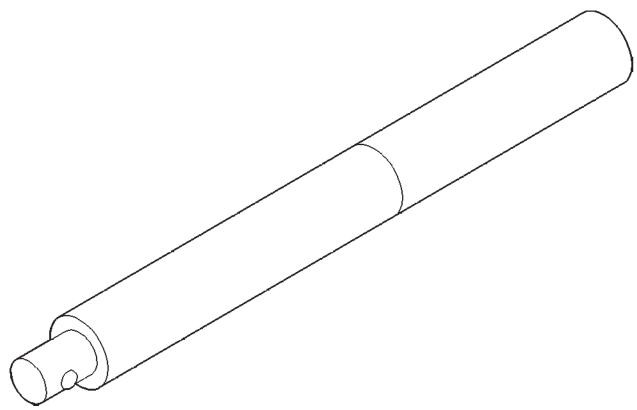
Installer, Seal—C-3972-A



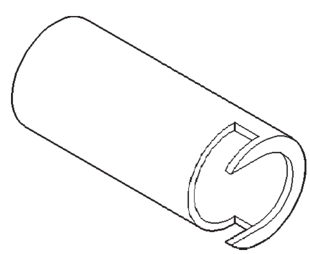
Remover, Bushing—6957



Installer, Bushing—6951

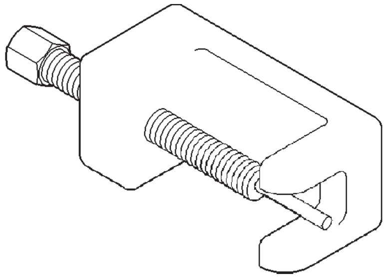


Handle—C-4171

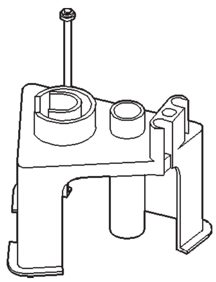


Remover—8117

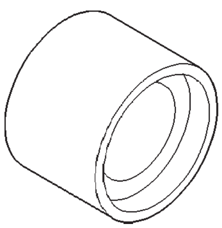
SPECIAL TOOLS (Continued)



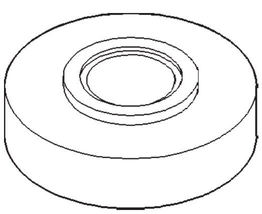
Remover/Installer, NV3500 Shift Rail Roll Pin—6858



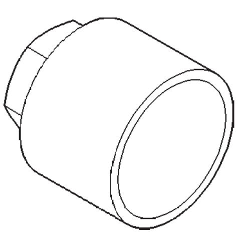
Fixture, NV3500—6747



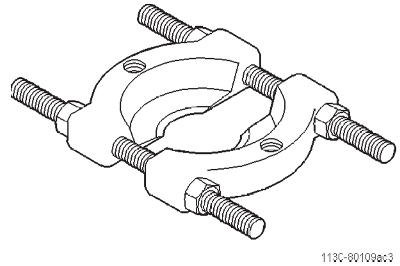
Adapter, Fixture—6747-1A



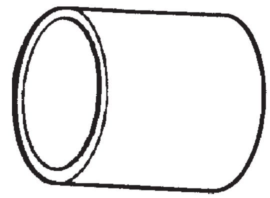
Adapter, Fixture—6747-2A



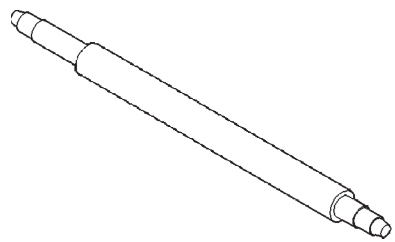
Cup, Fixture—8115



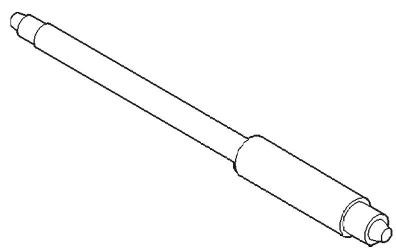
Splitter, Bearing—1130



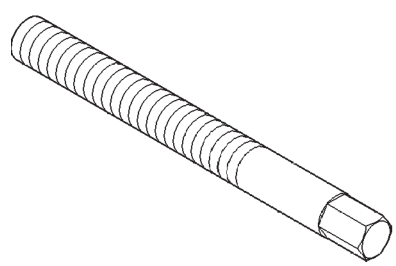
Tube—6310-1



Installer—8118

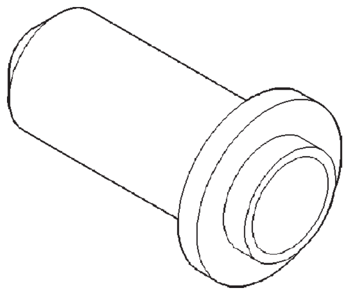


Remover/Installer—8119

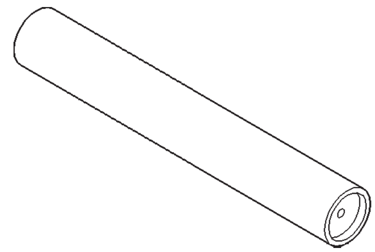


Stud, Alignment—8120

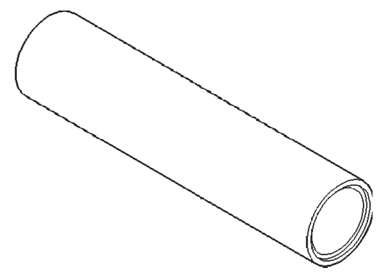
SPECIAL TOOLS (Continued)



Installer, Seal—C-3860-A



Installer—8123



Installer, Bearing Cone—6448

42RE AUTOMATIC TRANSMISSION

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
42RE AUTOMATIC TRANSMISSION . . . 85
FLUID . . . 92
TORQUE CONVERTER . . . 93
OIL PUMP . . . 97
VALVE BODY . . . 98
ACCUMULATOR . . . 117
PISTONS . . . 117
FRONT CLUTCH . . . 119
REAR CLUTCH . . . 120
OVERDRIVE CLUTCH . . . 122
OVERRUNNING CLUTCH . . . 122
PLANETARY GEARSET . . . 123
BANDS . . . 123
SERVOS . . . 124
GEARSHIFT MECHANISM . . . 125
CONVERTER DRAINBACK VALVE . . . 125
POWERTRAIN CONTROL MODULE (PCM) . . . 125
ELECTRONIC GOVERNOR . . . 126
GOVERNOR PRESSURE CURVES . . . 128
OVERDRIVE OFF SWITCH . . . 129

DIAGNOSIS AND TESTING
AUTOMATIC TRANSMISSION DIAGNOSIS . . . 129
EFFECTS OF INCORRECT FLUID LEVEL . . . 129
CAUSES OF BURNT FLUID . . . 129
FLUID CONTAMINATION . . . 129
PRELIMINARY DIAGNOSIS . . . 130
PARK/NEUTRAL POSITION SWITCH . . . 130
OVERDRIVE ELECTRICAL CONTROLS . . . 130
GEARSHIFT CABLE . . . 130
ROAD TESTING . . . 131
ANALYZING ROAD TEST . . . 131
HYDRAULIC PRESSURE TEST . . . 132
AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION . . . 134
CONVERTER HOUSING FLUID LEAK DIAGNOSIS . . . 135
DIAGNOSIS TABLES AND CHARTS—RE TRANSMISSION . . . 136

SERVICE PROCEDURES
FLUID LEVEL CHECK . . . 147
FLUID AND FILTER REPLACEMENT . . . 147
TRANSMISSION FILL PROCEDURE . . . 148
CONVERTER DRAINBACK CHECK VALVE SERVICE . . . 148
OIL PUMP VOLUME CHECK . . . 149
FLUSHING COOLERS AND TUBES . . . 149
ALUMINUM THREAD REPAIR . . . 150

REMOVAL AND INSTALLATION
TRANSMISSION . . . 150

page

TORQUE CONVERTER . . . 152
YOKE SEAL REPLACEMENT . . . 152
PARK/NEUTRAL POSITION SWITCH . . . 153
GEARSHIFT CABLE . . . 153
GOVERNOR SOLENOID AND PRESSURE SENSOR . . . 154
VALVE BODY . . . 155
OVERDRIVE UNIT . . . 157
OVERDRIVE HOUSING BUSHING . . . 159
OUTPUT SHAFT REAR BEARING . . . 159
OUTPUT SHAFT FRONT BEARING . . . 159

DISASSEMBLY AND ASSEMBLY
VALVE BODY . . . 160
TRANSMISSION . . . 178
OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER . . . 189
FRONT SERVO PISTON . . . 191
REAR SERVO PISTON . . . 192
OIL PUMP AND REACTION SHAFT SUPPORT . . . 192
FRONT CLUTCH . . . 195
REAR CLUTCH . . . 197
PLANETARY GEARTRAIN/OUTPUT SHAFT . . . 200
OVERDRIVE UNIT . . . 206

CLEANING AND INSPECTION
VALVE BODY . . . 222
TRANSMISSION . . . 223
OVERRUNNING CLUTCH/LOW-REVERSE DRUM/OVERDRIVE PISTON RETAINER . . . 223
ACCUMULATOR . . . 223
FRONT SERVO . . . 224
REAR SERVO . . . 224
OIL PUMP AND REACTION SHAFT SUPPORT . . . 224
FRONT CLUTCH . . . 225
REAR CLUTCH . . . 225
PLANETARY GEARTRAIN . . . 225
OVERDRIVE UNIT . . . 226

ADJUSTMENTS
TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT . . . 226
GEARSHIFT CABLE . . . 227
BAND ADJUSTMENTS . . . 228
VALVE BODY . . . 229

SCHEMATICS AND DIAGRAMS
HYDRAULIC SCHEMATICS . . . 229

SPECIFICATIONS
TRANSMISSION . . . 242

SPECIAL TOOLS
RE TRANSMISSIONS . . . 243

DESCRIPTION AND OPERATION

42RE AUTOMATIC TRANSMISSION

DESCRIPTION

The 42RE is a four speed fully automatic transmission (Fig. 1) with an electronic governor. The 42RE is equipped with a lock-up clutch in the torque converter. First through third gear ranges are provided by the clutches, bands, overrunning clutch, and planetary gear sets in the transmission. Fourth gear range is provided by the overdrive unit that contains an overdrive clutch, direct clutch, planetary gear set, and overrunning clutch.

The transmission contains a front, rear, and direct clutch which function as the input driving components. They also contain the kickdown (front) and the low/reverse (rear) bands which, along with the overrunning clutch and overdrive clutch, serve as the holding components. The driving and holding components combine to select the necessary planetary gear components, in the front, rear, or overdrive planetary gear set, transfer the engine power from the input shaft through to the output shaft.

The valve body is mounted to the lower side of the transmission and contains the valves to control pressure regulation, fluid flow control, and clutch/band application. The oil pump is mounted at the front of the transmission and is driven by the torque converter hub. The pump supplies the oil pressure necessary for clutch/band actuation and transmission lubrication.

The 42RE transmission is cooled by an integral fluid cooler inside the radiator.

DESCRIPTION AND OPERATION (Continued)

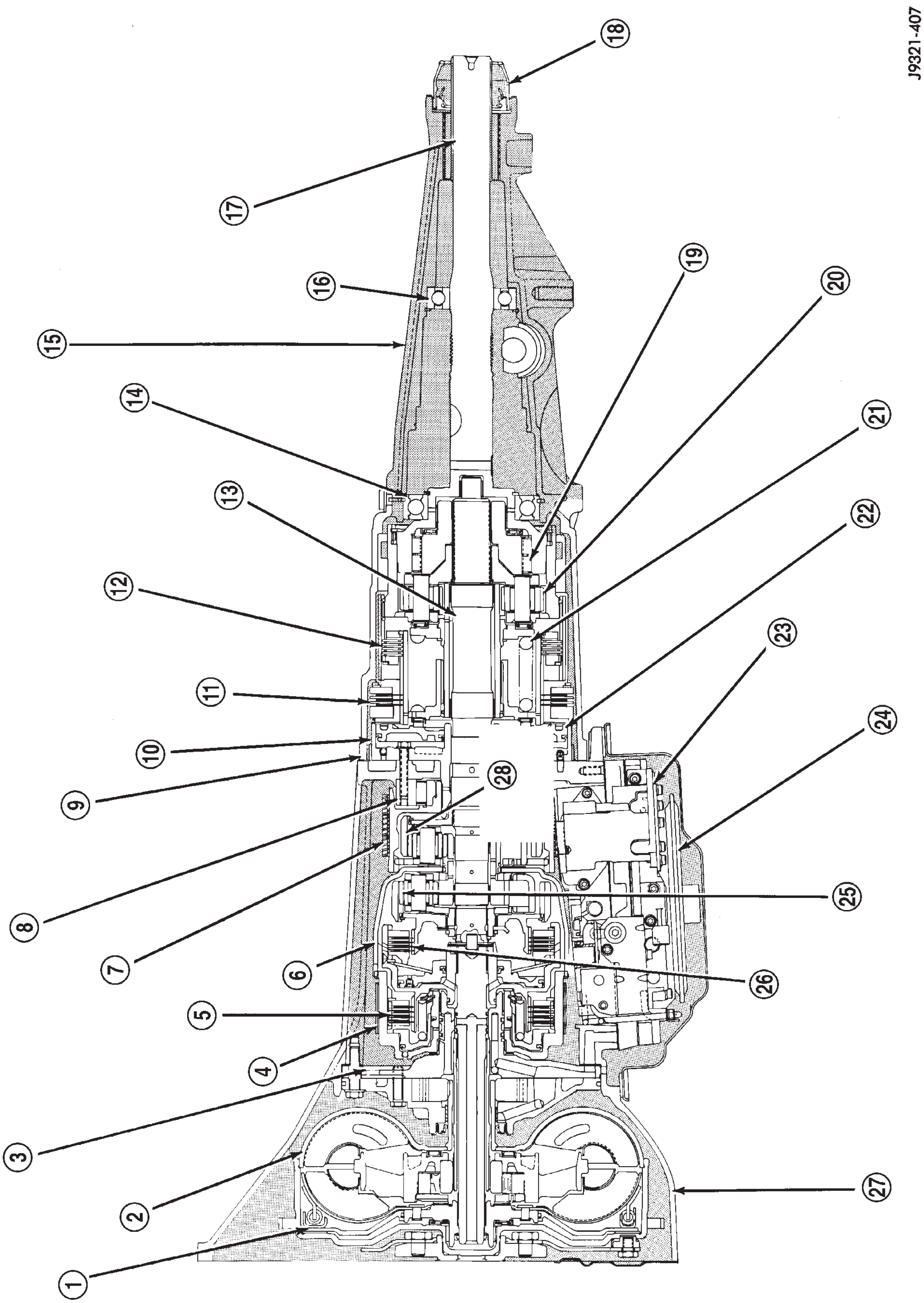


Fig. 1 42RE Transmission

DESCRIPTION AND OPERATION (Continued)

1 – CONVERTER CLUTCH
2 – TORQUE CONVERTER
3 – OIL PUMP AND REACTION SHAFT SUPPORT ASSEMBLY
4 – FRONT BAND
5 – FRONT CLUTCH
6 – DRIVING SHELL
7 – REAR BAND
8 – TRANSMISSION OVERRUNNING CLUTCH
9 – OVERDRIVE UNIT
10 – PISTON RETAINER
11 – OVERDRIVE CLUTCH
12 – DIRECT CLUTCH
13 – INTERMEDIATE SHAFT
14 – FRONT BEARING
15 – HOUSING
16 – REAR BEARING
17 – OUTPUT SHAFT
18 – SEAL
19 – OVERDRIVE OVERRUNNING CLUTCH
20 – OVERDRIVE PLANETARY GEAR
21 – DIRECT CLUTCH SPRING
22 – OVERDRIVE CLUTCH PISTON
23 – VALVE BODY ASSEMBLY
24 – FILTER
25 – FRONT PLANETARY GEAR
26 – REAR CLUTCH
27 – TRANSMISSION
28 – REAR PLANETARY GEAR

IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2). Refer to this information when ordering replacement parts.

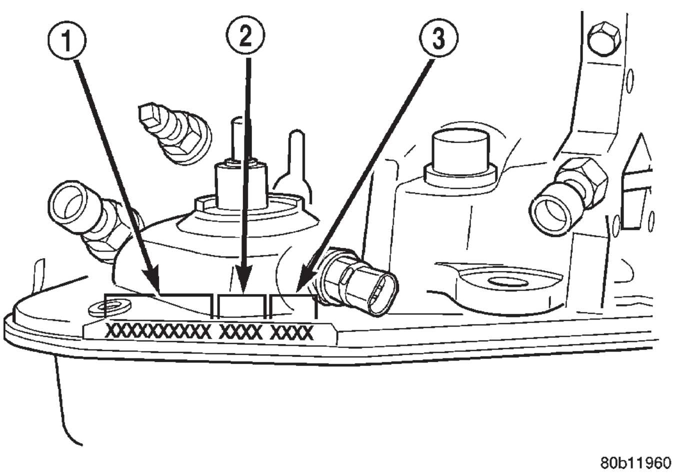


Fig. 2 Transmission Part And Serial Number Location

1 – PART NUMBER
2 – BUILD DATE
3 – SERIAL NUMBER

GEAR RATIOS

The 42RE gear ratios are:

- **1st** 2.74:1
- **2nd** 1.54:1
- **3rd** 1.00:1
- **4th** 0.69:1
- **Rev.** 2.21

OPERATION

The application of each driving or holding component is controlled by the valve body based upon the manual lever position and governor pressure. The governor pressure is a variable pressure input to the valve body and is one of the signals that a shift is necessary. First through fourth gear are obtained by selectively applying and releasing the different clutches and bands. Engine power is thereby routed to the various planetary gear assemblies which combine with the overrunning clutch assemblies to generate the different gear ratios. The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear when the O/D switch is OFF, when the vehicle is cruising on a level plane after the vehicle has warmed up. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased. The torque converter clutch feature increases fuel economy and reduces the transmission fluid temperature.

Since the overdrive clutch is applied in fourth gear only and the direct clutch is applied in all ranges except fourth gear, the transmission operation for park, neutral, and first through third gear will be described first. Once these powerflows are described, the third to fourth shift sequence will be described.

DESCRIPTION AND OPERATION (Continued)

PARK POWERFLOW

As the engine is running and the crankshaft is rotating, the flexplate and torque converter, which are also bolted to it, are all rotating in a clockwise direction as viewed from the front of the engine. The notched hub of the torque converter is connected to the oil pump's internal gear, supplying the transmission with oil pressure. As the converter turns, it turns the input shaft in a clockwise direction. As the input shaft is rotating, the front clutch hub-rear clutch retainer and all their associated parts are also rotating, all being directly connected to the input shaft. The power flow from the engine through the front-clutch-hub and rear-clutch-retainer stops at the rear-clutch-retainer. Therefore, no power flow to the output shaft occurs because no clutches are applied. The only mechanism in use at this time is the parking sprag (Fig. 3), which locks the parking gear on the output shaft to the transmission case.

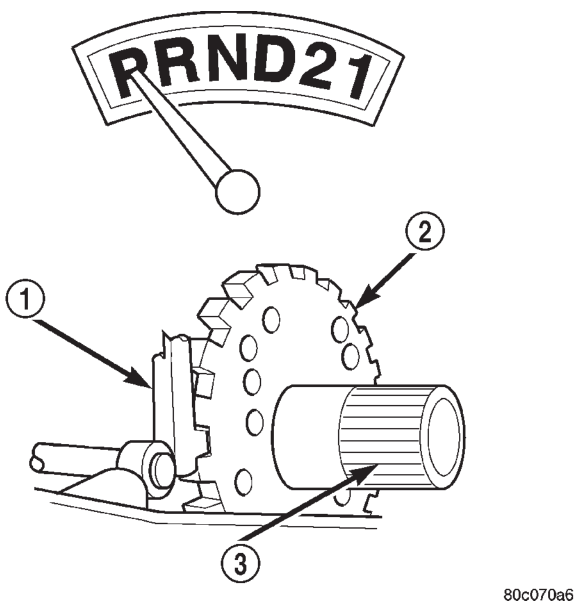


Fig. 3 Park Powerflow

1 – LEVER ENGAGED FOR PARK
2 – PARK SPRAG
3 – OUTPUT SHAFT

NEUTRAL POWERFLOW

With the gear selector in the neutral position (Fig. 4), the power flow of the transmission is essentially the same as in the park position. The only operational difference is that the parking sprag has been disengaged, unlocking the output shaft from the transmission case and allowing it to move freely.

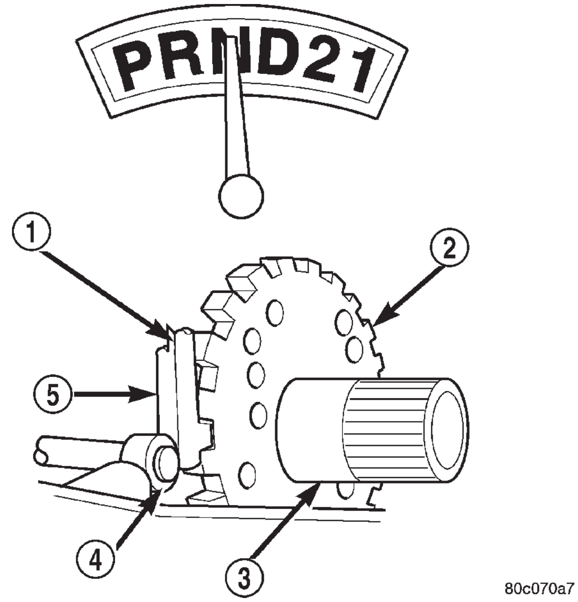


Fig. 4 Neutral Powerflow

1 – LEVER DISENGAGED FOR NEUTRAL
2 – PARK SPRAG
3 – OUTPUT SHAFT
4 – CAM
5 – LEVER

DESCRIPTION AND OPERATION (Continued)

REVERSE POWERFLOW

When the gear selector is moved into the reverse position (Fig. 5), the front clutch and the rear band are applied. With the application of the front clutch, engine torque is applied to the sun gear, turning it in a clockwise direction. The clockwise rotation of the sun gear causes the rear planet pinions to rotate against engine rotation in a counterclockwise direction. The rear band is holding the low reverse drum, which is splined to the rear carrier. Since the rear carrier is being held, the torque from the planet pinions is transferred to the rear annulus gear, which is splined to the output shaft. The output shaft in turn rotates with the annulus gear in a counterclockwise direction giving a reverse gear output. The entire transmission of torque is applied to the rear planetary gearset only. Although there is torque input to the front gearset through the sun gear, no other member of the gearset is being held. During the entire reverse stage of operation, the front planetary gears are in an idling condition.

FIRST GEAR POWERFLOW

When the gearshift lever is moved into the drive position the transmission goes into first gear (Fig. 6). As soon as the transmission is shifted from park or neutral to drive, the rear clutch applies, applying the rear clutch pack to the front annulus gear. Engine torque is now applied to the front annulus gear turning it in a clockwise direction. With the front annulus gear turning in a clockwise direction, it causes the front planets to turn in a clockwise direction. The rotation of the front planets cause the sun to revolve in a counterclockwise direction. The sun gear now transfers its counterclockwise rotation to the rear planets which rotate back in a clockwise direction. With the rear annulus gear stationary, the rear planet rotation on the annulus gear causes the rear planet carrier to revolve in a counterclockwise direction. The rear planet carrier is splined into the low-reverse drum, and the low reverse drum is splined to the inner race of the over-running clutch. With the over-running clutch locked, the planet carrier is held,

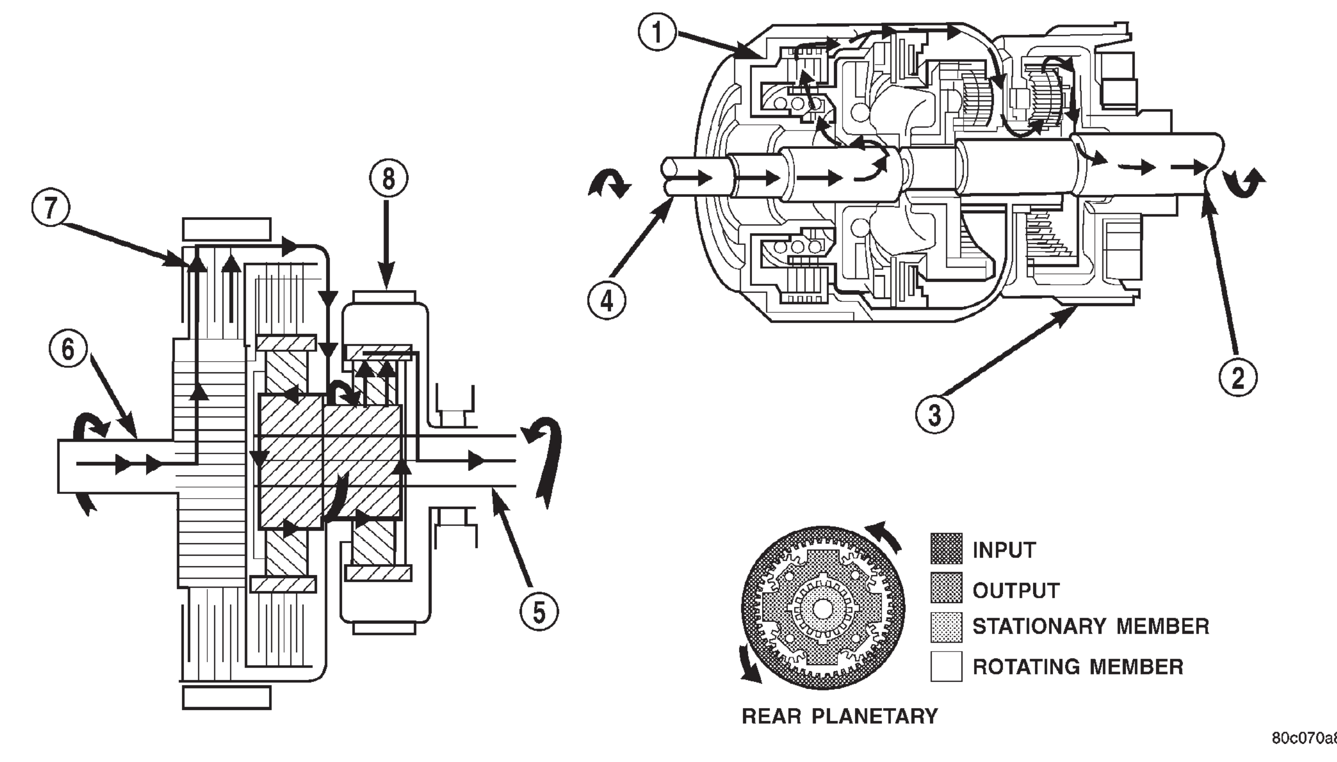


Fig. 5 Reverse Powerflow

1 – FRONT CLUTCH ENGAGED
2 – OUTPUT SHAFT
3 – LOW/REVERSE BAND APPLIED
4 – INPUT SHAFT
5 – OUTPUT SHAFT
6 – INPUT SHAFT
7 – FRONT CLUTCH ENGAGED
8 – LOW/REVERSE BAND APPLIED

DESCRIPTION AND OPERATION (Continued)

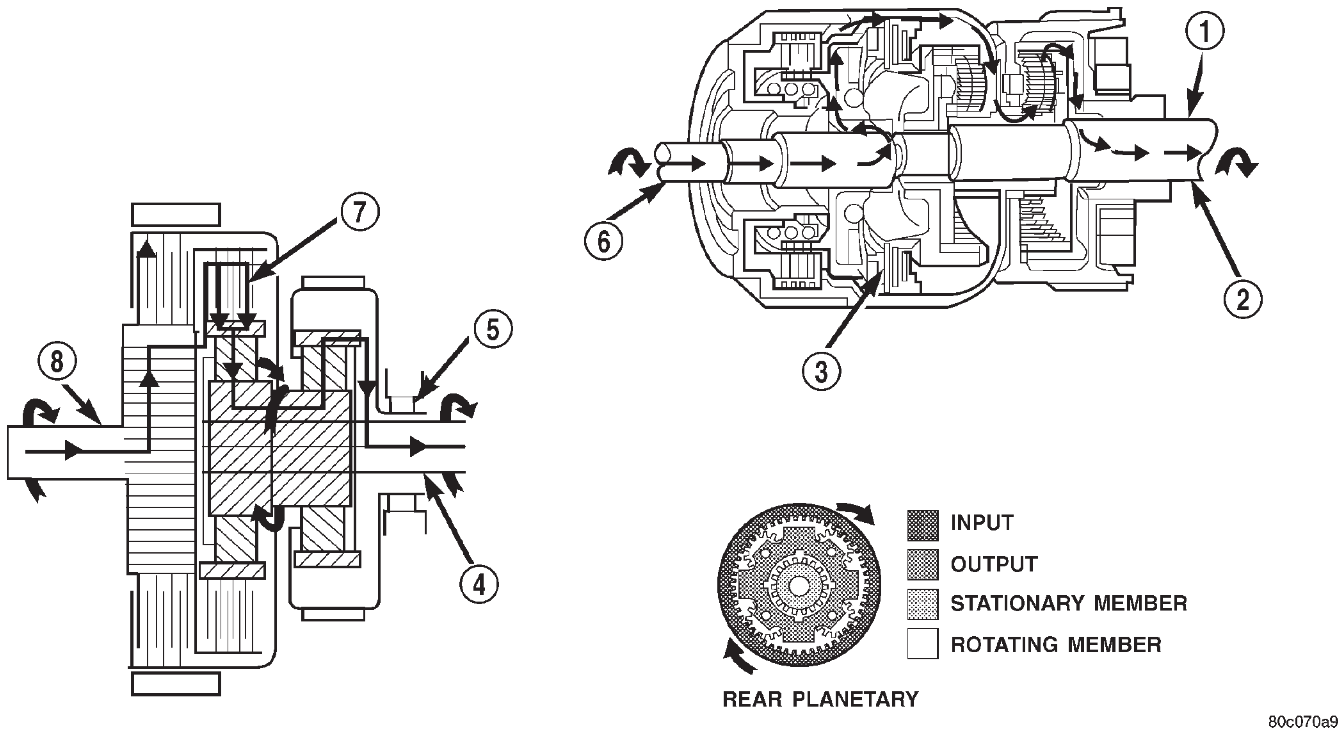


Fig. 6 First Gear Powerflow

1 – OUTPUT SHAFT
2 – OVER-RUNNING CLUTCH HOLDING
3 – REAR CLUTCH APPLIED
4 – OUTPUT SHAFT
5 – OVER-RUNNING CLUTCH HOLDING
6 – INPUT SHAFT
7 – REAR CLUTCH APPLIED
8 – INPUT SHAFT

and the resulting torque provided by the planet pinions is transferred to the rear annulus gear. The rear annulus gear is splined to the output shaft and rotated along with it (clockwise) in an underdrive gear reduction mode.

SECOND GEAR POWERFLOW

In drive-second (Fig. 7), the same elements are applied as in manual-second. Therefore, the power flow will be the same, and both gears will be discussed as one in the same. In drive-second, the transmission has proceeded from first gear to its shift point, and is shifting from first gear to second. The second gear shift is obtained by keeping the rear clutch applied and applying the front (kickdown) band. The front band holds the front clutch retainer that is locked to the sun gear driving shell. With the rear clutch still applied, the input is still on the front annulus gear turning it clockwise at engine speed. Now that the front band is holding the sun gear stationary, the annulus rotation causes the front planets to rotate in a clockwise direction. The front carrier is then also made to rotate in a clockwise direction but at a reduced speed. This will transmit the torque to the output shaft, which is directly connected to the front planet carrier. The rear planetary annulus gear will also be turning because it is directly splined to the output shaft. All power flow has occurred in the front planetary gear set during the drive-second stage of operation, and now the over-running clutch, in the rear of the transmission, is disengaged and freewheeling on its hub.

DESCRIPTION AND OPERATION (Continued)

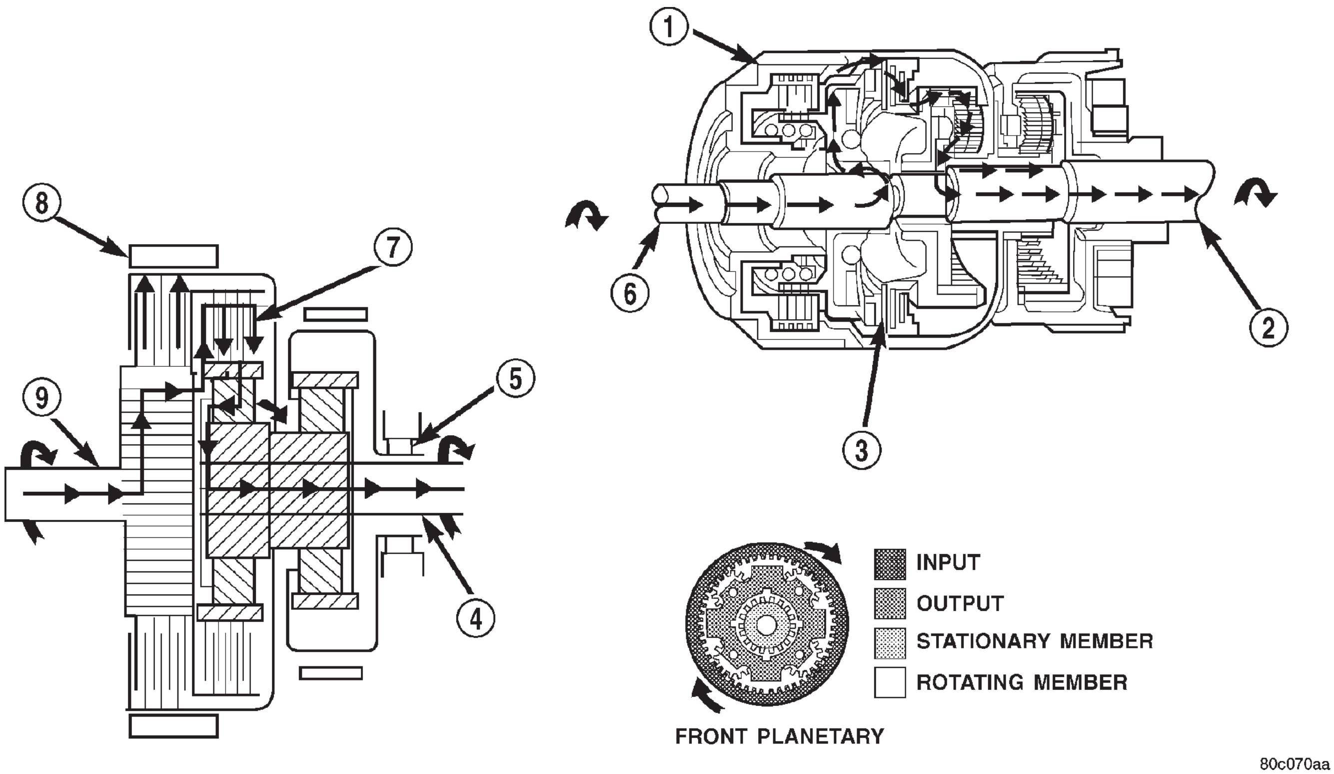


Fig. 7 Second Gear Powerflow

1 – KICKDOWN BAND APPLIED
2 – OUTPUT SHAFT
3 – REAR CLUTCH ENGAGED
4 – OUTPUT SHAFT
5 – OVER-RUNNING CLUTCH FREE-WHEELING
6 – INPUT SHAFT
7 – REAR CLUTCH APPLIED
8 – KICKDOWN BAND APPLIED
9 – INPUT SHAFT

DIRECT DRIVE POWERFLOW

The vehicle has accelerated and reached the shift point for the 2–3 upshift into direct drive (Fig. 8). When the shift takes place, the front band is released, and the front clutch is applied. The rear clutch stays applied as it has been in all the forward gears. With the front clutch now applied, engine torque is now on the front clutch retainer, which is locked to the sun gear driving shell. This means that the sun gear is now turning in engine rotation (clockwise) and at engine speed. The rear clutch is still applied so engine torque is also still on the front annulus gear. If two members of the same planetary set are driven, direct drive results. Therefore, when two members are rotating at the same speed and in the same direction, it is the same as being locked up. The rear planetary set is also locked up, given the sun gear is still the input, and the rear annulus gear must turn with the output shaft. Both gears are turning in the same direction and at the same speed. The front and rear planet pinions do not turn at all in direct drive. The only rotation is the input from the engine to the connected parts, which are acting as one common unit, to the output shaft.

DESCRIPTION AND OPERATION (Continued)

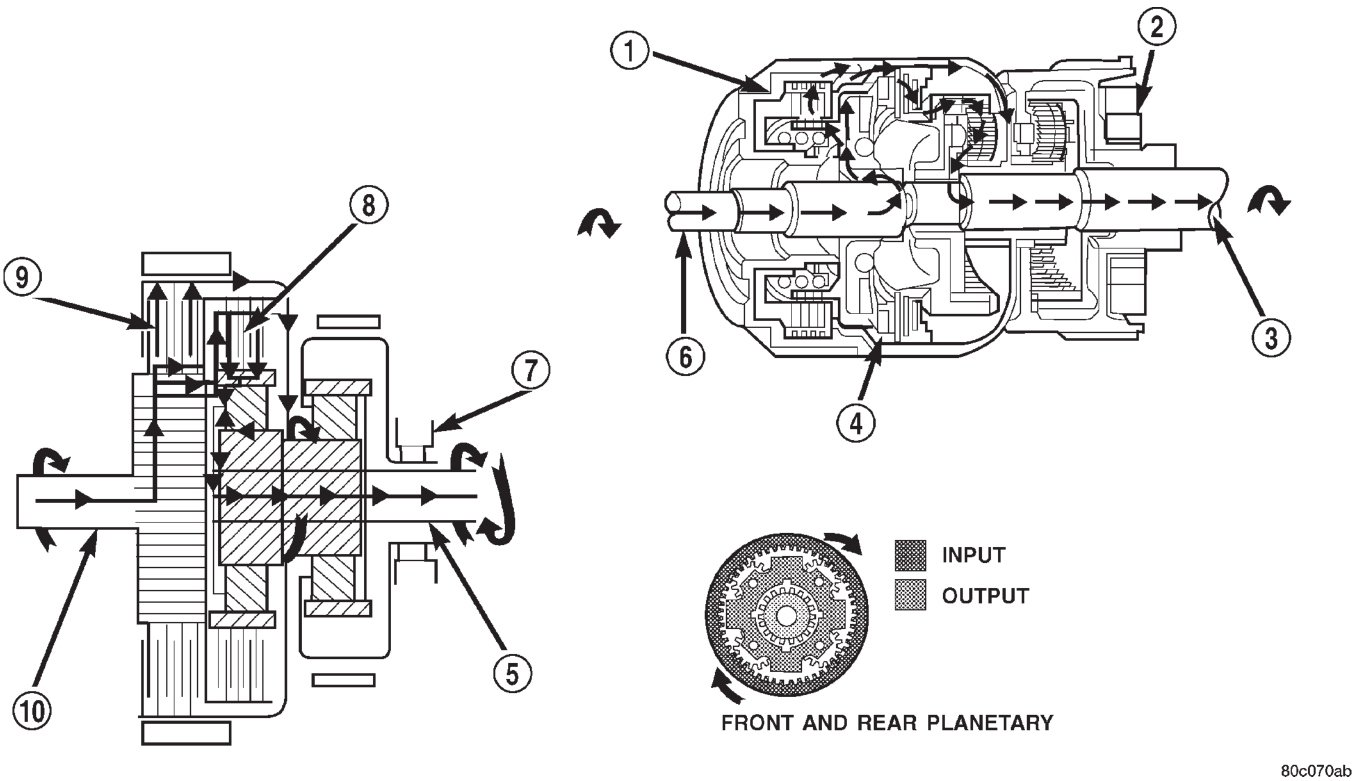


Fig. 8 Direct Drive Powerflow

1 – FRONT CLUTCH APPLIED
2 – OVER-RUNNING CLUTCH FREE-WHEELING
3 – OUTPUT SHAFT
4 – REAR CLUTCH APPLIED
5 – OUTPUT SHAFT
6 – INPUT SHAFT
7 – OVER-RUNNING CLUTCH FREE-WHEELING
8 – REAR CLUTCH APPLIED
9 – FRONT CLUTCH APPLIED
10 – INPUT SHAFT

FOURTH GEAR POWERFLOW

Fourth gear overdrive range is electronically controlled and hydraulically activated. Various sensor inputs are supplied to the powertrain control module to operate the overdrive solenoid on the valve body. The solenoid contains a check ball that opens and closes a vent port in the 3-4 shift valve feed passage. The overdrive solenoid (and check ball) are not energized in first, second, third, or reverse gear. The vent port remains open, diverting line pressure from the 2-3 shift valve away from the 3-4 shift valve. The overdrive control switch must be in the ON position to transmit overdrive status to the PCM. A 3-4 upshift occurs only when the overdrive solenoid is energized by the PCM. The PCM energizes the overdrive solenoid during the 3-4 upshift. This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position. This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston. Line pressure through the timing valve moves the overdrive piston into contact with the overdrive clutch. The direct clutch is disengaged before the overdrive clutch is engaged. The boost valve provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts, and when accelerating in fourth gear. The 3-4 accumulator cushions overdrive clutch engagement to smooth 3-4 upshifts. The accumulator is charged at the same time as apply pressure acts against the overdrive piston.

FLUID

NOTE: Refer to the maintenance schedules in Group 0, Lubrication and Maintenance for the recommended maintenance (fluid/filter change) intervals for this transmission.

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

DESCRIPTION AND OPERATION (Continued)

DESCRIPTION

Mopar® ATF Plus 3, Type 7176, automatic transmission fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Mopar® ATF Plus 3, Type 7176, automatic transmission fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** A dark brown/black fluid accompanied with a burnt odor and/or deterioration in shift quality may indicate fluid deterioration or transmission component failure.

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

OPERATION

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 9) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The converter clutch engages in third gear. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid. If the fluid is contaminated, flush the fluid cooler and lines.

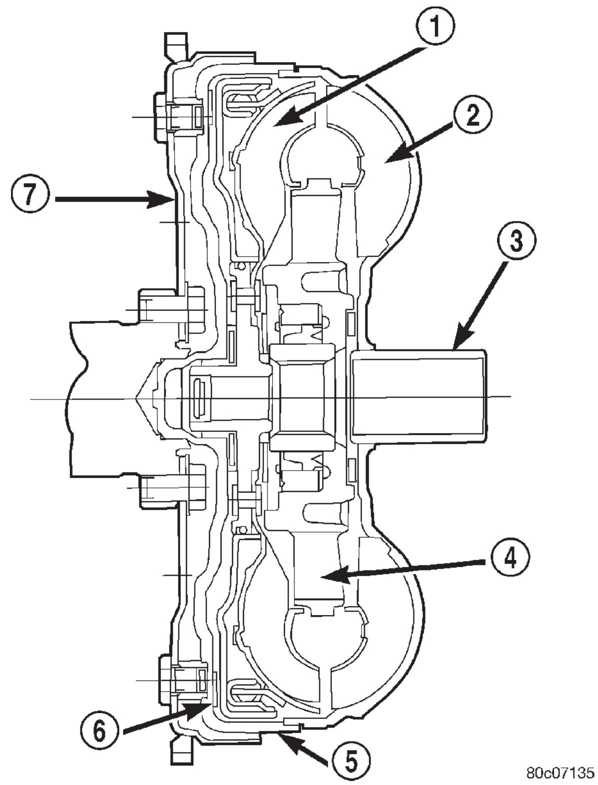


Fig. 9 Torque Converter Assembly

1 – TURBINE
2 – IMPELLER
3 – HUB
4 – STATOR
5 – FRONT COVER
6 – CONVERTER CLUTCH DISC
7 – DRIVE PLATE

IMPELLER

The impeller (Fig. 10) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the

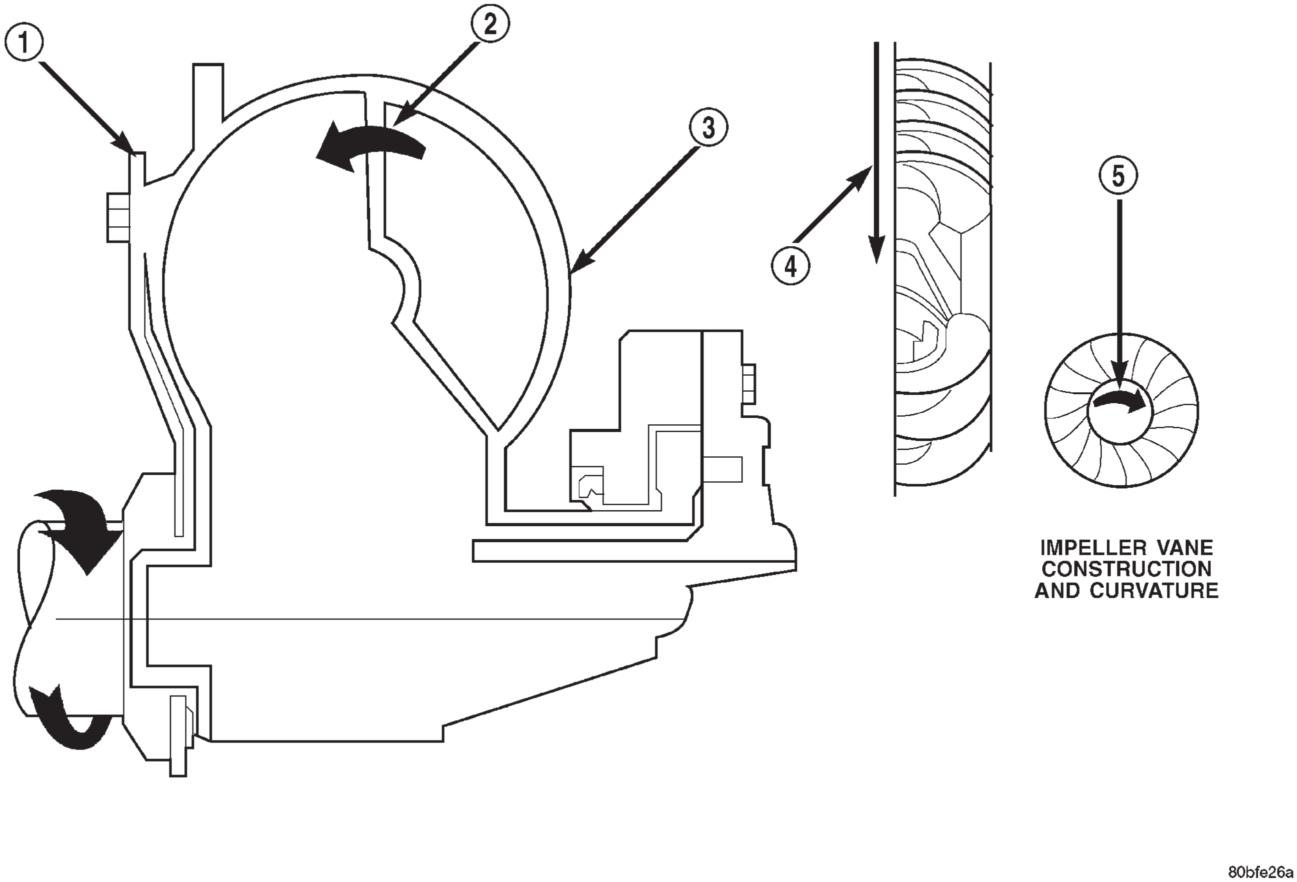


Fig. 10 Impeller

1 – ENGINE FLEXPLATE
2 – OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 – IMPELLER VANES AND COVER ARE INTEGRAL
4 – ENGINE ROTATION
5 – ENGINE ROTATION

impeller, because they are one and the same and are the driving member of the system.

TURBINE

The turbine (Fig. 11) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

DESCRIPTION AND OPERATION (Continued)

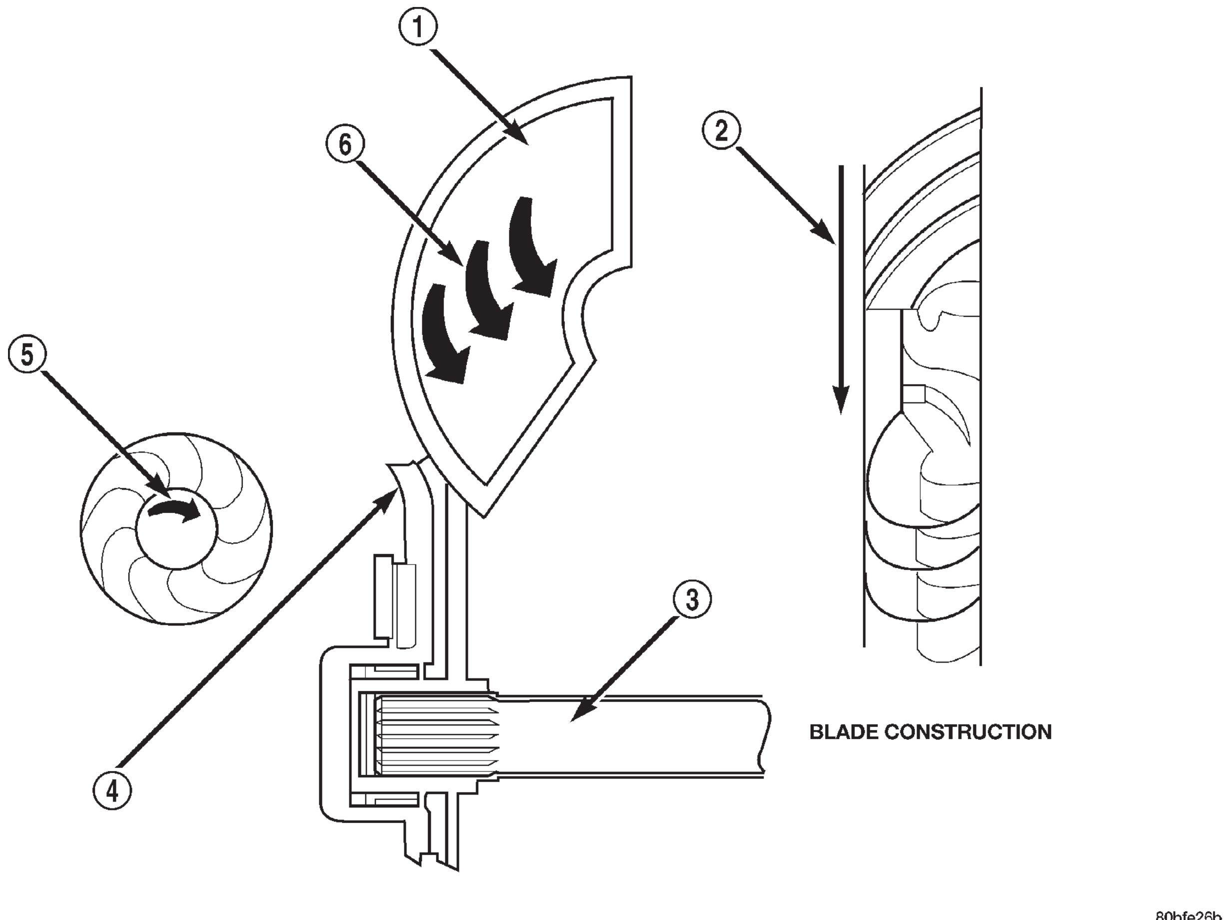


Fig. 11 Turbine

1 – TURBINE VANE
2 – ENGINE ROTATION
3 – INPUT SHAFT
4 – PORTION OF TORQUE CONVERTER COVER
5 – ENGINE ROTATION
6 – OIL FLOW WITHIN TURBINE SECTION

STATOR

The stator assembly (Fig. 12) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 13). The stator contains an over-running clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 14) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock–free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston was added to the turbine, and a friction material was added to the inside of the front cover to provide this mechanical lock-up.

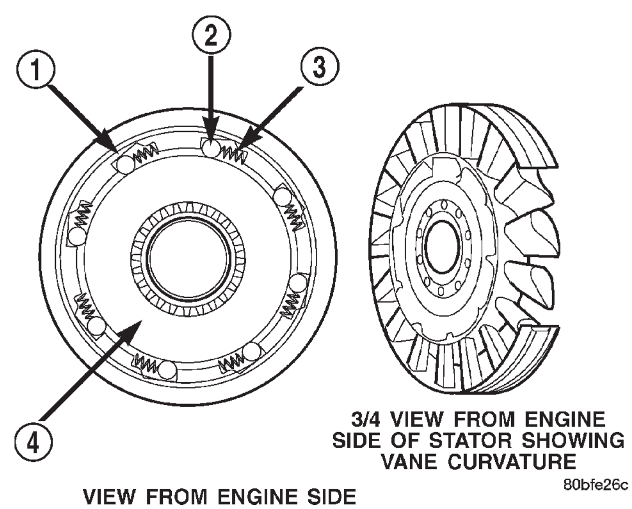


Fig. 12 Stator Components

1 – CAM (OUTER RACE)
2 – ROLLER
3 – SPRING
4 – INNER RACE

DESCRIPTION AND OPERATION (Continued)

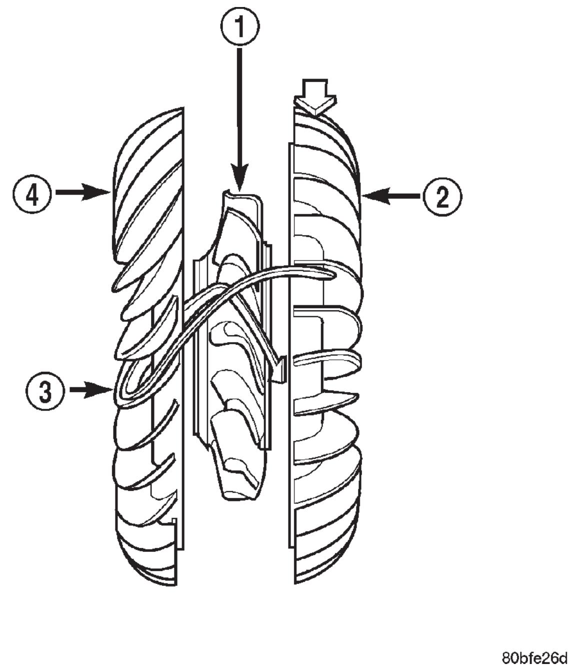


Fig. 13 Stator Location

1 – STATOR
2 – IMPELLER
3 – FLUID FLOW
4 – TURBINE

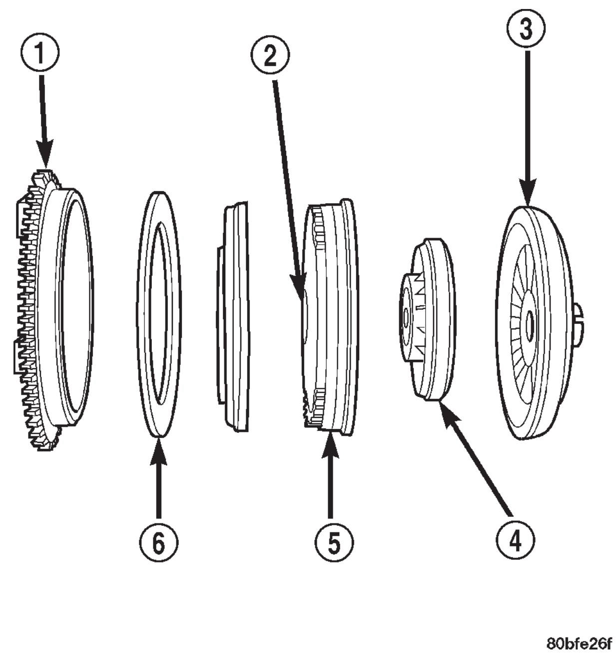


Fig. 14 Torque Converter Clutch (TCC)

1 – IMPELLER FRONT COVER
2 – THRUST WASHER ASSEMBLY
3 – IMPELLER
4 – STATOR
5 – TURBINE
6 – FRICTION DISC

OPERATION

The converter impeller (Fig. 15) (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 16). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over–running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock–up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston to the front cover's friction material, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

Converter clutch engagement in third or fourth gear range is controlled by sensor inputs to the powertrain control module. Inputs that determine clutch engagement are: coolant temperature, engine rpm, vehicle speed, throttle position, and manifold vacuum. The torque converter clutch is engaged by the

DESCRIPTION AND OPERATION (Continued)

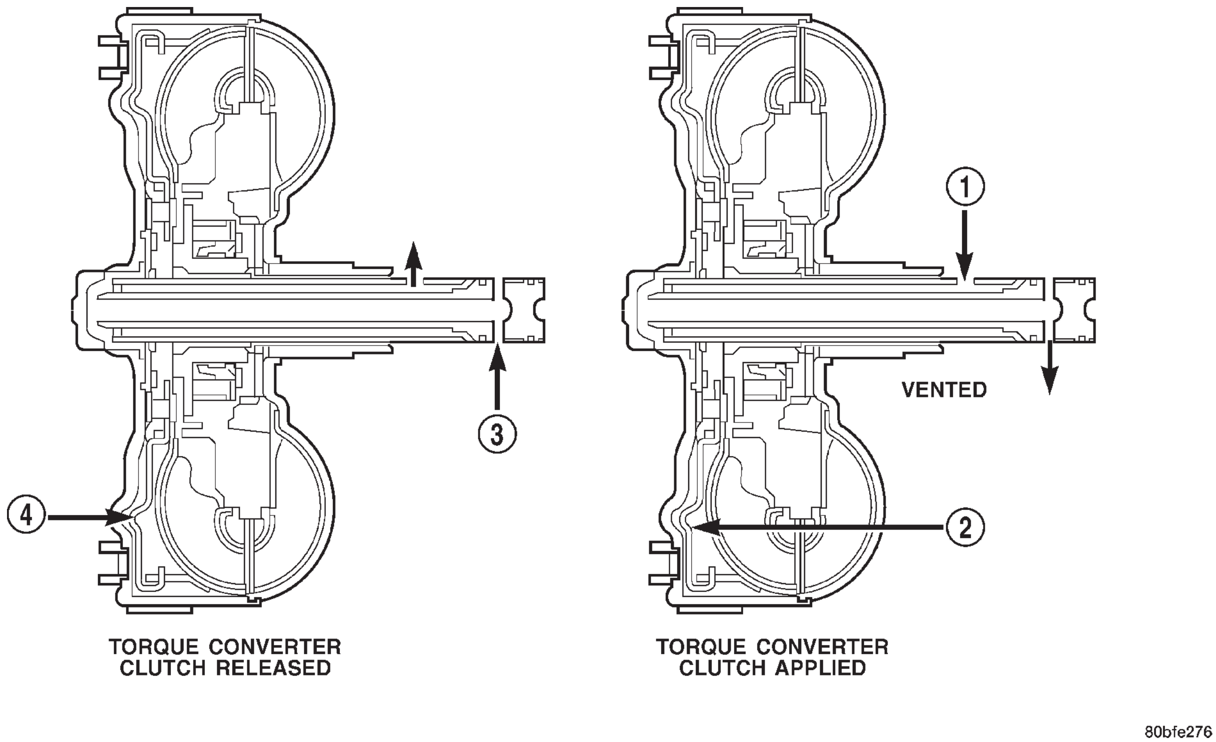


Fig. 15 Torque Converter Fluid Operation

1 – APPLY PRESSURE
2 – THE PISTON MOVES SLIGHTLY FORWARD
3 – RELEASE PRESSURE
4 – THE PISTON MOVES SLIGHTLY REARWARD

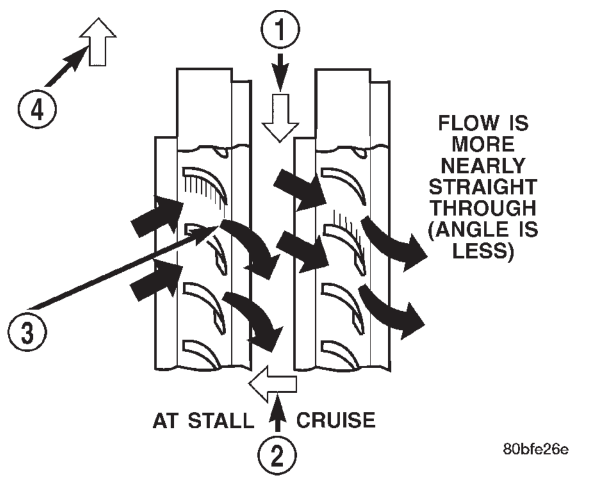


Fig. 16 Stator Operation

1 – DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 – FRONT OF ENGINE
3 – INCREASED ANGLE AS OIL STRIKES VANES
4 – DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

clutch solenoid on the valve body. The clutch can be engaged in third and fourth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear, and above approximately 72 km/h (45 mph). If the control switch is in the OFF position, the clutch will engage after the shift to third gear, at approximately 56 km/h (35 mph) at light throttle.

OIL PUMP

DESCRIPTION

The oil pump (Fig. 17) is located in the pump housing inside the bell housing of the transmission case. The oil pump consists of an inner and outer gear, a housing, and a cover that also serves as the reaction shaft support.

OPERATION

As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

DESCRIPTION AND OPERATION (Continued)

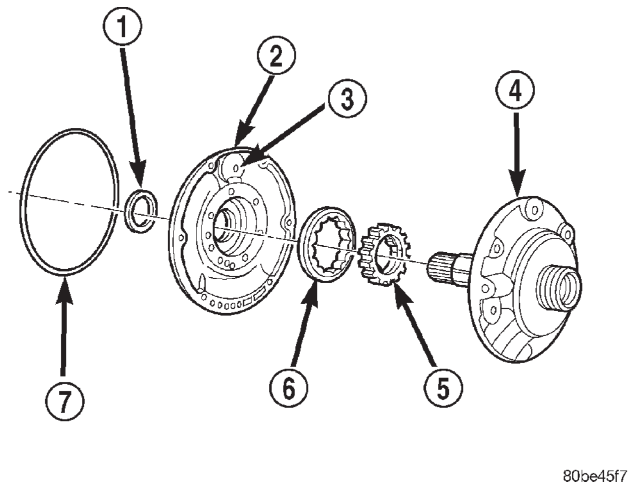


Fig. 17 Oil Pump Assembly

1 – OIL SEAL
2 – OIL PUMP BODY
3 – VENT
4 – REACTION SHAFT SUPPORT
5 – INNER ROTOR
6 – OUTER ROTOR
7 – “O” RING

VALVE BODY

DESCRIPTION

The valve body consists of a cast aluminum valve body, a separator plate, and transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components (Fig. 18), (Fig. 19), (Fig. 20), and (Fig. 21):

- Regulator valve
- Regulator valve throttle pressure plug
- Line pressure plug and sleeve
- Kickdown valve
- Kickdown limit valve
- 1–2 shift valve
- 1–2 control valve
- 2–3 shift valve
- 2–3 governor plug
- 3–4 shift valve
- 3–4 timing valve
- 3–4 quick fill valve
- 3–4 accumulator
- Throttle valve
- Throttle pressure plug
- Switch valve
- Manual valve
- Converter clutch lock-up valve
- Converter clutch lock-up timing Valve
- Shuttle valve
- Shuttle valve throttle plug
- Boost Valve
- 10 check balls

By adjusting the spring pressure acting on the regulator valve, transmission line pressure can be adjusted.

DESCRIPTION AND OPERATION (Continued)

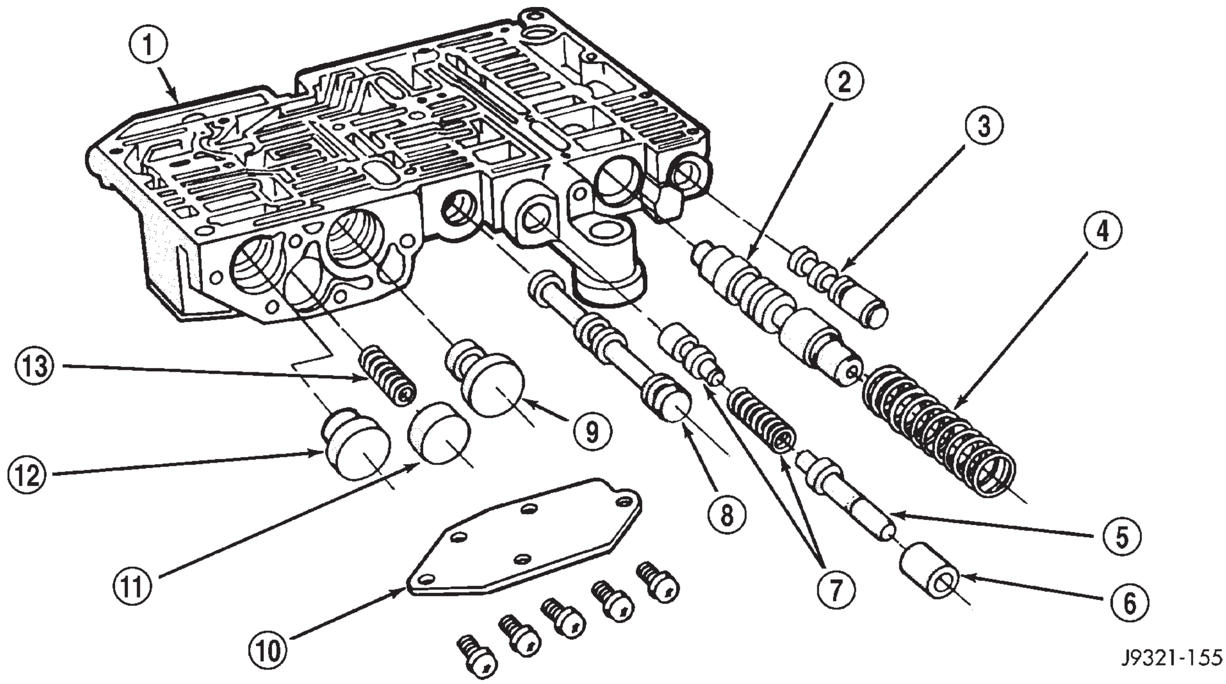


Fig. 18 Upper Housing Control Valve Locations

1 – UPPER HOUSING
2 – REGULATOR VALVE
3 – SWITCH VALVE
4 – REGULATOR VALVE SPRING
5 – KICKDOWN VALVE
6 – KICKDOWN DETENT
7 – THROTTLE VALVE AND SPRING
8 – MANUAL VALVE
9 – 1–2 GOVERNOR PLUG
10 – GOVERNOR PLUG COVER
11 – THROTTLE PLUG
12 – 2–3 GOVERNOR PLUG
13 – SHUTTLE VALVE PRIMARY SPRING

DESCRIPTION AND OPERATION (Continued)

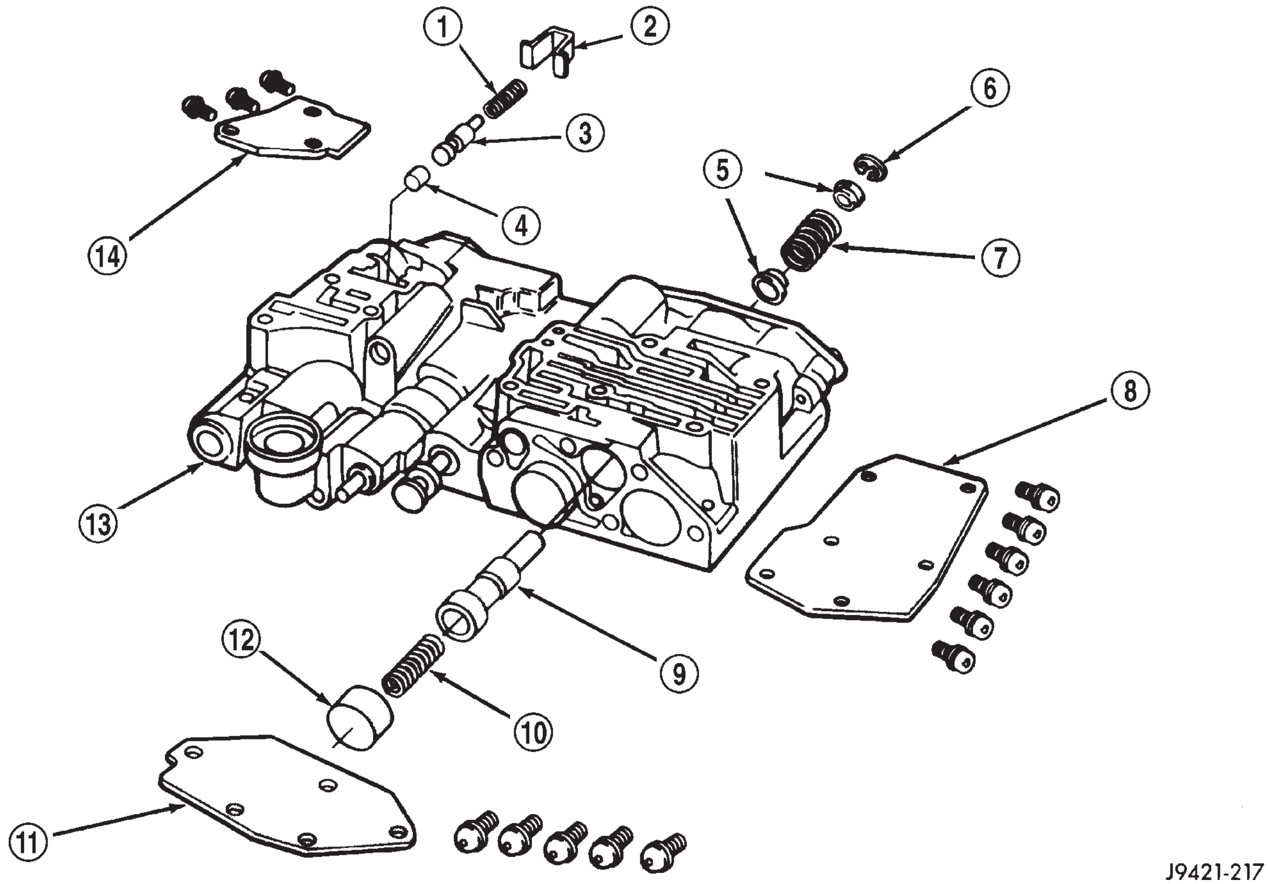


Fig. 19 Shuttle and Boost Valve Locations

1 – SPRING
2 – RETAINER
3 – BOOST VALVE
4 – BOOST VALVE PLUG
5 – SPRING GUIDES
6 – E-CLIP
7 – SHUTTLE VALVE SECONDARY SPRING
8 – SHUTTLE VALVE COVER
9 – SHUTTLE VALVE
10 – SHUTTLE VALVE PRIMARY SPRING
11 – GOVERNOR PLUG COVER
12 – THROTTLE PLUG
13 – UPPER HOUSING
14 – BOOST VALVE COVER

DESCRIPTION AND OPERATION (Continued)

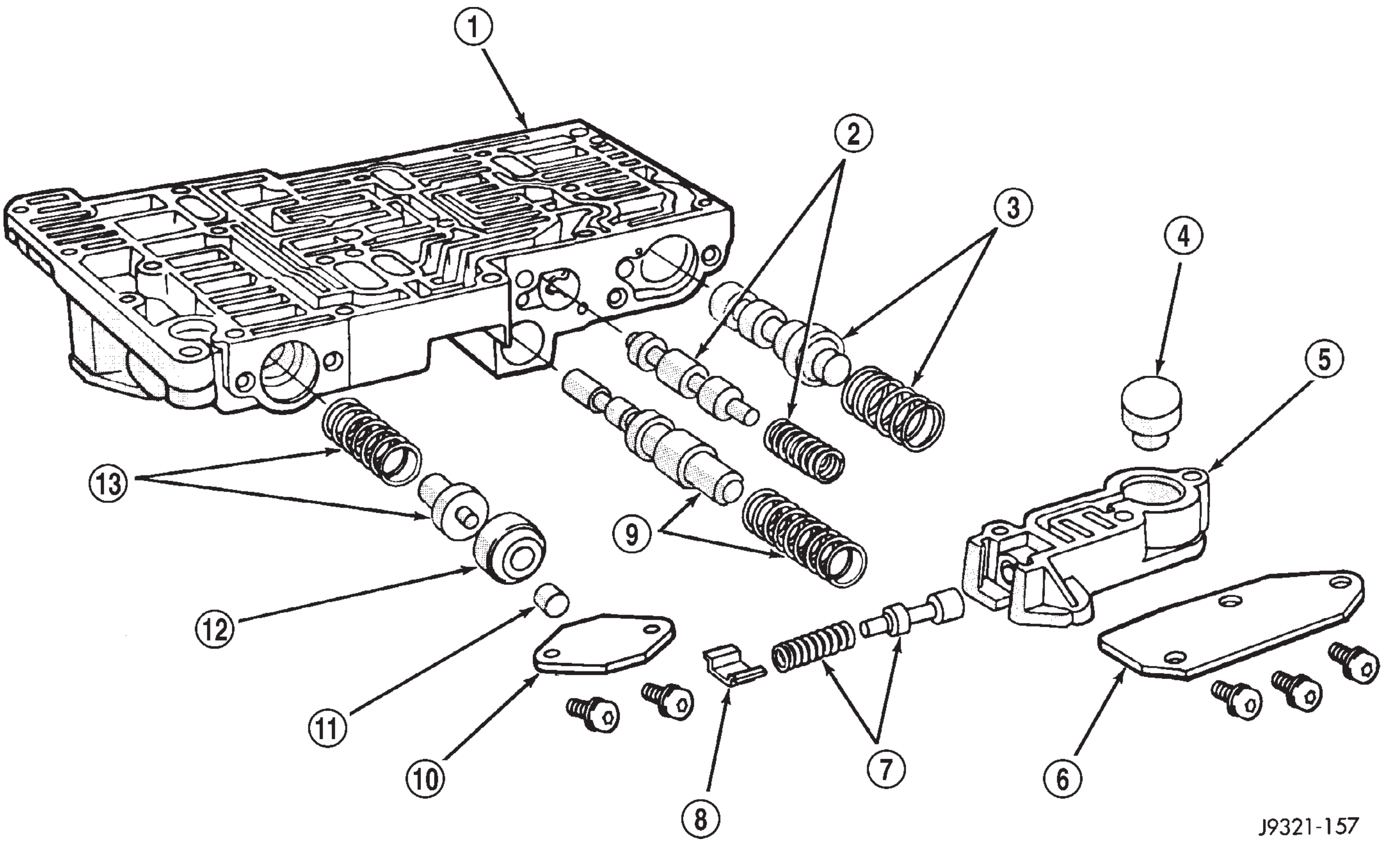


Fig. 20 Upper Housing Shift Valve and Pressure Plug Locations

1 – UPPER HOUSING
2 – 1–2 SHIFT VALVE AND SPRING
3 – 2–3 SHIFT VALVE AND SPRING
4 – 2–3 THROTTLE PLUG
5 – LIMIT VALVE HOUSING
6 – LIMIT VALVE COVER
7 – LIMIT VALVE AND SPRING
8 – RETAINER
9 – 1–2 SHIFT CONTROL VALVE AND SPRING
10 – PRESSURE PLUG COVER
11 – LINE PRESSURE PLUG
12 – PLUG SLEEVE
13 – THROTTLE PRESSURE SPRING AND PLUG

DESCRIPTION AND OPERATION (Continued)

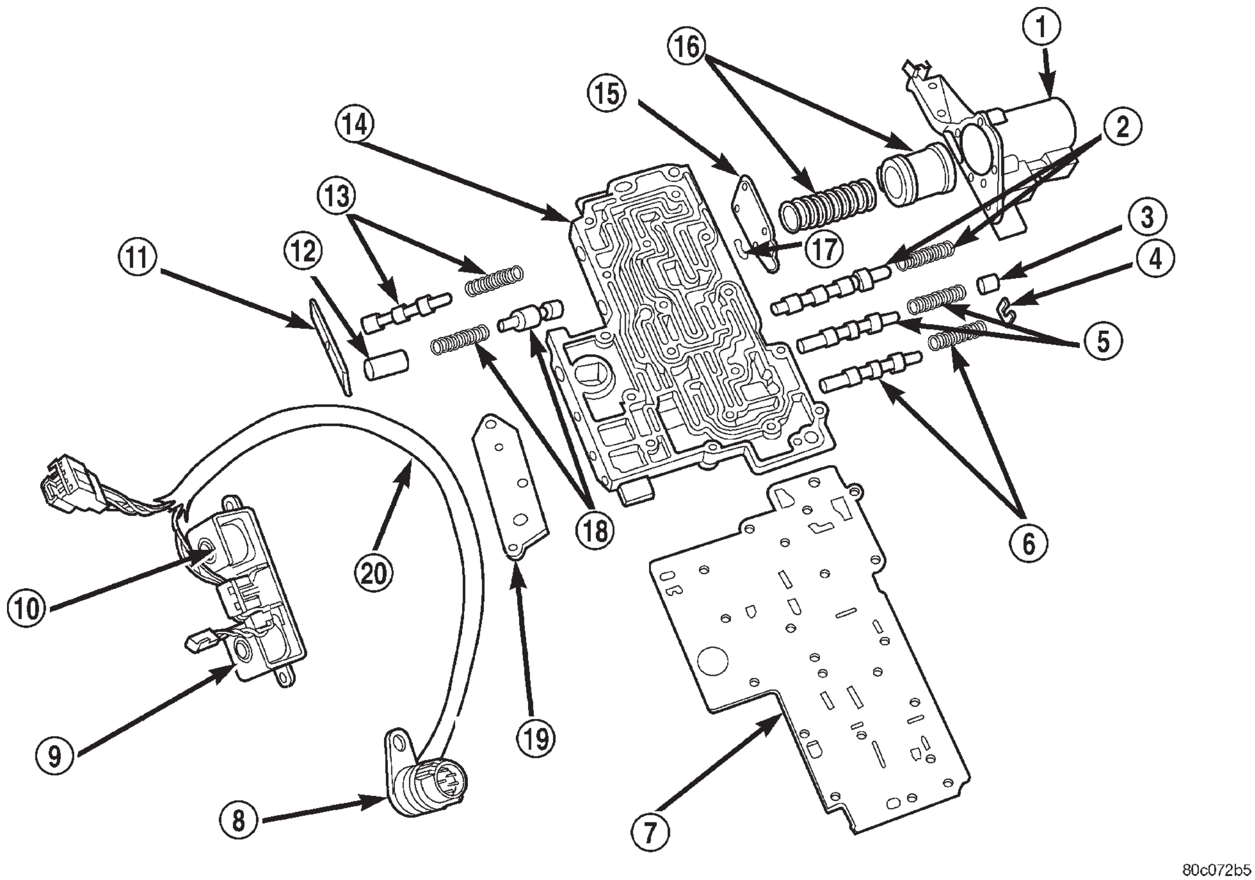


Fig. 21 Lower Housing Shift Valves And Springs

1 – 3-4 ACCUMULATOR HOUSING
2 – 3-4 SHIFT VALVE AND SPRING
3 – PLUG
4 – SPRING RETAINER
5 – CONVERTER CLUTCH VALVE AND SPRING
6 – CONVERTER CLUTCH TIMING VALVE AND SPRING
7 – OVERDRIVE SEPARATOR PLATE
8 – CASE CONNECTOR
9 – CONVERTER CLUTCH SOLENOID
10 – OVERDRIVE SOLENOID
11 – TIMING VALVE COVER
12 – PLUG
13 – 3-4 TIMING VALVE AND SPRING
14 – LOWER HOUSING
15 – ACCUMULATOR END PLATE
16 – 3-4 ACCUMULATOR PISTON AND SPRING
17 – E-CLIP
18 – 3-4 QUICK FILL SPRING AND VALVE
19 – SOLENOID GASKET
20 – HARNESS

OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

REGULATOR VALVE

The pressure regulator valve is needed to control the hydraulic pressure within the system and reduce the amount of heat produced in the fluid. The pressure regulator valve is located in the valve body near the manual valve. The pressure regulator valve train controls the maximum pressure in the lines by metering the dumping of fluid back into the sump. Regulated pressure is referred to as “line pressure.”

The regulator valve (Fig. 22) has a spring on one end that pushes the valve to the left. This closes a dump (vent) that is used to lower pressure. The closing of the dump will cause the oil pressure to increase. Oil pressure on the opposite end of the valve pushes the valve to the right, opening the dump and lowering oil pressure. The result is spring pressure working against oil pressure to maintain the oil at specific pressures. With the engine running, fluid flows from the pump to the pressure regulator valve, manual valve, and the interconnected circuits. As fluid is sent through passages to the regulator valve, the pressure pushes the valve to the right against the large spring. It is also sent to the reaction areas on the left side of the throttle pressure plug and the line pressure plug. With the gear selec-

DESCRIPTION AND OPERATION (Continued)

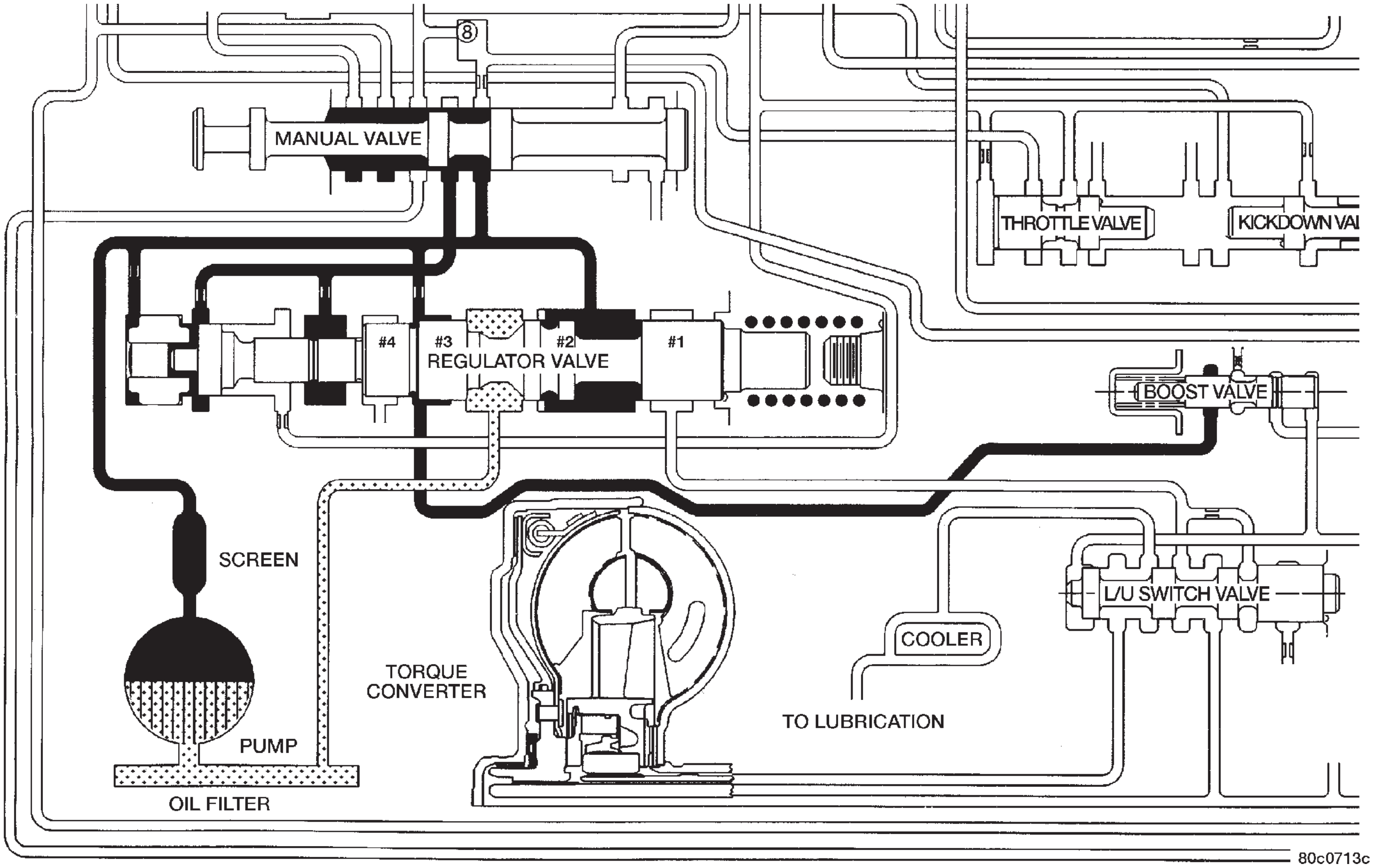


Fig. 22 Regulator Valve in Park Position

tor in the park position, fluid recirculates through the regulator and manual valves back to the sump.

Meanwhile, the torque converter is filled slowly. In all other gear positions (Fig. 23), fluid flows between two right side lands to the switch valve and torque converter. At low pump speeds, the flow is controlled by the pressure valve groove to reduce pressure to the torque converter. After the torque converter and switch valve fill with fluid, the switch valve becomes the controlling metering device for torque converter pressure. The regulator valve then begins to control the line pressure for the other transmission circuits. The balance of the fluid pressure pushing the valve to the right and the spring pressure pushing to the left determines the size of the metering passage at land #2 (land #1 being at the far right of the valve in the diagram). As fluid leaks past the land, it moves into a groove connected to the filter or sump. As the land meters the fluid to the sump, it causes the pressure to reduce and the spring decreases the size of the metering passage. When the size of the metering passage is reduced, the pressure rises again and the size of the land is increased again. Pressure is regulated by this constant balance of hydraulic and spring pressure.

The metering at land #2 establishes the line pressure throughout the transmission. It is varied according to changes in throttle position, engine speed, and transmission condition within a range of 57–94 psi (except in reverse) (Fig. 24). The regulated line pressure in reverse (Fig. 25) is held at much higher pressures than in the other gear positions: 145–280 psi. The higher pressure for reverse is achieved by the manual valve blocking the supply of line pressure to the reaction area left of land #4. With this pressure blocked, there is less area for pressure to act on to balance the force of the spring on the right. This allows line pressure to push the valve train to the right, reducing the amount of fluid returned to the pump's inlet, increasing line pressure.

DESCRIPTION AND OPERATION (Continued)

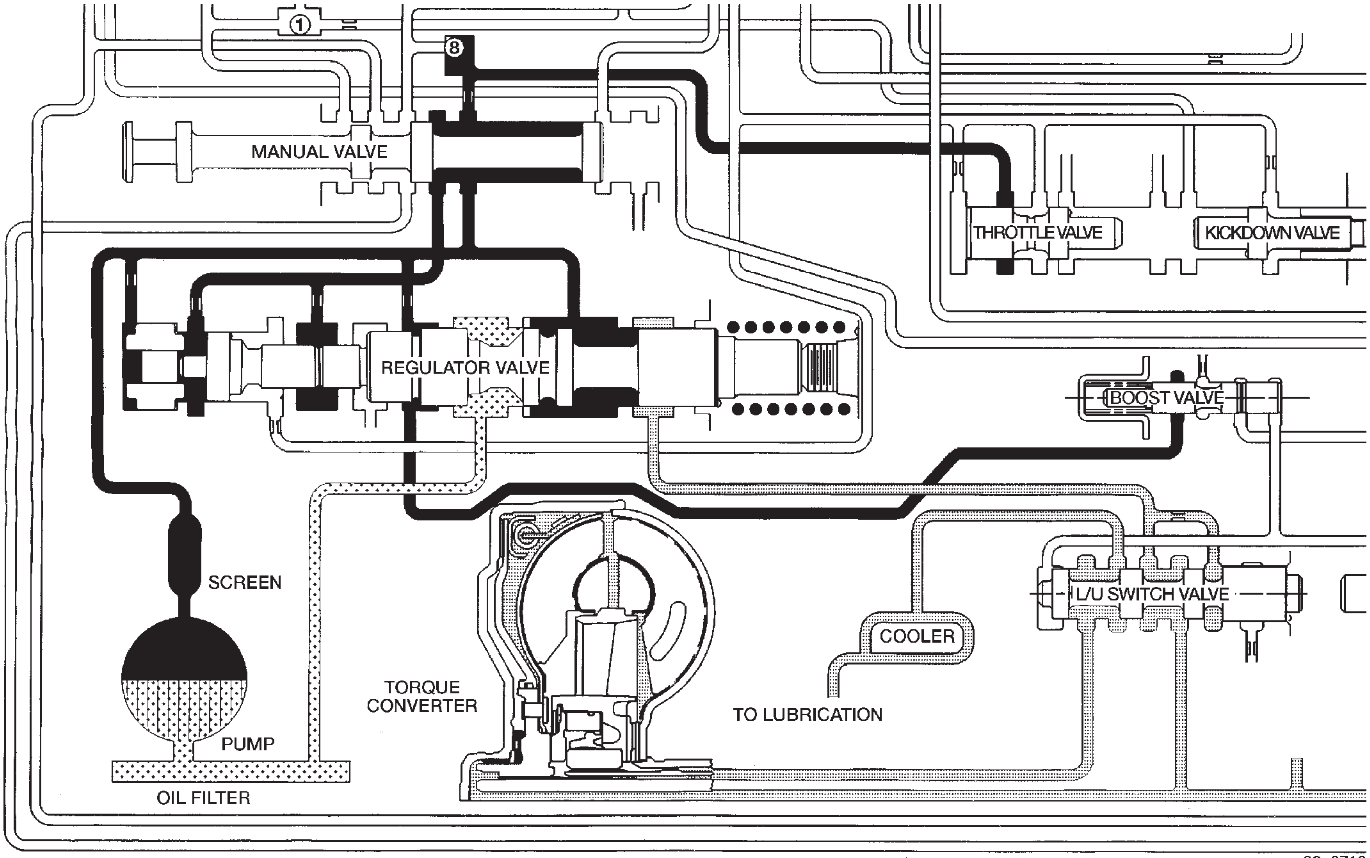


Fig. 23 Regulator Valve in Neutral Position

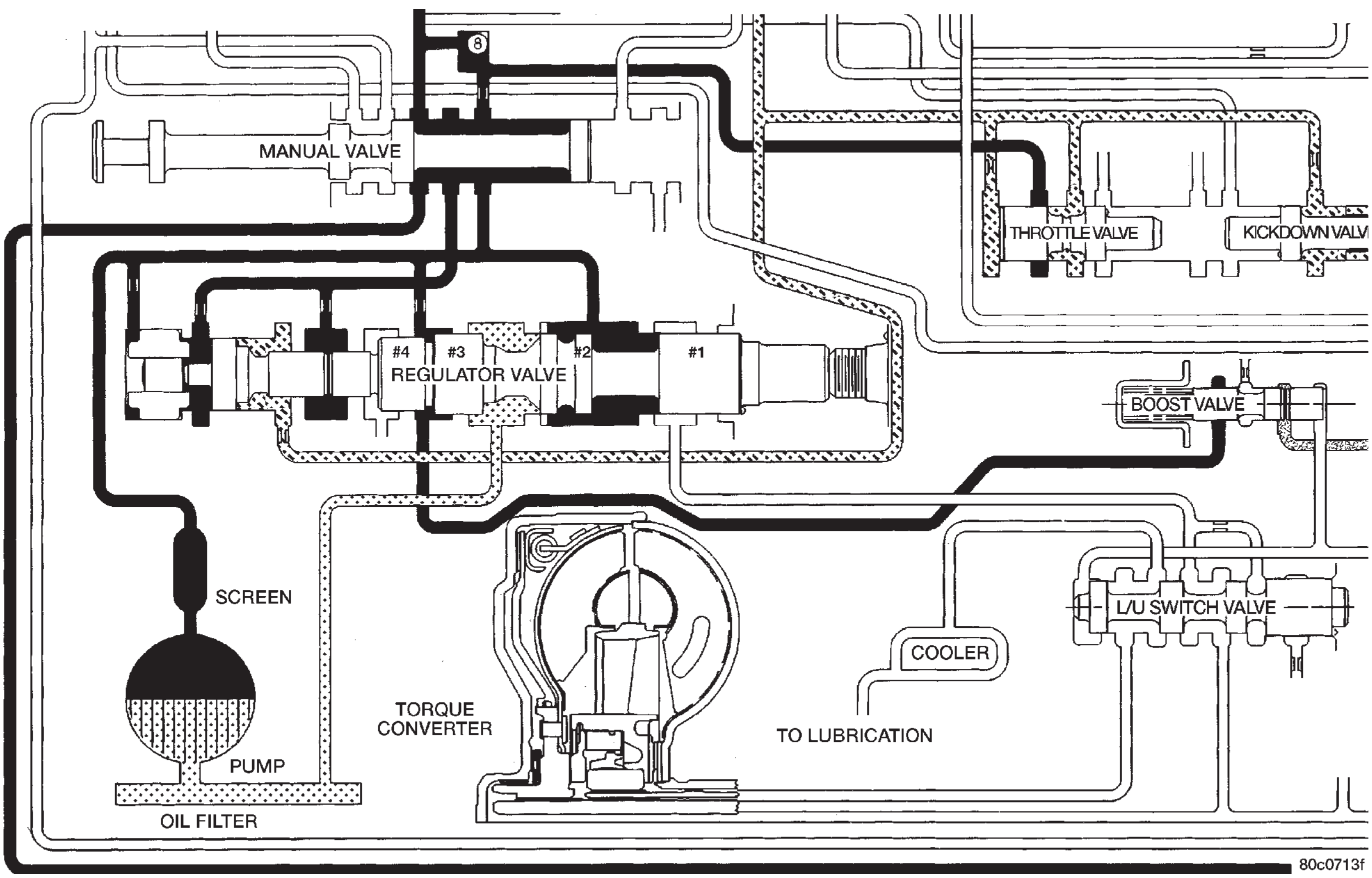


Fig. 24 Regulator Valve in Drive Position

DESCRIPTION AND OPERATION (Continued)

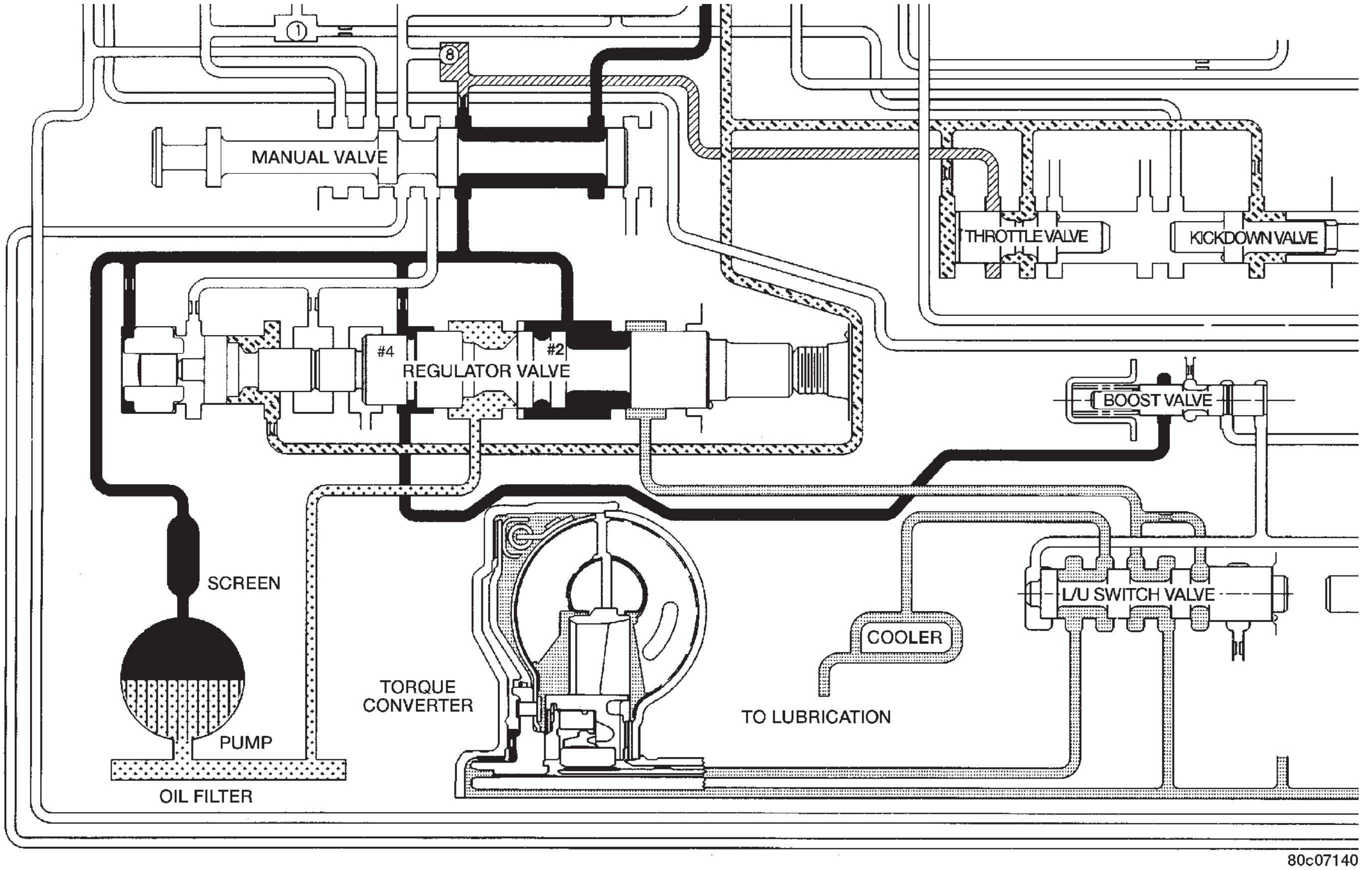


Fig. 25 Regulator Valve in Reverse Position

KICKDOWN VALVE

When the throttle valve is as far over to the left as it can go, the maximum line pressure possible will enter the throttle pressure circuit. In this case, throttle pressure will equal line pressure. With the kickdown valve (Fig. 26) pushed into the bore as far as it will go, fluid initially flows through the annular groove of the 2–3 shift valve (which will be in the direct drive position to the right).

After passing the annular groove, the fluid is routed to the spring end of the 2–3 shift valve. Fluid pressure reacting on the area of land #1 overcomes governor pressure, downshifting the 2–3 shift valve into the kickdown, or second gear stage of operation. The valve is held in the kickdown position by throttle pressure routed from a seated check ball (#2). Again, if vehicle speed is low enough, throttle pressure will also push the 1–2 shift valve left to seat its governor plug, and downshift to drive breakaway.

KICKDOWN LIMIT VALVE

The purpose of the limit valve is to prevent a 3–2 downshift at higher speeds when a part–throttle downshift is not desirable. At these higher speeds only a full throttle 3–2 downshift will occur. At low road speeds (Fig. 27) the limit valve does not come into play and does not affect the downshifts. As the vehicle's speed increases (Fig. 28), the governor pressure also increases. The increased governor pressure acts on the reaction area of the bottom land of the limit valve overcoming the spring force trying to push the valve toward the bottom of its bore. This pushes the valve upward against the spring and bottoms the valve against the top of the housing. With the valve bottomed against the housing, the throttle pressure supplied to the valve will be closed off by the bottom land of the limit valve. When the supply of throttle pressure has been shut off, the 3–2 part throttle downshift plug becomes inoperative, because no pressure is acting on its reaction area.

1–2 SHIFT VALVE

The 1–2 shift valve assembly (Fig. 29), or mechanism, consists of: the 1–2 shift valve, governor plug, and a spring on the end of the valve. After the manual valve has been placed into a forward gear range, line pressure is directed to the 1–2 shift valve. As the throttle is depressed, throttle pressure is applied to the right side of the 1–2 shift valve assembly. With throttle pressure applied to the right side of the valve, there is now both spring pressure and throttle pressure acting on the valve, holding it against the governor plug. As the vehicle begins to move and

DESCRIPTION AND OPERATION (Continued)

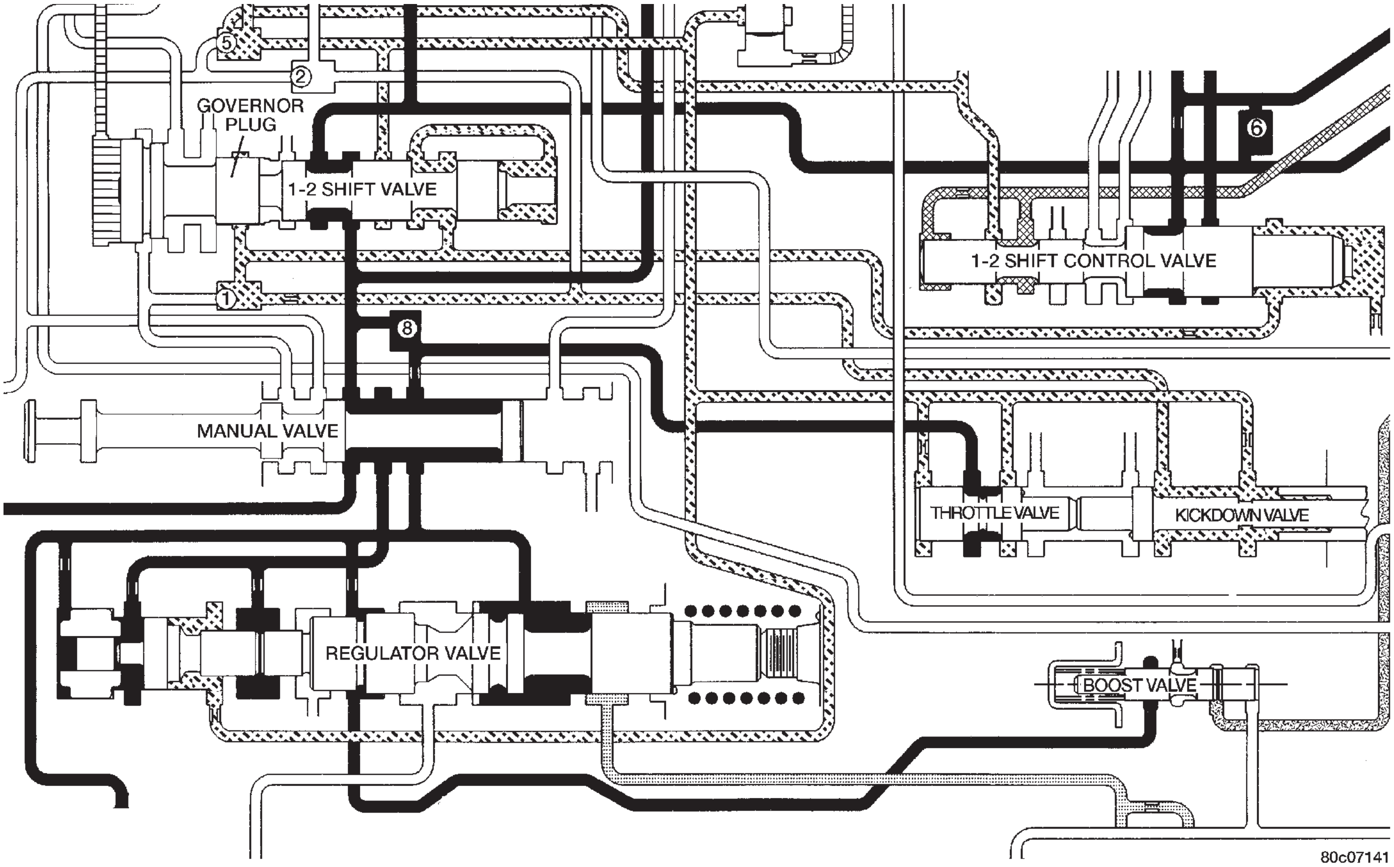


Fig. 26 Kickdown Valve–Wide Open Throttle

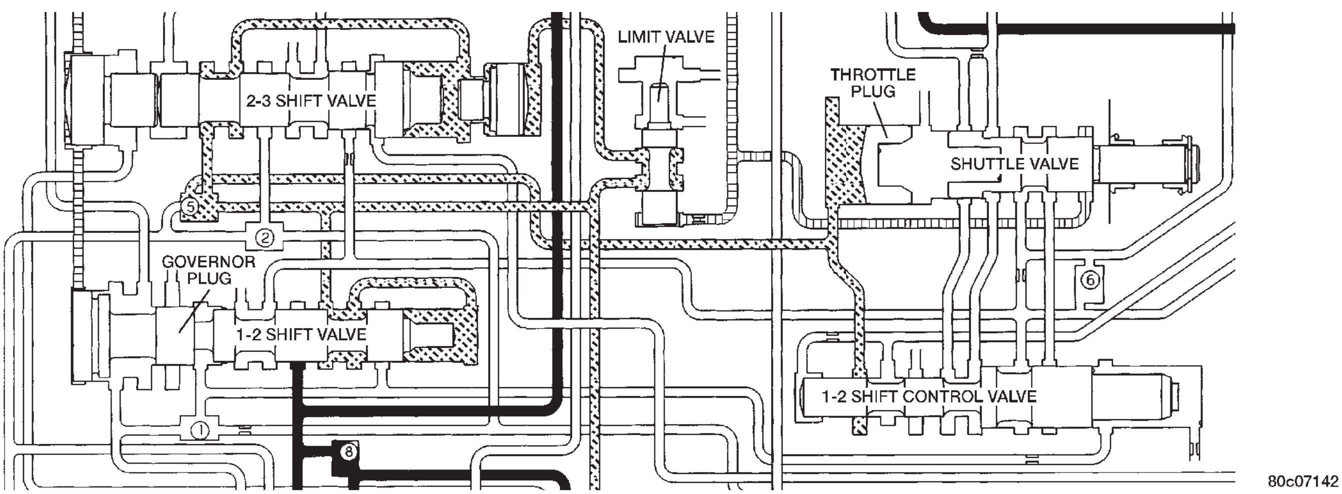


Fig. 27 Kickdown Limit Valve-Low Speeds

build speed, governor pressure is created and is applied to the left of the valve at the governor plug.

When governor pressure builds to a point where it can overcome the combined force of the spring and throttle pressure on the other side of the valve, the valve will begin to move over to the right. As the valve moves to the right, the middle land of the valve will close off the circuit supplying the throttle pressure to the right side of the valve. When the throttle pressure is closed off, the valve will move even further to the right, allowing line pressure to enter another circuit and energize the front servo, applying the front band (Fig. 30).

The governor plug serves a dual purpose:

• It allows the shift valves to move either left or right, allowing both upshifts and downshifts.

• When in a manual selection position, it will be hydraulically “blocked” into position so no upshift can occur.

DESCRIPTION AND OPERATION (Continued)

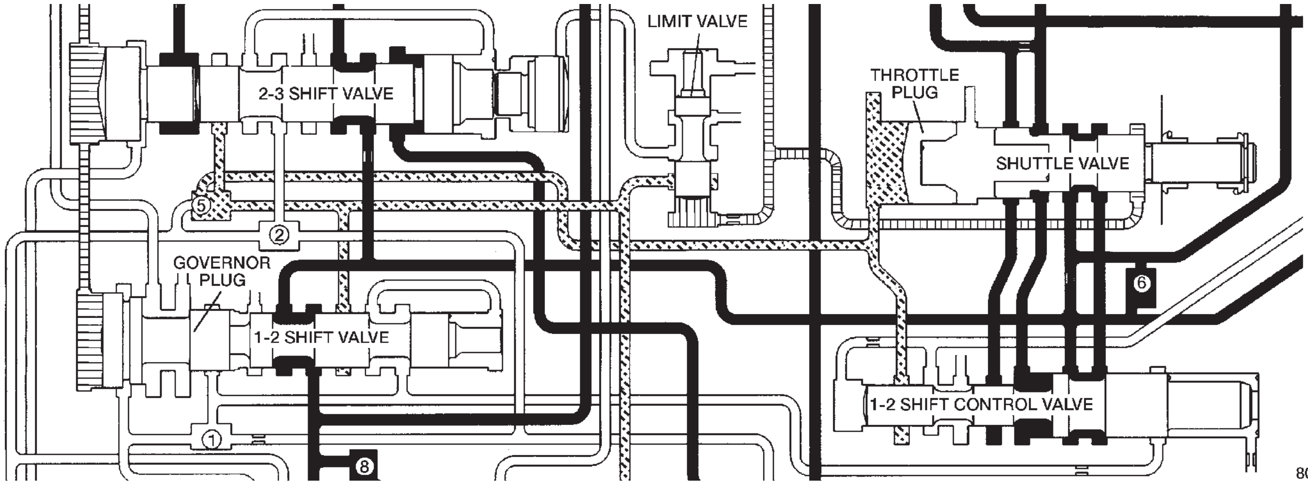


Fig. 28 Kickdown Limit Valve-High Speeds

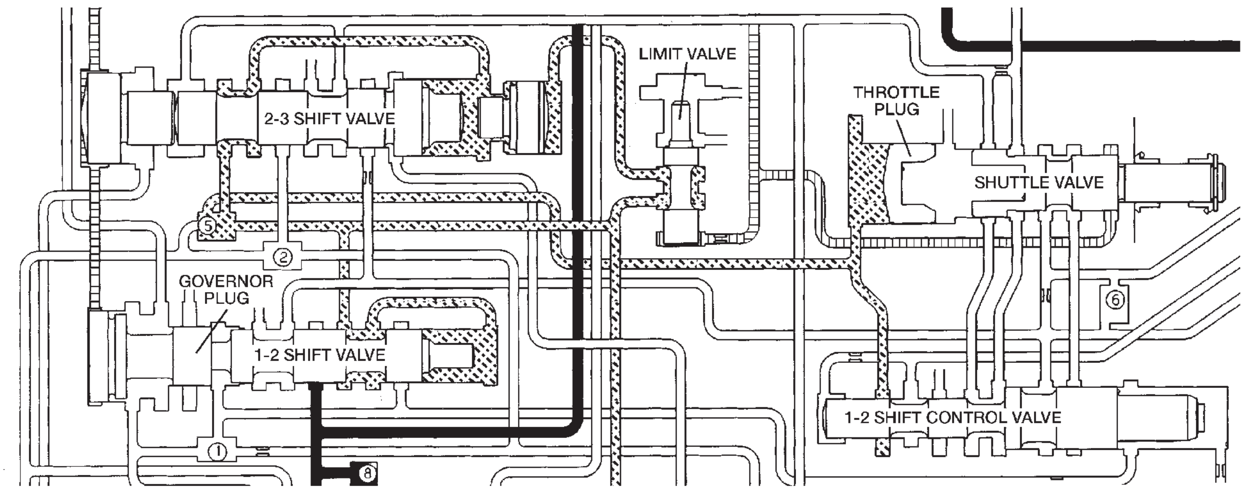


Fig. 29 1–2 Shift Valve-Before Shift

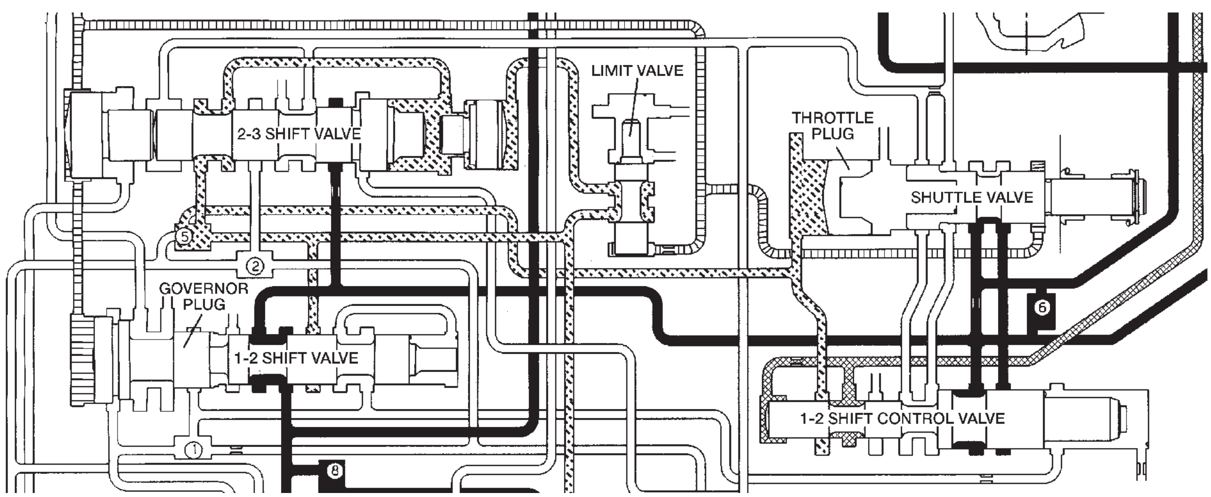


Fig. 30 1–2 Shift Valve-After Shift

The physical blocking of the upshift while in the manual “1” position is accomplished by the directing of line pressure between both lands of the governor plug. The line pressure reacts against the larger land of the plug, pushing the plug back against the end plate overcoming governor pressure. With the combination of the line pressure and spring pressure, the valve cannot move, preventing any upshift.

DESCRIPTION AND OPERATION (Continued)

1–2 SHIFT CONTROL VALVE

It contains a valve with four lands and a spring. It is used as both a “relay” and “balanced” valve.

The valve has two specific operations (Fig. 31):

- Aid in quality of the 1–2 upshift.
- Aid in the quality and timing of the 3–2 kickdown ranges.

When the manual valve is set to the Drive position and the transmission is in the first or second gear range, 1–2 shift control or “modulated throttle pressure” is supplied to the middle of the accumulator piston by the 1–2 shift control valve. During the 1–2 upshift, this pressure is used to control the kickdown servo apply pressure that is needed to apply the kickdown and accumulator pistons. Thus, the 1–2 shift point is “cushioned” and the quality is improved. During a WOT kickdown, kickdown pressure is applied between the kickdown valve and the 1–2 shift control valve. This additional pressure is directed to the 1–2 shift control’s spring cavity, adding to the spring load on the valve. The result of this increased “modulated” throttle pressure is a firmer WOT upshift.

2–3 SHIFT VALVE

The 2–3 shift valve mechanism (Fig. 32) consists of the 2–3 shift valve, governor plug and spring, and a throttle plug. After the 1–2 shift valve has completed its operation and applied the front band, line pressure is directed to the 2–3 shift valve through the connecting passages from the 1–2 shift valve. The line pressure will then dead–end at land #2 until the 2–3 valve is ready to make its shift. Now that the vehicle is in motion and under acceleration, there is throttle pressure being applied to the spring side of the valve and between lands #3 and #4.

As vehicle speed increases, governor pressure increases proportionately, until it becomes great enough to overcome the combined throttle and spring pressure on the right side of the valve. When this happens, the governor plug is forced against the shift valve moving it to the right. The shift valve causes land #4 to close the passage supplying throttle pressure to the 2–3 shift valve. Without throttle pressure present in the circuit now, the governor plug will push the valve over far enough to bottom the valve in its bore. This allows land #2 to direct line pressure to the front clutch.

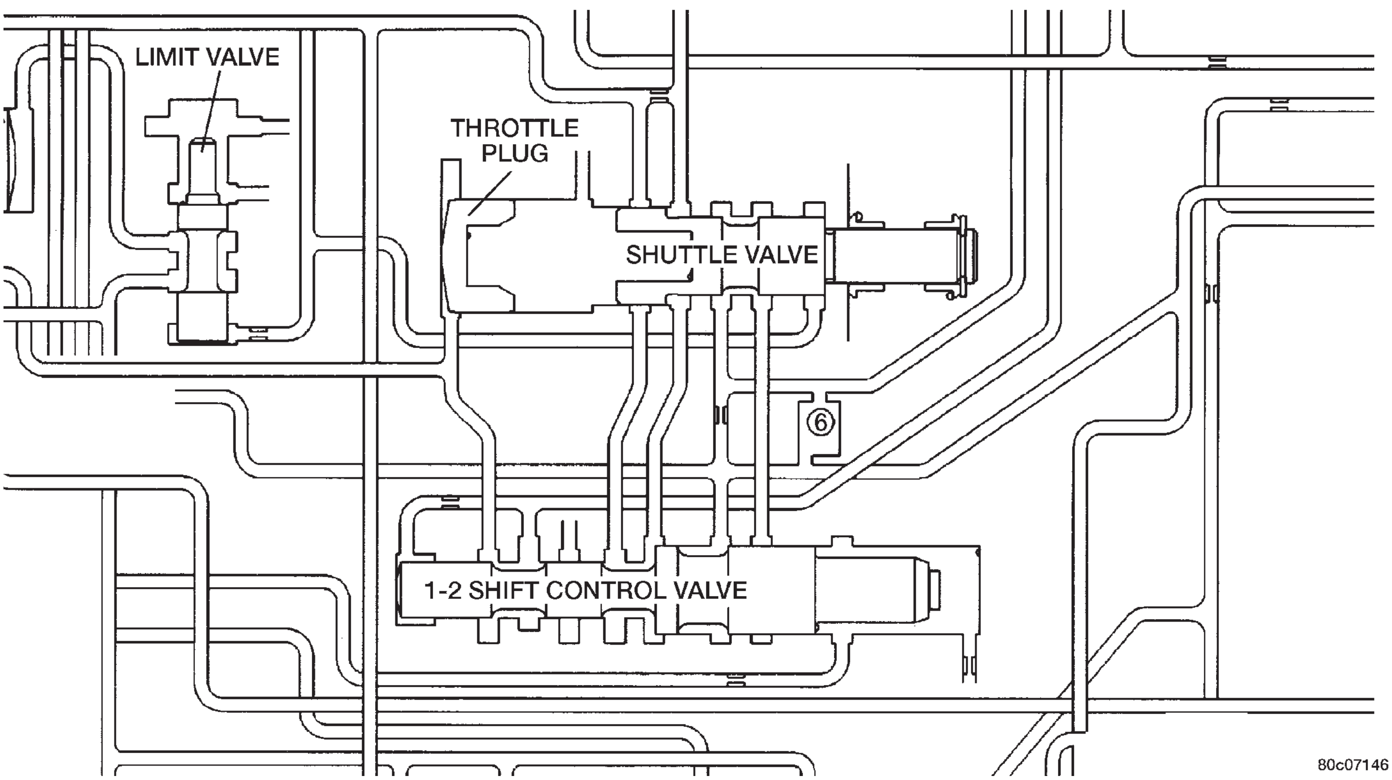


Fig. 31 1–2 Shift Control Valve

DESCRIPTION AND OPERATION (Continued)

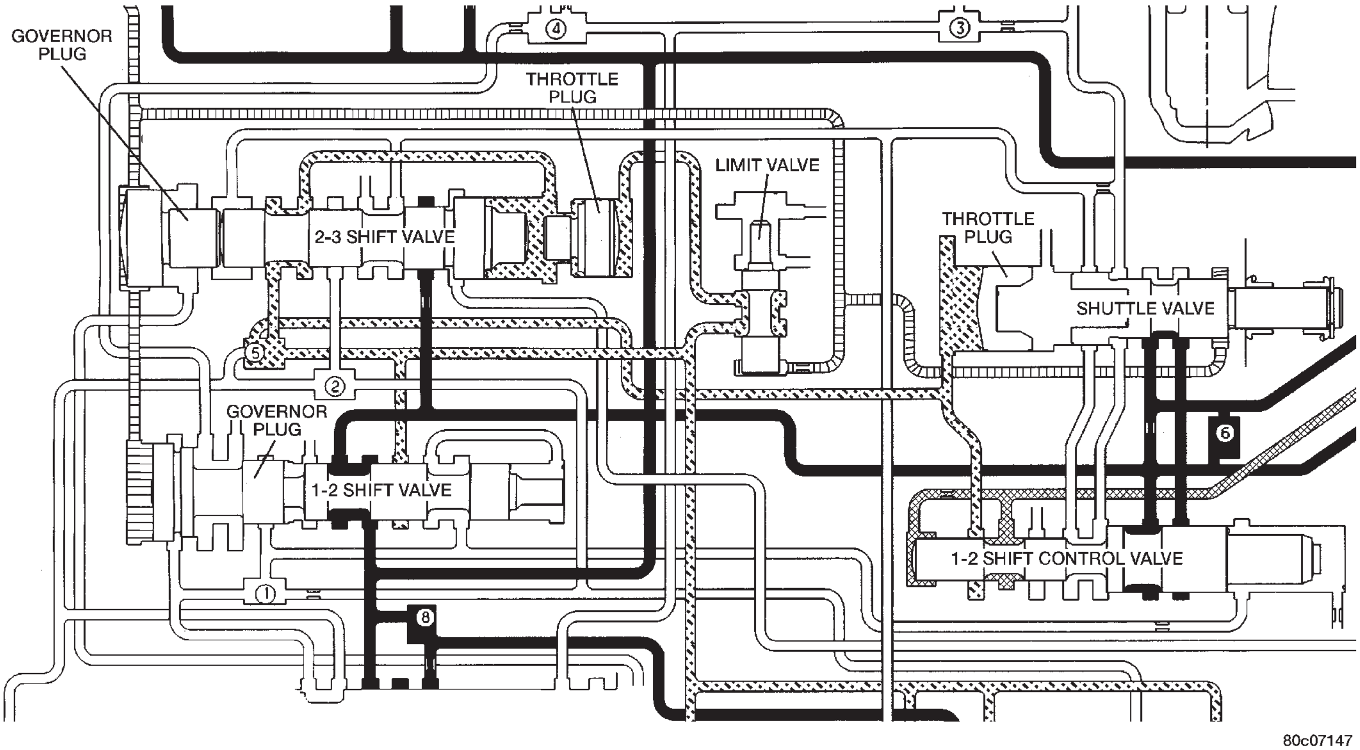


Fig. 32 2–3 Shift Valve-Before Shift

After the shift (Fig. 33), line pressure is directed to the land between the shift valve and the governor plug, and to the release side of the kickdown servo. This releases the front band and applies the front clutch, shifting into third gear or direct drive. The rear clutch remains applied, as it has been in the other gears. During a manual "1" or manual "2" gear selection, line pressure is sent between the two lands of the 2–3 governor plug. This line pressure at the governor plug locks the shift valve into the second gear position, preventing an upshift into direct drive. The theory for the blocking of the valve is the same as that of the 1–2 shift valve.

3–4 SHIFT VALVE

The PCM energizes the overdrive solenoid during the 3-4 upshift (Fig. 34). This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position (Fig. 35). This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston.

DESCRIPTION AND OPERATION (Continued)

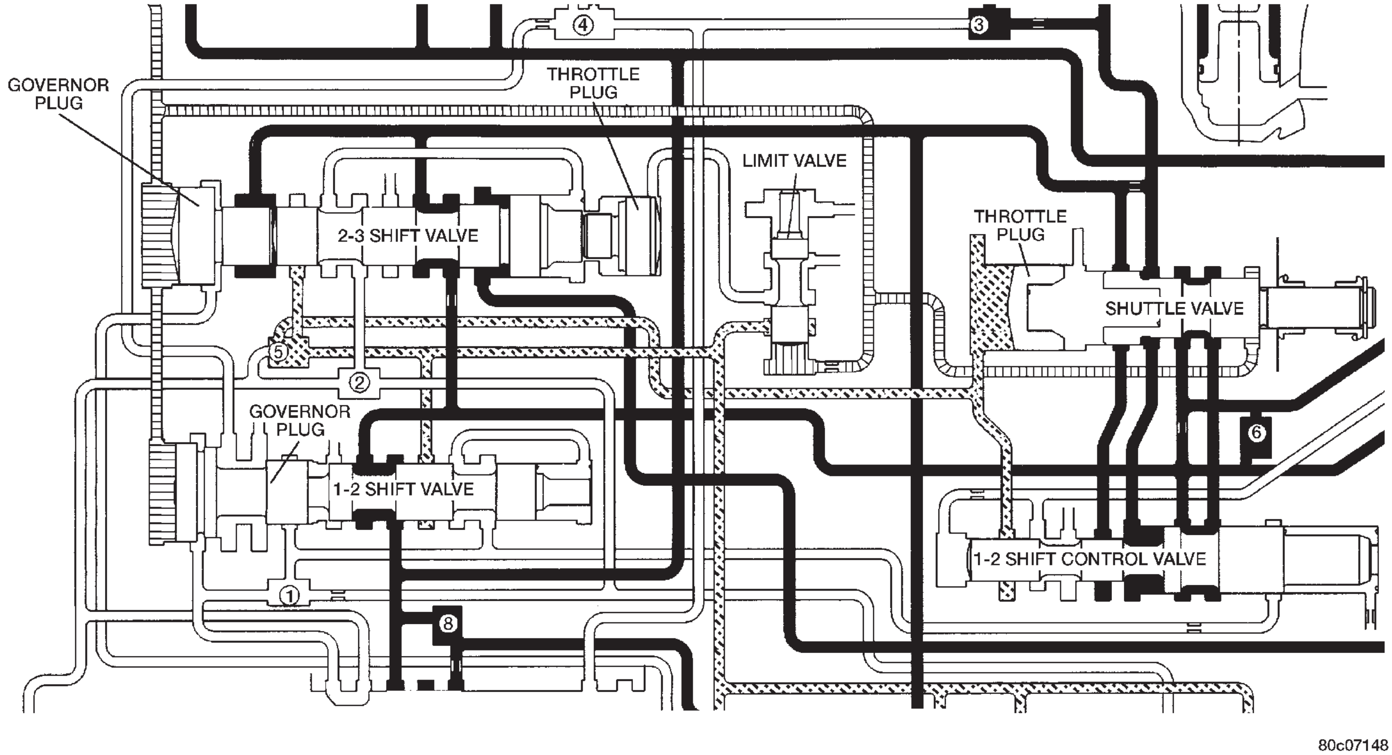


Fig. 33 2–3 Shift Valve-After Shift

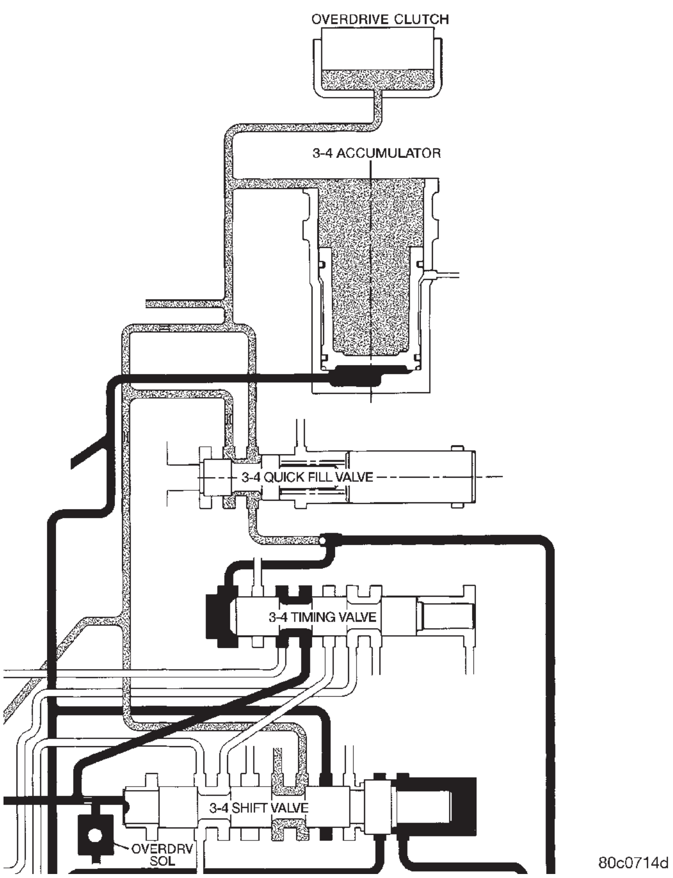


Fig. 34 3–4 Shift Valve Before Shift

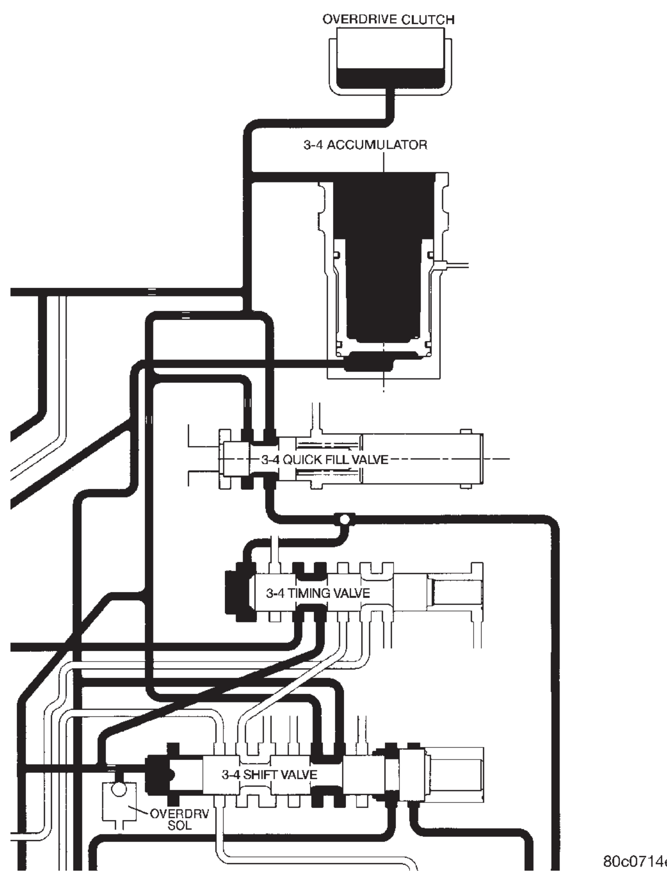


Fig. 35 3–4 Shift Valve After Shift

DESCRIPTION AND OPERATION (Continued)

3–4 TIMING VALVE

The 3-4 timing valve is moved by line pressure coming through the 3-4 shift valve (Fig. 36). The timing valve holds the 2-3 shift valve in an upshift position. The purpose is to prevent the 2-3 valve from up or downshifting before the 3-4 valve (Fig. 37).

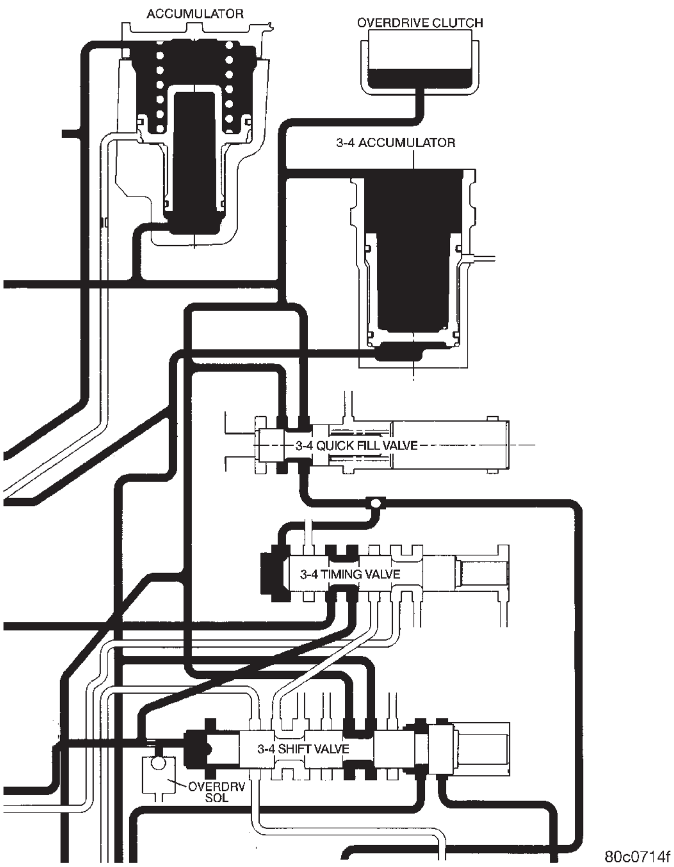


Fig. 36 3–4 Timing Valve Allowing 4–3 Shift

3–4 QUICK FILL VALVE

The 3-4 quick fill valve provides faster engagement of the overdrive clutch during 3-4 upshifts. The valve temporarily bypasses the clutch piston feed orifice at the start of a 3-4 upshift (Fig. 39). This exposes a larger passage into the piston retainer resulting in a much faster clutch fill and apply sequence. The quick fill valve does not bypass the regular clutch feed orifice throughout the 3-4 upshift. Instead, once a predetermined pressure develops within the clutch, the valve closes the bypass. Clutch fill is then completed through the regular feed orifice.

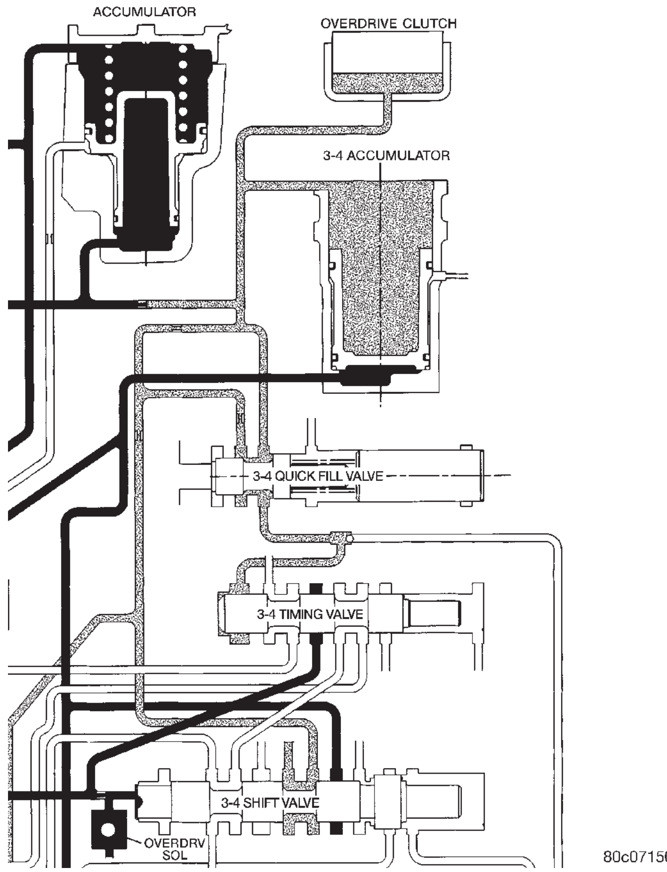


Fig. 37 3–4 Timing Valve Allowing 3–2 Shift

DESCRIPTION AND OPERATION (Continued)

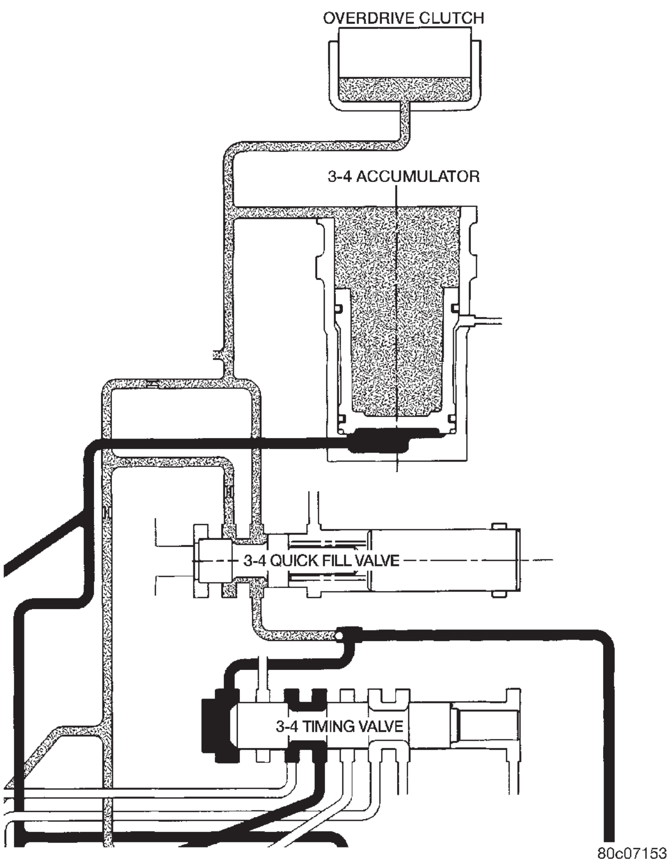


Fig. 38 3–4 Quick Fill Valve Before Shift

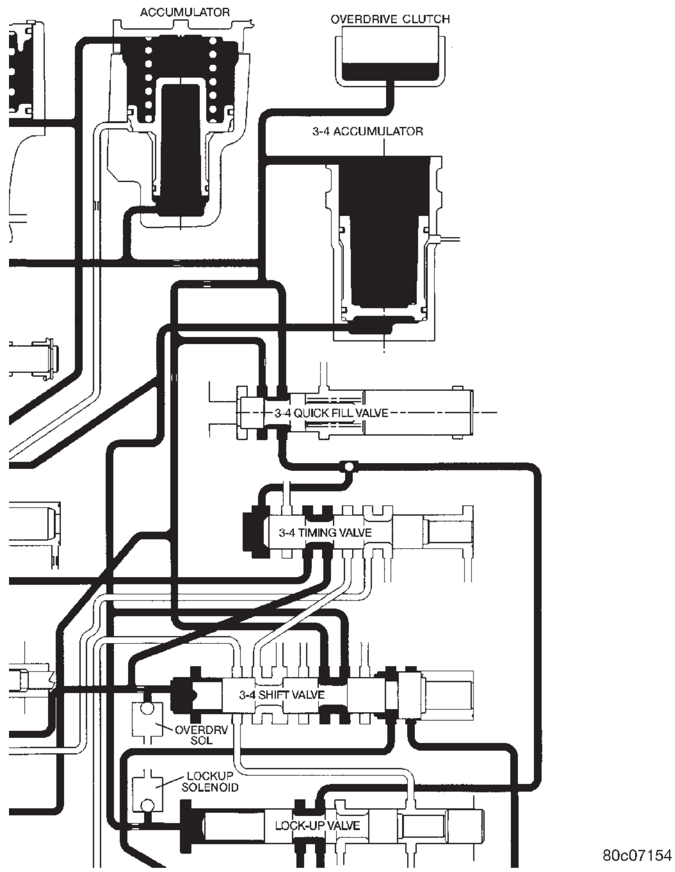


Fig. 39 3–4 Quick Fill Valve After Shift

THROTTLE VALVE

In all gear positions the throttle valve (Fig. 40) is being supplied with line pressure. The throttle valve meters and reduces the line pressure that now becomes throttle pressure. The throttle valve is moved by a spring and the kickdown valve, which is mechanically connected to the throttle. The larger the throttle opening, the higher the throttle pressure (to a maximum of line pressure). The smaller the throttle opening, the lower the throttle pressure (to a minimum of zero at idle). As engine speed increases, the increase in pump speed increases pump output. The increase in pressure and volume must be regulated to maintain the balance within the transmission. To do this, throttle pressure is routed to the reaction area on the right side of the throttle pressure plug (in the regulator valve).

DESCRIPTION AND OPERATION (Continued)

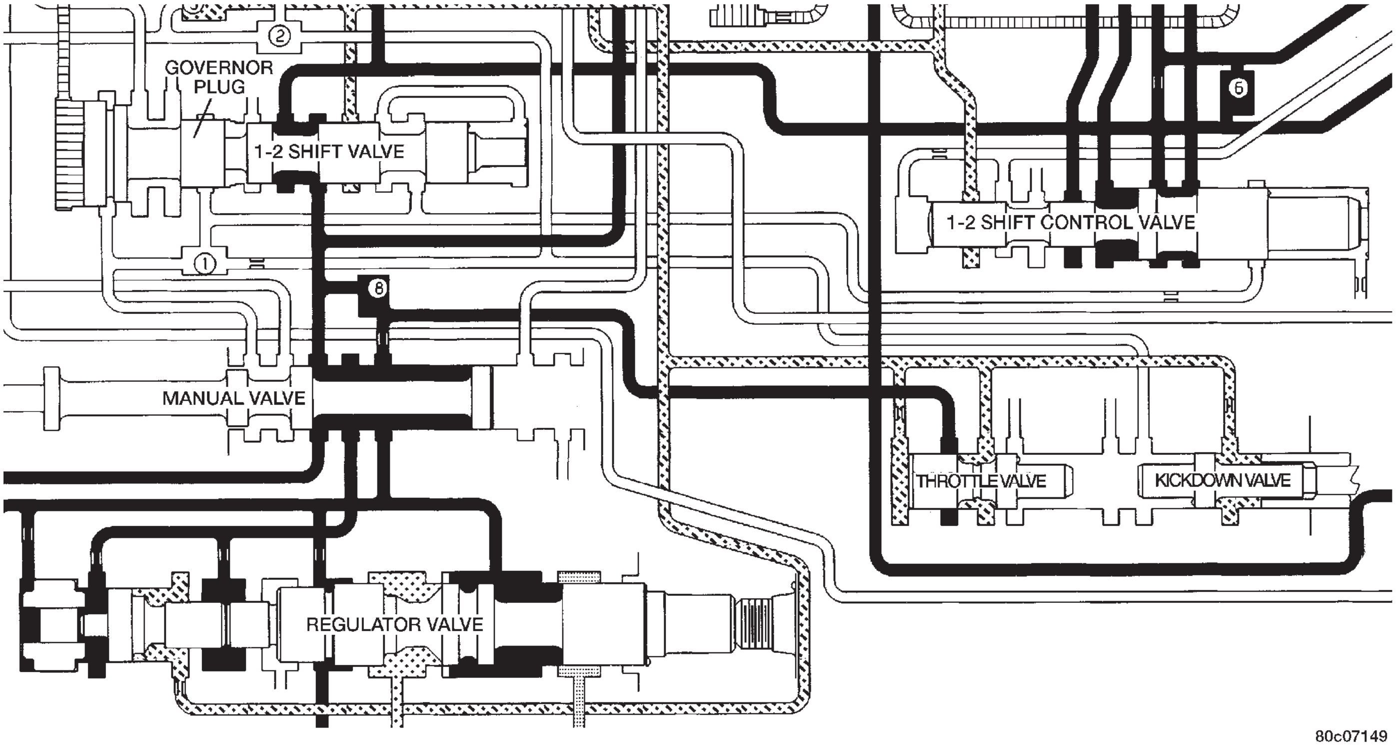


Fig. 40 Throttle Valve

The higher engine speed and line pressure would open the vent too far and reduce line pressure too much. Throttle pressure, which increases with engine speed (throttle opening), is used to oppose the movement of the pressure valve to help control the metering passage at the vent. The throttle pressure is combined with spring pressure to reduce the force of the throttle pressure plug on the pressure valve. The larger spring at the right closes the regulator valve passage and maintains or increases line pressure. The increased line pressure works against the reaction area of the line pressure plug and the reaction area left of land #3 simultaneously moves the regulator valve train to the right and controls the metering passage.

The kickdown valve, along with the throttle valve, serve to delay upshifts until the correct vehicle and engine speed have been reached. It also controls downshifts upon driver demand, or increased engine load. If these valves were not in place, the shift points would be at the same speed for all throttle positions. The kickdown valve is actuated by a cam connected to the throttle. This is accomplished through either a linkage or a cable. The cam forces the kickdown valve toward the throttle valve compressing the spring between them and moving the throttle valve. As the throttle valve land starts to uncover its port, line pressure is "metered" out into the circuits and viewed as throttle pressure. This increased throttle pressure is metered out into the circuits it is applied to: the 1–2 and 2–3 shift valves. When the throttle pressure is high enough, a 3–2 downshift will occur. If the vehicle speed is low enough, a 2–1 downshift will occur.

SWITCH VALVE

When the transmission is in Drive Second just before the TCC application occurs (Fig. 41), the pressure regulator valve is supplying torque converter pressure to the switch valve. The switch valve directs this pressure through the transmission input shaft, into the converter, through the converter, back out between the input shaft and the reaction shaft, and back up to the switch valve. From the switch valve, the fluid pressure is directed to the transmission cooler, and lubrication pressure returns from the cooler to lubricate different portions of the transmission.

DESCRIPTION AND OPERATION (Continued)

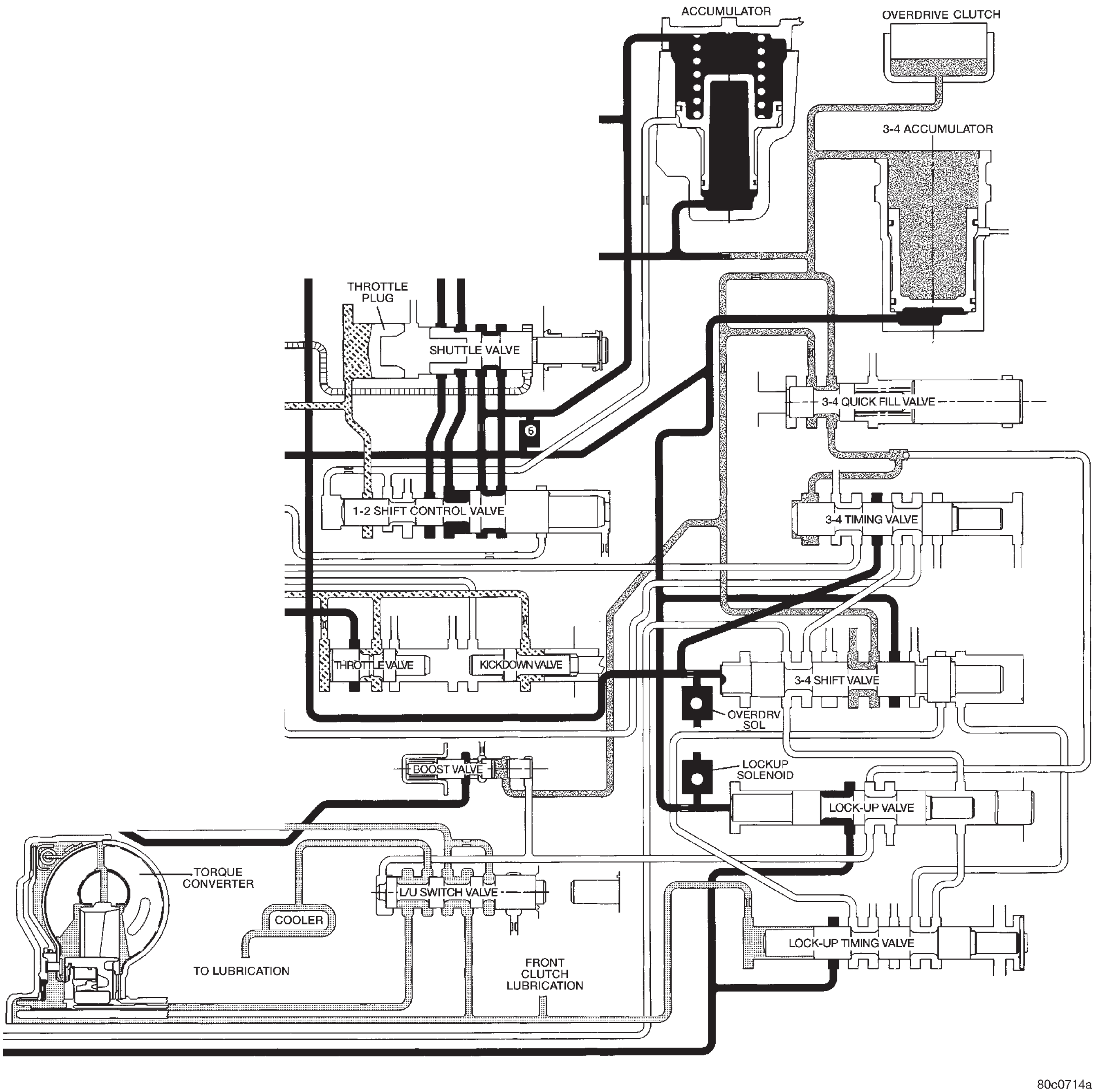


Fig. 41 Switch Valve-Torque Converter Unlocked

Once the TCC control valve has moved to the left (Fig. 42), line pressure is directed to the tip of the switch valve, forcing the valve to the right. The switch valve now vents oil from the front of the piston in the torque converter, and supplies line pressure to the (rear) apply side of the torque converter piston. This pressure differential causes the piston to apply against the friction material, cutting off any further flow of line pressure oil. After the switch valve is shuttled right allowing line pressure to engage the TCC, torque converter pressure is directed past the switch valve into the transmission cooler and lubrication circuits.

DESCRIPTION AND OPERATION (Continued)

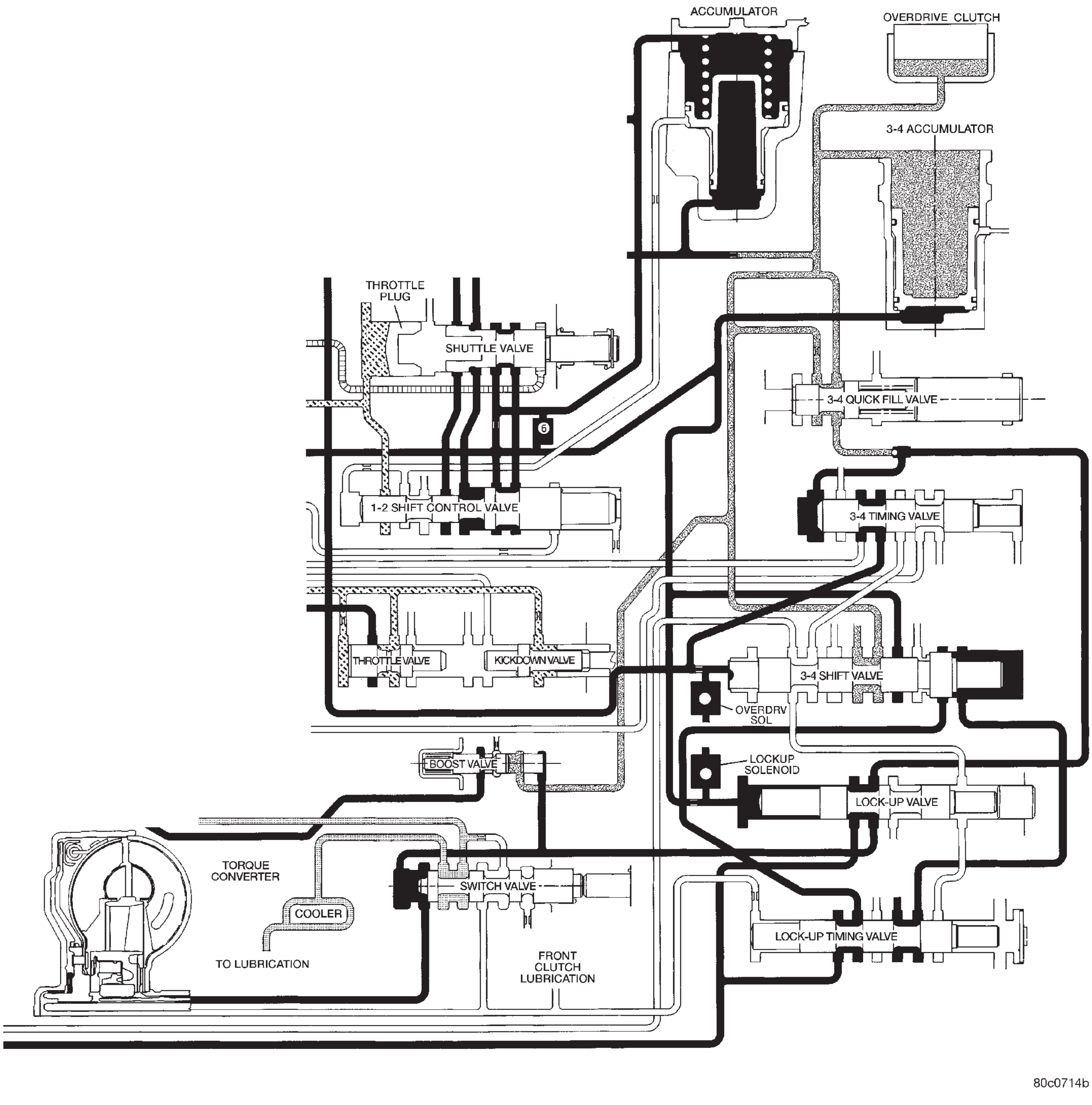


Fig. 42 Switch Valve-Torque Converter Locked

MANUAL VALVE

The manual valve (Fig. 43) is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the side of the valve body. The valve is connected mechanically by either a cable or linkage to the gearshift mechanism. The valve is held in each of its positions by a spring–loaded roller or ball that engages the “roostercomb” of the manual valve.

CONVERTER CLUTCH LOCK-UP VALVE

The torque converter clutch (TCC) lock-up valve controls the back (ON) side of the torque converter clutch. When the PCM energizes the TCC solenoid to engage the converter clutch piston, pressure is applied to the TCC lock-up valve which moves to the

DESCRIPTION AND OPERATION (Continued)

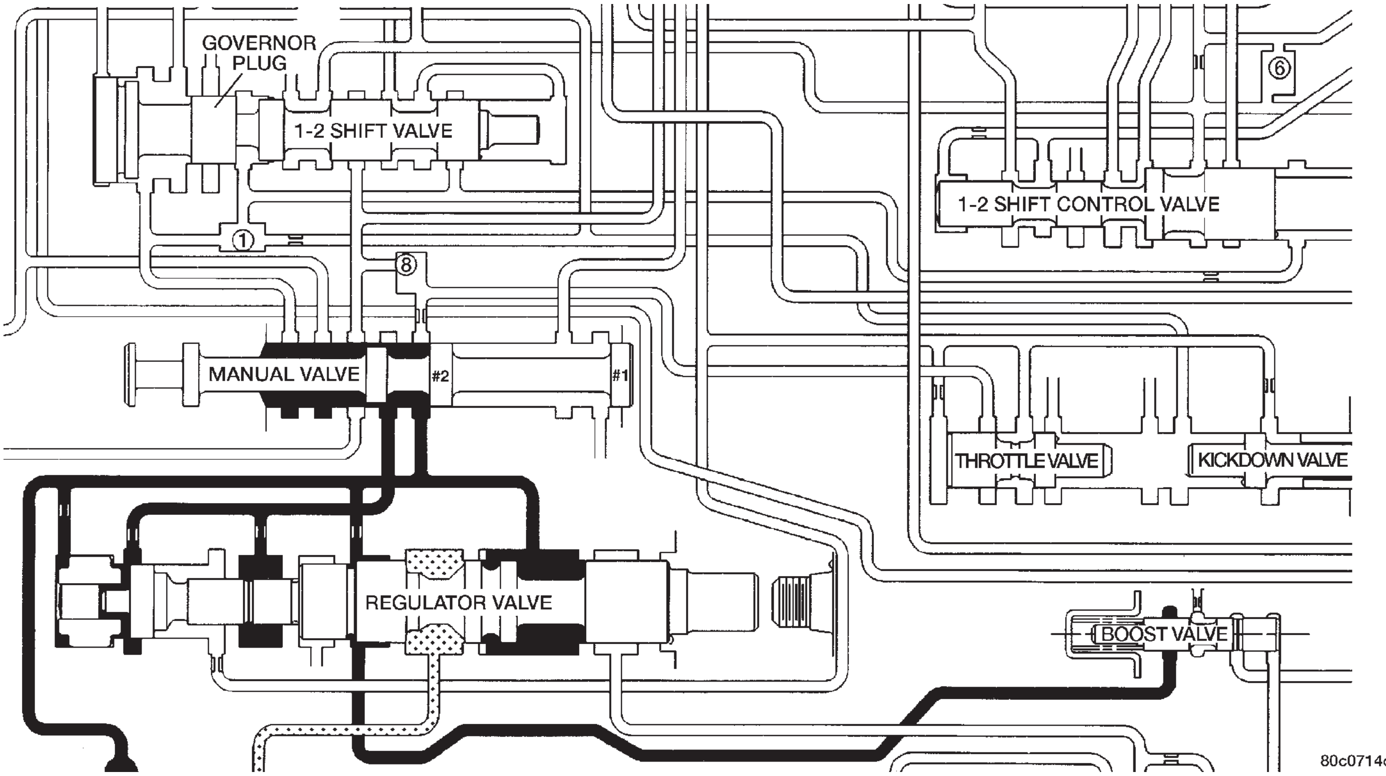


Fig. 43 Manual Valve

right and applies pressure to the torque converter clutch.

CONVERTER CLUTCH LOCK-UP TIMING VALVE

The torque converter clutch (TCC) lock-up timing valve is there to block any 4–3 downshift until the TCC is completely unlocked and the clutch is disengaged.

SHUTTLE VALVE

The assembly is contained in a bore in the valve body above the shift valves. When the manual valve is positioned in the Drive range, throttle pressure acts on the throttle plug of the shuttle valve (Fig. 31) to move it against a spring, increasing the spring force on the shuttle valve. During a part or full throttle 1–2 upshift, the throttle plug is bottomed by throttle pressure, holding the shuttle valve to the right against governor pressure, and opening a by–pass circuit. The shuttle valve controls the quality of the kickdown shift by restricting the rate of fluid discharge from the front clutch and servo release circuits. During a 3–2 kickdown, fluid discharges through the shuttle by–pass circuit. When the shuttle valve closes the by–pass circuit, fluid discharge is restricted and controlled for the application of the front band. During a 2–3 “lift foot” upshift, the shuttle valve by–passes the restriction to allow full fluid flow through the by-pass groove for a faster release of the band.

BOOST VALVE

The boost valve (Fig. 44) provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts (Fig. 45), and when accelerating in fourth gear.

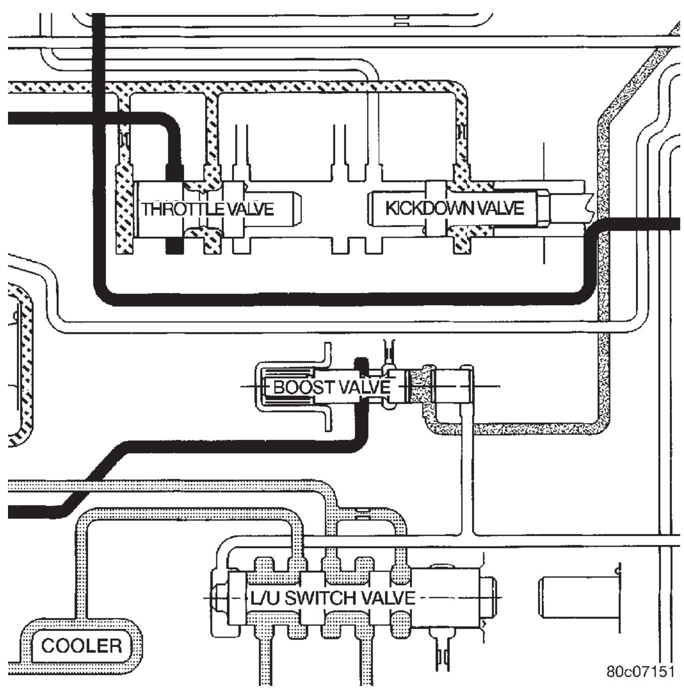


Fig. 44 Boost Valve Before Lock-up

DESCRIPTION AND OPERATION (Continued)

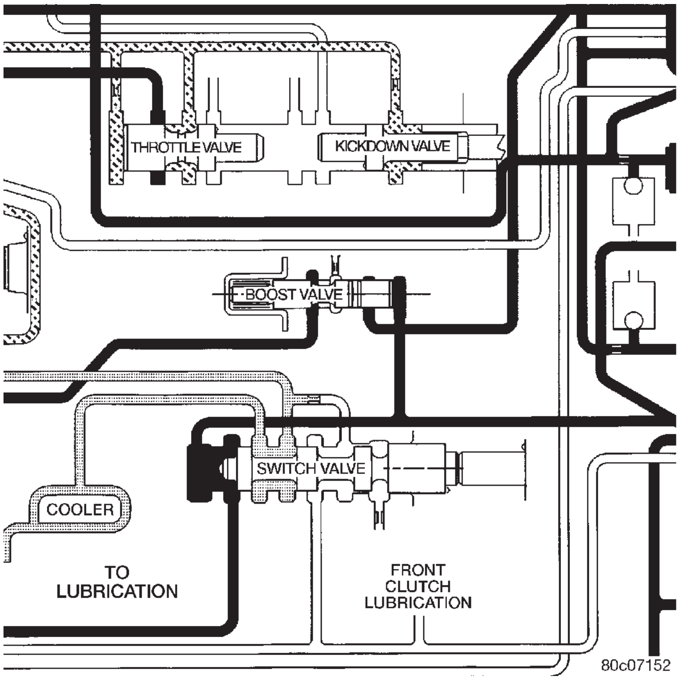


Fig. 45 Boost Valve After Lock-up

ACCUMULATOR

DESCRIPTION

The accumulator (Fig. 46) is a hydraulic device that has the sole purpose of cushioning the application of a band or clutch. The accumulator consists of a dual–land piston and a spring located in a bore in the transmission case. The 3–4 accumulator is located in a housing attached to the side of the valve body (Fig. 47).

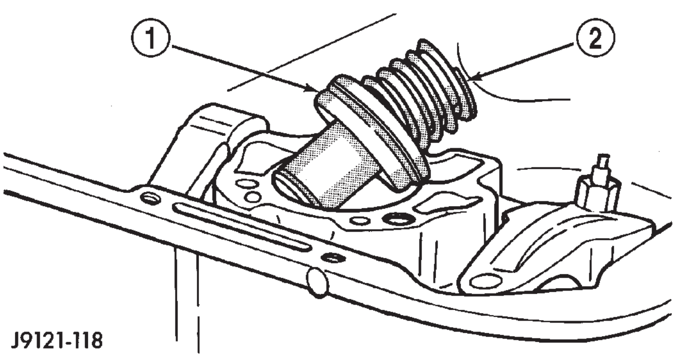


Fig. 46 Accumulator

1 – ACCUMULATOR PISTON
2 – PISTON SPRING

OPERATION

Both the accumulator and the 3–4 accumulator function the same. Line pressure is directed between the lands of the piston (Fig. 48), bottoming it against the accumulator plate. The accumulator stays in this position after the transmission is placed into a Drive

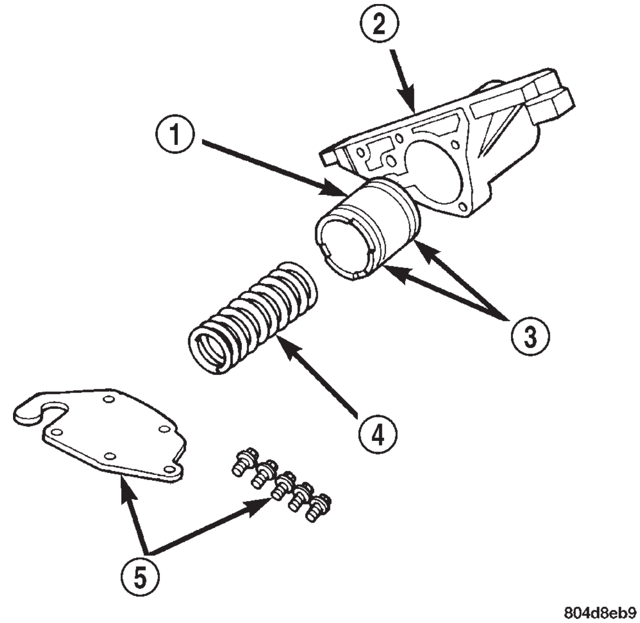


Fig. 47 3–4 Accumulator and Housing

1 – ACCUMULATOR PISTON
2 – 3–4 ACCUMULATOR HOUSING
3 – TEFLON SEALS
4 – PISTON SPRING
5 – COVER PLATE AND SCREWS

position. When the 1–2 upshift occurs (Fig. 49), line pressure is directed to the large end of the piston and then to the kickdown servo. As the line pressure reaches the accumulator, the combination of spring pressure and line pressure forces the piston away from the accumulator plate. This causes a balanced pressure situation, which results in a cushioned band application. After the kickdown servo has become immovable, line pressure will finish pushing the accumulator up into its bore. When the large end of the accumulator piston is seated in its bore, the band or clutch is fully applied.

NOTE: The accumulator is shown in the inverted position for illustrative purposes.

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches, while others are used to apply bands. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained

DESCRIPTION AND OPERATION (Continued)

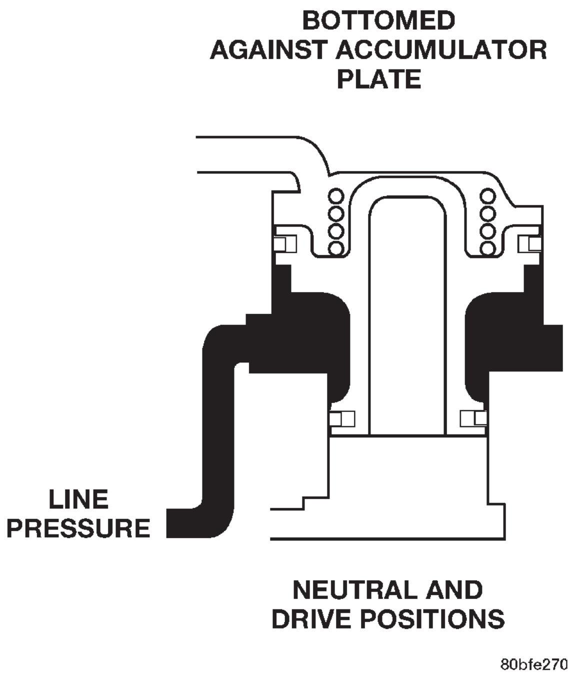


Fig. 48 Accumulator in Neutral and Drive Positions

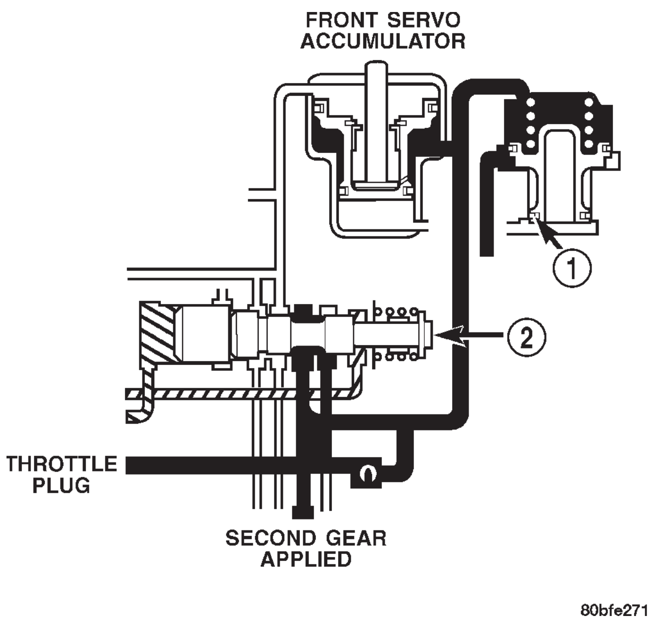


Fig. 49 Accumulator in Second Gear Position

1 – BOTTOM IN BORE
2 – SHUTTLE VALVE

within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PRESSURE

Pressure (Fig. 50) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in or 1 pound per square inch, or PSI as it is commonly referred to.

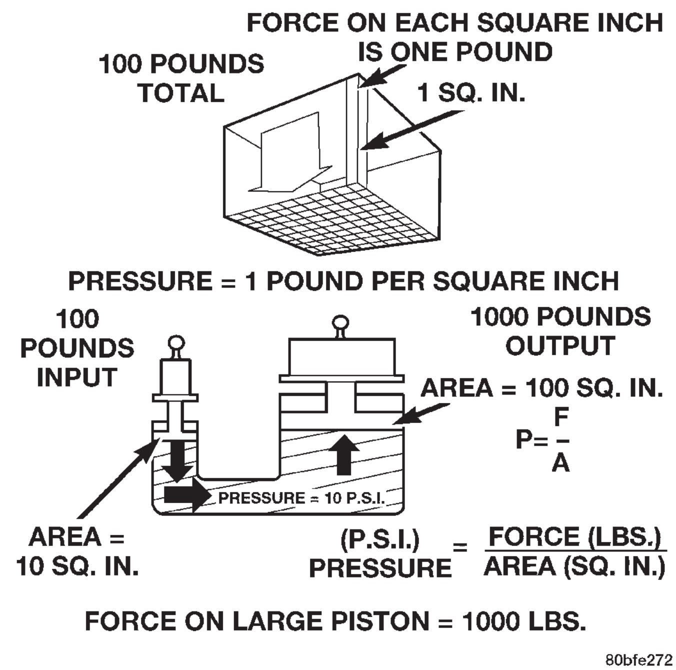


Fig. 50 Force and Pressure Relationship

PRESSURE ON A CONFINED FLUID

Pressure is exerted on a confined fluid (Fig. 51) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply "leak" past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O–rings, D–rings, lip seals, sealing rings, or extremely close tolerances between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal's Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the

DESCRIPTION AND OPERATION (Continued)

pressure in the fluid is the same everywhere within the container.

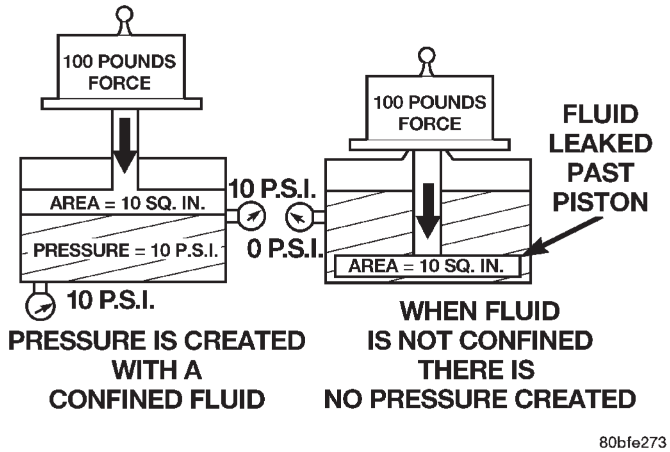


Fig. 51 Pressure on a Confined Fluid

FORCE MULTIPLICATION

Using the 10 PSI example used in the illustration (Fig. 52), a force of 1000 lbs. can be moved with a force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 52), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept "pressure is the same everywhere" means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

PISTON TRAVEL

The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it's a weight–to–distance output rather than a pressure–to–area output. Using the same forces and areas as in the previous example, the smaller piston (Fig. 53) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

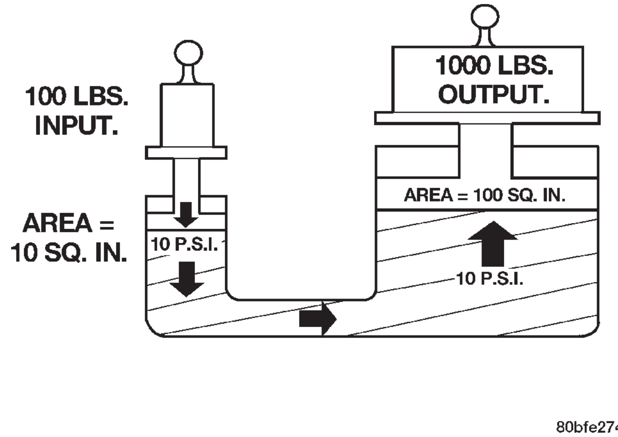


Fig. 52 Force Multiplication

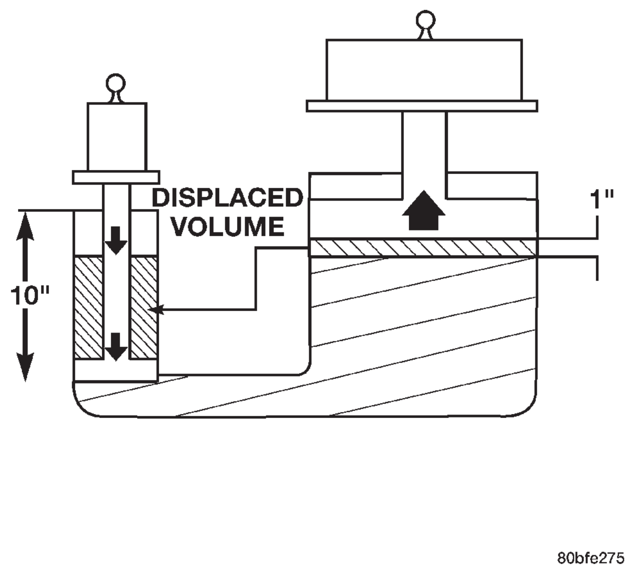


Fig. 53 Piston Travel

FRONT CLUTCH

DESCRIPTION

The front clutch assembly (Fig. 54) is composed of the front clutch retainer, pressure plate, four clutch plates, four driving discs, piston, piston return spring, return spring retainer, and snap rings. The front clutch is the forwardmost component in the transmission geartrain and is directly behind the oil pump and is considered a driving component.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

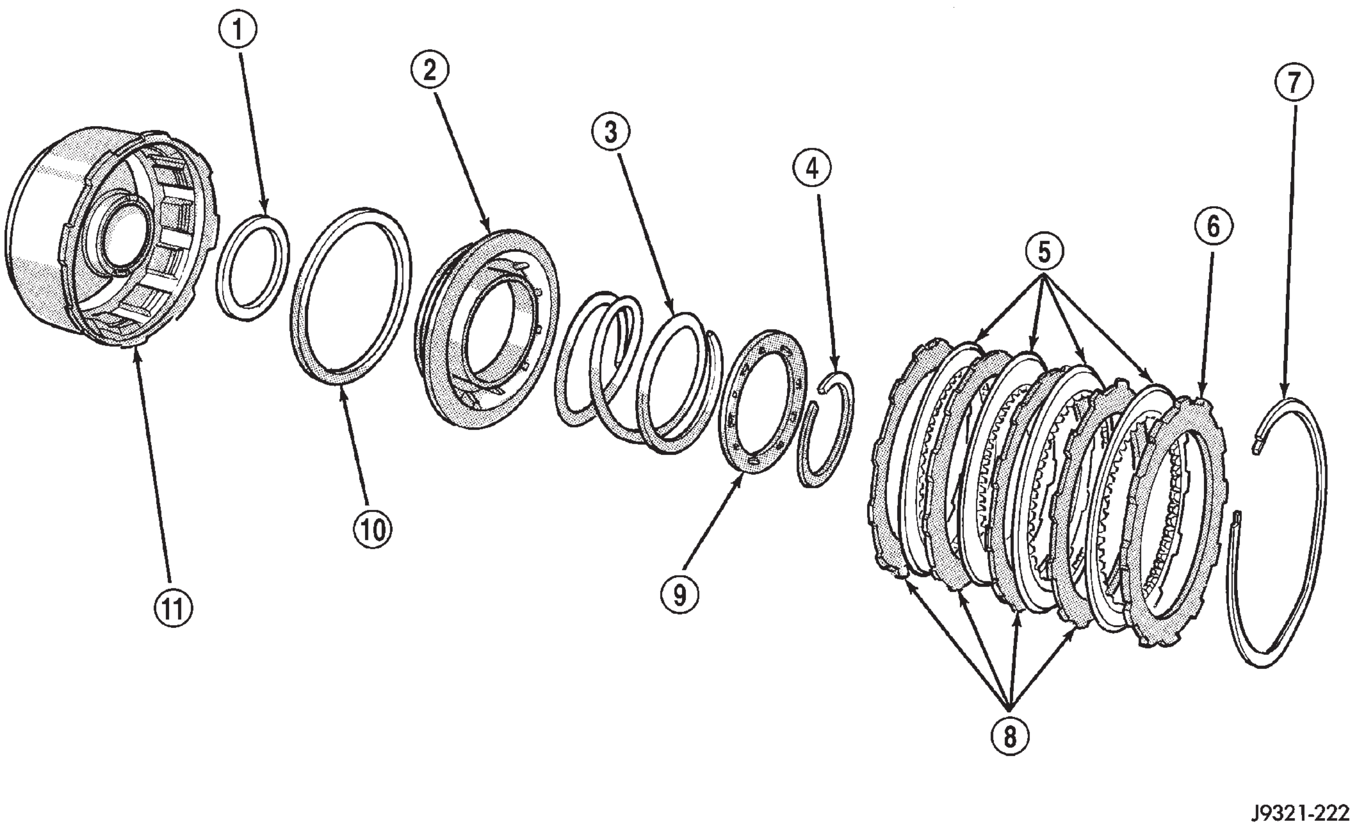


Fig. 54 Front Clutch

1 – RETAINER HUB SEAL
2 – CLUTCH PISTON
3 – PISTON SPRING
4 – SPRING RETAINER SNAP RING
5 – CLUTCH DISCS
6 – PRESSURE PLATE
7 – SNAP RING (WAVED)
8 – CLUTCH PLATES
9 – SPRING RETAINER
10 – PISTON SEAL
11 – FRONT CLUTCH RETAINER

OPERATION

To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are lugged to the clutch retainer. The waved snap ring is used to cushion the application of the clutch pack. In some transmissions, the snap ring is selective and used to adjust clutch pack clearance.

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assembly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one–way ball–check–valve located in the clutch retainer. The check–valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

REAR CLUTCH

DESCRIPTION

The rear clutch assembly (Fig. 55) is composed of the rear clutch retainer, pressure plate, three clutch plates, four driving discs, piston, Belleville spring, and snap rings. The Belleville spring acts as a lever to multiply the force applied on to it by the apply piston. The increased apply force on the rear clutch pack, in comparison to the front clutch pack, is needed to hold against the greater torque load imposed onto the rear pack. The rear clutch is directly behind the front clutch and is considered a driving component.

DESCRIPTION AND OPERATION (Continued)

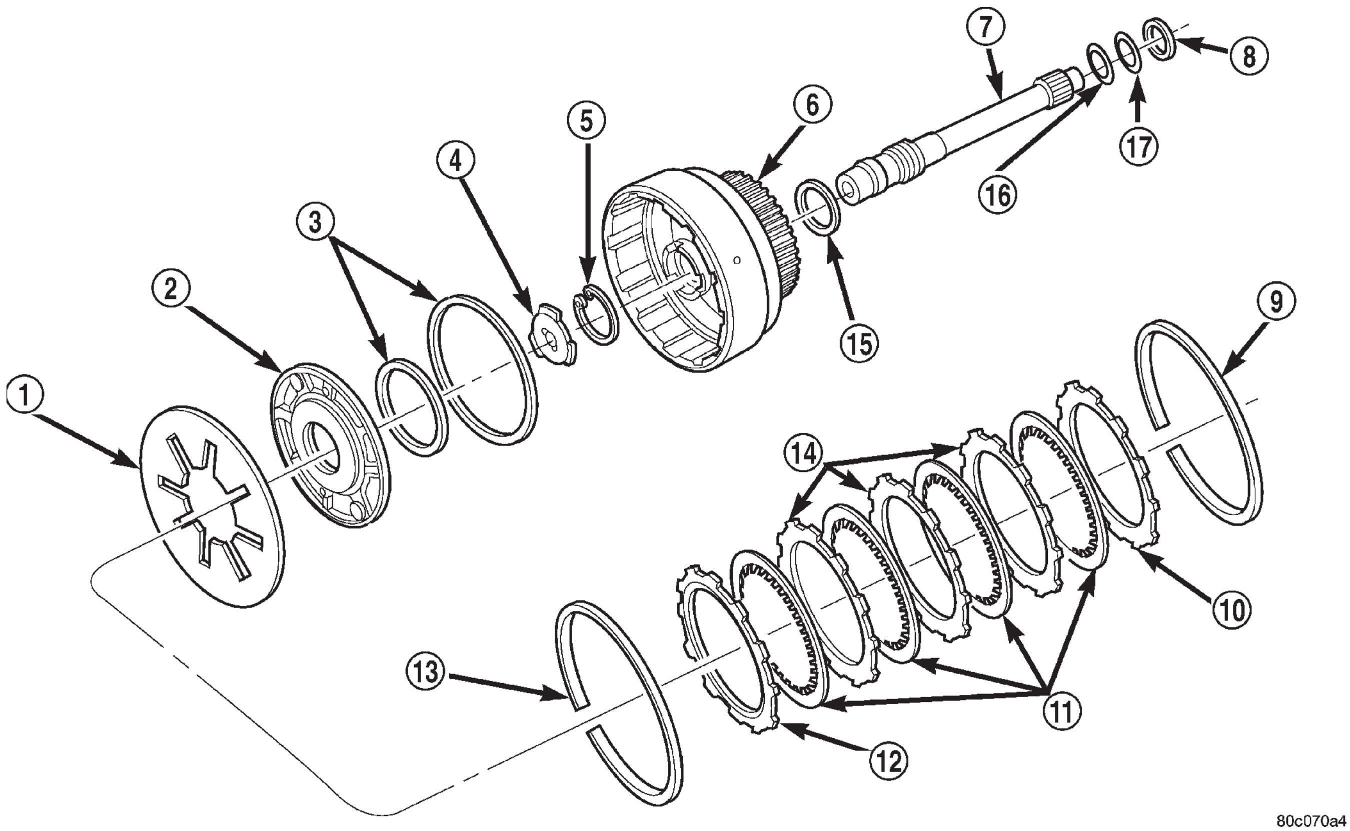


Fig. 55 Rear Clutch

1 – PISTON SPRING
2 – REAR CLUTCH PISTON
3 – CLUTCH PISTON SEALS
4 – OUTPUT SHAFT THRUST WASHER (METAL)
5 – INPUT SHAFT SNAP RING
6 – REAR CLUTCH RETAINER
7 – INPUT SHAFT
8 – REAR CLUTCH THRUST WASHER (FIBER)
9 – CLUTCH PACK SNAP RING (SELECTIVE)
10 – TOP PRESSURE PLATE
11 – CLUTCH DISCS (4)
12 – BOTTOM PRESSURE PLATE
13 – WAVE SPRING
14 – CLUTCH PLATES (3)
15 – RETAINER SEAL RING
16 – SHAFT REAR SEAL RING (PLASTIC)
17 – SHAFT FRONT SEAL RING (TEFLON)

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION

To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are lugged to the clutch retainer. The waved snap ring is used to cushion the application of the clutch pack. In some transmissions, the snap ring is selective and used to adjust clutch pack clearance.

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assembly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one–way ball–check–valve located in the clutch retainer. The check–valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

DESCRIPTION AND OPERATION (Continued)

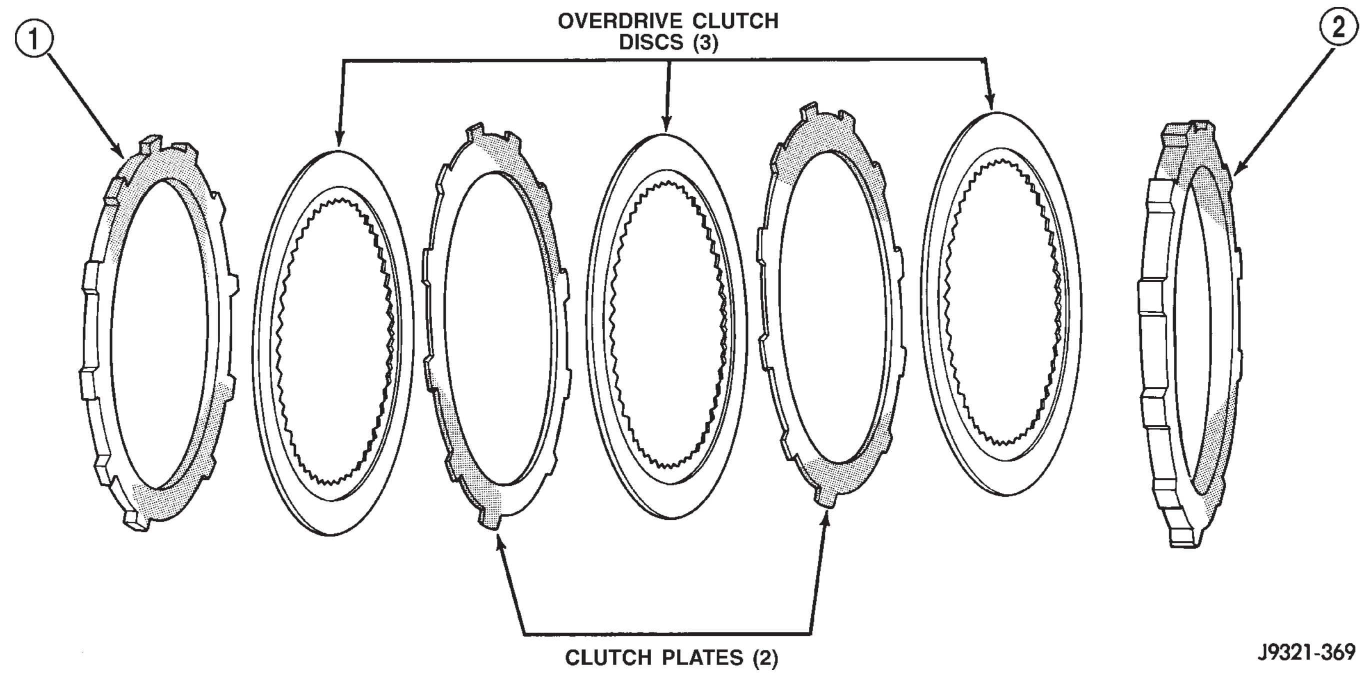


Fig. 56 Overdrive Clutch

1 – REACTION PLATE
2 – PRESSURE PLATE

OVERDRIVE CLUTCH

DESCRIPTION

The overdrive clutch (Fig. 56) is composed of the pressure plate, two clutch plates, three holding discs, overdrive piston retainer, piston, piston spacer, and snap rings. The overdrive clutch is the forwardmost component in the transmission overdrive unit and is considered a holding component. The overdrive piston retainer, piston, and piston spacer are located on the rear of the main transmission case.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION

To apply the clutch, pressure is applied between the piston retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through passages at the lower rear portion of the valve body area. With pressure applied between the piston retainer and piston, the piston moves away from the piston retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the intermediate shaft into the overdrive planetary gear set. The overdrive clutch discs are attached to the overdrive clutch hub while the overdrive clutch plates, reaction plate, and pressure plate are lugged to the overdrive housing. This allows the intermediate shaft to transfer the engine torque to the planetary gear and overrunning clutch. This drives the planetary gear inside the annulus, which is attached to the overdrive clutch drum and output shaft, creating the desired gear ratio. The waved snap ring is used to cushion the application of the clutch pack.

OVERRUNNING CLUTCH

DESCRIPTION

The overrunning clutch (Fig. 57) consists of an inner race, an outer race (or cam), rollers and springs, and the spring retainer. The number of rollers and springs depends on what transmission and which overrunning clutch is being dealt with.

OPERATION

As the inner race is rotated in a clockwise direction (as viewed from the front of the transmission), the race causes the rollers to roll toward the springs, causing them to compress against their retainer. The compression of the springs increases the clearance between the rollers and cam. This increased clearance between the rollers and cam results in a freewheeling condition. When the inner race attempts to rotate counterclockwise, the action causes the rollers to roll in the same direction as the race, aided by the pushing of the springs. As the rollers try to move in

DESCRIPTION AND OPERATION (Continued)

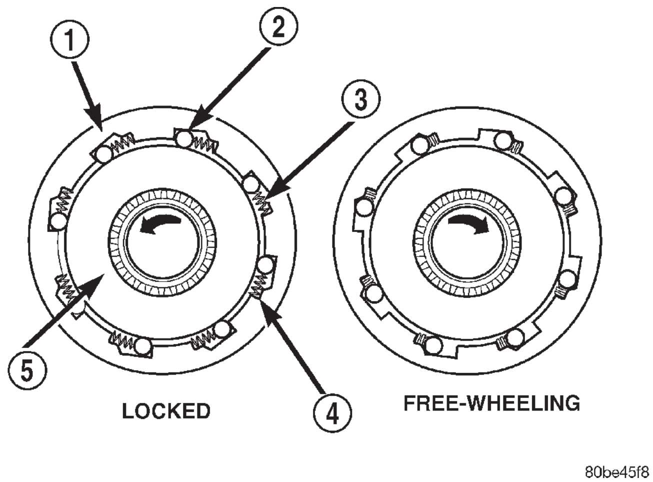


Fig. 57 Overrunning Clutch

1 – OUTER RACE (CAM)
2 – ROLLER
3 – SPRING
4 – SPRING RETAINER
5 – INNER RACE (HUB)

the same direction as the inner race, they are wedged between the inner and outer races due to the design of the cam. In this condition, the clutch is locked and acts as one unit.

PLANETARY GEARSET

DESCRIPTION

The planetary gearsets (Fig. 58) are designated as the front, rear, and overdrive planetary gear assemblies and located in such order. A simple planetary gearset consists of three main members:

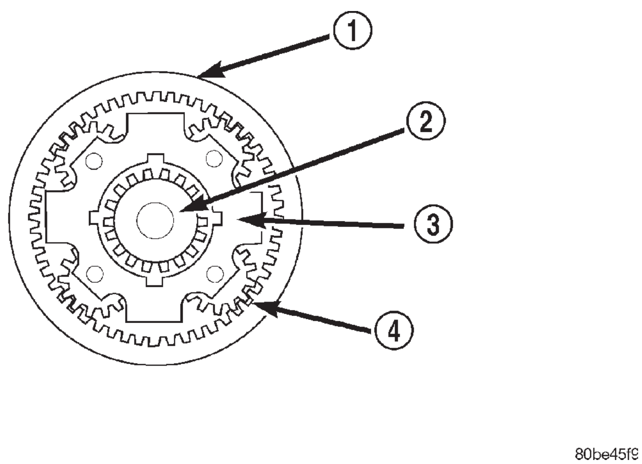


Fig. 58 Planetary Gearset

1 – ANNULUS GEAR
2 – SUN GEAR
3 – PLANET CARRIER
4 – PLANET PINIONS (4)

- The sun gear which is at the center of the system.
- The planet carrier with planet pinion gears which are free to rotate on their own shafts and are in mesh with the sun gear.
- The annulus gear, which rotates around and is in mesh with the planet pinion gears.

NOTE: The number of pinion gears does not affect the gear ratio, only the duty rating.

OPERATION

With any given planetary gearset, several conditions must be met for power to be able to flow:

- One member must be held.
- Another member must be driven or used as an input.
- The third member may be used as an output for power flow.
- For direct drive to occur, two gear members in the front planetary gearset must be driven.

NOTE: Gear ratios are dependent on the number of teeth on the annulus and sun gears.

BANDS

DESCRIPTION

KICKDOWN (FRONT) BAND

The kickdown, or “front”, band (Fig. 59) holds the common sun gear of the planetary gear sets. The front (kickdown) band is made of steel, and faced on its inner circumference with a friction–type lining. One end of the band is anchored to the transmission case, and the other is acted on with a pushing force by a servo piston. The front band is a single–wrap design (the band does not completely encompass/wrap the drum that it holds).

LOW/REVERSE (REAR) BAND

The low/reverse band, or “rear”, band (Fig. 60) is similar in appearance and operation to the front band.

OPERATION

KICKDOWN (FRONT) BAND

The kickdown band holds the common sun gear of the planetary gear sets by applying and holding the front clutch retainer, which is splined to the sun gear driving shell, and in turn splined directly to the sun gear. The application of the band by the servo is typically done by an apply lever and link bar.

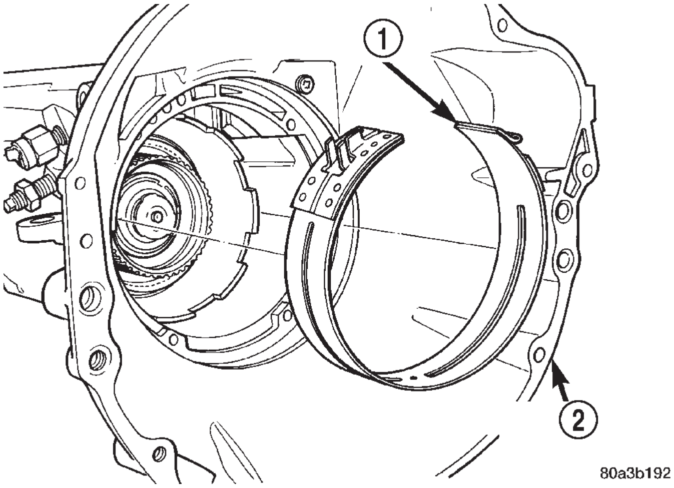


Fig. 59 Front Band

1 – FRONT BAND
2 – TRANSMISSION HOUSING

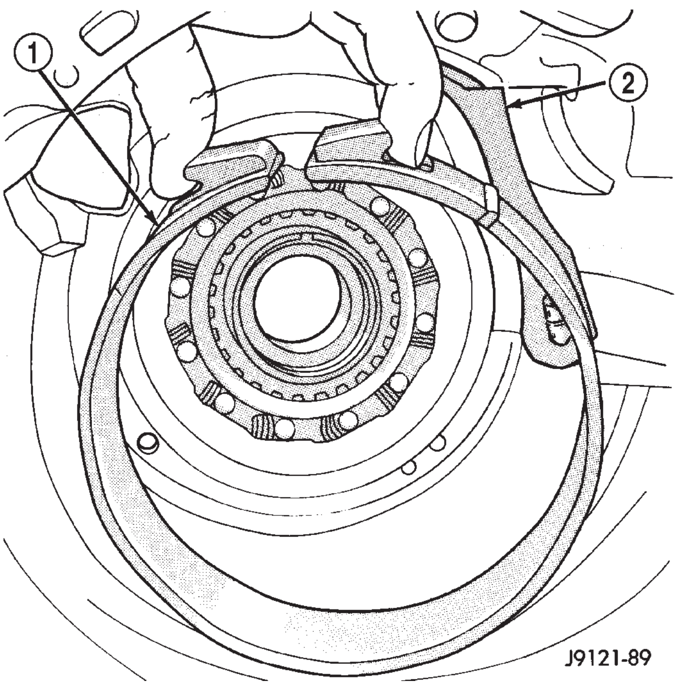


Fig. 60 Rear Band

1 – REAR BAND
2 – BAND LINK

LOW/REVERSE (REAR) BAND

The rear band holds the rear planet carrier stationary by being mounted around and applied to the low/reverse drum.

SERVOS

DESCRIPTION

KICKDOWN (FRONT) SERVO

The kickdown servo (Fig. 61) consists of a two–land piston with an inner piston, a piston rod and guide, and a return spring. The dual–land piston uses seal rings on its outer diameters and an O–ring for the inner piston.

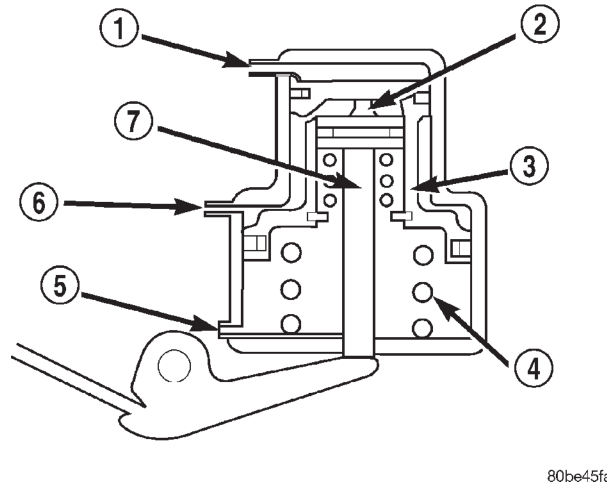


Fig. 61 Front Servo

1 – VENT
2 – INNER PISTON
3 – PISTON
4 – SPRING
5 – RELEASE PRESSURE
6 – APPLY PRESSURE
7 – PISTON ROD

LOW/REVERSE (REAR) SERVO

The rear (low/reverse) servo consists of a single stage or diameter piston and a spring loaded plug. The spring is used to cushion the application of the rear (low/reverse) band.

OPERATION

KICKDOWN (FRONT) SERVO

The application of the piston is accomplished by applying pressure between the two lands of the piston. The pressure acts against the larger lower land to push the piston downward, allowing the piston rod to extend though its guide against the apply lever. Release of the servo at the 2–3 upshift is accomplished by a combination of spring and line pressure,

DESCRIPTION AND OPERATION (Continued)

acting on the bottom of the larger land of the piston. The small piston is used to cushion the application of the band by bleeding oil through a small orifice in the larger piston. The release timing of the kickdown servo is very important to obtain a smooth but firm shift. The release has to be very quick, just as the front clutch application is taking place. Otherwise, engine runaway or a shift hesitation will occur. To accomplish this, the band retains its holding capacity until the front clutch is applied, giving a small amount of overlap between them.

LOW/REVERSE (REAR) SERVO

While in the de-energized state (no pressure applied), the piston is held up in its bore by the piston spring. The plug is held down in its bore, in the piston, by the plug spring. When pressure is applied to the top of the piston, the plug is forced down in its bore, taking up any clearance. As the piston moves, it causes the plug spring to compress, and the piston moves down over the plug. The piston continues to move down until it hits the shoulder of the plug and fully applies the band. The period of time from the initial application, until the piston is against the shoulder of the plug, represents a reduced shocking of the band that cushions the shift.

GEARSHIFT MECHANISM

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

OPERATION

Manual low (1) range provides first gear only. Overrun braking is also provided in this range. Manual second (2) range provides first and second gear only.

Drive range provides first, second third and overdrive fourth gear ranges. The shift into overdrive fourth gear range occurs only after the transmission has completed the shift into D third gear range. No further movement of the shift mechanism is required to complete the 3-4 shift.

The fourth gear upshift occurs automatically when the overdrive selector switch is in the ON position. No upshift to fourth gear will occur if any of the following are true:

- The transmission fluid temperature is below 10° C (50° F) or above 121° C (250° F).
- The shift to third is not yet complete.
- Vehicle speed is too low for the 3–4 shift to occur.
- Battery temperature is below –5° C (23° F).

CONVERTER DRAINBACK VALVE

DESCRIPTION

The drainback valve is located in the transmission cooler outlet (pressure) line.

OPERATION

The valve prevents fluid from draining from the converter into the cooler and lines when the vehicle is shut down for lengthy periods. Production valves have a hose nipple at one end, while the opposite end is threaded for a flare fitting. All valves have an arrow (or similar mark) to indicate direction of flow through the valve.

POWERTRAIN CONTROL MODULE (PCM)

DESCRIPTION

The Powertrain Control Module (PCM) is located in the engine compartment (Fig. 62). The PCM is referred to as JTEC.

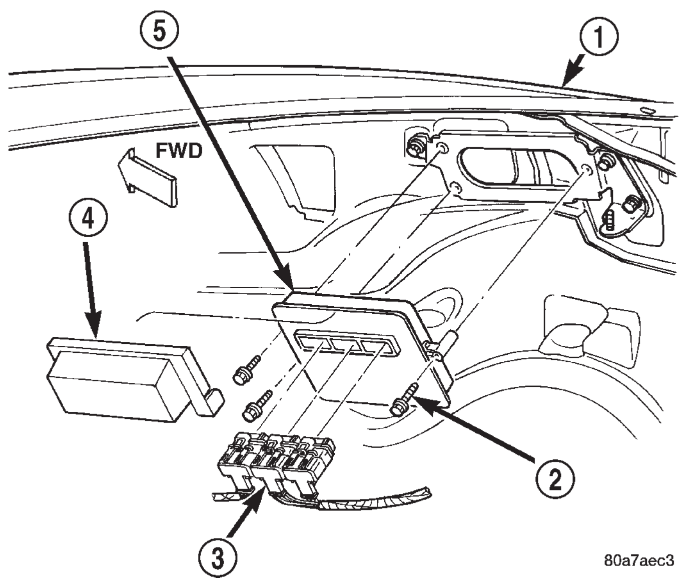


Fig. 62 PCM Location

1 – RIGHT FRONT FENDER
2 – PCM MOUNTING BOLTS (3)
3 – 32–WAY CONNECTORS (3)
4 – COVER
5 – POWERTRAIN CONTROL MODULE (PCM)

OPERATION

The PCM operates the fuel system. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio,

DESCRIPTION AND OPERATION (Continued)

emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

NOTE: PCM Inputs:

- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- CCD bus (+) circuits
- CCD bus (-) circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connection for DRB scan tool
- Engine coolant temperature sensor
- Fuel level
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure
- Output shaft speed sensor
- Overdrive/override switch
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transmission governor pressure sensor
- Transmission temperature sensor
- Vehicle speed inputs from ABS or RWAL system

NOTE: PCM Outputs:

- A/C clutch relay
- Auto shutdown (ASD) relay
- CCD bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Data link connection for DRB scan tool
- EGR valve control solenoid (if equipped)
- EVAP canister purge solenoid
- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Generator lamp (if equipped)
- Idle air control (IAC) motor
- Ignition coil
- Leak detection pump (if equipped)
- Malfunction indicator lamp (Check engine lamp). Driven through CCD circuits.
- Overdrive indicator lamp (if equipped)
- Radiator cooling fan (2.5L engine only)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through CCD circuits.
- Transmission convertor clutch circuit
- Transmission 3–4 shift solenoid
- Transmission relay
- Transmission temperature lamp (if equipped)
- Transmission variable force solenoid

ELECTRONIC GOVERNOR

DESCRIPTION

Governor pressure is controlled electronically. Components used for governor pressure control include:

- Governor body
- Valve body transfer plate
- Governor pressure solenoid valve
- Governor pressure sensor
- Fluid temperature thermistor
- Throttle position sensor (TPS)
- Transmission speed sensor
- Powertrain control module (PCM)

DESCRIPTION AND OPERATION (Continued)

GOVERNOR PRESSURE SOLENOID VALVE

The solenoid valve is a duty-cycle solenoid which regulates the governor pressure needed for upshifts and downshifts. It is an electro-hydraulic device located in the governor body on the valve body transfer plate (Fig. 63).

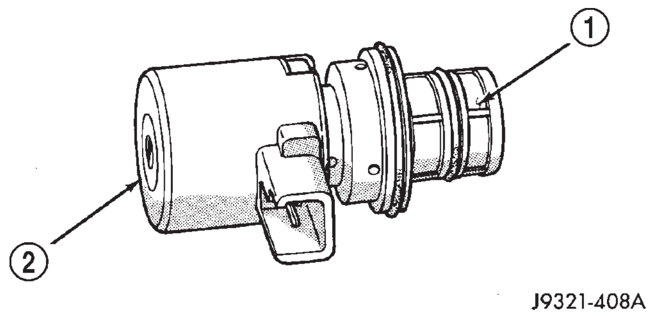


Fig. 63 Governor Pressure Solenoid Valve

1 – SOLENOID FILTER
2 – GOVERNOR PRESSURE SOLENOID

GOVERNOR PRESSURE SENSOR

The governor pressure sensor measures output pressure of the governor pressure solenoid valve (Fig. 64).

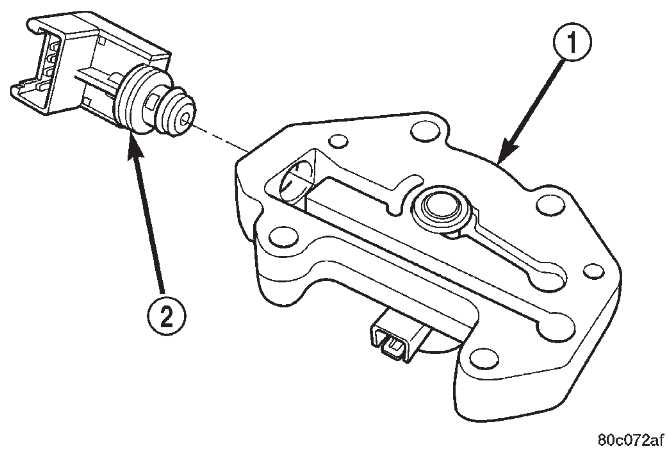


Fig. 64 Governor Pressure Sensor

1 – GOVERNOR BODY
2 – GOVERNOR PRESSURE SENSOR/TRANSMISSION FLUID TEMPERATURE THERMISTOR

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate is designed to supply transmission line pressure to the governor pressure solenoid valve and to return governor pressure.

The governor pressure solenoid valve is mounted in the governor body. The body is bolted to the lower side of the transfer plate (Fig. 64).

TRANSMISSION FLUID TEMPERATURE THERMISTOR

Transmission fluid temperature readings are supplied to the transmission control module by the thermistor. The temperature readings are used to control engagement of the fourth gear overdrive clutch, the converter clutch, and governor pressure. Normal resistance value for the thermistor at room temperature is approximately 1000 ohms.

The thermistor is part of the governor pressure sensor assembly and is immersed in transmission fluid at all times.

TRANSMISSION SPEED SENSOR

The speed sensor (Fig. 65) is located in the overdrive gear case. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed.

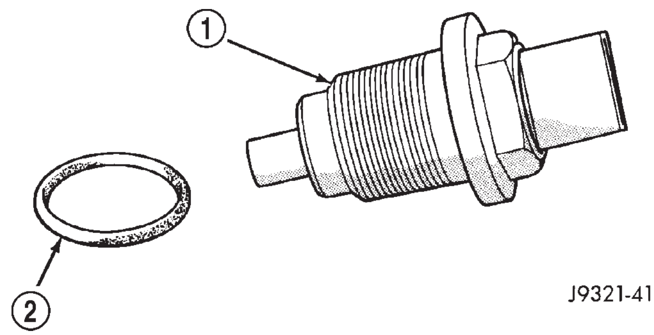


Fig. 65 Transmission Output Speed Sensor

1 – TRANSMISSION OUTPUT SHAFT SPEED SENSOR
2 – SEAL

OPERATION

Compensation is required for performance variations of two of the input devices. Though the slope of the transfer functions is tightly controlled, offset may vary due to various environmental factors or manufacturing tolerances.

The pressure transducer is affected by barometric pressure as well as temperature. Calibration of the zero pressure offset is required to compensate for shifting output due to these factors.

Normal calibration will be performed when sump temperature is above 50 degrees F, or in the absence of sump temperature data, after the first 10 minutes of vehicle operation. Calibration of the pressure transducer offset occurs each time the output shaft speed falls below 200 RPM. Calibration shall be repeated each 3 seconds the output shaft speed is below 200 RPM. A.5 second pulse of 95% duty cycle is applied to the governor pressure solenoid valve and the transducer output is read during this pulse. Averaging of the transducer signal is necessary to reject electrical noise.

Under cold conditions (below 50 degrees F sump), the governor pressure solenoid valve response may be too slow to guarantee 0 psi during the.5 second calibration pulse. Calibration pulses are continued during this period, however the transducer output

DESCRIPTION AND OPERATION (Continued)

valves are discarded. Transducer offset must be read at key-on, under conditions which promote a stable reading. This value is retained and becomes the offset during the “cold” period of operation.

GOVERNOR PRESSURE SOLENOID VALVE

The inlet side of the solenoid valve is exposed to normal transmission line pressure. The outlet side of the valve leads to the valve body governor circuit.

The solenoid valve regulates line pressure to produce governor pressure. The average current supplied to the solenoid controls governor pressure. One amp current produces zero kPa/psi governor pressure. Zero amps sets the maximum governor pressure.

The powertrain control module (PCM) turns on the trans control relay which supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC). The PCM controls the ground side of the solenoid using the governor pressure solenoid control circuit.

GOVERNOR PRESSURE SENSOR

The sensor output signal provides the necessary feedback to the PCM. This feedback is needed to adequately control governor pressure.

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate channels line pressure to the solenoid valve through the governor body. It also channels governor pressure from the solenoid valve to the governor circuit. It is the solenoid valve that develops the necessary governor pressure.

TRANSMISSION FLUID TEMPERATURE THERMISTOR

The PCM prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 10°C (50°F).

If fluid temperature exceeds 126°C (260°F), the PCM causes a 4-3 downshift and engage the converter clutch. Engagement is according to the third gear converter clutch engagement schedule.

The overdrive OFF lamp in the instrument panel illuminates when the shift back to third occurs. The transmission will not allow fourth gear operation until fluid temperature decreases to approximately 110°C (230°F).

TRANSMISSION SPEED SENSOR

Speed sensor signals are triggered by the park gear lugs as they rotate past the sensor pickup face. Input signals from the sensor are sent to the transmission control module for processing. The vehicle speed sensor also serves as a backup for the transmission speed sensor. Signals from this sensor are shared with the powertrain control module.

GOVERNOR PRESSURE CURVES

DESCRIPTION

There are four governor pressure curves programmed into the transmission control module. The different curves allow the control module to adjust governor pressure for varying conditions. One curve is used for operation when fluid temperature is at, or below, –1°C (30°F). A second curve is used when fluid temperature is at, or above, 10°C (50°F) during normal city or highway driving. A third curve is used during wide-open throttle operation. The fourth curve is used when driving with the transfer case in low range.

OPERATION

LOW TRANSMISSION FLUID TEMPERATURE

When the transmission fluid is cold the conventional governor can delay shifts, resulting in higher than normal shift speeds and harsh shifts. The electronically controlled low temperature governor pressure curve is higher than normal to make the transmission shift at normal speeds and sooner. The PCM uses a temperature sensor in the transmission oil sump to determine when low temperature governor pressure is needed.

NORMAL OPERATION

Normal operation is refined through the increased computing power of the PCM and through access to data on engine operating conditions provided by the PCM that were not available with the previous stand-alone electronic module. This facilitated the development of a load adaptive shift strategy - the ability to alter the shift schedule in response to vehicle load condition. One manifestation of this capability is grade “hunting” prevention - the ability of the transmission logic to delay an upshift on a grade if the engine does not have sufficient power to maintain speed in the higher gear. The 3-2 downshift and the potential for hunting between gears occurs with a heavily loaded vehicle or on steep grades. When hunting occurs, it is very objectionable because shifts are frequent and accompanied by large changes in noise and acceleration.

WIDE OPEN THROTTLE OPERATION

In wide-open throttle (WOT) mode, adaptive memory in the PCM assures that up-shifts occur at the preprogrammed optimum speed. WOT operation is determined from the throttle position sensor, which is also a part of the emission control system. The initial setting for the WOT upshift is below the optimum engine speed. As WOT shifts are repeated, the PCM learns the time required to complete the shifts

by comparing the engine speed when the shifts occur to the optimum speed. After each shift, the PCM adjusts the shift point until the optimum speed is reached. The PCM also considers vehicle loading, grade and engine performance changes due to high altitude in determining when to make WOT shifts. It does this by measuring vehicle and engine acceleration and then factoring in the shift time.

TRANSFER CASE LOW RANGE OPERATION

On four-wheel drive vehicles operating in low range, the engine can accelerate to its peak more rapidly than in Normal range, resulting in delayed shifts and undesirable engine "flare." The low range governor pressure curve is also higher than normal to initiate upshifts sooner. The PCM compares electronic vehicle speed signal used by the speedometer to the transmission output shaft speed signal to determine when the transfer case is in low range.

OVERDRIVE OFF SWITCH

DESCRIPTION

The overdrive OFF (control) switch is located in the shift lever arm.

OPERATION

The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function. At key-on, overdrive operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

DIAGNOSIS AND TESTING

AUTOMATIC TRANSMISSION DIAGNOSIS

Automatic transmission problems can be a result of poor engine performance, incorrect fluid level, incorrect linkage or cable adjustment, band or hydraulic control pressure adjustments, hydraulic system malfunctions or electrical/mechanical component malfunctions. Begin diagnosis by checking the easily accessible items such as: fluid level and condition, linkage adjustments and electrical connections. A road test will determine if further diagnosis is necessary.

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve, clutch and servo operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(2) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to reverse flush cooler and lines after repair
- failure to replace contaminated converter after repair

The use of non recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the

DIAGNOSIS AND TESTING (Continued)

time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission for some time, an overhaul may also be necessary; especially if shift problems had developed.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in recontamination. Flushing applies to auxiliary coolers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVEABLE

(1) Check for transmission fault codes using DRB scan tool.

(2) Check fluid level and condition.

(3) Adjust throttle and gearshift linkage if complaint was based on delayed, erratic, or harsh shifts.

(4) Road test and note how transmission upshifts, downshifts, and engages.

(5) Perform stall test if complaint is based on sluggish acceleration. Or, if abnormal throttle opening is needed to maintain normal speeds with a properly tuned engine.

(6) Perform hydraulic pressure test if shift problems were noted during road test.

(7) Perform air-pressure test to check clutch-band operation.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken or disconnected gearshift or throttle linkage.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:

(a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.

(b) If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged drive plate, converter, oil pump, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

PARK/NEUTRAL POSITION SWITCH

The center terminal of the park/neutral position switch is the starter-circuit terminal. It provides the ground for the starter solenoid circuit through the selector lever in PARK and NEUTRAL positions only. The outer terminals on the switch are for the backup lamp circuit.

SWITCH TEST

To test the switch, remove the wiring connector. Test for continuity between the center terminal and the transmission case. Continuity should exist only when the transmission is in PARK or NEUTRAL.

Shift the transmission into REVERSE and test continuity at the switch outer terminals. Continuity should exist only when the transmission is in REVERSE. Continuity should not exist between the outer terminals and the case.

Check gearshift linkage adjustment before replacing a switch that tests faulty.

OVERDRIVE ELECTRICAL CONTROLS

The overdrive off switch, valve body solenoid, case connectors and related wiring can all be tested with a 12 volt test lamp or a volt/ohmmeter. Check continuity of each component when diagnosis indicates this is necessary. Refer to Group 8W, Wiring Diagrams, for component locations and circuit information.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

GEARSHIFT CABLE

(1) The shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With shift lever handle in:

(a) PARK position—Apply forward force on center of lever and remove pressure. Engine starts must be possible.

DIAGNOSIS AND TESTING (Continued)

(b) PARK position—Apply rearward force on center of lever and remove pressure. Engine starts must be possible.

(c) NEUTRAL position—Normal position. Engine starts must be possible.

(d) NEUTRAL position—Engine running and brakes applied, apply forward force on center of shift lever. Transmission shall not be able to shift from neutral to reverse.

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul will be necessary to restore normal operation.

A slipping clutch or band can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch and Band Application chart provides a basis for analyzing road test results.

ANALYZING ROAD TEST

Refer to the Clutch and Band Application chart and note which elements are in use in the various gear ranges.

Note that the rear clutch is applied in all forward ranges (D, 2, 1). The transmission overrunning clutch is applied in first gear (D, 2 and 1 ranges) only. The rear band is applied in 1 and R range only.

Note that the overdrive clutch is applied only in fourth gear and the overdrive direct clutch and overrunning clutch are applied in all ranges except fourth gear.

For example: If slippage occurs in first gear in D and 2 range but not in 1 range, the transmission overrunning clutch is faulty. Similarly, if slippage occurs in any two forward gears, the rear clutch is slipping.

Applying the same method of analysis, note that the front and rear clutches are applied simultaneously only in D range third and fourth gear. If the transmission slips in third gear, either the front clutch or the rear clutch is slipping.

If the transmission slips in fourth gear but not in third gear, the overdrive clutch is slipping. By selecting another gear which does not use these clutches, the slipping unit can be determined. For example, if the transmission also slips in Reverse, the front clutch is slipping. If the transmission does not slip in Reverse, the rear clutch is slipping.

If slippage occurs during the 3-4 shift or only in fourth gear, the overdrive clutch is slipping. Similarly, if the direct clutch were to fail, the transmis-

SHIFT LEVER POSITION	TRANSMISSION CLUTCHES AND BANDS					OVERDRIVE CLUTCHES		
	FRONT CLUTCH	FRONT BAND	REAR CLUTCH	REAR BAND	OVERRUN. CLUTCH	OVERDRIVE CLUTCH	DIRECT CLUTCH	OVERRUN. CLUTCH
Reverse	X			X			X	
Drive Range								
First			X		X		X	X
Second		X	X				X	X
Third	X		X				X	X
Fourth	X		X			X		
2-Range (Manual) Second)		X	X		X		X	X
1-Range (Manual Low)			X	X	X		X	X

J9421-218

Clutch And Band Application Chart

DIAGNOSIS AND TESTING (Continued)

sion would lose both reverse gear and overrun braking in 2 position (manual second gear).

If the transmission will not shift to fourth gear, the control switch, overdrive solenoid or related wiring may also be the problem cause.

This process of elimination can be used to identify a slipping unit and check operation. Proper use of the Clutch and Band Application Chart is the key.

Although road test analysis will help determine the slipping unit, the actual cause of a malfunction usually cannot be determined until hydraulic and air pressure tests are performed. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Unless a malfunction is obvious, such as no drive in D range first gear, do not disassemble the transmission. Perform the hydraulic and air pressure tests to help determine the probable cause.

HYDRAULIC PRESSURE TEST

Hydraulic test pressures range from a low of one psi (6.895 kPa) governor pressure, to 300 psi (2068 kPa) at the rear servo pressure port in reverse.

An accurate tachometer and pressure test gauges are required. Test Gauge C-3292 has a 100 psi range and is used at the accumulator, governor, and front servo ports. Test Gauge C-3293-SP has a 300 psi range and is used at the rear servo and overdrive ports where pressures exceed 100 psi.

Pressure Test Port Locations

Test ports are located at both sides of the transmission case (Fig. 66).

Line pressure is checked at the accumulator port on the right side of the case. The front servo pressure port is at the right side of the case just behind the filler tube opening.

The rear servo and governor pressure ports are at the right rear of the transmission case. The overdrive clutch pressure port is at the left rear of the case.

Test One - Transmission In Manual Low

NOTE: This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Both test gauges are required for this test.

(1) Connect tachometer to engine. Position tachometer so it can be observed from driver seat if helper will be operating engine. Raise vehicle on hoist that will allow rear wheels to rotate freely.

(2) Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port.

(3) Disconnect throttle and gearshift cables from levers on transmission valve body manual shaft.

(4) Have helper start and run engine at 1000 rpm.

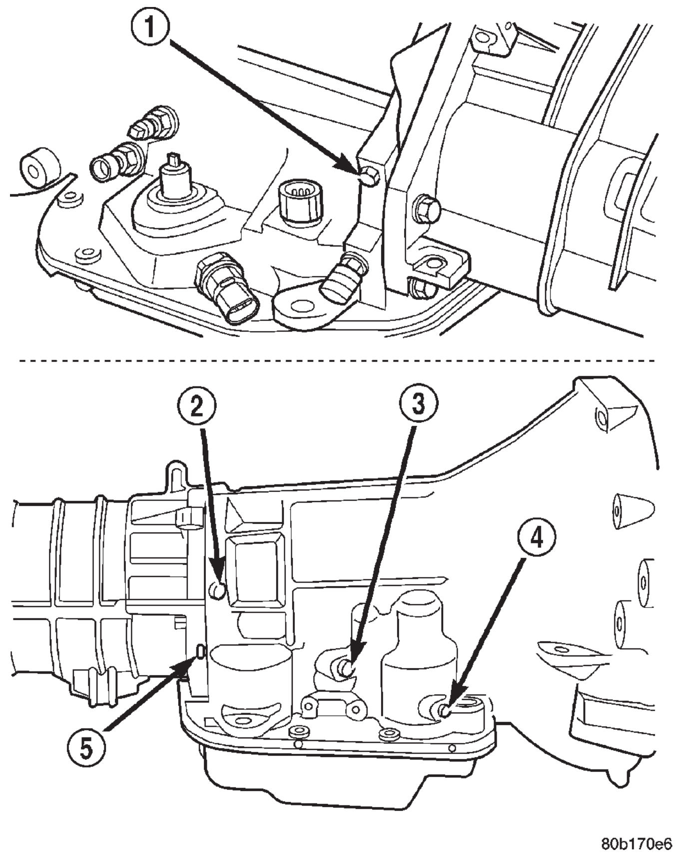


Fig. 66 Pressure Test Port Locations

1 – OVERDRIVE CLUTCH TEST PORT
2 – GOVERNOR TEST PORT
3 – ACCUMULATOR TEST PORT
4 – FRONT SERVO TEST PORT
5 – REAR SERVO TEST PORT

(5) Move transmission shift lever fully forward into 1 range.

(6) Gradually move transmission throttle lever from full forward to full rearward position and note pressures on both gauges:

- Line pressure at accumulator port should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as throttle lever is moved rearward.
- Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two—Transmission In 2 Range

NOTE: This test checks pump output, line pressure and pressure regulation. Use 100 psi Test Gauge C-3292 for this test.

(1) Leave vehicle in place on hoist and leave Test Gauge C-3292 connected to accumulator port.

(2) Have helper start and run engine at 1000 rpm.

(3) Move transmission shift lever one detent rearward from full forward position. This is 2 range.

DIAGNOSIS AND TESTING (Continued)

(4) Move transmission throttle lever from full forward to full rearward position and read pressure on gauge.

(5) Line pressure should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as lever is moved rearward.

Test Three—Transmission In D Range Third Gear

NOTE: This test checks pressure regulation and condition of the clutch circuits. Both test gauges are required for this test.

(1) Turn OD switch off.

(2) Leave vehicle on hoist and leave Gauge C-3292 in place at accumulator port.

(3) Move Gauge C-3293-SP over to front servo port for this test.

(4) Have helper start and run engine at 1600 rpm for this test.

(5) Move transmission shift lever two detents rearward from full forward position. This is D range.

(6) Read pressures on both gauges as transmission throttle lever is gradually moved from full forward to full rearward position:

- Line pressure at accumulator in D range third gear, should be 54-60 psi (372-414 kPa) with throttle lever forward and increase as lever is moved rearward.
- Front servo pressure in D range third gear, should be within 3 psi (21 kPa) of line pressure up to kickdown point.

Test Four—Transmission In Reverse

NOTE: This test checks pump output, pressure regulation and the front clutch and rear servo circuits. Use 300 psi Test Gauge C-3293-SP for this test.

(1) Leave vehicle on hoist and leave gauge C3292 in place at accumulator port.

(2) Move 300 psi Gauge C-3293-SP back to rear servo port.

(3) Have helper start and run engine at 1600 rpm for test.

(4) Move transmission shift lever four detents rearward from full forward position. This is Reverse range.

(5) Move transmission throttle lever fully forward then fully rearward and note reading at Gauge C-3293-SP.

(6) Pressure should be 145 - 175 psi (1000-1207 kPa) with throttle lever forward and increase to 230 - 280 psi (1586-1931 kPa) as lever is gradually moved rearward.

Test Five—Governor Pressure

NOTE: This test checks governor operation by measuring governor pressure response to changes in vehicle speed. It is usually not necessary to check governor operation unless shift speeds are incorrect or if the transmission will not downshift. The test should be performed on the road or on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port.

(2) Move transmission shift lever two detents rearward from full forward position. This is D range.

(3) Have helper start and run engine at curb idle speed. Then firmly apply service brakes so wheels will not rotate.

(4) Note governor pressure:

- Governor pressure should be no more than 20.6 kPa (3 psi) at curb idle speed and wheels not rotating.
- If pressure exceeds 20.6 kPa (3 psi), a fault exists in governor pressure control system.

(5) Release brakes, slowly increase engine speed, and observe speedometer and pressure test gauge (do not exceed 30 mph on speedometer). Governor pressure should increase in proportion to vehicle speed. Or approximately 6.89 kPa (1 psi) for every 1 mph.

(6) Governor pressure rise should be smooth and drop back to no more than 20.6 kPa (3 psi), after engine returns to curb idle and brakes are applied to prevent wheels from rotating.

(7) Compare results of pressure test with analysis chart.

Test Six—Transmission In Overdrive Fourth Gear

NOTE: This test checks line pressure at the overdrive clutch in fourth gear range. Use 300 psi Test Gauge C-3293-SP for this test. The test should be performed on the road or on a chassis dyno.

(1) Remove tachometer; it is not needed for this test.

(2) Move 300 psi Gauge to overdrive clutch pressure test port. Then remove other gauge and reinstall test port plug.

(3) Lower vehicle.

(4) Turn OD switch on.

(5) Secure test gauge so it can be viewed from drivers seat.

(6) Start engine and shift into D range.

(7) Increase vehicle speed gradually until 3-4 shift occurs and note gauge pressure.

(8) Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-827 kPa (90-120 psi) at 1/2 to 3/4 throttle. Note that pressure can increase to around 896 kPa (130 psi) at full throttle.

DIAGNOSIS AND TESTING (Continued)

(9) Return to shop or move vehicle off chassis dyno.

PRESSURE TEST ANALYSIS CHART

TEST CONDITION	INDICATION
Line pressure OK during any one test	Pump and regulator valve OK
Line pressure OK in R but low in D, 2, 1	Leakage in rear clutch area (seal rings, clutch seals)
Pressure low in D Fourth Gear Range	Overdrive clutch piston seal, or check ball problem
Pressure OK in 1, 2 but low in D3 and R	Leakage in front clutch area
Pressure OK in 2 but low in R and 1	Leakage in rear servo
Front servo pressure low in 2	Leakage in servo; broken servo ring or cracked servo piston
Pressure low in all positions	Clogged filter, stuck regulator valve, worn or faulty pump, low oil level
Governor pressure too high at idle speed	Governor pressure solenoid valve system fault. Refer to diagnostic book.
Governor pressure low at all mph figures	Faulty governor pressure solenoid, transmission control module, or governor pressure sensor
Lubrication pressure low at all throttle positions	Clogged fluid cooler or lines, seal rings leaking, worn pump bushings, pump, clutch retainer, or clogged filter.
Line pressure high	Output shaft plugged, sticky regulator valve
Line pressure low	Sticky regulator valve, clogged filter, worn pump

AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION

Air-pressure testing can be used to check transmission front/rear clutch and band operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check, after overhaul.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The servo and clutch apply passages are shown (Fig. 67).

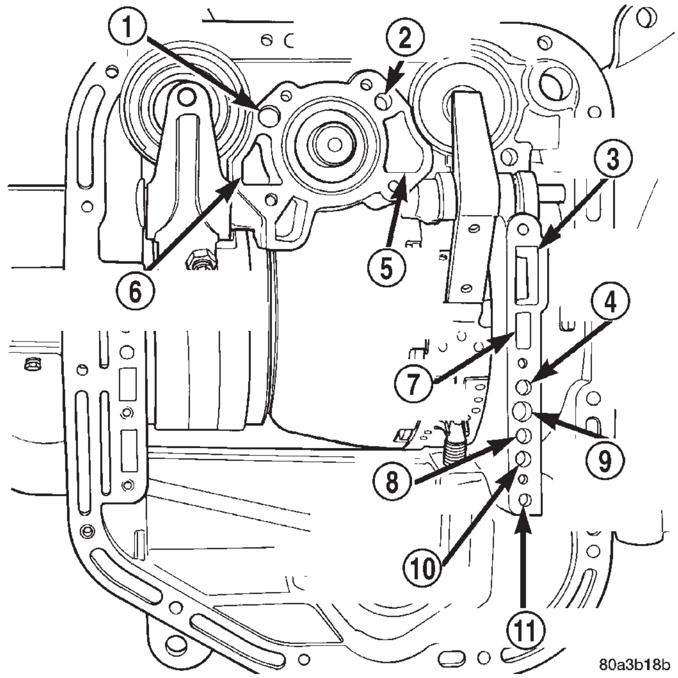


Fig. 67 Air Pressure Test Passages

1 – REAR SERVO APPLY
2 – FRONT SERVO APPLY
3 – PUMP SUCTION
4 – FRONT CLUTCH APPLY
5 – FRONT SERVO RELEASE
6 – LINE PRESSURE TO ACCUMULATOR
7 – PUMP PRESSURE
8 – TO CONVERTER
9 – REAR CLUTCH APPLY
10 – FROM CONVERTER
11 – TO COOLER

Front Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

Rear Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through rear clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

Front Servo Apply Air Test

Apply air pressure to the front servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

DIAGNOSIS AND TESTING (Continued)

Rear Servo Air Test

Apply air pressure to the rear servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, two items must be established before repair.

(1) Verify that a leak condition actually exists.

(2) Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump O-ring or pump body leaks follow the same path as a seal leak (Fig. 68). Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 68). Pump seal or gasket leaks usually travel down the inside of the converter housing. Front band lever pin plug leaks are generally deposited on the housing and not on the converter.

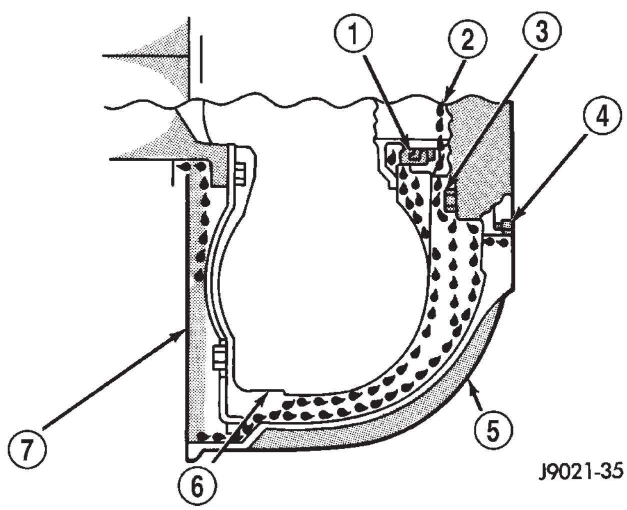


Fig. 68 Converter Housing Leak Paths

1 – PUMP SEAL
2 – PUMP VENT
3 – PUMP BOLT
4 – PUMP GASKET
5 – CONVERTER HOUSING
6 – CONVERTER
7 – REAR MAIN SEAL LEAK

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 69).

(2) Leaks at the converter hub weld (Fig. 69).

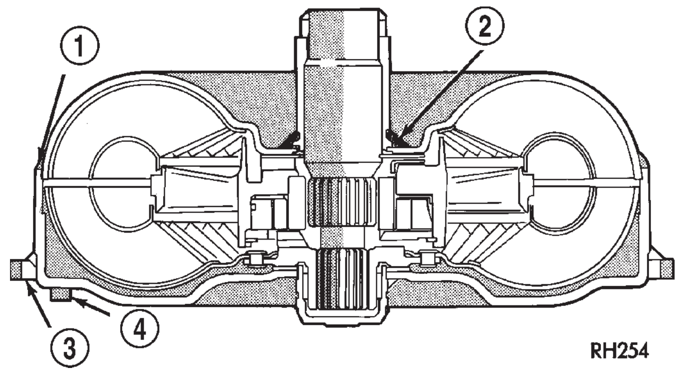


Fig. 69 Converter Leak Points—Typical

1 – OUTSIDE DIAMETER WELD
2 – TORQUE CONVERTER HUB WELD
3 – STARTER RING GEAR
4 – LUG

CONVERTER HOUSING AREA LEAK CORRECTION

(1) Remove converter.

(2) Tighten front band adjusting screw until band is tight around front clutch retainer. This prevents front/rear clutches from coming out when oil pump is removed.

(3) Remove oil pump and remove pump seal. Inspect pump housing drainback and vent holes for obstructions. Clear holes with solvent and wire.

(4) Inspect pump bushing and converter hub. If bushing is scored, replace it. If converter hub is scored, either polish it with crocus cloth or replace converter.

(5) Install new pump seal, O-ring, and gasket. Replace oil pump if cracked, porous or damaged in any way. Be sure to loosen the front band before installing the oil pump, damage to the oil pump seal may occur if the band is still tightened to the front clutch retainer.

(6) Loosen kickdown lever pin access plug three turns. Apply Loctite 592, or Permatex No. 2 to plug threads and tighten plug to 17 N·m (150 in. lbs.) torque.

(7) Adjust front band.

(8) Lubricate pump seal and converter hub with transmission fluid or petroleum jelly and install converter.

(9) Install transmission and converter housing dust shield.

(10) Lower vehicle.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS TABLES AND CHARTS—RE TRANSMISSION

The diagnosis charts provide additional reference when diagnosing a transmission fault. The charts provide general information on a variety of transmission, overdrive unit and converter clutch fault conditions.

The hydraulic flow charts in the Schematics and Diagrams section of this group, outline fluid flow and hydraulic circuitry. Circuit operation is provided for neutral, third, fourth and reverse gear ranges. Normal working pressures are also supplied for each of the gear ranges.

DIAGNOSIS CHARTS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low	1. Add Fluid
	2. Throttle Linkage Misadjusted	2. Adjust linkage - setting may be too long.
	3. Mount and Driveline Bolts Loose	3. Check engine mount, transmission mount, propeller shaft, rear spring to body bolts, rear control arms, crossmember and axle bolt torque. Tighten loose bolts and replace missing bolts.
	4. U-Joint Worn/Broken	4. Remove propeller shaft and replace U-Joint.
	5. Axle Backlash Incorrect	5. Check per Service Manual. Correct as needed.
	6. Hydraulic Pressure Incorrect	6. Check pressure. Remove, overhaul or adjust valve body as needed.
	7. Band Misadjusted.	7. Adjust rear band.
	8. Valve Body Check Balls Missing.	8. Inspect valve body for proper check ball installation.
	9. Axle Pinion Flange Loose.	9. Replace nut and check pinion threads before installing new nut. Replace pinion gear if threads are damaged.
	10. Clutch, band or planetary component damaged.	10. Remove, disassemble and repair transmission as necessary.
	11. Converter Clutch Faulty.	11. Replace converter and flush cooler and line before installing new converter.
DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low.	1. Correct level and check for leaks.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	2. Filter Clogged.	2. Change filter.
	3. Gearshift Linkage Misadjusted.	3. Adjust linkage and repair linkage if worn or damaged.
	4. Torque Converter Drain Back (Oil drains from torque converter into transmission sump)	4. If vehicle moves normally after 5 seconds after shifting into gear, no repair is necessary. If longer, inspect pump bushing for wear. Replace pump house.
	5. Rear Band Misadjusted.	5. Adjust band.
	6. Valve Body Filter Plugged.	6. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.
	7. Oil Pump Gears Worn/Damaged.	7. Remove transmission and replace oil pump.
	8. Governor Circuit and Solenoid Valve Electrical Fault.	8. Test with DRB scan tool and repair as required.
	9. Hydraulic Pressure Incorrect.	9. Perform pressure test, remove transmission and repair as needed.
	10. Reaction Shaft Seal Rings Worn/Broken.	10. Remove transmission, remove oil pump and replace seal rings.
	11. Rear Clutch/Input Shaft, Rear Clutch Seal Rings Damaged.	11. Remove and disassemble transmission and repair as necessary.
	12. Regulator Valve Stuck.	12. Clean.
	13. Cooler Plugged.	13. Transfer case failure can plug cooler.
NO DRIVE RANGE (REVERSE OK)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Repair or replace linkage components.
	3. Rear Clutch Burnt.	3. Remove and disassemble transmission and rear clutch and seals. Repair/replace worn or damaged parts as needed.
	4. Valve Body Malfunction.	4. Remove and disassemble valve body. Replace assembly if any valves or bores are damaged.
	5. Transmission Overrunning Clutch Broken.	5. Remove and disassemble transmission. Replace overrunning clutch.
	6. Input Shaft Seal Rings Worn/ Damaged.	6. Remove and disassemble transmission. Replace seal rings and any other worn or damaged parts.
	7. Front Planetary Failed Broken.	7. Remove and repair.
NO DRIVE OR REVERSE (VEHICLE WILL NOT MOVE)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Inspect, adjust and reassemble linkage as needed. Replace worn/damaged parts.
	3. U-Joint/Axle/Transfer Case Broken.	3. Perform preliminary inspection procedure for vehicle that will not move. Refer to procedure in diagnosis section.
	4. Filter Plugged.	4. Remove and disassemble transmission. Repair or replace failed components as needed. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test. Flush oil. Replace cooler as necessary.
	5. Oil Pump Damaged.	5. Perform pressure test to confirm low pressure. Replace pump body assembly if necessary.
	6. Valve Body Malfunctioned.	6. Check and inspect valve body. Replace valve body (as assembly) if any valve or bore is damaged. Clean and reassemble correctly if all parts are in good condition.
	7. Transmission Internal Component Damaged.	7. Remove and disassemble transmission. Repair or replace failed components as needed.
	8. Park Sprag not Releasing - Check Stall Speed, Worn/Damaged/Stuck.	8. Remove, disassemble, repair.
	9. Torque Converter Damage.	9. Inspect and replace as required.
SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)	1. Fluid Level Low/High.	1. Correct fluid level and check for leaks if low.
	2. Fluid Filter Clogged.	2. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage as described in service section.
	4. Throttle Linkage Binding.	4. Check cable for binding. Check for return to closed throttle at transmission.
	5. Gearshift Linkage/Cable Misadjusted.	5. Adjust linkage/cable as described in service section.
	6. Clutch or Servo Failure.	6. Remove valve body and air test clutch, and band servo operation. Disassemble and repair transmission as needed.
	7. Governor Circuit Electrical Fault.	7. Test using DRB scan tool and repair as required.
	8. Front Band Misadjusted.	8. Adjust band.
	9. Pump Suction Passage Leak.	9. Check for excessive foam on dipstick after normal driving. Check for loose pump bolts, defective gasket. Replace pump assembly if needed.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO REVERSE (D RANGES OK)	1. Gearshift Linkage/Cable Misadjusted/Damaged.	1. Repair or replace linkage parts as needed.
	2. Park Sprag Sticking.	2. Replace overdrive annulus gear.
	3. Rear Band Misadjusted/Worn.	3. Adjust band; replace.
	4. Valve Body Malfunction.	4. Remove and service valve body. Replace valve body if any valves or valve bores are worn or damaged.
	5. Rear Servo Malfunction.	5. Remove and disassemble transmission. Replace worn/damaged servo parts as necessary.
	6. Direct Clutch in Overdrive Worn	6. Disassemble overdrive. Replace worn or damaged parts.
	7. Front Clutch Burnt.	7. Remove and disassemble transmission. Replace worn, damaged clutch parts as required.
HAS FIRST/REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)	1. Governor Circuit Electrical Fault.	1. Test using DRB scan tool and repair as required.
	2. Valve Body Malfunction.	2. Repair stuck 1-2 shift valve or governor plug.
	3. Front Servo/Kickdown Band Damaged/Burned.	3. Repair/replace.
MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW	1. Valve Body Malfunction.	1. Remove, clean and inspect. Look for stuck 1-2 valve or governor plug.
	2. Governor Valve Sticking.	2. Remove, clean and inspect. Replace faulty parts.
NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)	1. Governor Valve Sticking.	1. Remove governor, clean, inspect and repair as required.
	2. Governor Circuit Electrical Fault.	2. Test with DRB scan tool and repair as required.
	3. Valve Body Malfunction.	3. Remove, clean and inspect. Look for sticking 1-2 shift valve, 2-3 shift valve, governor plug or broken springs.
	4. Front Servo Piston Cocked in Bore.	4. Inspect servo and repair as required.
	5. Front Band Linkage Malfunction	5. Inspect linkage and look for bind in linkage.
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Throttle Linkage Misadjusted.	1. Adjust linkage.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	2. Accelerator Pedal Travel Restricted.	2. Verify floor mat is not under pedal, repair worn accelerator cable or bent brackets.
	3. Valve Body Hydraulic Pressures Too High or Too Low Due to Valve Body Malfunction or Incorrect Hydraulic Control Pressure Adjustments.	3. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	4. Governor Circuit Electrical Fault.	4. Test with DRB scan tool and repair as required.
	5. Valve Body Malfunction.	5. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	6. TPS Malfunction.	6. Replace sensor, check with DRB scan tool.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if required.
	8. Valve Body Malfunction.	8. Repair sticking 1-2, 2-3 shift valves, governor plugs, 3-4 solenoid, 3-4 shift valve, 3-4 timing valve.
STUCK IN LOW GEAR (WILL NOT UPSHIFT)	1. Throttle Linkage Misadjusted/ Stuck.	1. Adjust linkage and repair linkage if worn or damaged. Check for binding cable or missing return spring.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage and repair linkage if worn or damaged.
	3. Governor Component Electrical Fault.	3. Check operating pressures and test with DRB scan tool, repair faulty component.
	4. Front Band Out of Adjustment.	4. Adjust Band.
	5. Clutch or Servo Malfunction.	5. Air pressure check operation of clutches and bands. Repair faulty component.
CREEPS IN NEUTRAL	1. Gearshift Linkage Misadjusted.	1. Adjust linkage.
	2. Rear Clutch Dragging/Warped.	2. Disassemble and repair.
	3. Valve Body Malfunction.	3. Perform hydraulic pressure test to determine cause and repair as required.
BUZZING NOISE	1. Fluid Level Low	1. Add fluid and check for leaks.
	2. Shift Cable Misassembled.	2. Route cable away from engine and bell housing.
	3. Valve Body Misassembled.	3. Remove, disassemble, inspect valve body. Reassemble correctly if necessary. Replace assembly if valves or springs are damaged. Check for loose bolts or screws.
	4. Pump Passages Leaking	4. Check pump for porous casting, scores on mating surfaces and excess rotor clearance. Repair as required. Loose pump bolts.
	5. Cooling System Cooler Plugged.	5. Flow check cooler circuit. Repair as needed.
	6. Overrunning Clutch Damaged.	6. Replace clutch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN REVERSE ONLY	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage.
	3. Rear Band Misadjusted.	3. Adjust band.
	4. Rear Band Worn.	4. Replace as required.
	5. Overdrive Direct Clutch Worn.	5. Disassemble overdrive. Repair as needed.
	6. Hydraulic Pressure Too Low.	6. Perform hydraulic pressure tests to determine cause.
	7. Rear Servo Leaking.	7. Air pressure check clutch-servo operation and repair as required.
	8. Band Linkage Binding.	8. Inspect and repair as required.
SLIPS IN FORWARD DRIVE RANGES	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Fluid Foaming.	2. Check for high oil level, bad pump gasket or seals, dirt between pump halves and loose pump bolts. Replace pump if necessary.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage.
	4. Gearshift Linkage Misadjusted.	4. Adjust linkage.
	5. Rear Clutch Worn.	5. Inspect and replace as needed.
	6. Low Hydraulic Pressure Due to Worn Pump, Incorrect Control Pressure Adjustments, Valve Body Warpage or Malfunction, Sticking, Leaking Seal Rings, Clutch Seals Leaking, Servo Leaks, Clogged Filter or Cooler Lines	6. Perform hydraulic and air pressure tests to determine cause.
	7. Rear Clutch Malfunction, Leaking Seals or Worn Plates.	7. Air pressure check clutch-servo operation and repair as required.
	8. Overrunning Clutch Worn, Not Holding (Slips in 1 Only).	8. Replace Clutch.
SLIPS IN LOW GEAR “D” ONLY, BUT NO IN 1 POSITION	Overrunning Clutch Faulty.	Replace overrunning clutch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GROWLING, GRATING OR SCRAPING NOISES	1. Drive Plate Broken.	1. Replace.
	2. Torque Converter Bolts Hitting Dust Shield.	2. Dust shield bent. Replace or repair.
	3. Planetary Gear Set Broken/ Seized.	3. Check for debris in oil pan and repair as required.
	4. Overrunning Clutch Worn/Broken.	4. Inspect and check for debris in oil pan. Repair as required.
	5. Oil Pump Components Scored/ Binding.	5. Remove, inspect and repair as required.
	6. Output Shaft Bearing or Bushing Damaged.	6. Remove, inspect and repair as required.
	7. Clutch Operation Faulty.	7. Perform air pressure check and repair as required.
	8. Front and Rear Bands Misadjusted.	8. Adjust bands.
DRAGS OR LOCKS UP	1. Fluid Level Low.	1. Check and adjust level.
	2. Clutch Dragging/Failed	2. Air pressure check clutch operation and repair as required.
	3. Front or Rear Band Misadjusted.	3. Adjust bands.
	4. Case Leaks Internally.	4. Check for leakage between passages in case.
	5. Servo Band or Linkage Malfunction.	5. Air pressure check servo operation and repair as required.
	6. Overrunning Clutch Worn.	6. Remove and inspect clutch. Repair as required.
	7. Planetary Gears Broken.	7. Remove, inspect and repair as required (look for debris in oil pan).
	8. Converter Clutch Dragging.	8. Check for plugged cooler. Perform flow check. Inspect pump for excessive side clearance. Replace pump as required.
NO 4-3 DOWNSHIFT	1. Circuit Wiring and/or Connectors Shorted.	1. Test wiring and connectors with test lamp and volt/ohmmeter. Repair wiring as necessary. Replace connectors and/or harnesses as required.
	2. PCM Malfunction.	2. Check PCM operation with DRB scan tool. Replace PCM only if faulty.
	3. TPS Malfunction	3. Check TPS with DRB scan tool at PCM.
	4. Lockup Solenoid Not Venting.	4. Remove valve body and replace solenoid assembly if plugged or shorted.
	5. Overdrive Solenoid Not Venting.	5. Remove valve body and replace solenoid if plugged or shorted.
	6. Valve Body Valve Sticking.	6. Repair stuck 3-4 shift valve or lockup timing valve.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF	1. Control Switch Open/Shorted.	1. Test and replace switch if faulty.
	2. Overdrive Solenoid Connector Shorted.	2. Test solenoids and replace if seized or shorted.
	3. PCM Malfunction.	3. Test with DRB scan tool. Replace PCM if faulty.
	4. Valve Body Stuck Valves.	4. Repair stuck 3-4, lockup or lockup timing valve.
CLUNK NOISE FROM DRIVELINE ON CLOSED THROTTLE 4-3 DOWNSHIFT	1. Transmission Fluid Low.	1. Add Fluid.
	2. Throttle Cable Misadjusted.	2. Adjust cable.
	3. Overdrive Clutch Select Spacer Wrong Spacer.	3. Replace overdrive piston thrust plate spacer.
3-4 UPSHIFT OCCURS IMMEDIATELY AFTER 2-3 SHIFT	1. Overdrive Solenoid Connector or Wiring Shorted.	1. Test connector and wiring for loose connections, shorts or ground and repair as needed.
	2. TPS Malfunction.	2. Test TPS and replace as necessary. Check with DRB scan tool.
	3. PCM Malfunction.	3. Test PCM with DRB scan tool and replace controller if faulty.
	4. Overdrive Solenoid Malfunction.	4. Replace solenoid.
	5. Valve Body Malfunction.	5. Remove, disassemble, clean and inspect valve body components. Make sure all valves and plugs slide freely in bores. Polish valves with crocus cloth if needed.
WHINE/NOISE RELATED TO ENGINE SPEED	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Shift Cable Incorrect Routing.	2. Check shift cable for correct routing. Should not touch engine or bell housing.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 3-4 UPSHIFT	1. Dash O/D Switch In OFF Position.	1. Turn control switch to ON position.
	2. Overdrive Circuit Fuse Blown.	2. Replace fuse. Determine why fuse failed and repair as necessary (i.e., shorts or grounds in circuit).
	3. O/D Switch Wire Shorted/Open Cut.	3. Check wires/connections with 12V test lamp and voltmeter. Repair damaged or loose wire/connection as necessary.
	4. Distance or Coolant Sensor Malfunction.	4. Check with DRB scan tool and repair or replace as necessary.
	5. TPS Malfunction.	5. Check with DRB scan tool and replace if necessary.
	6. Neutral Switch to PCM Wire Shorted/Cut.	6. Test switch as described in service section and replace if necessary. Engine no start.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if necessary.
	8. Overdrive Solenoid Shorted/Open.	8. Replace solenoid if shorted or open and repair loose or damaged wires (DRB scan tool).
	9. Solenoid Feed Orifice in Valve Body Blocked.	9. Remove, disassemble, and clean valve body thoroughly. Check feed orifice.
	10. Overdrive Clutch Failed.	10. Disassemble overdrive and repair as needed.
	11. Hydraulic Pressure Low.	11. Pressure test transmission to determine cause.
	12. Valve Body Valve Stuck.	12. Repair stuck 3-4 shift valve, 3-4 timing valve.
	13. O/D Piston Incorrect Spacer.	13. Remove unit, check end play and install correct spacer.
	14. Overdrive Piston Seal Failure.	14. Replace both seals.
	15. O/D Check Valve/Orifice Failed.	15. Check for free movement and secure assembly (in piston retainer). Check ball bleed orifice.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN OVERDRIVE FOURTH GEAR	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Overdrive Clutch Pack Worn.	2. Remove overdrive unit and rebuild clutch pack.
	3. Overdrive Piston Retainer Bleed Orifice Blown Out.	3. Disassemble transmission, remove retainer and replace orifice.
	4. Overdrive Piston or Seal Malfunction.	4. Remove overdrive unit. Replace seals if worn. Replace piston if damaged. If piston retainer is damaged, remove and disassemble the transmission.
	5. 3-4 Shift Valve, Timing Valve or Accumulator Malfunction.	5. Remove and overhaul valve body. Replace accumulator seals. Make sure all valves operate freely in bores and do not bind or stick. Make sure valve body screws are correctly tightened and separator plates are properly positioned.
	6. Overdrive Unit Thrust Bearing Failure.	6. Disassemble overdrive unit and replace thrust bearing (NO. 1 thrust bearing is between overdrive piston and clutch hub; NO. 2 thrust bearing is between the planetary gear and the direct clutch spring plate; NO. 3 thrust bearing is between overrunning clutch hub and output shaft).
	7. O/D Check Valve/Bleed Orifice Failure.	7. Check for function/secure orifice insert in O/D piston retainer.
DELAYED 3-4 UPSHIFT (SLOW TO ENGAGE)	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Throttle Valve Cable Misadjusted.	2. Adjust throttle valve cable.
	3. Overdrive Clutch Pack Worn/ Burnt.	3. Remove unit and rebuild clutch pack.
	4. TPS Faulty.	4. Test with DRB scan tool and replace as necessary
	5. Overdrive Clutch Bleed Orifice Plugged.	5. Disassemble transmission and replace orifice.
	6. Overdrive Solenoid or Wiring Shorted/Open.	6. Test solenoid and check wiring for loose/corroded connections or shorts/ grounds. Replace solenoid if faulty and repair wiring if necessary.
	7. Overdrive Excess Clearance	7. Remove unit. Measure end play and select proper spacer.
	8. O/D Check Valve Missing or Stuck.	8. Check for presence of check valve. Repair or replace as required.
TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR	Lockup Solenoid, Relay or Wiring Shorted/Open.	Test solenoid, relay and wiring for continuity, shorts or grounds. Replace solenoid and relay if faulty. Repair wiring and connectors as necessary.
HARSH 1-2, 2-3, 3-4 OR 3-2 SHIFTS	Lockup Solenoid Malfunction.	Remove valve body and replace solenoid assembly.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO START IN PARK OR NEUTRAL	1. Gearshift Linkage/Cable Misadjusted.	1. Adjust linkage/cable.
	2. Neutral Switch Wire Open/Cut.	2. Check continuity with test lamp. Repair as required.
	3. Neutral Switch Faulty.	3. Refer to service section for test and replacement procedure.
	4. Neutral Switch Connect Faulty.	4. Connectors spread open. Repair.
	5. Valve Body Manual Lever Assembly Bent/Worn/Broken.	5. Inspect lever assembly and replace if damaged.
NO REVERSE (OR SLIPS IN REVERSE)	1. Direct Clutch Pack (front clutch) Worn.	1. Disassemble unit and rebuild clutch pack.
	2. Rear Band Misadjusted.	2. Adjust band.
	3. Front Clutch Malfunctioned/ Burned.	3. Air-pressure test clutch operation. Remove and rebuild if necessary.
	4. Overdrive Thrust Bearing Failure.	4. Disassemble geartrain and replace bearings.
	5. Direct Clutch Spring Collapsed/ Broken.	5. Remove and disassemble unit. Check clutch position and replace spring.
OIL LEAKS.	1. Fluid Lines and Fittings Loose/ Leaks/Damaged.	1. Tighten fittings. If leaks persist, replace fittings and lines if necessary.
	2. Fill Tube (where tube enters case) Leaks/Damaged.	2. Replace tube seal. Inspect tube for cracks in fill tube.
	3. Pressure Port Plug Loose Loose/Damaged.	3. Tighten to correct torque. Replace plug or reseal if leak persists.
	4. Pan Gasket Leaks.	4. Tighten pan screws (150 in. lbs.). If leaks persist, replace gasket.
	5. Valve Body Manual Lever Shaft Seal Leaks/Worn.	5. Replace shaft seal.
	6. Rear Bearing Access Plate Leaks.	6. Replace gasket. Tighten screws.
	7. Gasket Damaged or Bolts are Loose.	7. Replace bolts or gasket or tighten both.
	8. Adapter/Extension Gasket Damaged Leaks/Damaged.	8. Replace gasket.
	9. Neutral Switch Leaks/Damaged.	9. Replace switch and gasket.
	10. Converter Housing Area Leaks.	10. Check for leaks at seal caused by worn seal or burr on converter hub (cutting seal), worn bushing, missing oil return, oil in front pump housing or hole plugged. Check for leaks past O-ring seal on pump or past pump-to-case bolts; pump housing porous, oil coming out vent due to overfill or leak past front band shaft access plug.
	11. Pump Seal Leaks/Worn/ Damaged.	11. Replace seal.
	12. Torque Converter Weld Leak/Cracked Hub.	12. Replace converter.
	13. Case Porosity Leaks.	13. Replace case.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY OPERATION IN FOURTH GEAR ONLY	1. Overdrive Clutch Discs, Plates or Snap Rings Damaged.	1. Remove unit and rebuild clutch pack.
	2. Overdrive Piston or Planetary Thrust Bearing Damaged.	2. Remove and disassemble unit. Replace either thrust bearing if damaged.
	3. Output Shaft Bearings Scored/ Damaged.	3. Remove and disassemble unit. Replace either bearing if damaged.
	4. Planetary Gears Worn/Chipped.	4. Remove and overhaul overdrive unit.
	5. Overdrive Unit Overrunning Clutch Rollers Worn/Scored.	5. Remove and overhaul overdrive unit.

SERVICE PROCEDURES

FLUID LEVEL CHECK

Transmission fluid level should be checked monthly under normal operation. If the vehicle is used for trailer towing or similar heavy load hauling, check fluid level and condition weekly. Fluid level is checked with the engine running at curb idle speed, the transmission in NEUTRAL and the transmission fluid at normal operating temperature.

FLUID LEVEL CHECK PROCEDURE

(1) Transmission fluid must be at normal operating temperature for accurate fluid level check. Drive vehicle if necessary to bring fluid temperature up to normal hot operating temperature of 82°C (180°F).

(2) Position vehicle on level surface.

(3) Start and run engine at curb idle speed.

(4) Apply parking brakes.

(5) Shift transmission momentarily into all gear ranges. Then shift transmission back to Neutral.

(6) Clean top of filler tube and dipstick to keep dirt from entering tube.

(7) Remove dipstick (Fig. 70) and check fluid level as follows:

(a) Correct acceptable level is in crosshatch area.

(b) Correct maximum level is to MAX arrow mark.

(c) Incorrect level is at or below MIN line.

(d) If fluid is low, add only enough Mopar® ATF Plus 3 to restore correct level. Do not overfill.

CAUTION: Do not overfill the transmission. Overfilling may cause leakage out the pump vent which can be mistaken for a pump seal leak. Overfilling will also cause fluid aeration and foaming as the excess fluid is picked up and churned by the gear train. This will significantly reduce fluid life.

FLUID AND FILTER REPLACEMENT

Refer to the Maintenance Schedules in Group 0, Lubrication and Maintenance, for proper service intervals. The service fluid fill after a filter change is approximately 3.8 liters (4.0 quarts).

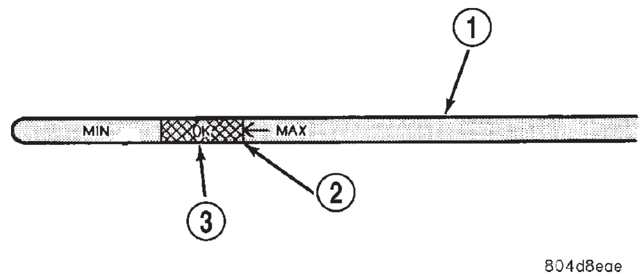


Fig. 70 Dipstick Fluid Level Marks—Typical

1 – DIPSTICK
2 – MAXIMUM CORRECT FLUID LEVEL
3 – ACCEPTABLE FLUID LEVEL

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Place a large diameter shallow drain pan beneath the transmission pan.

(3) Remove bolts holding front and sides of pan to transmission (Fig. 71).

(4) Loosen bolts holding rear of pan to transmission.

(5) Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.

(6) Hold up pan and remove remaining bolt holding pan to transmission.

(7) While holding pan level, lower pan away from transmission.

(8) Pour remaining fluid in pan into drain pan.

(9) Remove screws holding filter to valve body (Fig. 72).

(10) Separate filter from valve body and pour fluid in filter into drain pan.

(11) Dispose of used trans fluid and filter properly.

INSPECTION

Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch or band material on the bottom of the pan does not indicate a problem unless accompanied by slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts or debris, refer to the diagnosis section of this group.

SERVICE PROCEDURES (Continued)

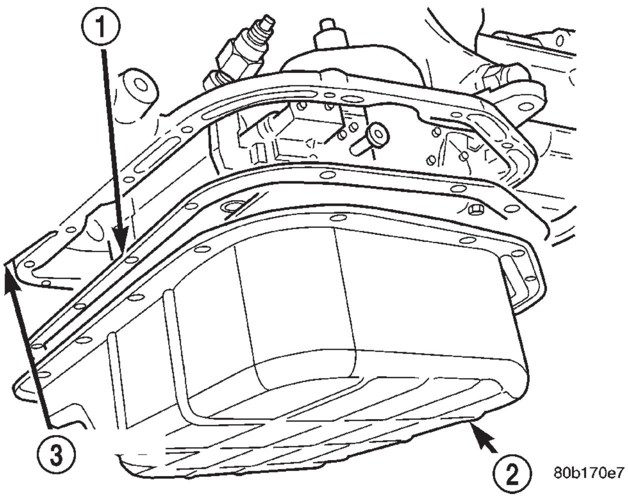


Fig. 71 Transmission Pan—Typical

1 – GASKET
2 – PAN
3 – TRANSMISSION

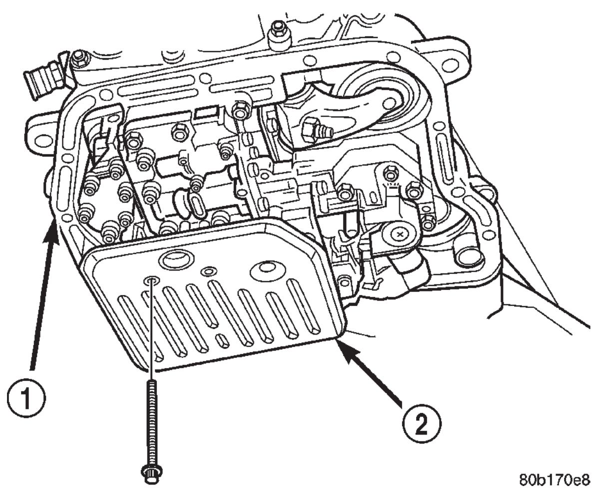


Fig. 72 Transmission Filter—Typical

1 – TRANSMISSION
2 – FILTER

Check the adjustment of the front and rear bands, adjust if necessary.

CLEANING

(1) Using a suitable solvent, clean pan and magnet.

(2) Using a suitable gasket scraper, clean gasket material from gasket surface of transmission case and the gasket flange around the pan.

INSTALLATION

(1) Place replacement filter in position on valve body.

(2) Install screws to hold filter to valve body (Fig. 72). Tighten screws to 4 N·m (35 in. lbs.) torque.

(3) Place new gasket in position on pan and install pan on transmission.

(4) Place pan in position on transmission.

(5) Install screws to hold pan to transmission (Fig. 71). Tighten bolts to 17 N·m (150 in. lbs.) torque.

(6) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

TRANSMISSION FILL PROCEDURE

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF Plus 3 to transmission:

(a) If only fluid and filter were changed, add **3 pints (1-1/2 quarts)** of ATF Plus 3 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **12 pints (6 quarts)** of ATF Plus 3 to transmission.

(3) Apply parking brakes.

(4) Start and run engine at normal curb idle speed.

(5) Apply service brakes, shift transmission through all gear ranges then back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.

(7) Drive vehicle until transmission fluid is at normal operating temperature.

(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

CONVERTER DRAINBACK CHECK VALVE SERVICE

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator tank. The valve prevents fluid drainback when the vehicle is parked for lengthy periods. The valve check ball is spring loaded and has an opening pressure of approximately 2 psi.

SERVICE PROCEDURES (Continued)

The valve is serviced as an assembly; it is not repairable. Do not clean the valve if restricted, or contaminated by sludge, or debris. If the valve fails, or if a transmission malfunction occurs that generates significant amounts of sludge and/or clutch particles and metal shavings, the valve must be replaced.

The valve must be removed whenever the cooler and lines are reverse flushed. The valve can be flow tested when necessary. The procedure is exactly the same as for flow testing a cooler.

If the valve is restricted, installed backwards, or in the wrong line, it will cause an overheating condition and possible transmission failure.

CAUTION: The drainback valve is a one-way flow device. It must be properly oriented in terms of flow direction for the cooler to function properly. The valve must be installed in the pressure line. Otherwise flow will be blocked and would cause an overheating condition and eventual transmission failure.

OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF+3, type 7176, Automatic Transmission Fluid.

(1) Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If one quart of transmission fluid is collected in the container in 20 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 20 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.

(4) Re-connect the **To cooler** line to the transmission cooler inlet.

(5) Refill the transmission to proper level.

FLUSHING COOLERS AND TUBES

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906A Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906A

(1) Remove cover plate filler plug on Tool 6906A. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906A.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines.

(8) Turn pump OFF.

SERVICE PROCEDURES (Continued)

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF Plus 3, type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL AND INSTALLATION

TRANSMISSION

The overdrive unit can be removed and serviced separately. It is not necessary to remove the entire transmission assembly to perform overdrive unit repairs.

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter drive plate, pump bushing, or oil seal can be damaged if the converter is left attached to the driveplate during removal.

REMOVAL

(1) Disconnect battery negative cable.

(2) Hoist and support vehicle.

(3) Remove skid plate, if equipped.

(4) Remove skid plate support crossmember, if equipped.

(5) Disconnect and lower or remove necessary exhaust components.

(6) Remove starter motor.

(7) Support engine with suitable support stand and wood block.

(8) Remove bolts attaching engine-to-transmission brackets to transmission.

(9) Remove bolt and nut attaching each engine-to-transmission bracket to the motor mounts.

(10) Remove bolts holding the engine-to-transmission brackets to the front axle, if equipped.

(11) Loosen bolts attaching engine-to-transmission brackets to each side of the engine block.

(12) Raise engine slightly.

(13) Remove torque converter access cover.

(14) Tighten bolts attaching engine-to-transmission brackets to each side of the engine block.

(15) Lower engine.

(16) Disconnect fluid cooler lines at transmission.

(17) If transmission is being removed for overhaul, remove transmission oil pan, drain fluid and reinstall pan.

(18) Remove fill tube bracket bolts and pull tube out of transmission. Retain fill tube seal. On 4 x 4 models, it will also be necessary to remove bolt attaching transfer case vent tube to converter housing (Fig. 73).

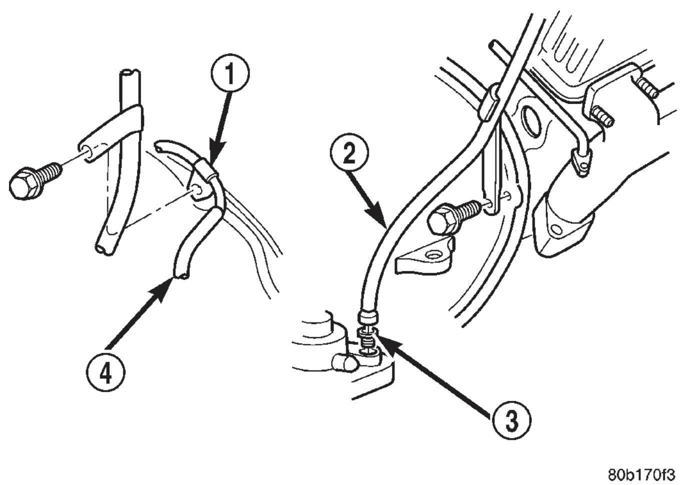


Fig. 73 Fill Tube Attachment

1 – TRANSFER CASE VENT TUBE
2 – FILL TUBE (V8)
3 – TUBE SEAL
4 – FILL TUBE (V6)

(19) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(20) Mark propeller shaft and axle companion flanges for assembly alignment. Then disconnect and remove propeller shaft.

REMOVAL AND INSTALLATION (Continued)

(21) Disconnect wires from park/neutral position switch and transmission solenoid.

(22) Disconnect throttle valve cable from transmission bracket and throttle valve lever.

(23) On 4 x 4 models, disconnect shift rod from transfer case shift lever. Or remove shift lever from transfer case and tie rod and lever to chassis component with wire.

(24) Raise transmission slightly with service jack to relieve load on crossmember and supports.

(25) Remove bolts securing rear support and cushion to transmission and crossmember. Raise transmission slightly, slide exhaust hanger arm from bracket (Fig. 74) and remove rear support.

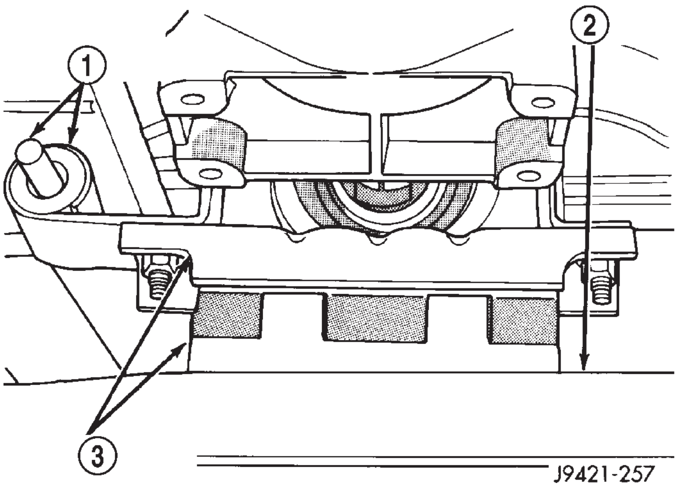


Fig. 74 Rear Support Cushion

1 – EXHAUST PIPE ARM AND BRACKET
2 – CROSSMEMBER
3 – REAR SUPPORT AND CUSHION

(26) Remove bolts attaching crossmember to frame and remove crossmember.

(27) On 4 x 4 models, disconnect vent hose from transfer case. Then remove transfer case with transmission jack or aid of helper.

(28) Remove all converter housing bolts.

(29) Carefully work transmission and torque converter assembly rearward off engine block dowels.

(30) Lower transmission and remove assembly from under the vehicle.

INSTALLATION

(1) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

(2) Lubricate oil pump seal lip with transmission fluid.

(3) Lubricate converter pilot hub pocket in the rear of the crankshaft with a light coating ofMopar® High Temp Grease.

(4) Align and install converter in oil pump.

(5) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(6) Check converter seating with steel scale and straightedge (Fig. 75). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) Temporarily secure converter with wedge tool or C-clamp.

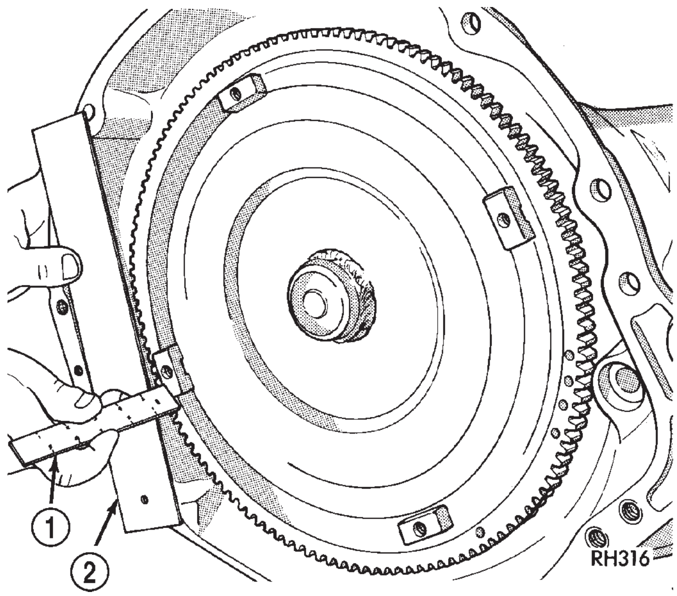


Fig. 75 Typical Method Of Checking Converter Seating

1 – SCALE
2 – STRAIGHTEDGE

(8) Position transmission on jack and secure it with chains.

(9) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to held transmission in alignment.**

(10) Raise transmission and align converter with drive plate and converter housing with engine block.

(11) Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

(12) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

(13) Install bolts attaching converter housing to engine.

REMOVAL AND INSTALLATION (Continued)

(14) Install rear support. Then lower transmission onto crossmember and install bolts attaching transmission mount to crossmember.

(15) Install new plastic retainer grommet on any shift linkage rod or lever that was disconnected. Grommets should not be reused.

(16) Connect gearshift and throttle cable to transmission.

(17) Connect wires to park/neutral position switch, transmission solenoid(s) and oxygen sensor. Be sure transmission harnesses are properly routed.

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

(18) Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in. lbs.).

(19) Raise engine slightly.

(20) Loosen bolts attaching engine-to-transmission brackets to each side of the engine block.

(21) Install converter housing access cover.

(22) Install bolts attaching engine-to-transmission brackets to transmission.

(23) Tighten bolts attaching engine-to-transmission brackets to each side of the engine block.

(24) Lower engine.

(25) Install bolt and nut attaching each engine-to-transmission bracket to the motor mounts.

(26) Remove engine support.

(27) Install bolts to hold engine-to-transmission brackets to the front axle, if equipped.

(28) Install starter motor and cooler line bracket.

(29) Connect cooler lines to transmission.

(30) Install transmission fill tube. Install new seal on tube before installation.

(31) Install exhaust components.

(32) Install transfer case, if necessary.

(33) Align and connect propeller shaft(s).

(34) Install rear skid plate, if equipped.

(35) Adjust gearshift linkage and throttle valve cable if necessary.

(36) Install front skid plate, if equipped.

(37) Lower vehicle.

(38) Fill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

TORQUE CONVERTER

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition.

The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

(1) Lubricate oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 76). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

YOKE SEAL REPLACEMENT

REMOVAL

(1) Raise vehicle.

(2) Mark propeller shaft and axle companion flange for alignment reference.

(3) Disconnect and remove propeller shaft.

(4) Remove old seal with Seal Remover C-3985-B (Fig. 77) from overdrive housing.

INSTALLATION

(1) Place seal in position on overdrive housing.

REMOVAL AND INSTALLATION (Continued)

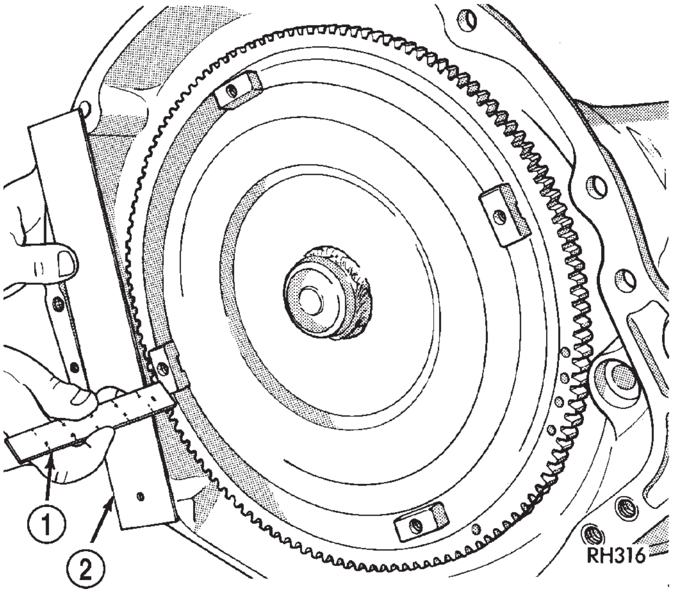


Fig. 76 Checking Torque Converter Seating

1 – SCALE
2 – STRAIGHTEDGE

(2) Drive seal into overdrive housing with Seal Installer C-3995-A (Fig. 78).

(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle companion flange.

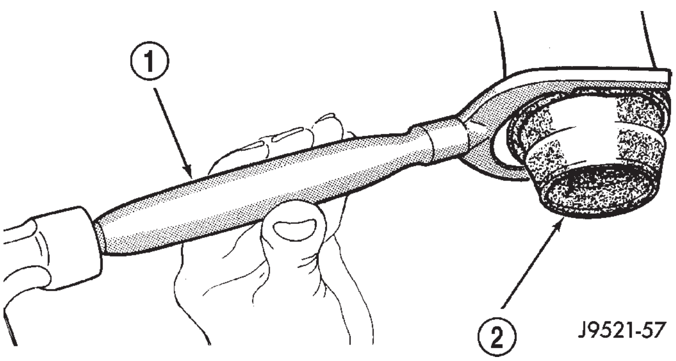


Fig. 77 Removing Overdrive Housing Yoke Seal

1 – SPECIAL TOOL C-3985–B
2 – SEAL

PARK/NEUTRAL POSITION SWITCH

REMOVAL

(1) Raise vehicle and position drain pan under switch.

(2) Disconnect switch wires.

(3) Remove switch from case.

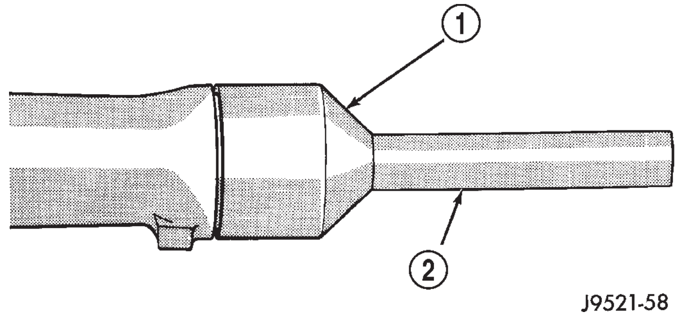


Fig. 78 Installing Overdrive Housing Yoke Seal

1 – SPECIAL TOOL C-3995–A OR C-3972–A
2 – SPECIAL TOOL C-4471

INSTALLATION

(1) Move shift lever to Park and Neutral positions. Verify that switch operating lever fingers are centered in switch opening in case (Fig. 79).

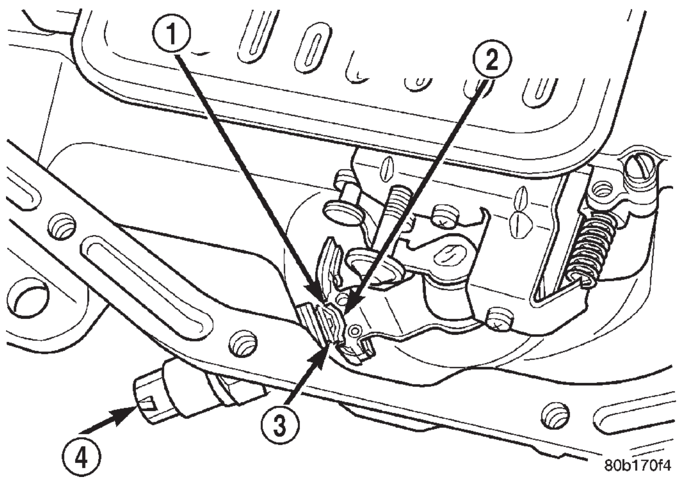


Fig. 79 Park/Neutral Position Switch

1 – NEUTRAL CONTACT
2 – MANUAL LEVER AND SWITCH PLUNGER IN REVERSE POSITION
3 – PARK CONTACT
4 – SWITCH

(2) Install new seal on switch and install switch in case. Tighten switch to 34 N·m (25 ft. lbs.) torque.

(3) Test continuity of new switch with 12V test lamp.

(4) Connect switch wires and lower vehicle.

(5) Top off transmission fluid level.

GEARSHIFT CABLE

REMOVAL

(1) Shift transmission into Park.

(2) Remove nuts retaining the shift cable housing to the dash panel (Fig. 80).

(3) Disconnect cable at lower column lever and feed cable through dash panel opening to underside of vehicle (Fig. 81).

(4) Raise vehicle.

(5) Disengage cable eyelet at transmission shift lever and pull cable adjuster out of mounting bracket (Fig. 82). Remove old cable from vehicle.

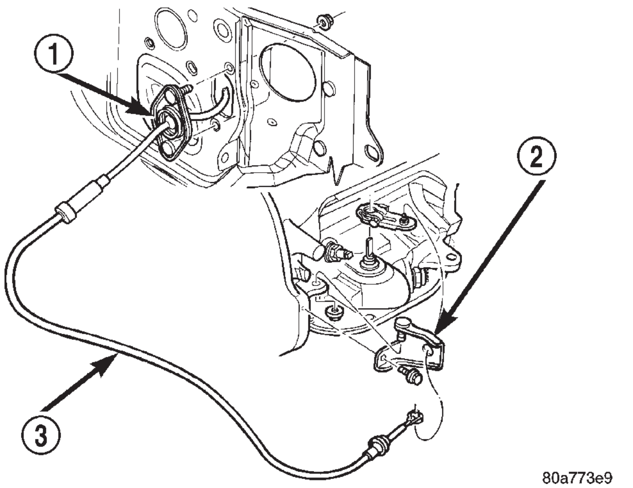


Fig. 80 Cable Mounting

1 – CABLE MOUNTING
2 – CABLE BRACKET AT TRANS.
3 – GEARSHIFT CABLE

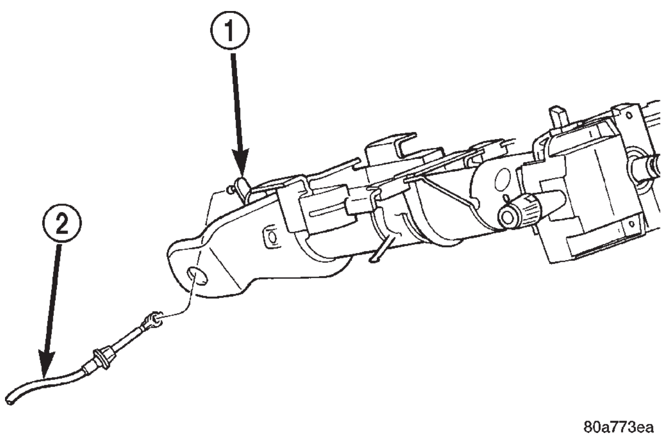


Fig. 81 Cable at Gearshift Lever

1 – GEARSHIFT LEVER
2 – GEARSHIFT CABLE

INSTALLATION

(1) Snap the cable into the transmission bracket so the retaining ears are engaged and connect cable end fitting onto the manual control lever ball stud.

(2) Lower vehicle.

(3) Route cable through hole in dash panel. Seat cable bracket to dash panel. Install retaining nuts to cable housing bracket studs inside the vehicle at the dash panel.

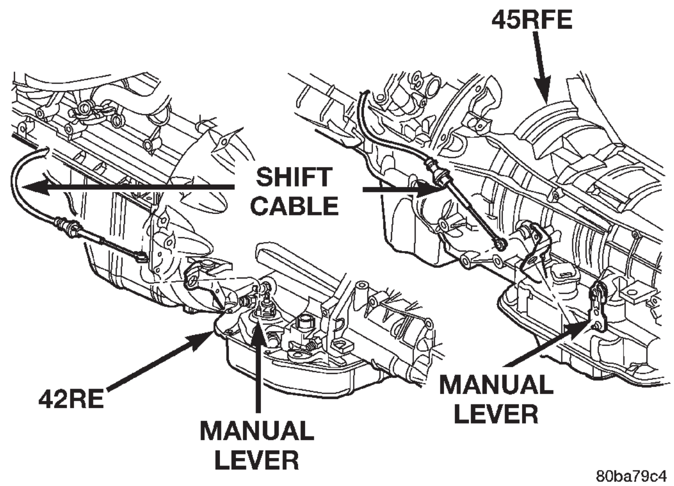


Fig. 82 Shift Cable at the Transmission

(4) Place the auto transmission manual shift control lever in "Park" detent (rearmost) position and rotate prop shaft to ensure transmission is in park.

(5) Connect shift cable to shifter lever by snapping cable retaining ears into shifter bracket and press cable end fitting into lever.

(6) Check for proper operation of Park/Neutral switch.

(7) If the gearshift cable is out of adjustment, refer to Adjustments section.

GOVERNOR SOLENOID AND PRESSURE SENSOR

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove transmission fluid pan and filter.

(3) Disengage wire connectors from pressure sensor and solenoid (Fig. 83).

(4) Remove screws holding pressure solenoid retainer to governor body.

(5) Separate solenoid retainer from governor (Fig. 84).

(6) Pull solenoid from governor body (Fig. 85).

(7) Pull pressure sensor from governor body.

(8) Remove bolts holding governor body to valve body.

(9) Separate governor body from valve body (Fig. 86).

(10) Remove governor body gasket.

INSTALLATION

Before installing the pressure sensor and solenoid in the governor body, replace O-ring seals, clean the gasket surfaces and replace gasket.

(1) Place gasket in position on back of governor body (Fig. 86).

(2) Place governor body in position on valve body.

(3) Install bolts to hold governor body to valve body.

REMOVAL AND INSTALLATION (Continued)

(4) Lubricate O-ring on pressure sensor with transmission fluid.

(5) Align pressure sensor to bore in governor body.

(6) Push pressure sensor into governor body.

(7) Lubricate O-ring, on pressure solenoid, with transmission fluid.

(8) Align pressure solenoid to bore in governor body (Fig. 85).

(9) Push solenoid into governor body.

(10) Place solenoid retainer in position on governor (Fig. 84).

(11) Install screws to hold pressure solenoid retainer to governor body.

(12) Engage wire connectors into pressure sensor and solenoid (Fig. 83).

(13) Install transmission fluid pan and (new) filter.

(14) Lower vehicle and road test to verify repair.

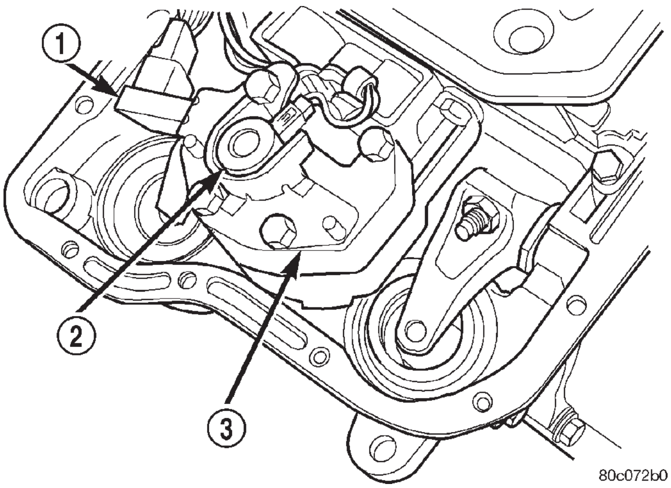


Fig. 83 Governor Solenoid And Pressure Sensor

1 – PRESSURE SENSOR
2 – PRESSURE SOLENOID
3 – GOVERNOR

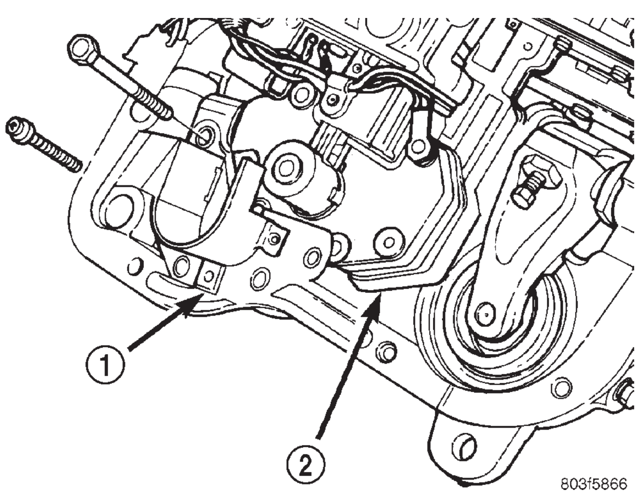


Fig. 84 Pressure Solenoid Retainer

1 – PRESSURE SOLENOID RETAINER
2 – GOVERNOR

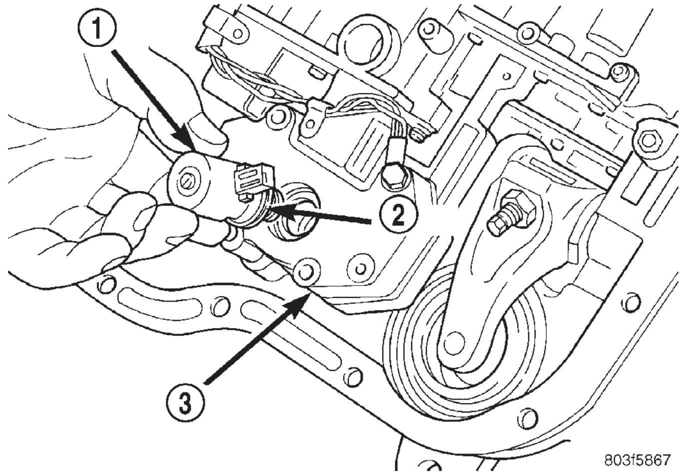


Fig. 85 Pressure Solenoid and O-ring

1 – PRESSURE SOLENOID
2 – O-RING
3 – GOVERNOR

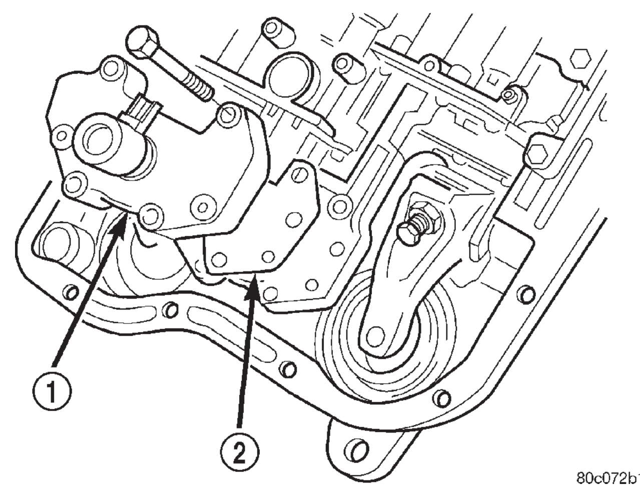


Fig. 86 Governor Body and Gasket

1 – GOVERNOR BODY
2 – GASKET

VALVE BODY

The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to Disassembly and Assembly section for proper procedures.

The only replaceable valve body components are:

- Manual lever.
- Manual lever washer, seal, E-clip, and shaft seal.
- Manual lever detent ball.
- Throttle lever.
- Fluid filter.
- Pressure adjusting screw bracket.

REMOVAL AND INSTALLATION (Continued)

• Governor pressure solenoid.
• Governor pressure sensor (includes transmission temperature thermistor).
• Converter clutch/overdrive solenoid assembly and harness.
• Governor housing gasket.
• Solenoid case connector O-rings.

The remaining valve body components are serviced only as part of a complete valve body assembly.

REMOVAL

(1) Shift transmission into NEUTRAL.
(2) Raise vehicle.
(3) Remove gearshift and throttle levers from shaft of valve body manual lever.
(4) Disconnect wires at solenoid case connector (Fig. 87).
(5) Position drain pan under transmission oil pan.
(6) Remove transmission oil pan and gasket.
(7) Remove fluid filter from valve body.
(8) Remove bolts attaching valve body to transmission case.
(9) Lower valve body enough to remove accumulator piston and springs.
(10) Work manual lever shaft and electrical connector out of transmission case.
(11) Lower valve body, rotate valve body away from case, pull park rod out of sprag, and remove valve body (Fig. 88).

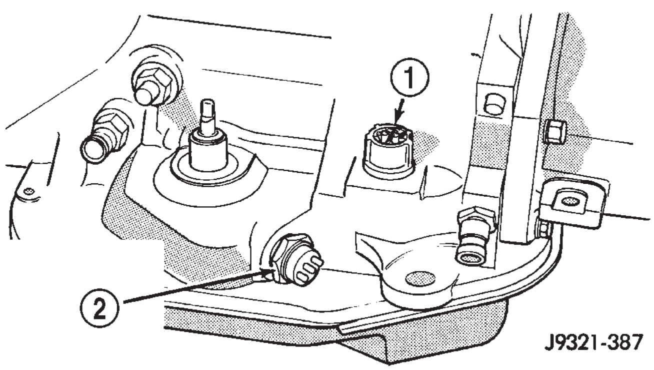


Fig. 87 Transmission Case Connector

1 – SOLENOID CASE CONNECTOR
2 – PARK/NEUTRAL POSITION SWITCH CONNECTOR TERMINAL

INSTALLATION

(1) Check condition of O-ring seals on valve body harness connector (Fig. 89). Replace seals on connector body if cut or worn.
(2) Check condition of manual lever shaft seal in transmission case. Replace seal if lip is cut or worn. Install new seal with 15/16 deep well socket (Fig. 90).
(3) Check condition of seals on accumulator piston (Fig. 91). Install new piston seals, if necessary.

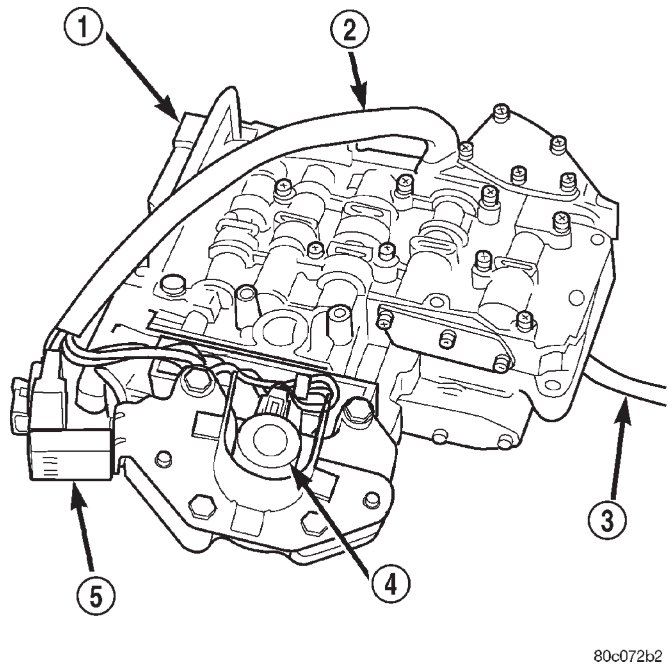


Fig. 88 Valve Body

1 – VALVE BODY
2 – WIRE HARNESS
3 – PARK ROD
4 – GOVERNOR PRESSURE SOLENOID
5 – GOVERNOR PRESSURE SENSOR

(4) Place valve body manual lever in low (1 position) so ball on park lock rod will be easier to install in sprag.
(5) Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal in case.
(6) Lubricate seal rings on valve body harness connector with petroleum jelly.
(7) Position valve body in case and work end of park lock rod into and through pawl sprag. Turn propeller shaft to align sprag and park lock teeth if necessary. The rod will click as it enters pawl. Move rod to check engagement.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into this cavity.

(8) Install accumulator springs and piston into case. Then swing valve body over piston and outer spring to hold it in place.
(9) Align accumulator piston and outer spring, manual lever shaft and electrical connector in case.
(10) Then seat valve body in case and install one or two bolts to hold valve body in place.
(11) Tighten valve body bolts alternately and evenly to 11 N·m (100 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

(12) Install new fluid filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.) torque.

(13) Install throttle and gearshift levers on valve body manual lever shaft.

(14) Check and adjust front and rear bands if necessary.

(15) Connect solenoid case connector wires.

(16) Install oil pan and new gasket. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(17) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

(18) Check and adjust gearshift and throttle valve cables, if necessary.

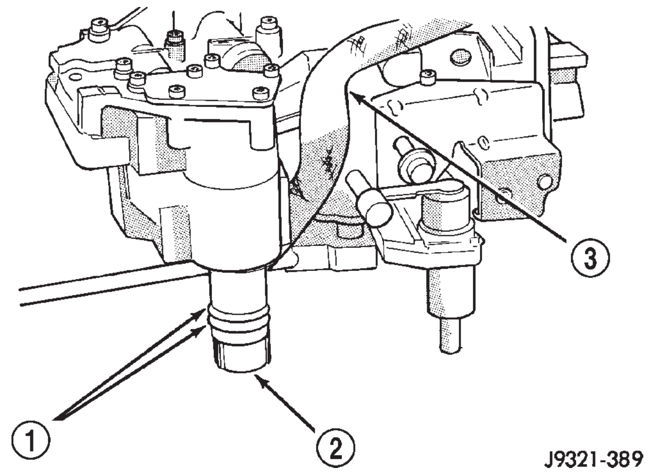


Fig. 89 Valve Body Harness Connector O-Ring Seal

1 – CONNECTOR O-RINGS
2 – VALVE BODY HARNESS CONNECTOR
3 – HARNESS

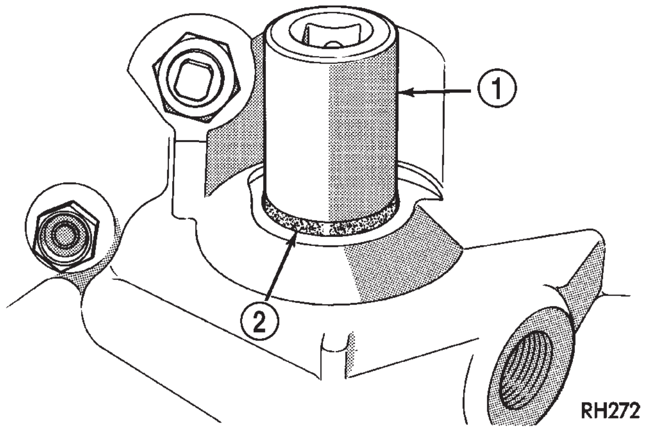


Fig. 90 Manual Lever Shaft Seal

1 – 15/16′′ SOCKET
2 – SEAL

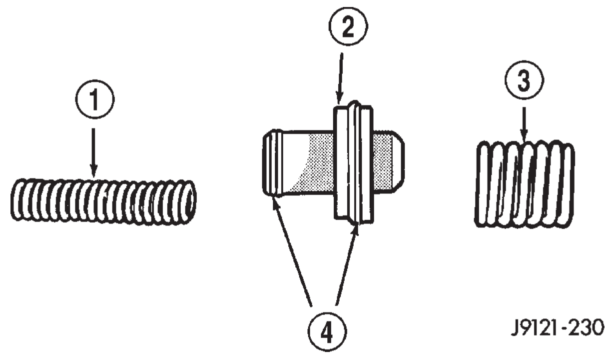


Fig. 91 Accumulator Piston Components

1 – INNER SPRING
2 – ACCUMULATOR PISTON
3 – OUTER SPRING
4 – SEAL RINGS

OVERDRIVE UNIT

REMOVAL

(1) Shift transmission into Park.

(2) Raise vehicle.

(3) Remove transfer case, if equipped.

(4) Mark propeller shaft universal joint(s) and axle pinion yoke, or the companion flange and flange yoke, for alignment reference at installation, if neccesary.

(5) Disconnect and remove the rear propeller shaft, if necessary.

(6) Remove transmission oil pan, remove gasket, drain oil and reinstall pan.

(7) If overdrive unit had malfunctioned, or if fluid is contaminated, remove entire transmission. If diagnosis indicated overdrive problems only, remove just the overdrive unit.

(8) Support transmission with transmission jack.

(9) Remove vehicle speed sensor.

(10) Remove bolts attaching overdrive unit to transmission (Fig. 92).

CAUTION: Support the overdrive unit with a jack before moving it rearward. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

(11) Carefully work overdrive unit off intermediate shaft. Do not tilt unit during removal. Keep it as level as possible.

(12) If overdrive unit does not require service, immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch to prevent splines from rotating out of alignment. If misalignment occurs, overdrive unit will have to be disassembled in order to realign splines.

REMOVAL AND INSTALLATION (Continued)

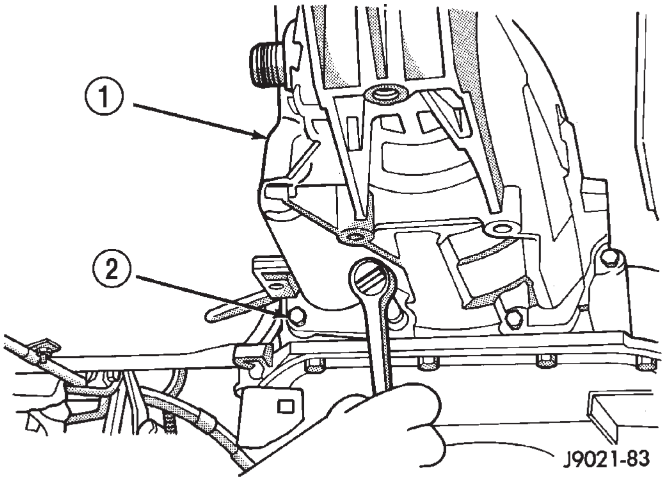


Fig. 92 Overdrive Unit Bolts

1 – OVERDRIVE UNIT
2 – ATTACHING BOLTS (7)

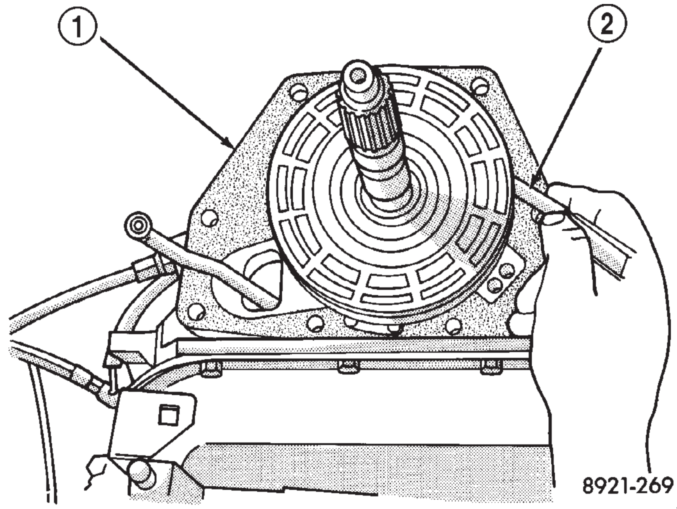


Fig. 93 Trimming Overdrive Case Gasket

1 – GASKET
2 – SHARP KNIFE

(13) Remove and retain overdrive piston thrust bearing. Bearing may remain on piston or in clutch hub during removal.

(14) Position drain pan on workbench.

(15) Place overdrive unit over drain pan. Tilt unit to drain residual fluid from case.

(16) Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

(17) If overdrive unit does not require any service, leave alignment tool in position. Tool will prevent accidental misalignment of planetary gear and overrunning clutch splines.

INSTALLATION

(1) Be sure overdrive unit Alignment Tool 6227-2 is fully seated before moving unit. If tool is not seated and gear splines rotate out of alignment, overdrive unit will have to be disassembled in order to realign splines.

(2) If overdrive piston retainer was not removed during service and original case gasket is no longer reusable, prepare new gasket by trimming it.

(3) Cut out old case gasket around piston retainer with razor knife (Fig. 93).

(4) Use old gasket as template and trim new gasket to fit.

(5) Position new gasket over piston retainer and on transmission case. Use petroleum jelly to hold gasket in place if necessary. Do not use any type of sealer to secure gasket. Use petroleum jelly only.

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 94).

(7) Install thrust bearing in overdrive unit sliding hub. Use petroleum jelly to hold bearing in position.

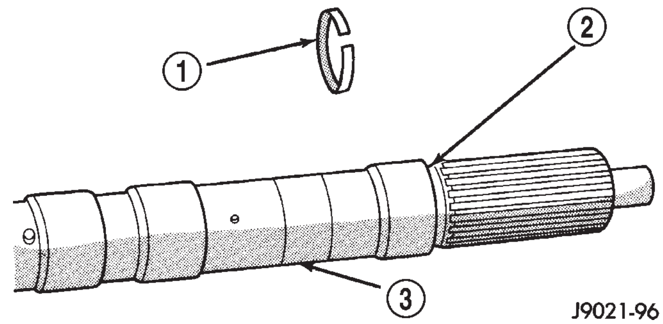


Fig. 94 Intermediate Shaft Selective Spacer Location

1 – SELECTIVE SPACER
2 – SPACER GROOVE
3 – INTERMEDIATE SHAFT

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(8) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Alignment Tool 6227-2. Overdrive unit cannot be installed if splines are not aligned. If splines have rotated out of alignment, unit will have to be disassembled to realign splines.

(9) Carefully slide Alignment Tool 6227-2 out of overdrive planetary gear and overrunning clutch splines.

(10) Raise overdrive unit and carefully slide it straight onto intermediate shaft. Insert park rod into park lock reaction plug at same time. Avoid tilting overdrive during installation as this could cause planetary gear and overrunning clutch splines to rotate out of alignment. If this occurs, it will be necessary to remove and disassemble overdrive unit to realign splines.

REMOVAL AND INSTALLATION (Continued)

(11) Work overdrive unit forward on intermediate shaft until seated against transmission case.

(12) Install bolts attaching overdrive unit to transmission unit. Tighten bolts in diagonal pattern to 34 N·m (25 ft-lbs).

(13) Install speed sensor.

(14) Connect speed sensor and overdrive wires.

(15) Install the transfer case, if equipped.

(16) Align and install rear propeller shaft, if necessary.

OVERDRIVE HOUSING BUSHING

REMOVAL

(1) Remove overdrive housing yoke seal.

(2) Insert Remover 6957 into overdrive housing. Tighten tool to bushing and remove bushing (Fig. 95).

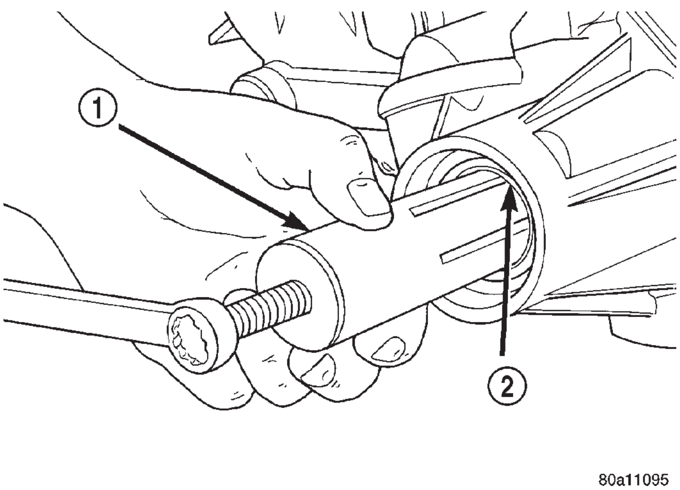


Fig. 95 Bushing Removal—Typical

1 – REMOVER 6957
2 – EXTENSION HOUSING BUSHING

INSTALLATION

(1) Align bushing oil hole with oil slot in overdrive housing.

(2) Tap bushing into place with Installer 6951 and Handle C-4171.

(3) Install new oil seal in housing using Seal Installer C-3995–A (Fig. 96).

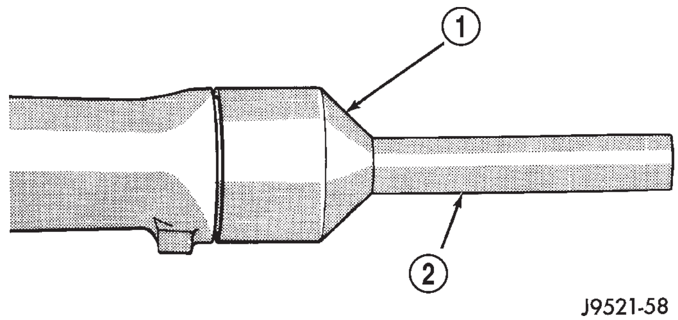


Fig. 96 Overdrive Housing Seal Installation

1 – SPECIAL TOOL C-3995–A OR C-3972–A
2 – SPECIAL TOOL C-4471

OUTPUT SHAFT REAR BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

(3) Remove snap ring holding output shaft rear bearing into overdrive housing (Fig. 97).

(4) Using a suitable driver inserted through the rear end of housing, drive bearing from housing.

INSTALLATION

(1) Place replacement bearing in position in housing.

(2) Using a suitable driver, drive bearing into housing until the snap ring groove is visible.

(3) Install snap ring to hold bearing into housing (Fig. 97).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

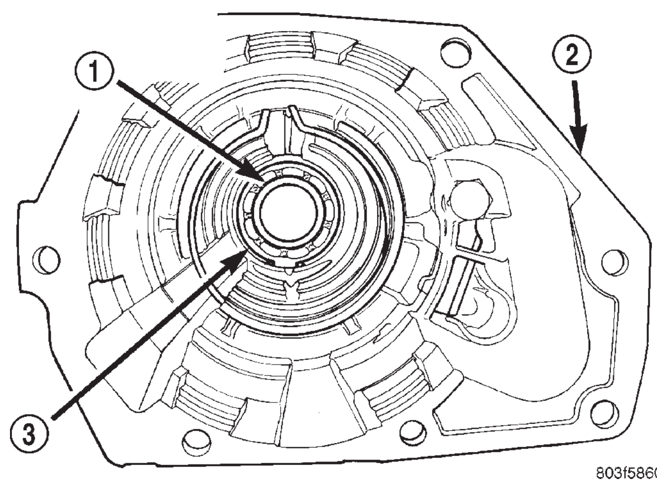


Fig. 97 Output Shaft Rear Bearing

1 – OUTPUT SHAFT REAR BEARING
2 – OVERDRIVE HOUSING
3 – SNAP RING

OUTPUT SHAFT FRONT BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

(3) Remove snap ring holding output shaft front bearing to overdrive geartrain. (Fig. 98).

(4) Pull bearing from output shaft.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place replacement bearing in position on geartrain with locating retainer groove toward the rear.

(2) Push bearing onto shaft until the snap ring groove is visible.

(3) Install snap ring to hold bearing onto output shaft (Fig. 98).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

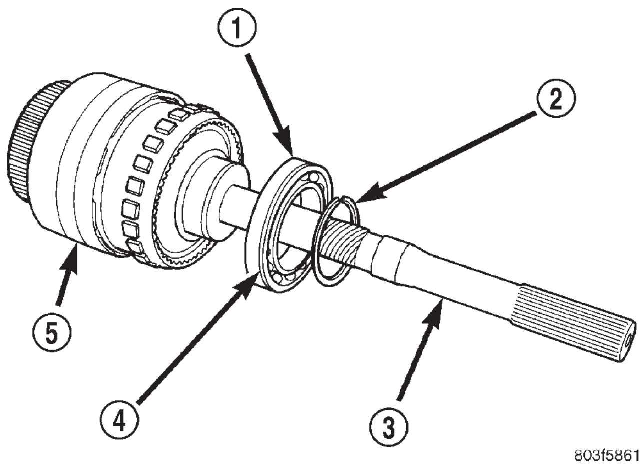


Fig. 98 Output Shaft Front Bearing

1 – OUTPUT SHAFT FRONT BEARING
2 – SNAP RING
3 – OUTPUT SHAFT
4 – GROOVE TO REAR
5 – OVERDRIVE GEARTRAIN

DISASSEMBLY AND ASSEMBLY

VALVE BODY

Remove the valve body from the transmission, refer to Removal and Installation procedures section in this group.

DISASSEMBLY

CAUTION: Do not clamp any valve body component in a vise. This practice can damage the component resulting in unsatisfactory operation after assembly and installation. Do not use pliers to remove any of the valves, plugs or springs and do not force any of the components out or into place. The valves and valve body housings will be damaged if force is used. Tag or mark the valve body springs for reference as they are removed. Do not allow them to become intermixed.

(1) Remove fluid filter.

(2) Disconnect wires from governor pressure sensor and solenoid.

(3) Remove screws attaching governor body and retainer plate to transfer plate.

(4) Remove retainer plate, governor body and gasket from transfer plate.

(5) Remove governor pressure sensor from governor body

(6) Remove governor pressure solenoid by pulling it straight out of bore in governor body. Remove and discard solenoid O-rings if worn, cut, or torn.

(7) Remove small shoulder bolt that secures solenoid harness case connector to 3-4 accumulator housing (Fig. 99). **Retain shoulder bolt. Either tape it to harness or thread it back into accumulator housing after connector removal.**

(8) Unhook overdrive/converter solenoid harness from 3-4 accumulator cover plate (Fig. 100).

(9) Turn valve body over and remove screws that attach overdrive/converter solenoid assembly to valve body (Fig. 101).

(10) Remove solenoid and harness assembly from valve body (Fig. 102).

(11) Remove boost valve cover (Fig. 103).

(12) Remove boost valve retainer, valve spring and boost valve (Fig. 104).

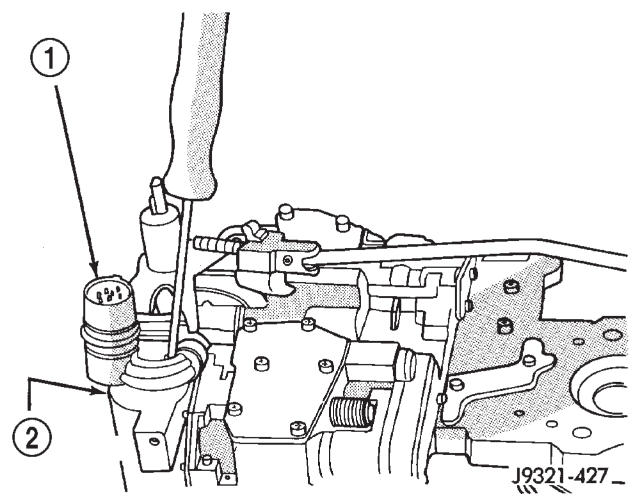


Fig. 99 Solenoid Harness Case Connector Shoulder Bolt

1 – SOLENOID HARNESS CASE CONNECTOR
2 – 3–4 ACCUMULATOR HOUSING

(13) Secure detent ball and spring with Retainer Tool 6583 (Fig. 105).

(14) Remove park rod E-clip and separate rod from manual lever (Fig. 106).

DISASSEMBLY AND ASSEMBLY (Continued)

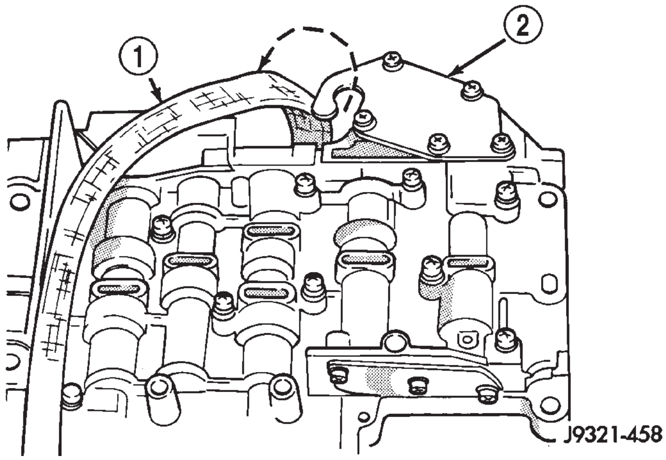


Fig. 100 Unhooking Solenoid Harness From Accumulator Cover Plate

1 – OVERDRIVE/CONVERTER SOLENOID WIRE HARNESS
2 – 3–4 ACCUMULATOR COVER PLATE

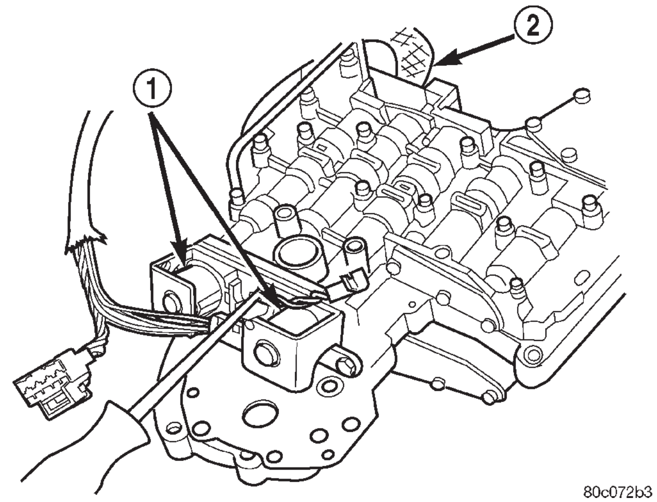


Fig. 101 Solenoid Assembly Screws

1 – OVERDRIVE/CONVERTER CLUTCH SOLENOID ASSEMBLY
2 – HARNESS

(15) Remove E-clip and washer that retains throttle lever shaft in manual lever (Fig. 107).

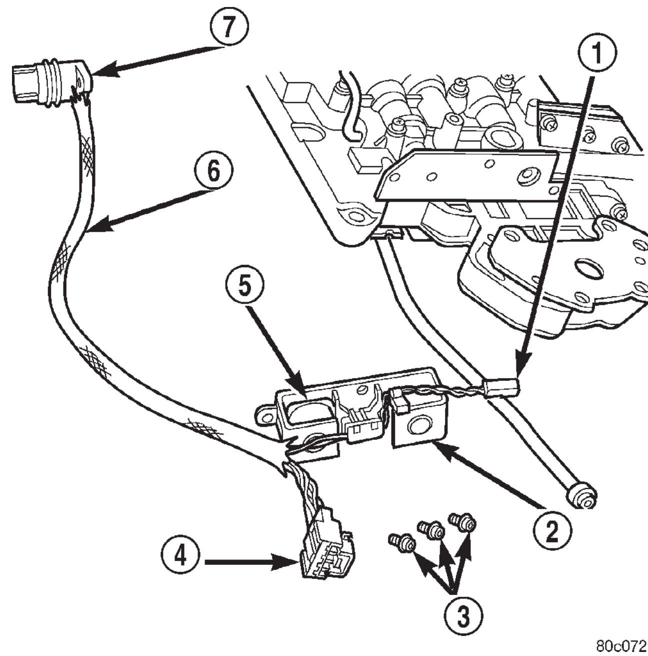


Fig. 102 Solenoid Assembly

1 – GOVERNOR SOLENOID WIRES
2 – CONVERTER CLUTCH SOLENOID
3 – SOLENOID SCREWS
4 – GOVERNOR SENSOR WIRES
5 – OVERDRIVE SOLENOID
6 – HARNESS
7 – CASE CONNECTOR

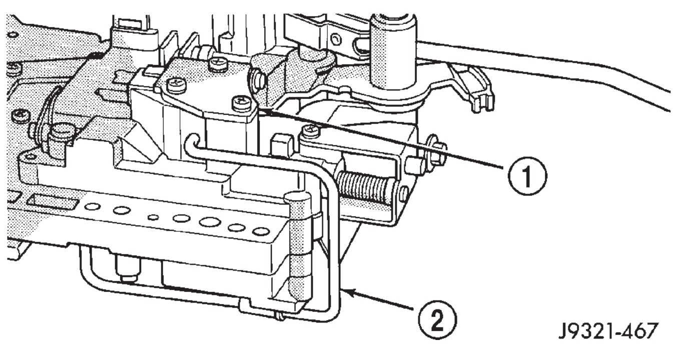


Fig. 103 Boost Valve Cover Location

1 – BOOST VALVE HOUSING AND COVER
2 – BOOST VALVE TUBE

DISASSEMBLY AND ASSEMBLY (Continued)

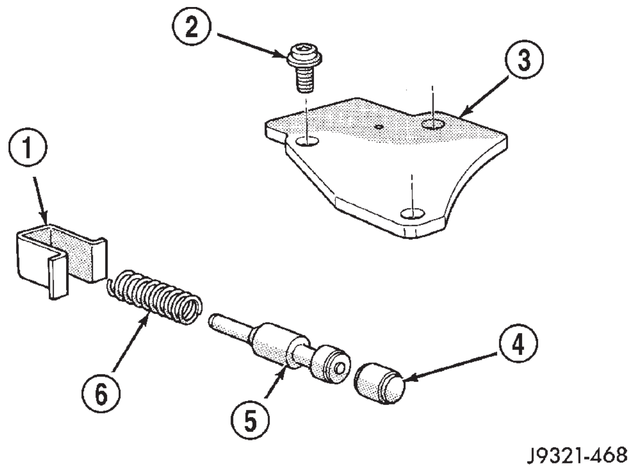


Fig. 104 Boost Valve Components

1 – SPRING AND VALVE RETAINER
2 – COVER SCREWS
3 – BOOST VALVE COVER
4 – BOOST VALVE PLUG
5 – BOOST VALVE
6 – BOOST VALVE SPRING

(16) Remove manual lever and throttle lever (Fig. 108). Rotate and lift manual lever off valve body and throttle lever shaft. Then slide throttle lever out of valve body.

(17) Position pencil magnet next to detent housing to catch detent ball and spring. Then carefully remove Retainer Tool 6583 and remove detent ball and spring (Fig. 109).

(18) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate (Fig. 110). Hold bracket firmly against spring tension while removing last screw.

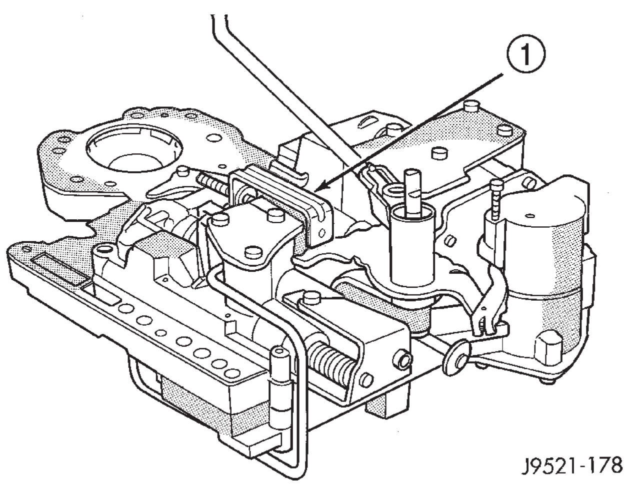


Fig. 105 Detent Ball And Spring

1 – SPECIAL TOOL 6583 POSITIONED ON DETENT HOUSING

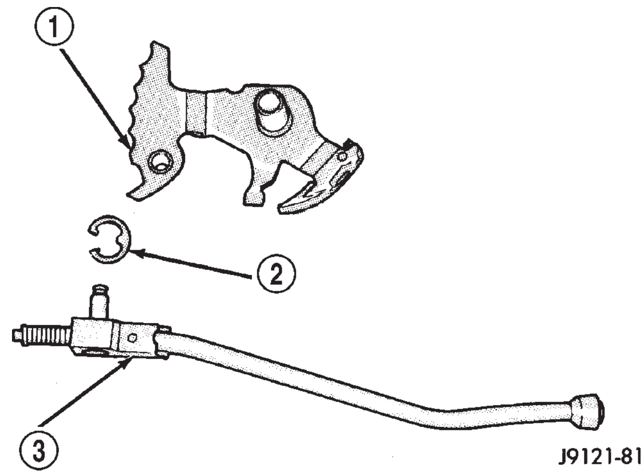


Fig. 106 Park Rod

1 – MANUAL LEVER
2 – E-CLIP
3 – PARK ROD

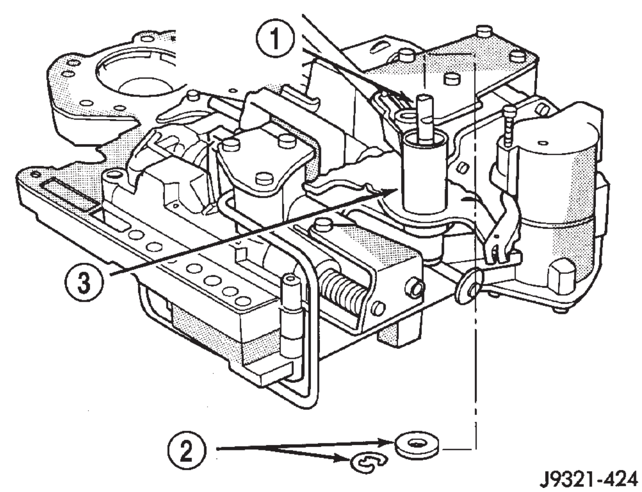


Fig. 107 Throttle Lever E-Clip And Washer

1 – THROTTLE LEVER SHAFT
2 – E-CLIP AND WASHER
3 – MANUAL SHAFT

(19) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator valve spring and switch valve spring (Fig. 111). **Do not remove throttle pressure adjusting screw from bracket and do not disturb setting of either adjusting screw during removal.**

(20) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 112).

(21) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 112).

DISASSEMBLY AND ASSEMBLY (Continued)

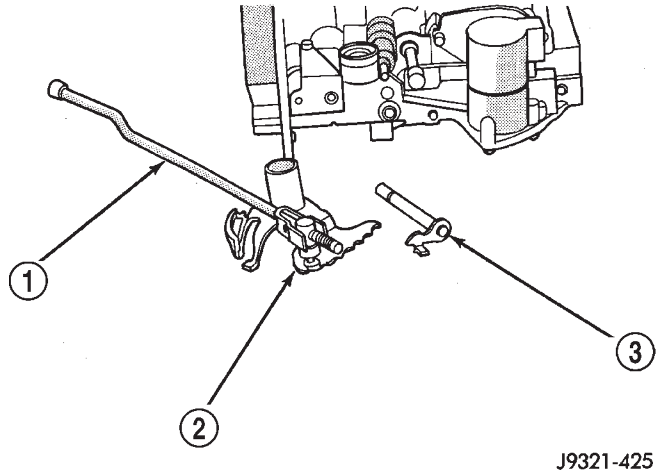


Fig. 108 Manual And Throttle Lever

1 – PARK ROD
2 – MANUAL LEVER ASSEMBLY
3 – THROTTLE LEVER

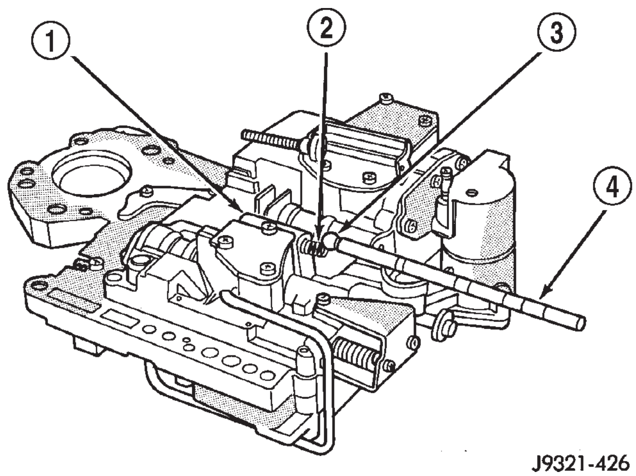


Fig. 109 Detent Ball And Spring

1 – DETENT HOUSING
2 – DETENT SPRING
3 – DETENT BALL
4 – PENCIL MAGNET

(22) Loosen left-side 3-4 accumulator housing attaching screw about 2-3 threads. Then remove center and right-side housing attaching screws (Fig. 113).

(23) Carefully rotate 3-4 accumulator housing upward and remove 3-4 shift valve spring and converter clutch valve plug and spring (Fig. 114).

(24) Remove left-side screw and remove 3-4 accumulator housing from valve body (Fig. 115).

(25) Bend back tabs on boost valve tube brace (Fig. 116).

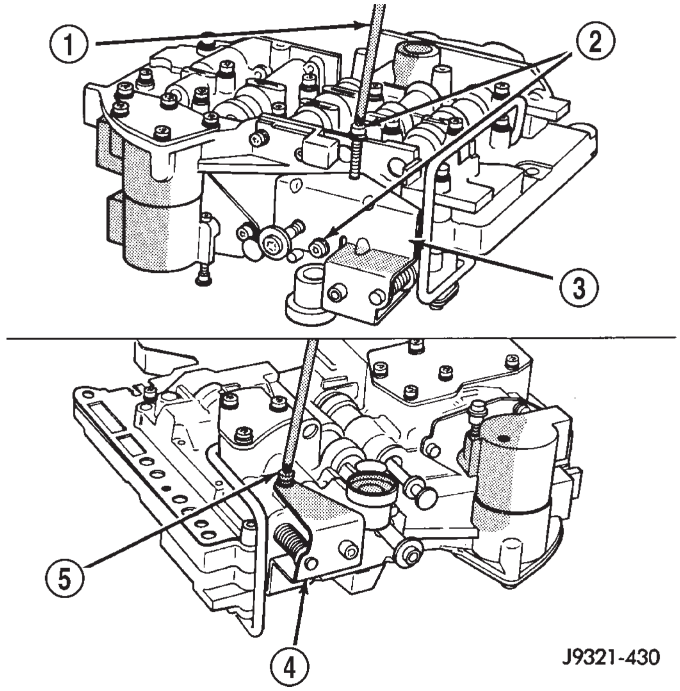


Fig. 110 Adjusting Screw Bracket Fastener

1 – T25 TORX BIT
2 – REMOVE THESE SCREWS FIRST
3 – BRACKET
4 – BRACKET
5 – REMOVE THIS SCREW LAST

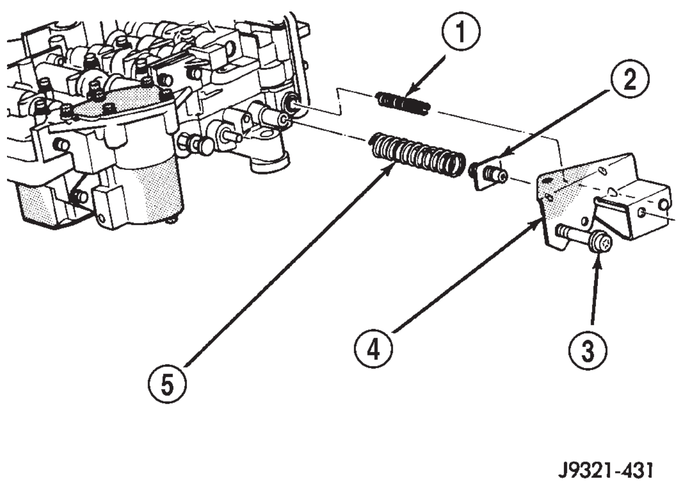


Fig. 111 Adjusting Screw Bracket And Spring

1 – SWITCH VALVE SPRING
2 – LINE PRESSURE SCREW
3 – THROTTLE PRESSURE ADJUSTING SCREW
4 – ADJUSTING SCREW BRACKET
5 – PRESSURE REGULATOR VALVE SPRING

DISASSEMBLY AND ASSEMBLY (Continued)

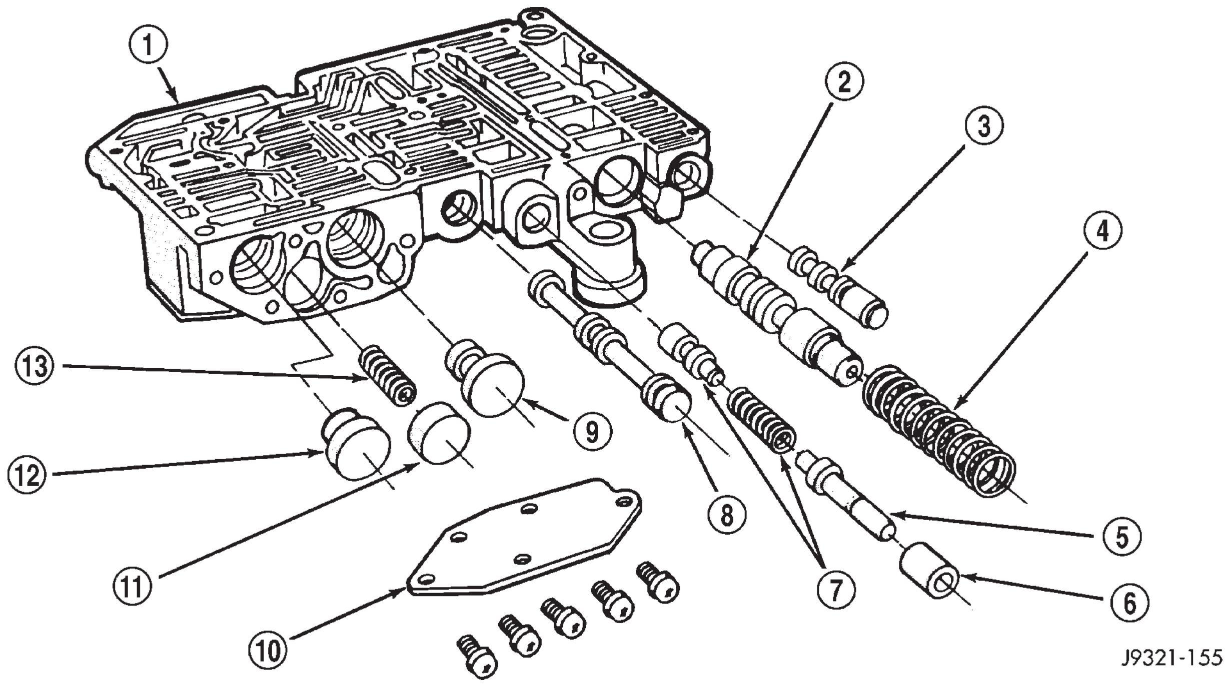


Fig. 112 Upper Housing Control Valve Locations

1 – UPPER HOUSING
2 – REGULATOR VALVE
3 – SWITCH VALVE
4 – REGULATOR VALVE SPRING
5 – KICKDOWN VALVE
6 – KICKDOWN DETENT
7 – THROTTLE VALVE AND SPRING
8 – MANUAL VALVE
9 – 1–2 GOVERNOR PLUG
10 – GOVERNOR PLUG COVER
11 – THROTTLE PLUG
12 – 2–3 GOVERNOR PLUG
13 – SHUTTLE VALVE PRIMARY SPRING

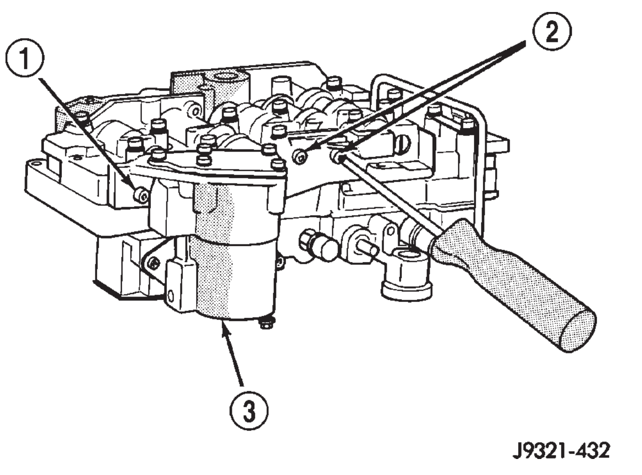


Fig. 113 Accumulator Housing Screw Locations

1 – LOOSEN THIS SCREW
2 – REMOVE THESE SCREWS
3 – 3–4 ACCUMULATOR HOUSING

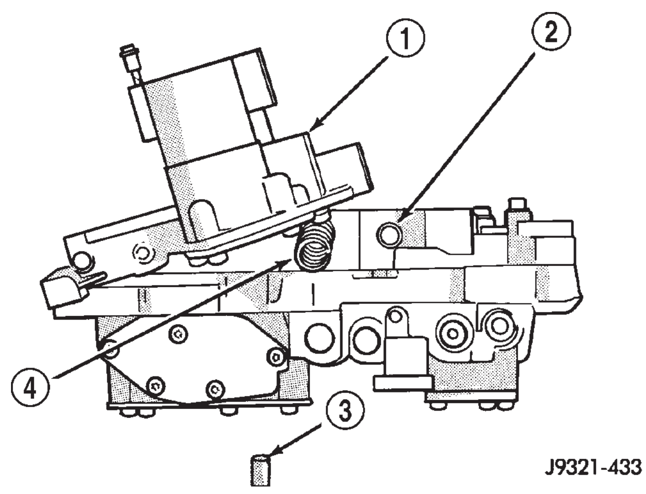


Fig. 114 3-4 Shift And Converter Clutch Valve Springs And Plug

1 – ACCUMULATOR HOUSING
2 – CONVERTER CLUTCH VALVE SPRING
3 – CLUTCH VALVE PLUG
4 – 3–4 SHIFT VALVE SPRING

DISASSEMBLY AND ASSEMBLY (Continued)

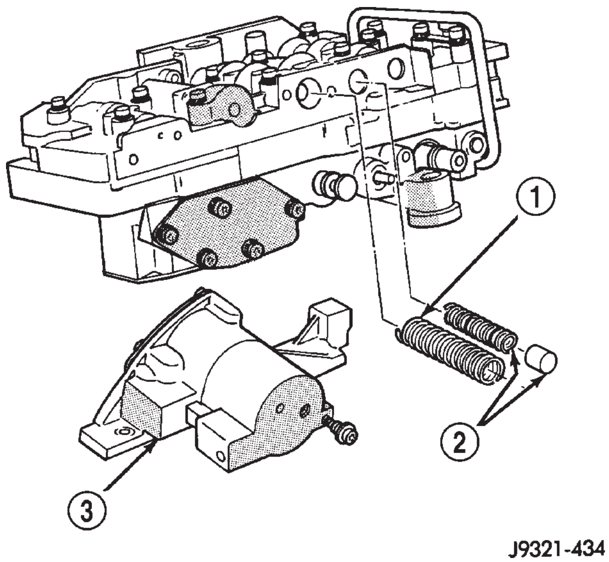


Fig. 115 Accumulator Housing, Valve Springs And Plug

1 – 3–4 SHIFT VALVE SPRING
2 – CONVERTER CLUTCH VALVE SPRING AND PLUG
3 – 3–4 ACCUMULATOR HOUSING

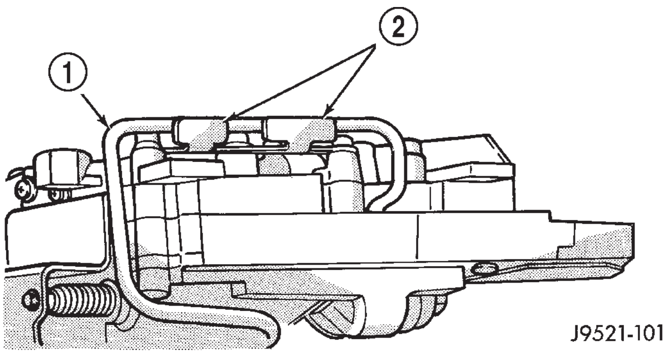


Fig. 116 Boost Valve Tube Brace

1 – BOOST VALVE TUBE
2 – TUBE BRACE (DOUBLE TAB)

(26) Remove boost valve connecting tube (Fig. 117). Disengage tube from upper housing port first. Then rock opposite end of tube back and forth to work it out of lower housing.

CAUTION: Do not use tools to loosen or pry the connecting tube out of the valve body housings. Loosen and remove the tube by hand only.

(27) Turn valve body over so lower housing is facing upward (Fig. 118). In this position, the two check balls in upper housing will remain in place and not fall out when lower housing and separator plate are removed.

(28) Remove screws attaching valve body lower housing to upper housing and transfer plate (Fig. 118). **Note position of boost valve tube brace for assembly reference.**

(29) Remove lower housing and overdrive separator plate from transfer plate (Fig. 118).

(30) Remove the ECE check ball from the transfer plate (Fig. 119). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(31) Remove transfer plate from upper housing (Fig. 120).

(32) Turn transfer plate over so upper housing separator plate is facing upward.

(33) Remove upper housing separator plate from transfer plate (Fig. 121). Note position of filter in separator plate for assembly reference.

(34) Remove rear clutch and rear servo check balls from transfer plate. Note check ball location for assembly reference (Fig. 122).

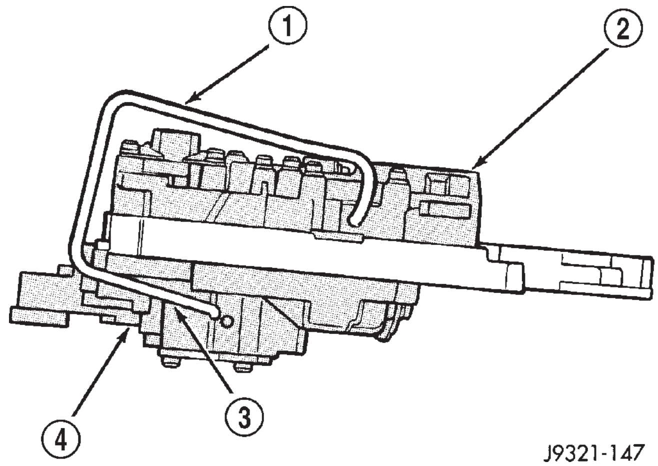


Fig. 117 Boost Valve Tube

1 – BOOST VALVE TUBE
2 – LOWER HOUSING
3 – DISENGAGE THIS END OF TUBE FIRST
4 – UPPER HOUSING

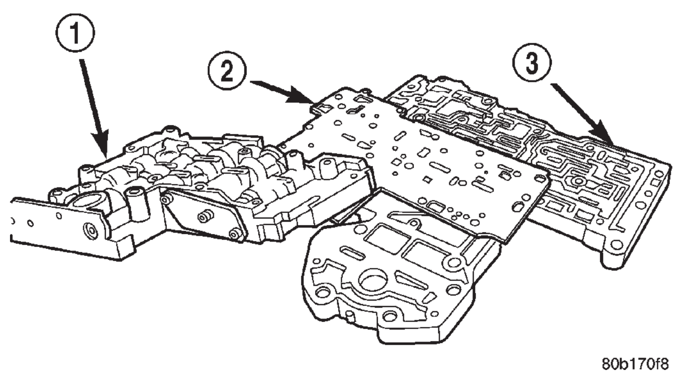


Fig. 118 Lower Housing

1 – LOWER HOUSING
2 – OVERDRIVE SEPARATOR PLATE
3 – TRANSFER PLATE AND UPPER HOUSING

DISASSEMBLY AND ASSEMBLY (Continued)

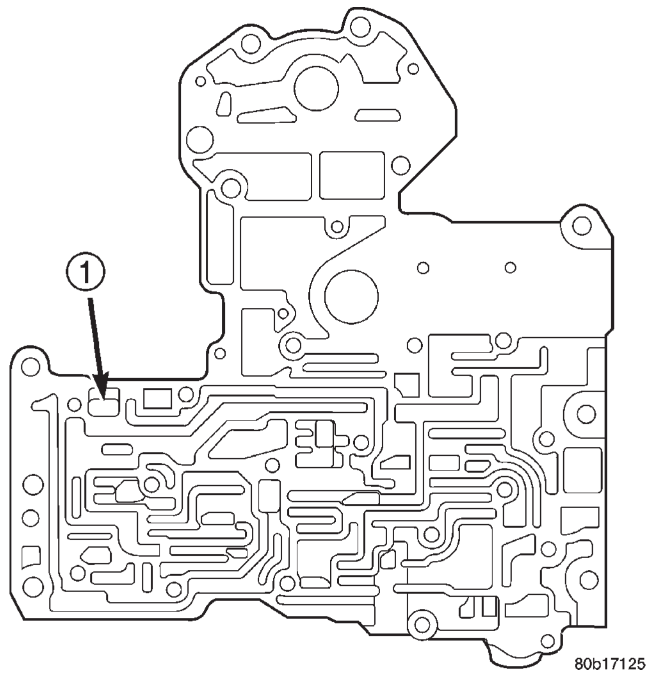


Fig. 119 ECE Check Ball

1 – ECE CHECK BALL (3/16”)

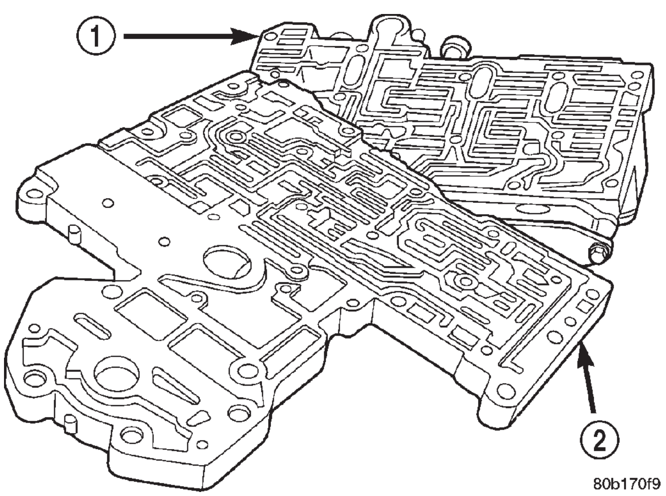


Fig. 120 Transfer Plate

1 – UPPER HOUSING
2 – TRANSFER PLATE

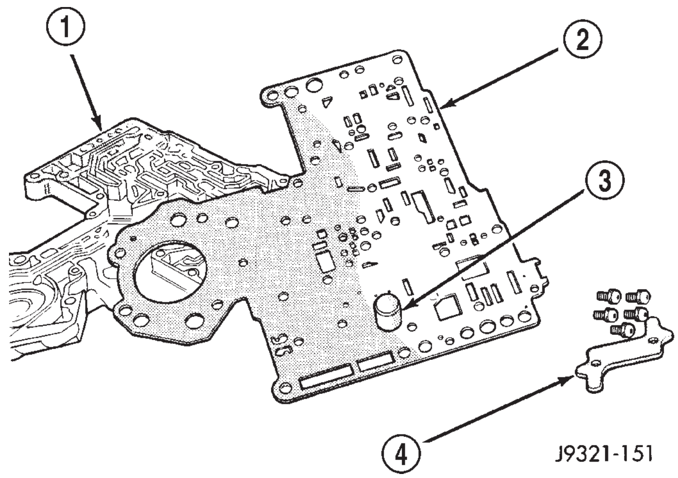


Fig. 121 Upper Housing Separator Plate

1 – TRANSFER PLATE
2 – UPPER HOUSING SEPARATOR PLATE
3 – FILTER SCREEN
4 – BRACE

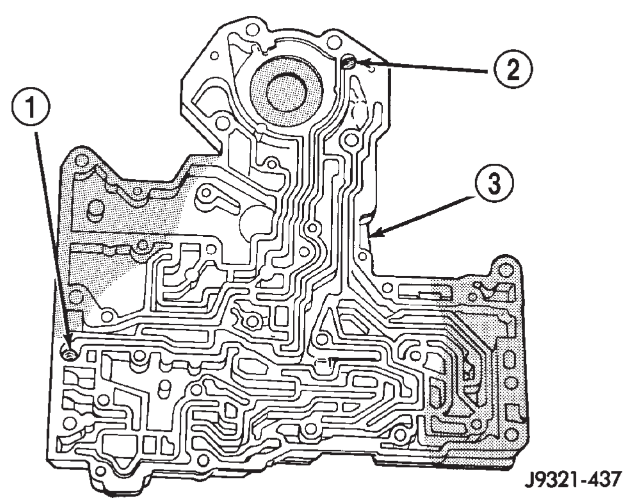


Fig. 122 Rear Clutch And Rear Servo Check Ball Locations

1 – REAR CLUTCH CHECK BALL
2 – REAR SERVO CHECK BALL
3 – TRANSFER PLATE

DISASSEMBLY AND ASSEMBLY (Continued)

VALVE BODY UPPER HOUSING

(1) Note location of check balls in valve body upper housing (Fig. 123). Then remove the one large diameter and the six smaller diameter check balls.

(2) Remove governor plug and shuttle valve covers (Fig. 125).

(3) Remove E-clip that secures shuttle valve secondary spring on valve stem (Fig. 124).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 125).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 112).

(7) Turn upper housing around and remove limit valve and shift valve covers (Fig. 126).

(8) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 126).

(9) Remove 1-2 shift control valve and spring (Fig. 126).

(10) Remove 1-2 shift valve and spring (Fig. 126).

(11) Remove 2-3 shift valve and spring from valve body (Fig. 126).

(12) Remove pressure plug cover (Fig. 126).

(13) Remove line pressure plug, sleeve, throttle pressure plug and spring (Fig. 126).

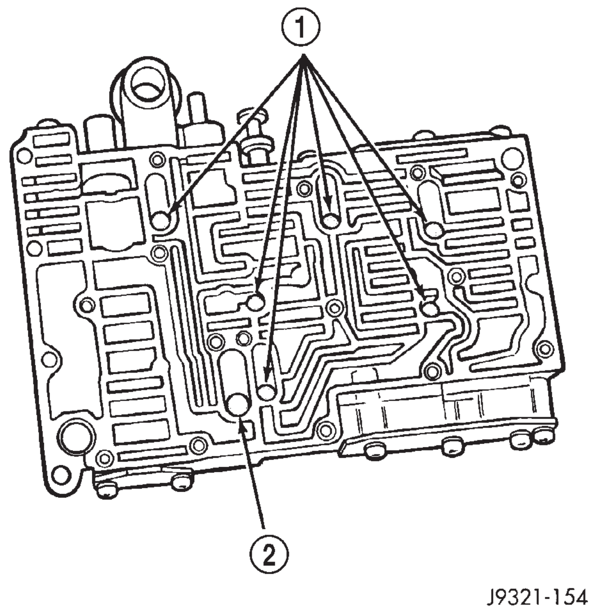


Fig. 123 Check Ball Locations In Upper Housing

1 – SMALL DIAMETER CHECK BALLS (6)
2 – LARGE DIAMETER CHECK BALL (1)

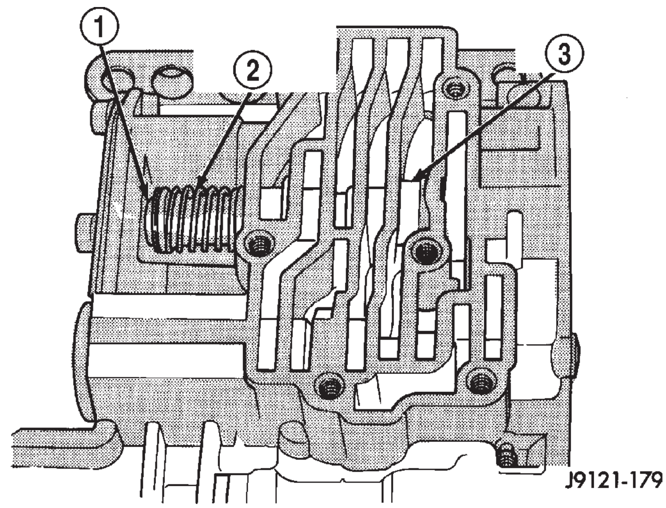


Fig. 124 Shuttle Valve E-Clip And Secondary Spring Location

1 – E-CLIP
2 – SECONDARY SPRING AND GUIDES
3 – SHUTTLE VALVE

VALVE BODY LOWER HOUSING

(1) Remove timing valve cover.

(2) Remove 3-4 timing valve and spring.

(3) Remove 3-4 quick fill valve, spring and plug.

(4) Remove 3-4 shift valve and spring.

(5) Remove converter clutch valve, spring and plug (Fig. 127).

(6) Remove converter clutch timing valve, retainer and valve spring.

3-4 ACCUMULATOR HOUSING

(1) Remove end plate from housing.

(2) Remove piston spring.

(3) Remove piston. Remove and discard piston seals (Fig. 128).

ASSEMBLY

CAUTION: Do not force valves or plugs into place during reassembly. If the valve body bores, valves and plugs are free of distortion or burrs, the valve body components should all slide into place easily. In addition, do not overtighten the transfer plate and valve body screws during reassembly. Overtightening can distort the housings resulting in valve sticking, cross leakage and unsatisfactory operation. Tighten valve body screws to recommended torque only.

DISASSEMBLY AND ASSEMBLY (Continued)

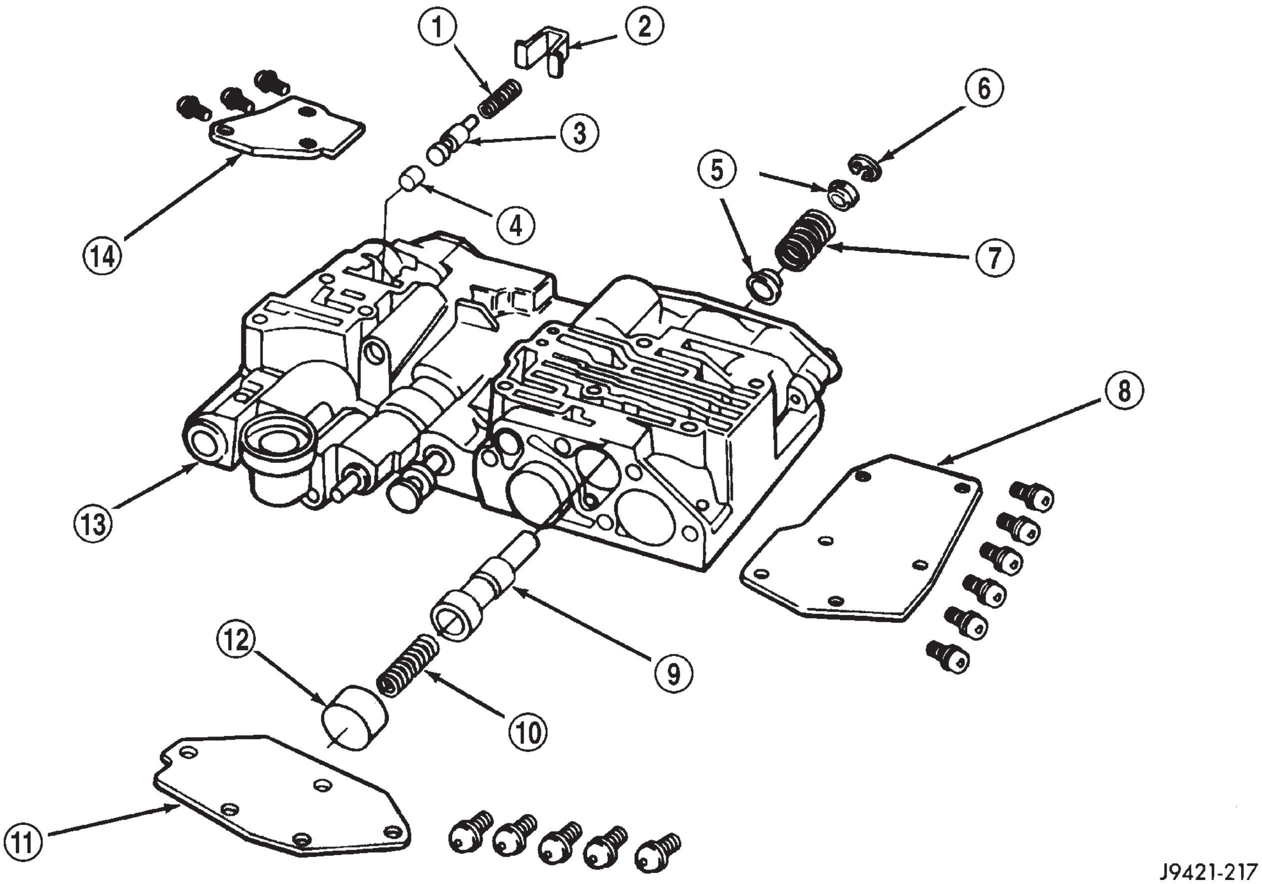


Fig. 125 Shuttle And Boost Valve Components

1 – SPRING
2 – RETAINER
3 – BOOST VALVE
4 – BOOST VALVE PLUG
5 – SPRING GUIDES
6 – E-CLIP
7 – SHUTTLE VALVE SECONDARY SPRING
8 – SHUTTLE VALVE COVER
9 – SHUTTLE VALVE
10 – SHUTTLE VALVE PRIMARY SPRING
11 – GOVERNOR PLUG COVER
12 – THROTTLE PLUG
13 – UPPER HOUSING
14 – BOOST VALVE COVER

DISASSEMBLY AND ASSEMBLY (Continued)

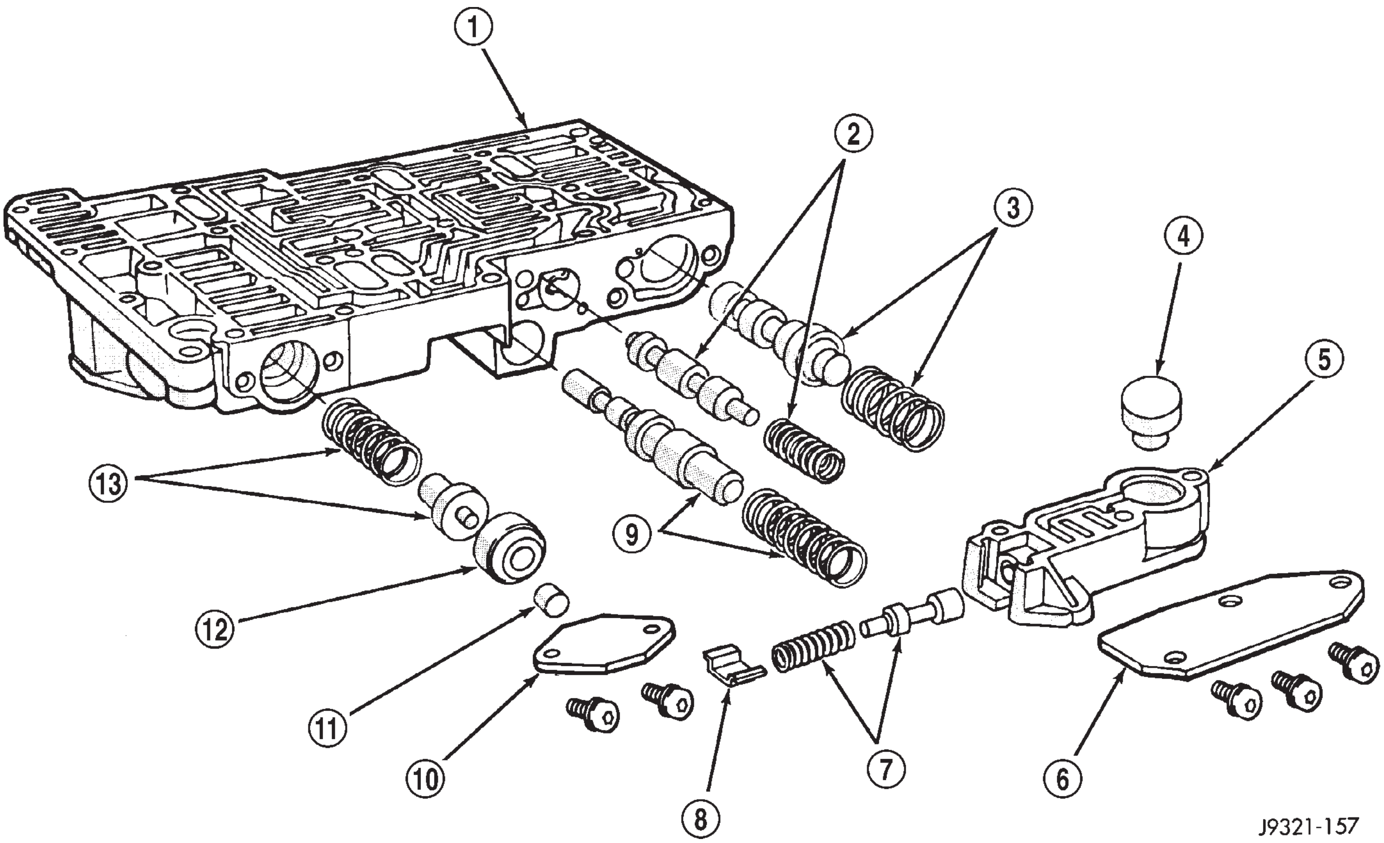


Fig. 126 Upper Housing Shift Valve And Pressure Plug Locations

1 – UPPER HOUSING
2 – 1–2 SHIFT VALVE AND SPRING
3 – 2–3 SHIFT VALVE AND SPRING
4 – 2–3 THROTTLE PLUG
5 – LIMIT VALVE HOUSING
6 – LIMIT VALVE COVER
7 – LIMIT VALVE AND SPRING
8 – RETAINER
9 – 1–2 SHIFT CONTROL VALVE AND SPRING
10 – PRESSURE PLUG COVER
11 – LINE PRESSURE PLUG
12 – PLUG SLEEVE
13 – THROTTLE PRESSURE SPRING AND PLUG

DISASSEMBLY AND ASSEMBLY (Continued)

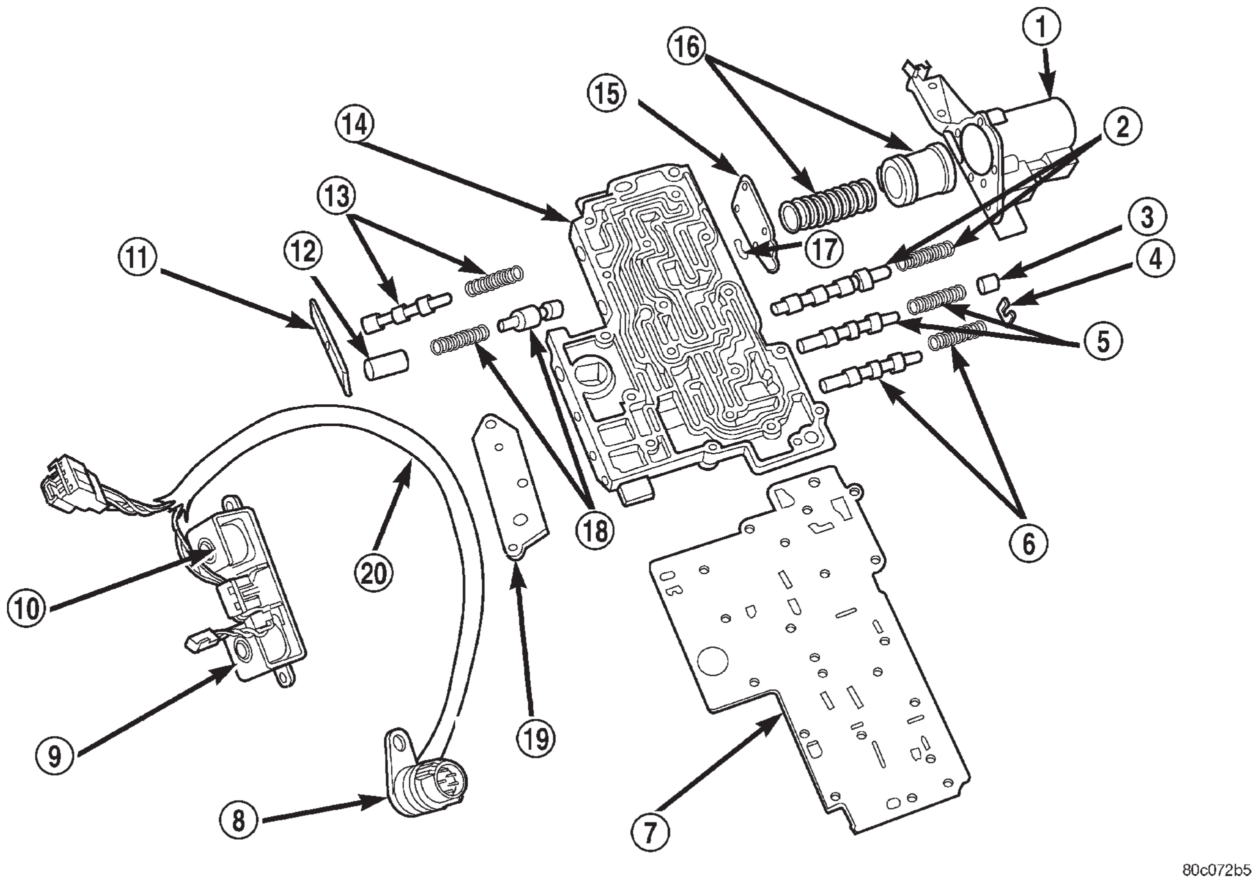


Fig. 127 Lower Housing Shift Valves And Springs

1 – 3-4 ACCUMULATOR HOUSING
2 – 3-4 SHIFT VALVE AND SPRING
3 – PLUG
4 – SPRING RETAINER
5 – CONVERTER CLUTCH VALVE AND SPRING
6 – CONVERTER CLUTCH TIMING VALVE AND SPRING
7 – OVERDRIVE SEPARATOR PLATE
8 – CASE CONNECTOR
9 – CONVERTER CLUTCH SOLENOID
10 – OVERDRIVE SOLENOID
11 – TIMING VALVE COVER
12 – PLUG
13 – 3-4 TIMING VALVE AND SPRING
14 – LOWER HOUSING
15 – ACCUMULATOR END PLATE
16 – 3-4 ACCUMULATOR PISTON AND SPRING
17 – E-CLIP
18 – 3-4 QUICK FILL SPRING AND VALVE
19 – SOLENOID GASKET
20 – HARNESS

DISASSEMBLY AND ASSEMBLY (Continued)

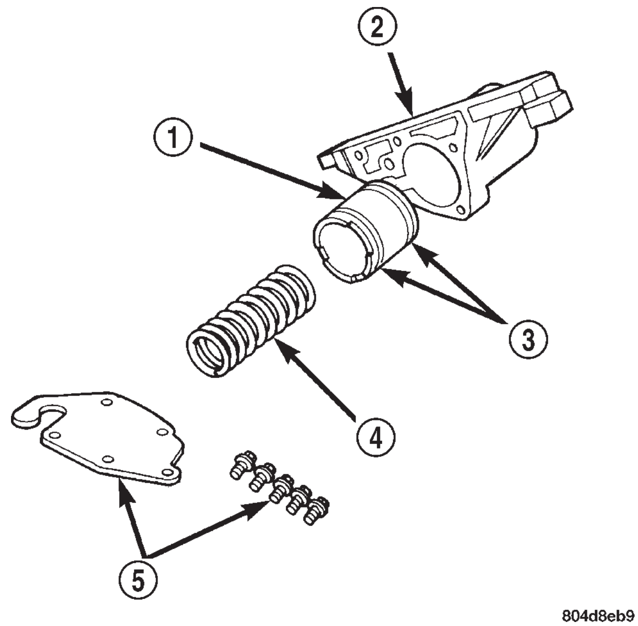


Fig. 128 Accumulator Housing Components

1 – ACCUMULATOR PISTON
2 – 3–4 ACCUMULATOR HOUSING
3 – TEFLON SEALS
4 – PISTON SPRING
5 – COVER PLATE AND SCREWS

LOWER HOUSING

(1) Lubricate valves, springs, and the housing valve and plug bores with clean transmission fluid (Fig. 127).

(2) Install 3-4 timing valve spring and valve in lower housing.

(3) Install 3-4 quick fill valve in lower housing.

(4) Install 3-4 quick fill valve spring and plug in housing.

(5) Install timing valve end plate. Tighten end plate screws to 4 N·m (35 in. lbs.) torque.

3-4 ACCUMULATOR

(1) Lubricate accumulator piston, seals and housing piston bore with clean transmission fluid (Fig. 128).

(2) Install new seal rings on accumulator piston.

(3) Install piston and spring in housing.

(4) Install end plate on housing.

TRANSFER PLATE

(1) Install rear clutch and rear servo check balls in transfer plate (Fig. 129).

(2) Install filter screen in upper housing separator plate (Fig. 130).

(3) Align and position upper housing separator plate on transfer plate (Fig. 131).

(4) Install brace plate (Fig. 131). Tighten brace attaching screws to 4 N·m (35 in. lbs.) torque.

(5) Install remaining separator plate attaching screws. Tighten screws to 4 N·m (35 in. lbs.) torque.

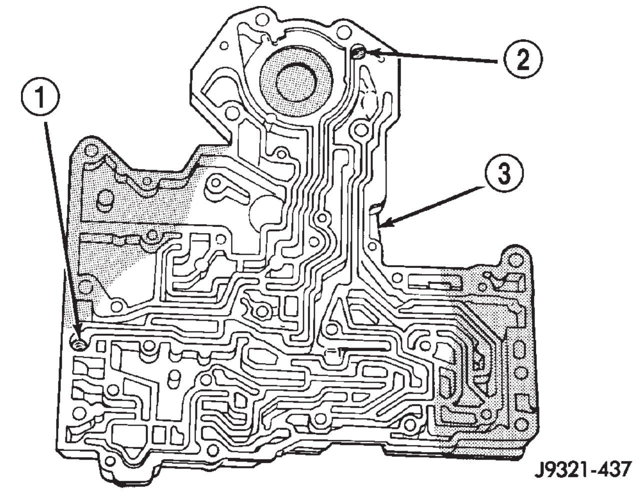


Fig. 129 Rear Clutch And Rear Servo Check Ball Locations

1 – REAR CLUTCH CHECK BALL
2 – REAR SERVO CHECK BALL
3 – TRANSFER PLATE

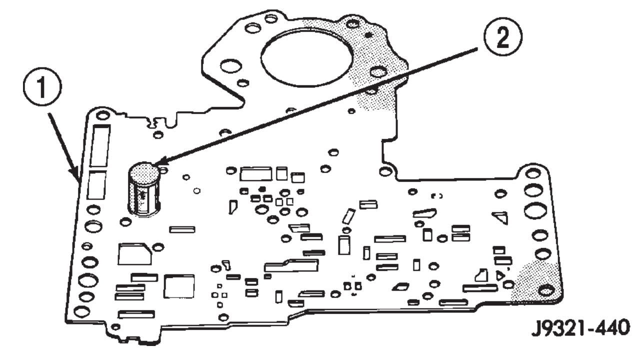


Fig. 130 Separator Plate Filter Screen Installation

1 – UPPER HOUSING SEPARATOR PLATE
2 – FILTER SCREEN

UPPER AND LOWER HOUSING

(1) Position upper housing so internal passages and check ball seats are facing upward. Then install check balls in housing (Fig. 132). Eight check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The single small check ball is approximately 4.8 mm (3/16 in.) in diameter. The remaining 6 check balls are approximately 6.3 mm (1/4 in.) in diameter.

(2) Position assembled transfer plate and upper housing separator plate on upper housing (Fig. 133). Be sure filter screen is seated in proper housing recess.

(3) Install the ECE check ball into the transfer plate (Fig. 119). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

DISASSEMBLY AND ASSEMBLY (Continued)

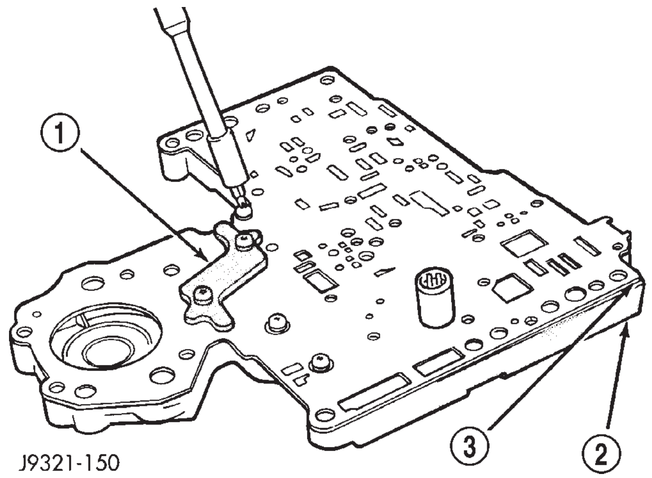


Fig. 131 Brace Plate

1 – BRACE
2 – TRANSFER PLATE
3 – SEPARATOR PLATE

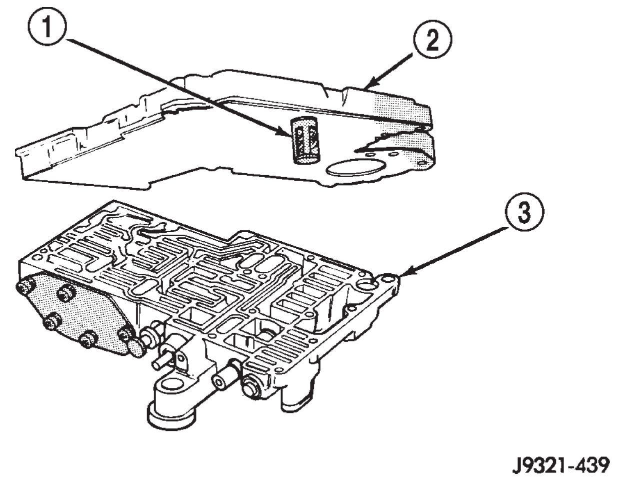


Fig. 133 Installing Transfer Plate On Upper Housing

1 – FILTER SCREEN
2 – TRANSFER PLATE/SEPARATOR PLATE ASSEMBLY
3 – UPPER HOUSING

(4) Position lower housing separator plate on transfer plate (Fig. 134).

(5) Install lower housing on assembled transfer plate and upper housing (Fig. 135).

(6) Install and start all valve body screws by hand except for the screws to hold the boost valve tube brace. Save those screws for later installation. Then tighten screws evenly to 4 N·m (35 in. lbs.) torque. Start at center and work out to sides when tightening screws (Fig. 135).

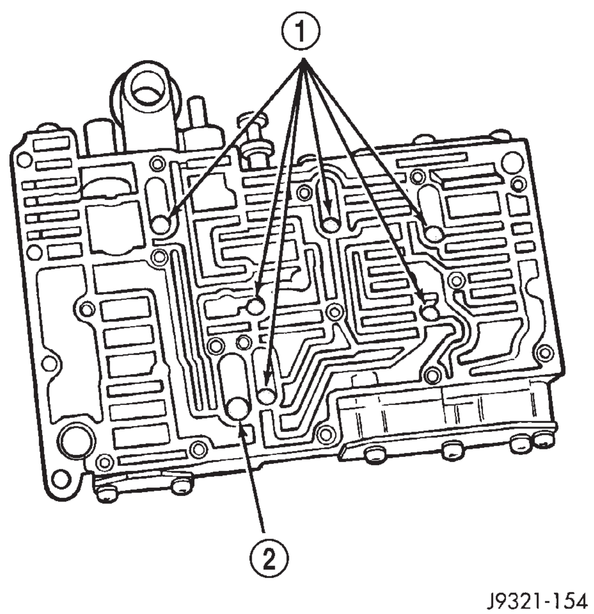


Fig. 132 Check Ball Locations In Upper Housing

1 – SMALL DIAMETER CHECK BALLS (6)
2 – LARGE DIAMETER CHECK BALL (1)

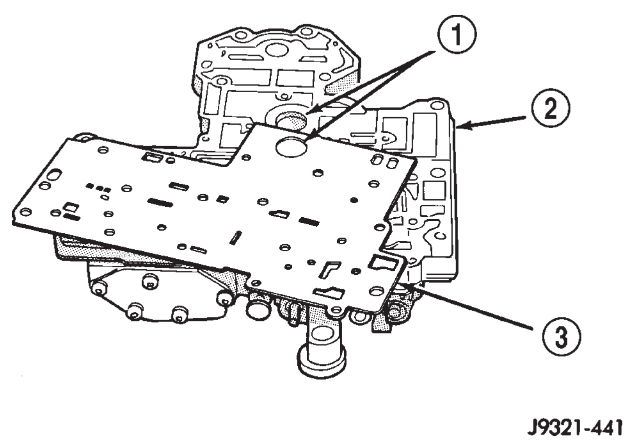


Fig. 134 Lower Housing Separator Plate

1 – BE SURE TO ALIGN BORES
2 – TRANSFER PLATE
3 – LOWER HOUSING (OVERDRIVE) SEPARATOR PLATE

UPPER HOUSING VALVE AND PLUG

Refer to (Fig. 136), (Fig. 137) and (Fig. 138) to perform the following steps.

(1) Lubricate valves, plugs, springs with clean transmission fluid.

(2) Assemble regulator valve line pressure plug, sleeve, throttle plug and spring. Insert assembly in upper housing and install cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(3) Install 1-2 and 2-3 shift valves and springs.

(4) Install 1-2 shift control valve and spring.

(5) Install retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing.

(6) Install limit valve housing and cover plate. Tighten screws to 4 N·m (35 in. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

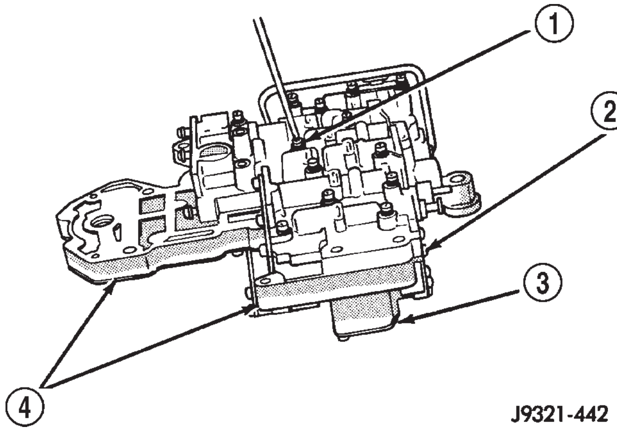


Fig. 135 Installing Lower Housing On Transfer Plate And Upper Housing

1 – VALVE BODY SCREWS (13)
2 – LOWER HOUSING
3 – UPPER HOUSING
4 – TRANSFER PLATE

(7) Install shuttle valve as follows:

(a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.

(b) Install shuttle valve into housing.

(c) Hold shuttle valve in place.

(d) Compress secondary spring and install E-clip in groove at end of shuttle valve.

(e) Verify that spring and E-clip are properly seated before proceeding.

(8) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(9) Install 1-2 and 2-3 valve governor plugs in valve body.

(10) Install shuttle valve primary spring and throttle plug.

(11) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

BOOST VALVE TUBE AND BRACE

(1) Position valve body assembly so lower housing is facing upward (Fig. 139).

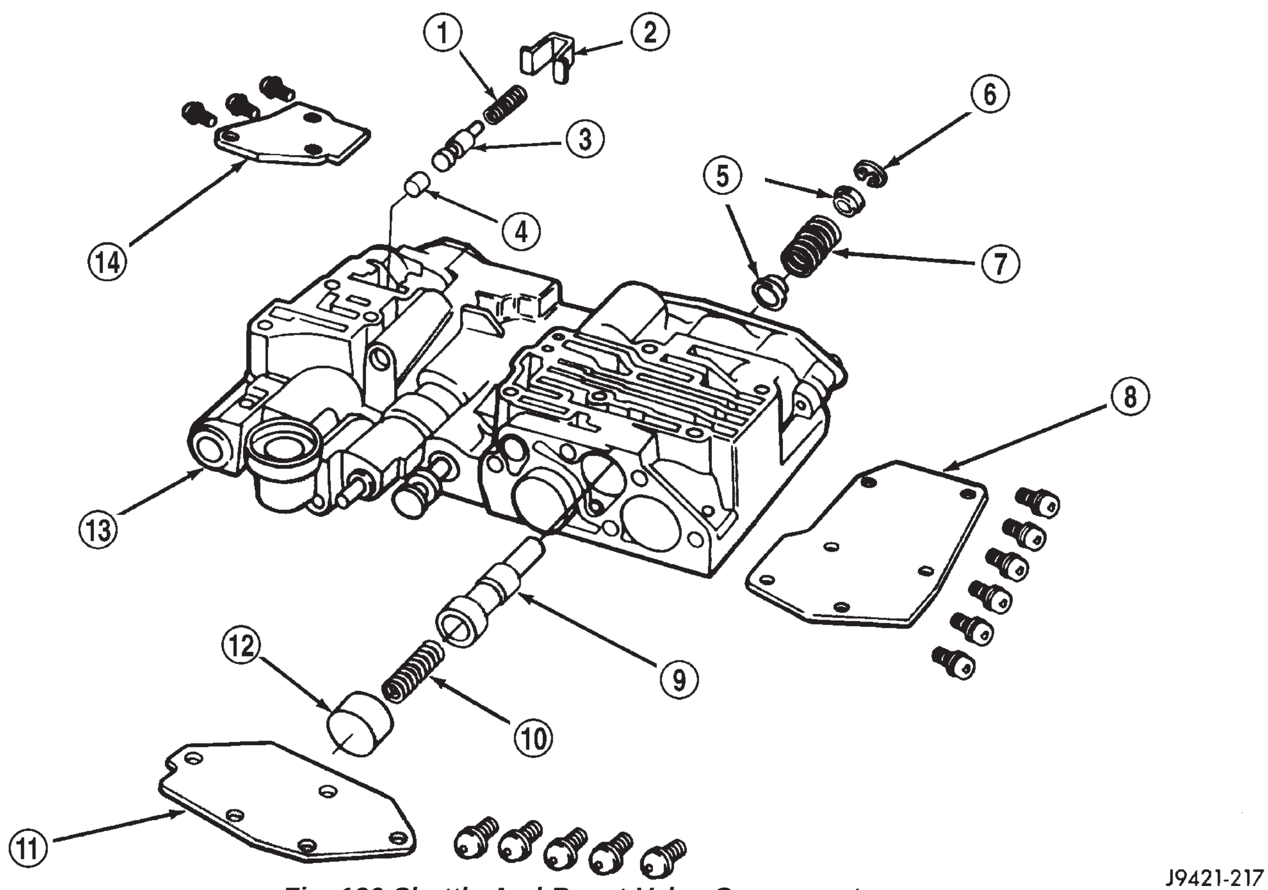


Fig. 136 Shuttle And Boost Valve Components

1 – SPRING
2 – RETAINER
3 – BOOST VALVE
4 – BOOST VALVE PLUG
5 – SPRING GUIDES
6 – E-CLIP
7 – SHUTTLE VALVE SECONDARY SPRING
8 – SHUTTLE VALVE COVER
9 – SHUTTLE VALVE
10 – SHUTTLE VALVE PRIMARY SPRING
11 – GOVERNOR PLUG COVER
12 – THROTTLE PLUG
13 – UPPER HOUSING
14 – BOOST VALVE COVER

DISASSEMBLY AND ASSEMBLY (Continued)

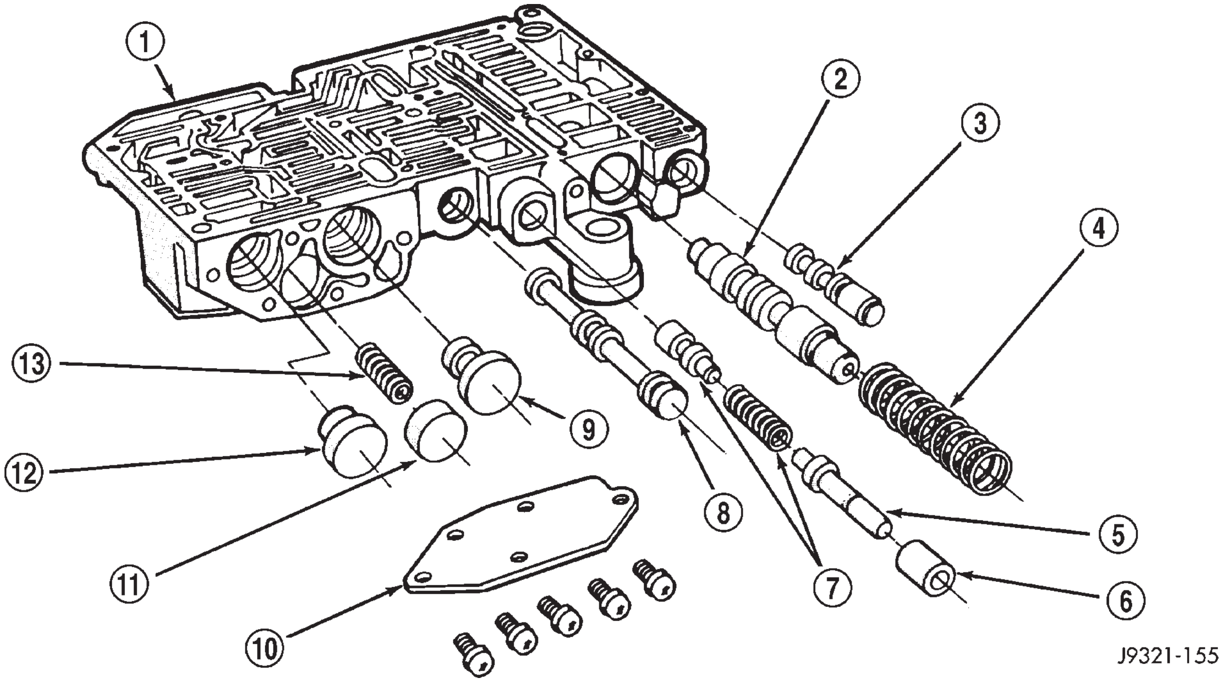


Fig. 137 Upper Housing Control Valve Locations

1 – UPPER HOUSING
2 – REGULATOR VALVE
3 – SWITCH VALVE
4 – REGULATOR VALVE SPRING
5 – KICKDOWN VALVE
6 – KICKDOWN DETENT
7 – THROTTLE VALVE AND SPRING
8 – MANUAL VALVE
9 – 1–2 GOVERNOR PLUG
10 – GOVERNOR PLUG COVER
11 – THROTTLE PLUG
12 – 2–3 GOVERNOR PLUG
13 – SHUTTLE VALVE PRIMARY SPRING

DISASSEMBLY AND ASSEMBLY (Continued)

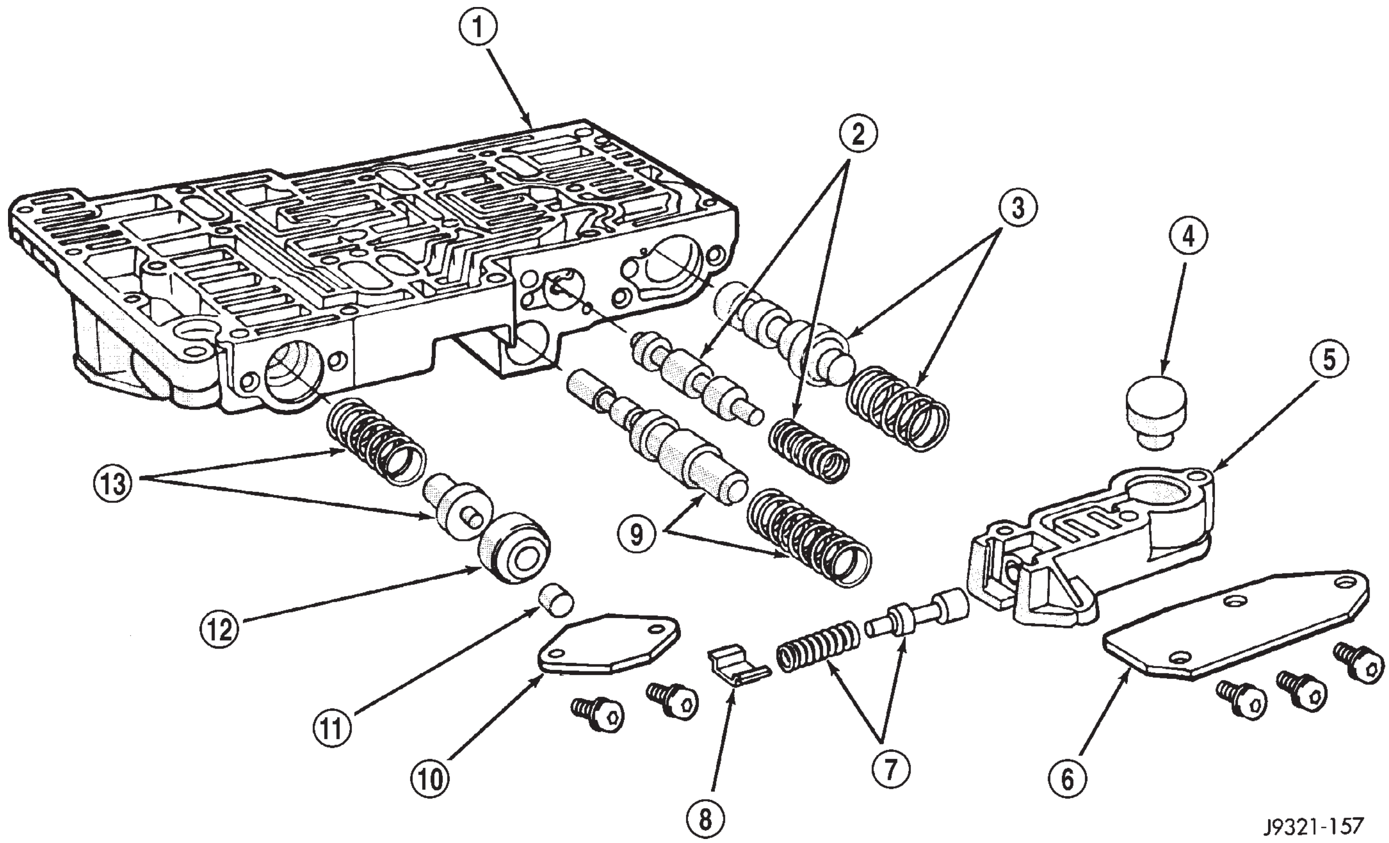


Fig. 138 Upper Housing Shift Valve And Pressure Plug Locations

1 – UPPER HOUSING
2 – 1–2 SHIFT VALVE AND SPRING
3 – 2–3 SHIFT VALVE AND SPRING
4 – 2–3 THROTTLE PLUG
5 – LIMIT VALVE HOUSING
6 – LIMIT VALVE COVER
7 – LIMIT VALVE AND SPRING
8 – RETAINER
9 – 1–2 SHIFT CONTROL VALVE AND SPRING
10 – PRESSURE PLUG COVER
11 – LINE PRESSURE PLUG
12 – PLUG SLEEVE
13 – THROTTLE PRESSURE SPRING AND PLUG

(2) Lubricate tube ends and housing ports with transmission fluid or petroleum jelly.

(3) Start tube in lower housing port first. Then swing tube downward and work opposite end of tube into upper housing port (Fig. 139).

(4) Insert and seat each end of tube in housings.

(5) Slide tube brace under tube and into alignment with valve body screw holes (Fig. 140).

(6) Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 140).

(7) Bend tube brace tabs up and against tube to hold it in position (Fig. 141).

(8) Tighten all valve body housing screws to 4 N·m (35 in. lbs.) torque after tube and brace are installed. Tighten screws in diagonal pattern starting at center and working outward.

DISASSEMBLY AND ASSEMBLY (Continued)

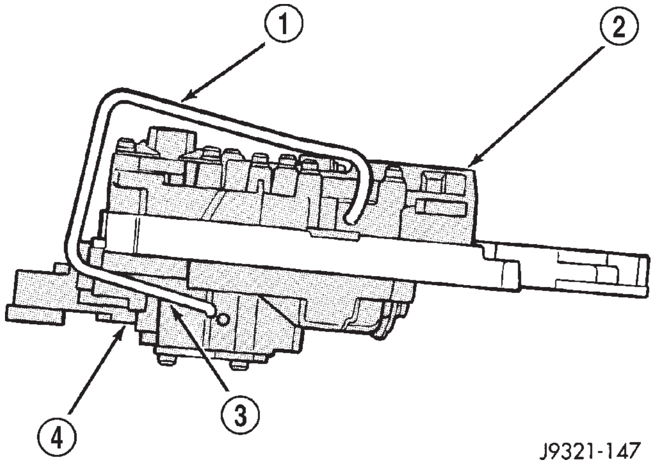


Fig. 139 Boost Valve Tube

1 – BOOST VALVE TUBE
2 – LOWER HOUSING
3 – DISENGAGE THIS END OF TUBE FIRST
4 – UPPER HOUSING

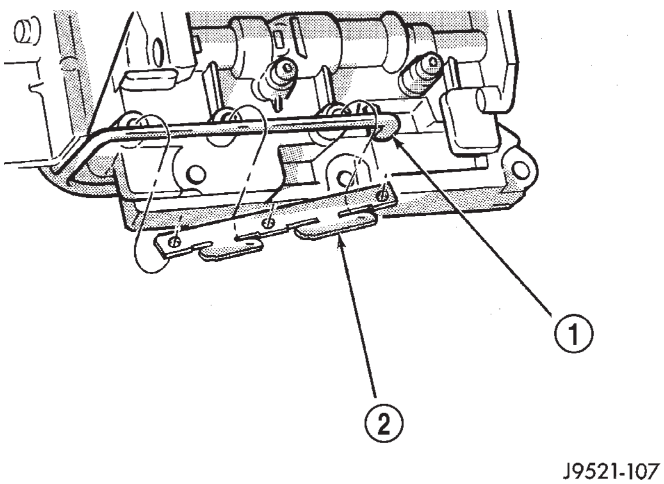


Fig. 140 Boost Valve Tube And Brace

1 – BOOST VALVE TUBE
2 – TUBE BRACE

3-4 ACCUMULATOR

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 142).

(2) Loosely attach accumulator housing with right-side screw (Fig. 142). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

(3) Install 3-4 shift valve and spring.

(4) Install converter clutch timing valve and spring.

(5) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(6) Swing accumulator housing upward over valve springs and plug.

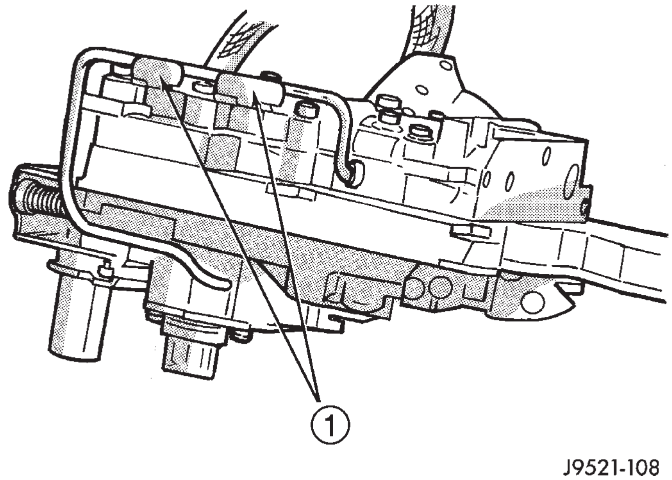


Fig. 141 Securing Boost Valve Tube With Brace Tabs

1 – BEND TABS UP AGAINST TUBE AS SHOWN

(7) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 143). Tighten screws to 4 N·m (35 in. lbs.).

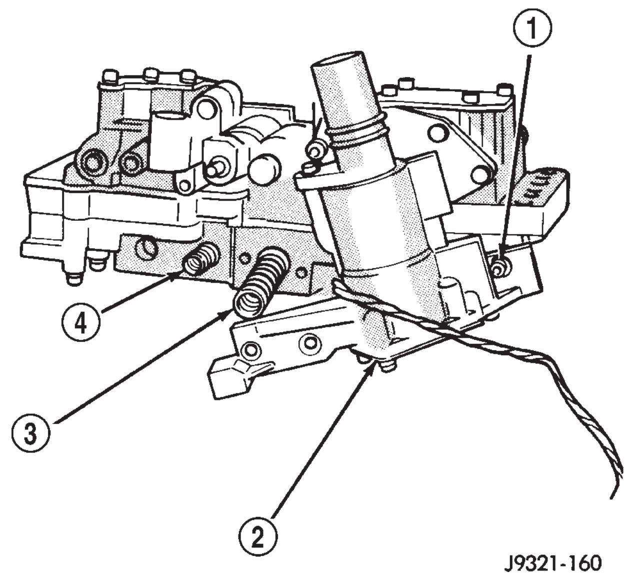


Fig. 142 Converter Clutch And 3-4 Shift Valve Springs

1 – RIGHT-SIDE SCREW
2 – 3–4 ACCUMULATOR
3 – 3–4 SHIFT VALVE SPRING
4 – CONVERTER CLUTCH VALVE SPRING

VALVE BODY FINAL

(1) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(2) Insert manual lever detent spring in upper housing.

DISASSEMBLY AND ASSEMBLY (Continued)

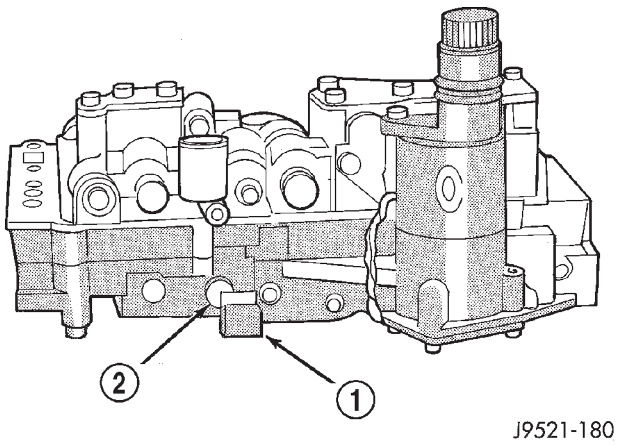


Fig. 143 Seating 3-4 Accumulator On Lower Housing

1 – ACCUMULATOR BOX
2 – CONVERTER CLUTCH VALVE PLUG

(3) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 144).

(4) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.

(5) Align manual lever with detent ball and manual valve. Hold throttle lever upward. Then press down on manual lever until fully seated. Remove detent ball retainer tool after lever is seated.

(6) Then install manual lever seal, washer and E-clip.

(7) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 145).

(8) Position line pressure adjusting screw in adjusting screw bracket.

(9) Install spring on end of line pressure regulator valve.

(10) Install switch valve spring on tang at end of adjusting screw bracket.

(11) Install manual valve.

(12) Install throttle valve and spring.

(13) Install kickdown valve and detent.

(14) Install pressure regulator valve.

(15) Install switch valve.

(16) Position adjusting screw bracket on valve body. Align valve springs and press bracket into place. Install short, upper bracket screws first and long bottom screw last. Verify that valve springs and bracket are properly aligned. Then tighten all three bracket screws to 4 N·m (35 in. lbs.) torque.

(17) Perform Line Pressure and Throttle Pressure adjustments. Refer to adjustment section of this group for proper procedures.

(18) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

(19) Attach solenoid case connector to 3-4 accumulator with shoulder-type screw. Connector has small locating tang that fits in dimple at top of accumulator housing (Fig. 146). Seat tang in dimple before tightening connector screw.

(20) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(21) Verify that solenoid wire harness is properly routed (Fig. 147). **Solenoid harness must be clear of manual lever and park rod and not be pinched between accumulator housing and cover.**

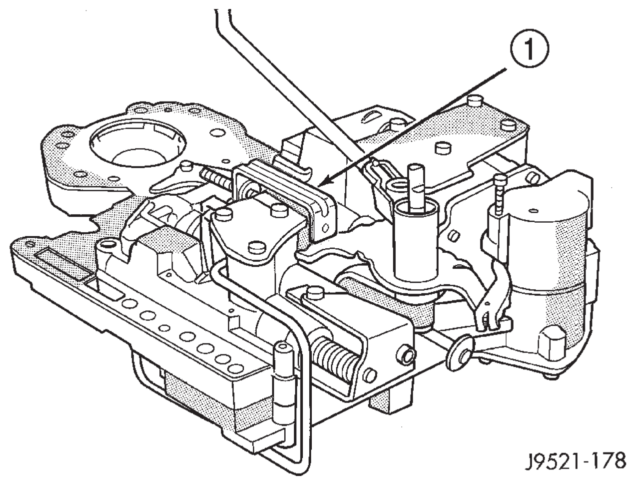


Fig. 144 Detent Ball Spring

1 – SPECIAL TOOL 6583 POSITIONED ON DETENT HOUSING

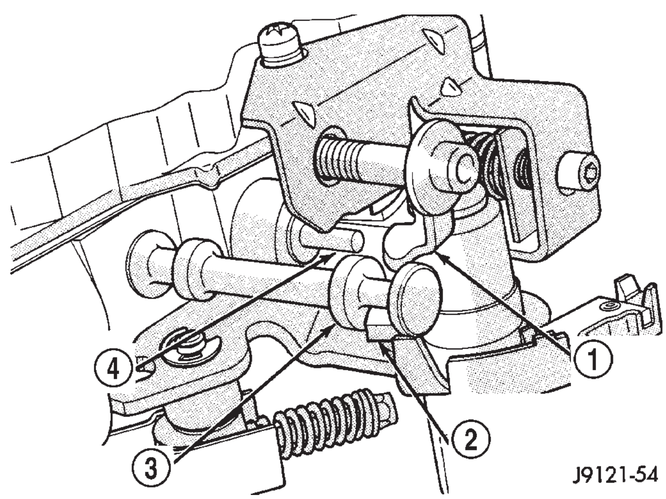


Fig. 145 Manual And Throttle Lever Alignment

1 – THROTTLE LEVER
2 – MANUAL LEVER VALVE ARM
3 – MANUAL VALVE
4 – KICKDOWN VALVE

DISASSEMBLY AND ASSEMBLY (Continued)

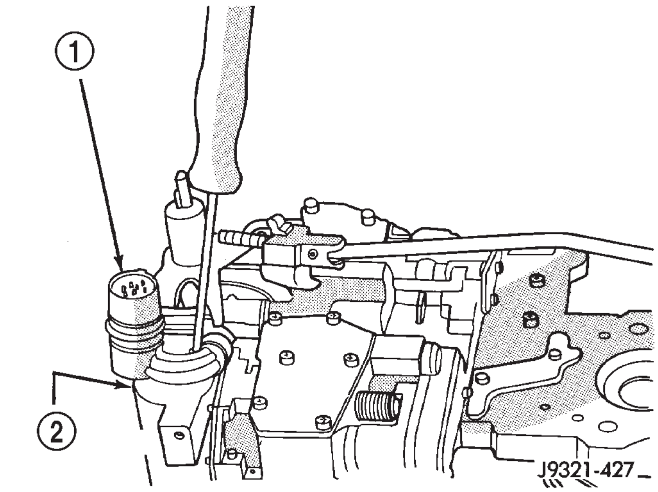


Fig. 146 Solenoid Harness Case Connector Shoulder Bolt

1 – SOLENOID HARNESS CASE CONNECTOR
2 – 3–4 ACCUMULATOR HOUSING

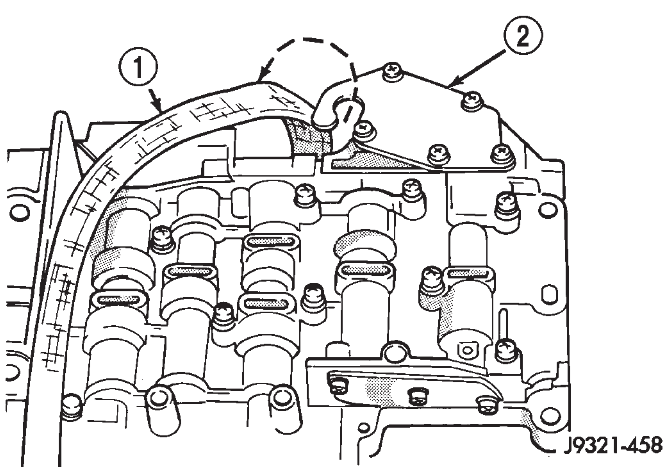


Fig. 147 Solenoid Harness Routing

1 – OVERDRIVE/CONVERTER SOLENOID WIRE HARNESS
2 – 3–4 ACCUMULATOR COVER PLATE

GOVERNOR BODY, SENSOR AND SOLENOID

(1) Turn valve body assembly over so accumulator side of transfer plate is facing down.

(2) Install new O-rings on governor pressure solenoid and sensor.

(3) Lubricate solenoid and sensor O-rings with clean transmission fluid.

(4) Install governor pressure sensor in governor body.

(5) Install governor pressure solenoid in governor body. Push solenoid in until it snaps into place in body.

(6) Position governor body gasket on transfer plate.

(7) Install retainer plate on governor body and around solenoid. Be sure solenoid connector is positioned in retainer cutout.

(8) Align screw holes in governor body and transfer plate. Then install and tighten governor body screws to 4 N·m (35 in. lbs.) torque.

(9) Connect harness wires to governor pressure solenoid and governor pressure sensor.

(10) Install fluid filter and pan.

(11) Lower vehicle.

(12) Fill transmission with recommended fluid and road test vehicle to verify repair.

TRANSMISSION

DISASSEMBLY

(1) Clean transmission exterior with steam gun or with solvent. Wear eye protection during cleaning operations.

(2) Place transmission in a vertical position.

(3) Measure and record input shaft end play readings.

(4) Remove shift and throttle levers from valve body manual lever shaft.

(5) Place transmission in horizontal position.

(6) Remove transmission oil pan and gasket.

(7) Remove filter from valve body (Fig. 148). Keep filter screws separate from other valve body screws. Filter screws are longer and should be kept with filter.

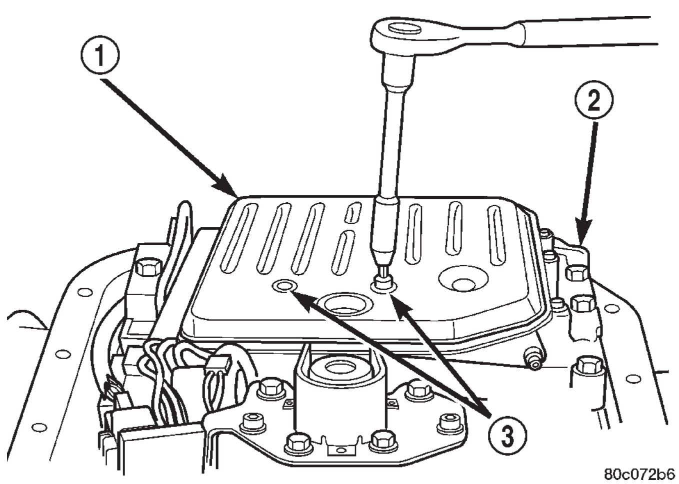


Fig. 148 Oil Filter Removal

1 – OIL FILTER
2 – VALVE BODY
3 – FILTER SCREWS (2)

(8) Remove park/neutral position switch.

(9) Remove hex head bolts attaching valve body to transmission case (Fig. 149). A total of 10 bolts are used. Note different bolt lengths for assembly reference.

DISASSEMBLY AND ASSEMBLY (Continued)

(10) Remove valve body assembly. Push valve body harness connector out of case. Then work park rod and valve body out of case (Fig. 150).

(11) Remove accumulator piston and inner and outer springs (Fig. 151).

(12) Remove pump oil seal with suitable pry tool or slide-hammer mounted screw.

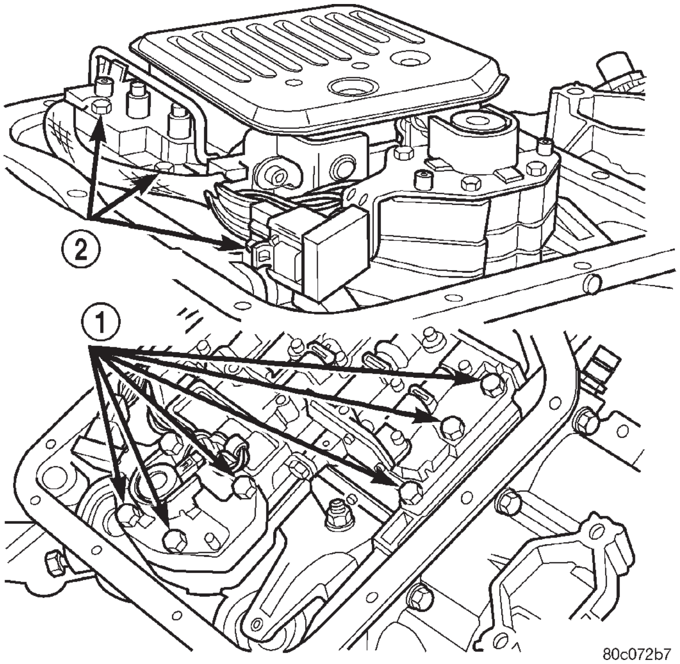


Fig. 149 Valve Body Bolt Locations

1 – VALVE BODY BOLTS
2 – VALVE BODY BOLTS

(13) Loosen front band adjusting screw locknut 4-5 turns. Then tighten band adjusting screw until band is tight around front clutch retainer. This prevents front/rear clutches from coming out with pump and possibly damaging clutch or pump components.

(14) Remove oil pump bolts.

(15) Thread bolts of Slide Hammer Tools C-3752 into threaded holes in pump body flange (Fig. 152).

(16) Bump slide hammer weights outward to remove pump and reaction shaft support assembly from case (Fig. 152).

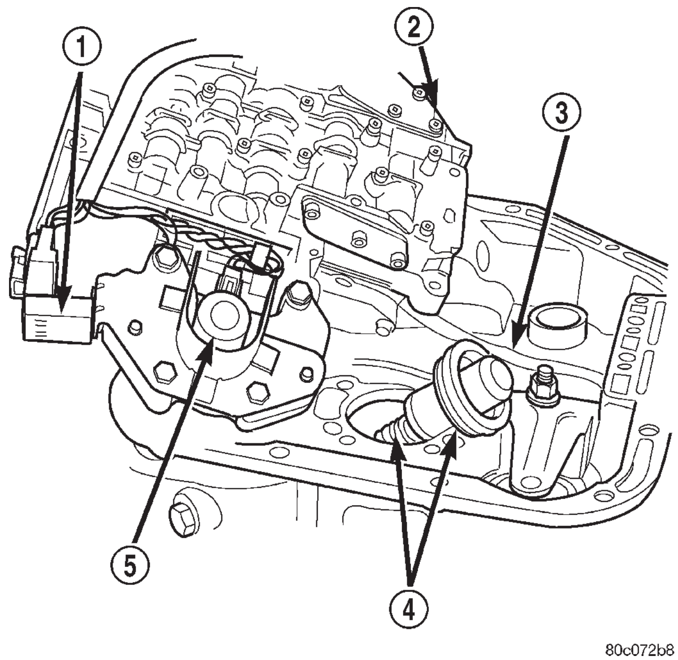


Fig. 150 Valve Body Removal

1 – GOVERNOR PRESSURE SENSOR
2 – VALVE BODY
3 – PARK ROD
4 – ACCUMULATOR PISTON
5 – GOVERNOR PRESSURE SOLENOID

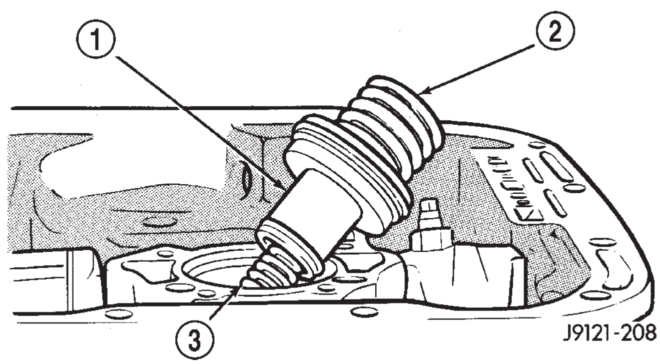


Fig. 151 Accumulator Piston And Springs

1 – ACCUMULATOR PISTON
2 – OUTER SPRING
3 – INNER SPRING

DISASSEMBLY AND ASSEMBLY (Continued)

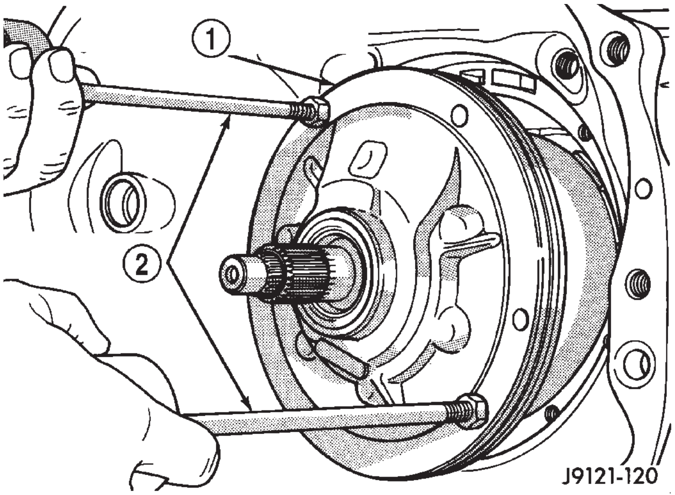


Fig. 152 Removing Oil Pump And Reaction Shaft Support Assembly

1 – OIL PUMP AND REACTION SHAFT SUPPORT ASSEMBLY
2 – SLIDE HAMMER TOOLS C-3752

(17) Loosen front band adjusting screw until band is completely loose.

(18) Squeeze front band together and remove band strut (Fig. 153).

(19) Remove front band lever (Fig. 154).

(20) Remove front band lever shaft plug, if necessary, from converter housing.

(21) Remove front band lever shaft.

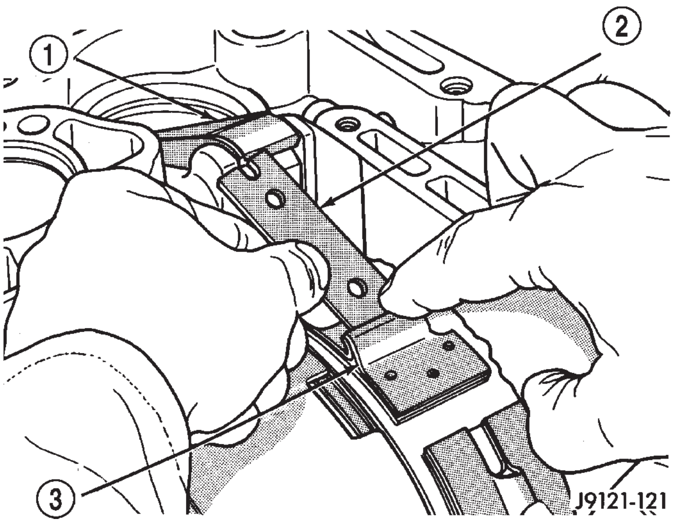


Fig. 153 Removing/Installing Front Band Strut

1 – BAND LEVER
2 – BAND STRUT
3 – FRONT BAND

(22) Remove front and rear clutch units as assembly. Grasp input shaft, hold clutch units together and remove them from case (Fig. 155).

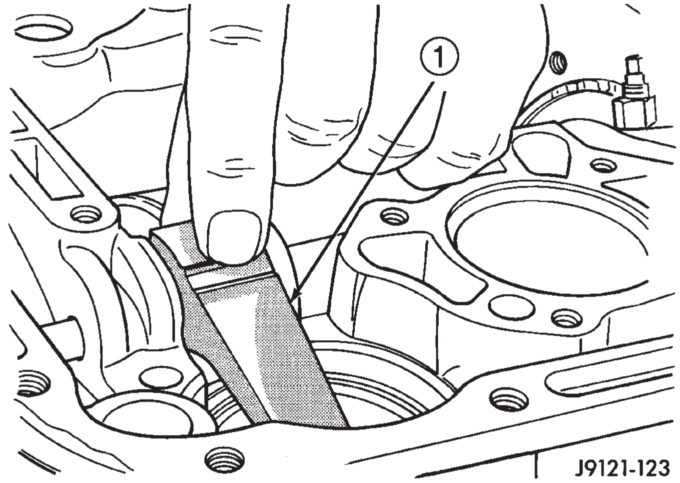


Fig. 154 Removing/Installing Front Band Lever

1 – FRONT BAND LEVER

(23) Lift front clutch off rear clutch (Fig. 156). Set clutch units aside for overhaul.

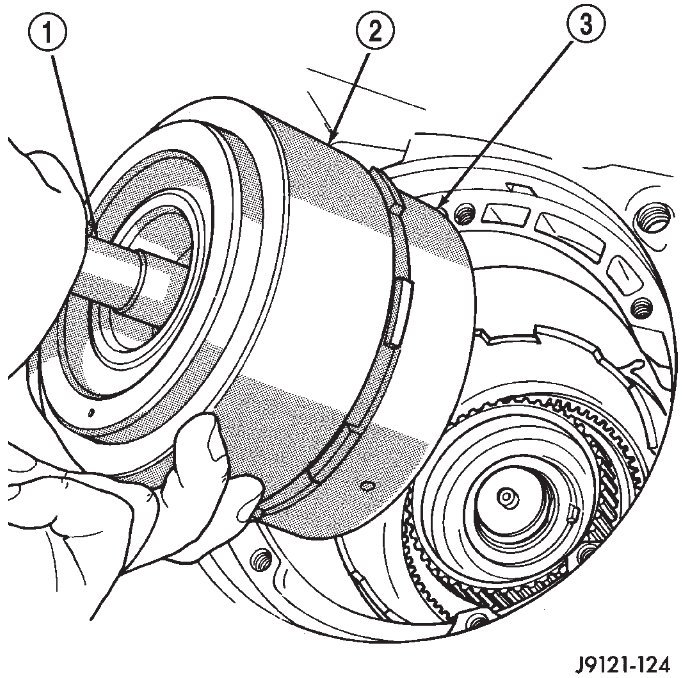


Fig. 155 Removing Front/Rear Clutch Assemblies

1 – INPUT SHAFT
2 – FRONT CLUTCH
3 – REAR CLUTCH

(24) Remove intermediate shaft thrust washer from front end of shaft or from rear clutch hub (Fig. 157).

(25) Remove output shaft thrust plate from intermediate shaft hub (Fig. 158).

(26) Slide front band off driving shell (Fig. 159) and remove band from case.

DISASSEMBLY AND ASSEMBLY (Continued)

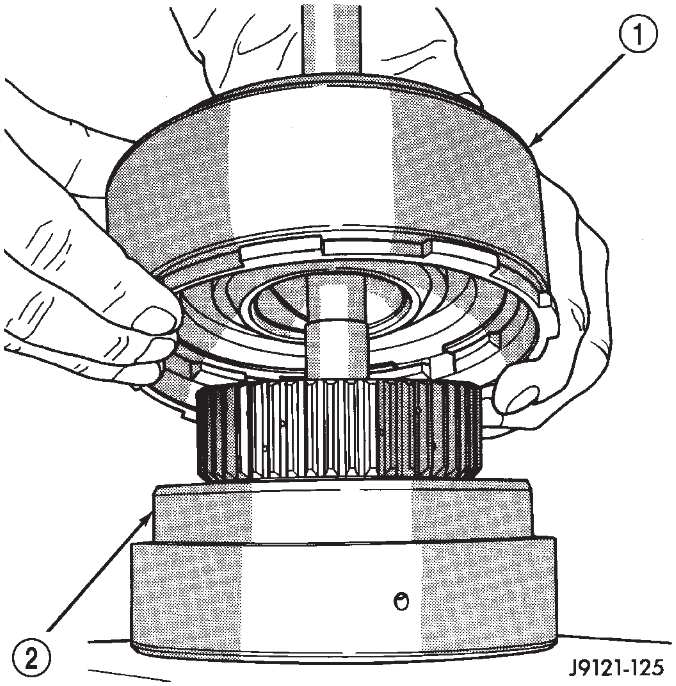


Fig. 156 Separating Front/Rear Clutch Assemblies

1 – FRONT CLUTCH
2 – REAR CLUTCH

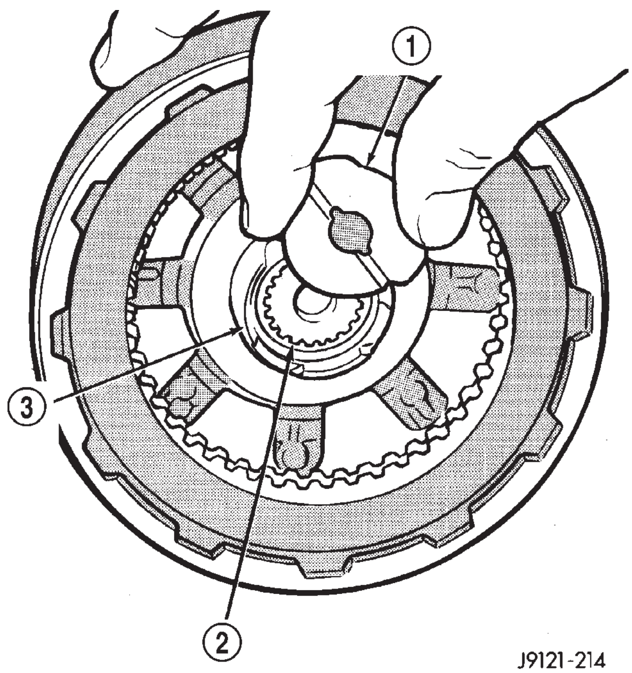


Fig. 157 Removing Intermediate Shaft Thrust Washer

1 – INTERMEDIATE SHAFT THRUST WASHER
2 – INPUT SHAFT
3 – REAR CLUTCH RETAINER HUB

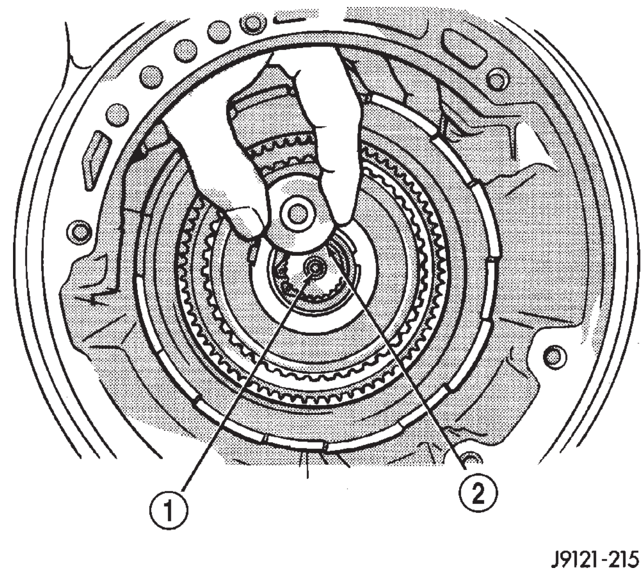


Fig. 158 Removing Intermediate Shaft Thrust Plate

1 – INTERMEDIATE SHAFT HUB
2 – INTERMEDIATE SHAFT THRUST PLATE

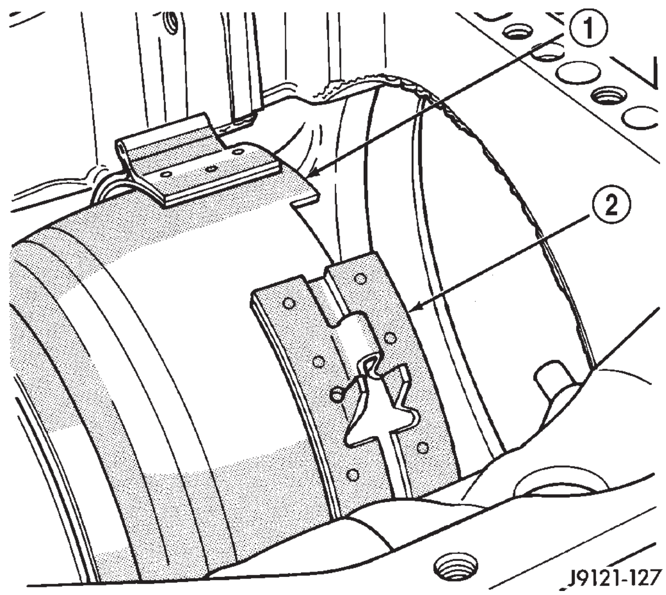


Fig. 159 Front Band Removal/Installation

1 – DRIVING SHELL
2 – FRONT BAND

(27) Remove planetary geartrain as assembly (Fig. 160). Support geartrain with both hands during removal. Do not allow machined surfaces on intermediate shaft or overdrive piston retainer to become nicked or scratched.

(28) If overdrive unit is not to be serviced, install Alignment Shaft 6227-2 into the overdrive unit to prevent misalignment of the overdrive clutches during service of main transmission components.

(29) Loosen rear band adjusting screw 4-5 turns.

DISASSEMBLY AND ASSEMBLY (Continued)

(30) Remove low-reverse drum snap ring (Fig. 161).

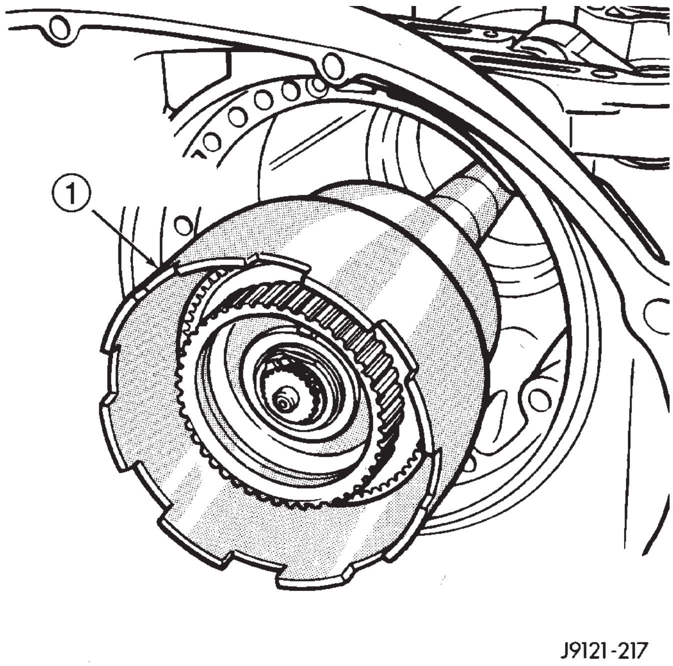


Fig. 160 Removing Planetary Geartrain And Intermediate Shaft Assembly

1 – PLANETARY GEARTRAIN AND INTERMEDIATE SHAFT ASSEMBLY

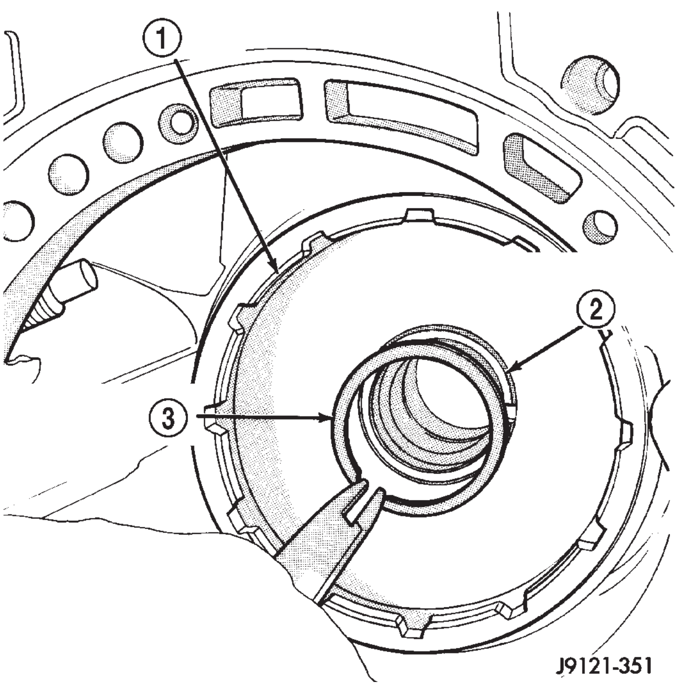


Fig. 161 Removing Low-Reverse Drum Snap Ring

1 – LOW-REVERSE DRUM
2 – HUB OF OVERDRIVE PISTON RETAINER
3 – LOW-REVERSE DRUM SNAP RING

(31) Remove low-reverse drum and reverse band.

(32) Remove overrunning clutch roller and spring assembly as a unit (Fig. 162).

(33) Compress front servo rod guide about 1/8 inch with Valve Spring Compressor C-3422-B (Fig. 163).

(34) Remove front servo rod guide snap ring. **Exercise caution when removing snap ring. Servo bore can be scratched or nicked if care is not exercised.**

(35) Remove compressor tools and remove front servo rod guide, spring and servo piston.

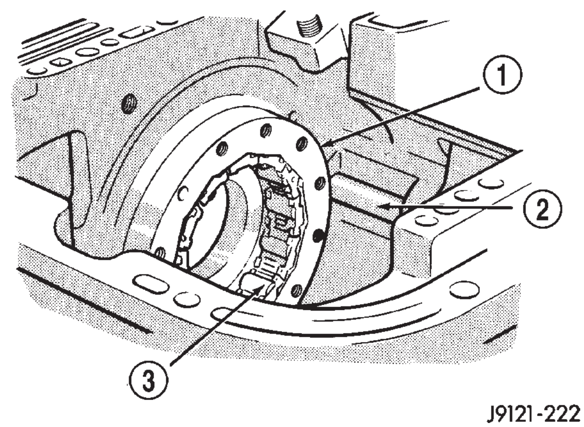


Fig. 162 Overrunning Clutch Assembly Removal

1 – OVERRUNNING CLUTCH CAM
2 – REAR BAND REACTION PIN
3 – OVERRUNNING CLUTCH ASSEMBLY

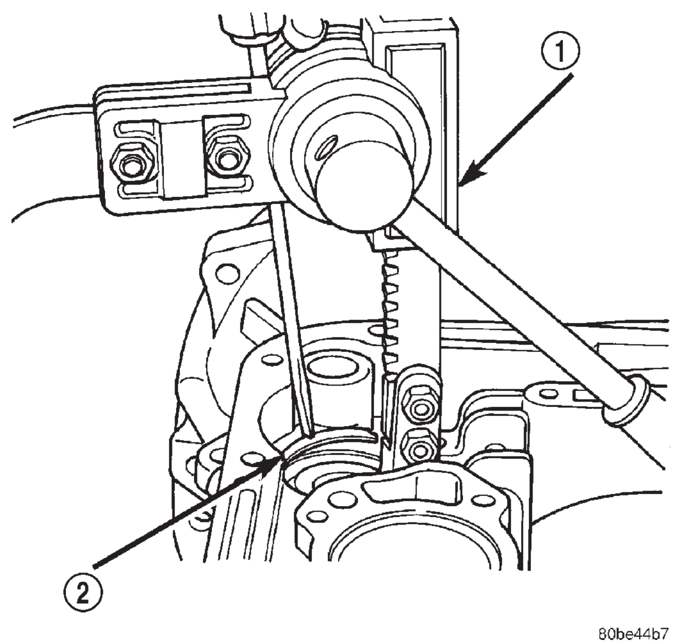


Fig. 163 Compressing Front Servo Rod Guide

1 – SPRING COMPRESSOR TOOL C-3422-B
2 – ROD GUIDE SNAP RING

DISASSEMBLY AND ASSEMBLY (Continued)

(36) Compress rear servo spring retainer about 1/16 inch with Valve Spring Compressor C-3422-B (Fig. 164).

(37) Remove rear servo spring retainer snap ring. Then remove compressor tools and remove rear servo spring and piston.

(38) Inspect transmission components.

NOTE: TO SERVICE THE OVERRUNNING CLUTCH CAM OR OVERDRIVE PISTON RETAINER, REFER TO OVERRUNNING CLUTCH CAM SERVICE IN THIS SECTION.

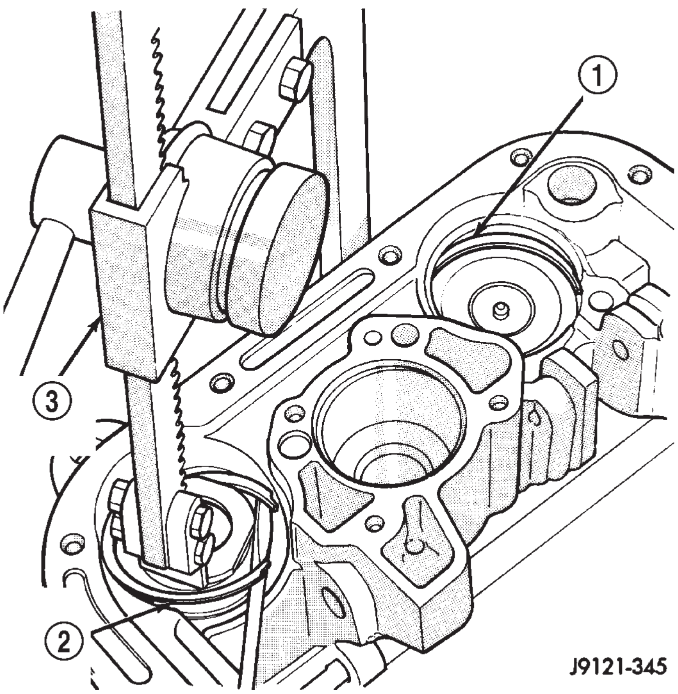


Fig. 164 Compressing Rear Servo Spring

1 – FRONT SERVO SNAP RING
2 – REAR SERVO SNAP RING
3 – SPECIAL TOOL

ASSEMBLY

Do not allow dirt, grease, or foreign material to enter the case or transmission components during assembly. Keep the transmission case and components clean. Also make sure the tools and workbench area used for assembly operations are equally clean.

Shop towels used for wiping off tools and hands must be made from **lint free** material. Lint will stick to transmission parts and could interfere with valve operation, or even restrict fluid passages.

Lubricate the transmission components with Mopar® transmission fluid during reassembly. Use Mopar® Door Ease, or Ru-Glyde on seals and O-rings to ease installation.

Petroleum jelly can also be used to hold thrust washers, thrust plates and gaskets in position during assembly. However, **do not** use chassis grease, bearing grease, white grease, or similar lubricants on any transmission part. These types of lubricants can eventually block or restrict fluid passages and interfere with valve operation. Use petroleum jelly only.

Do not force parts into place. The transmission components and subassemblies are easily installed by hand when properly aligned.

If a part seems extremely difficult to install, it is either misaligned or incorrectly assembled. Also verify that thrust washers, thrust plates and seal rings are correctly positioned before assembly. These parts can interfere with proper assembly if mis-positioned.

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install when the transmission case is upright.

(1) Install rear servo piston, spring and retainer (Fig. 165). Install spring on top of servo piston and install retainer on top of spring.

(2) Install front servo piston assembly, servo spring and rod guide (Fig. 166).

(3) Compress front/rear servo springs with Valve Spring Compressor C-3422-B and install each servo snap ring (Fig. 167).

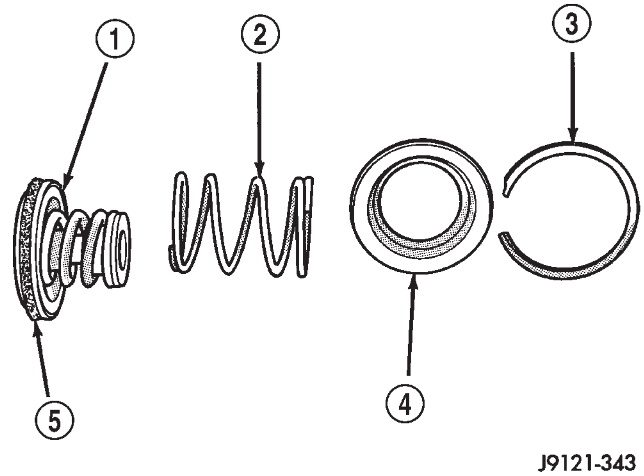


Fig. 165 Rear Servo Components

1 – SERVO PISTON
2 – PISTON SPRING
3 – SNAP RING
4 – RETAINER
5 – PISTON SEAL

(4) Lubricate clutch cam rollers with transmission fluid.

(5) Install rear band in case (Fig. 168). Be sure twin lugs on band are seated against reaction pin.

(6) Install low-reverse drum and check overrunning clutch operation as follows:

(a) Lubricate overrunning clutch race (on drum hub) with transmission fluid.

(b) Guide drum through rear band.

DISASSEMBLY AND ASSEMBLY (Continued)

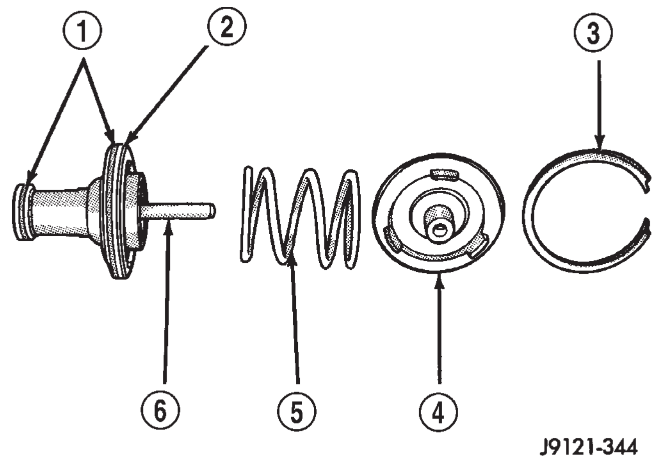


Fig. 166 Front Servo Components

1 – PISTON SEAL RINGS
2 – SERVO PISTON
3 – SNAP RING
4 – ROD GUIDE
5 – SPRING
6 – ROD

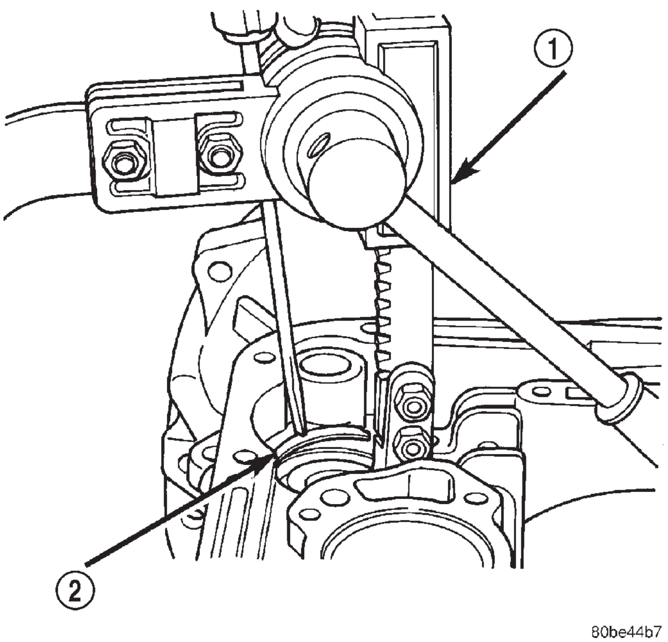


Fig. 167 Compressing Front/Rear Servo Springs

1 – SPRING COMPRESSOR TOOL C-3422-B
2 – ROD GUIDE SNAP RING

(c) Tilt drum slightly and start race (on drum hub) into overrunning clutch rollers.

(d) Press drum rearward and turn it in clockwise direction until drum seats in overrunning clutch (Fig. 169).

(e) Turn drum back and forth. **Drum should rotate freely in clockwise direction and lock**

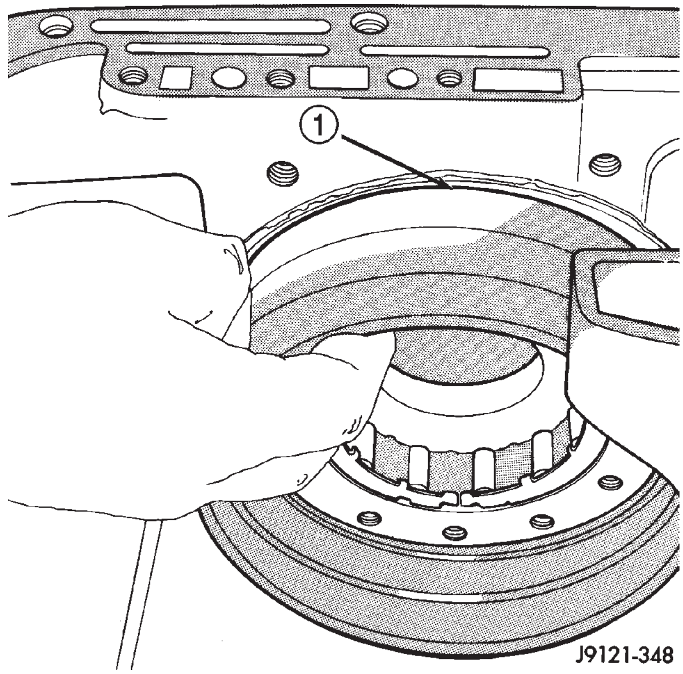


Fig. 168 Rear Band Installation

1 – REAR BAND

in counterclockwise direction (as viewed from front of case).

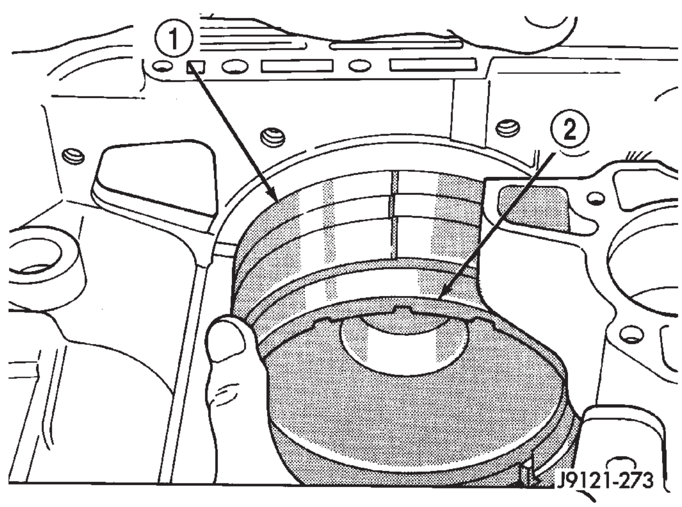


Fig. 169 Installing Low-Reverse Drum

1 – REAR BAND
2 – LOW-REVERSE DRUM

(7) Install snap ring that secures low-reverse drum to hub of overdrive piston retainer (Fig. 170).

(8) Install rear band lever and pivot pin (Fig. 171). Align lever with pin bores in case and push pivot pin into place.

(9) Install planetary geartrain assembly (Fig. 172).

DISASSEMBLY AND ASSEMBLY (Continued)

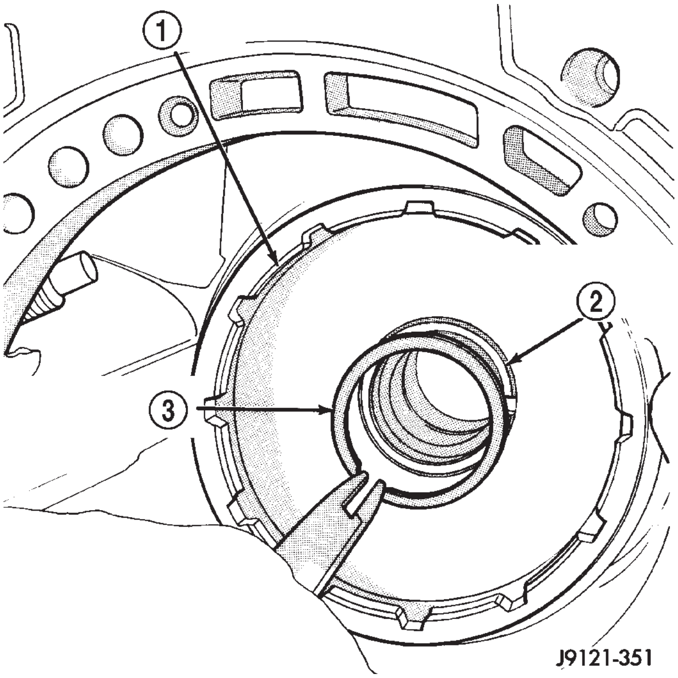


Fig. 170 Installing Low-Reverse Drum Retaining Snap Ring

1 – LOW-REVERSE DRUM
2 – HUB OF OVERDRIVE PISTON RETAINER
3 – LOW-REVERSE DRUM SNAP RING

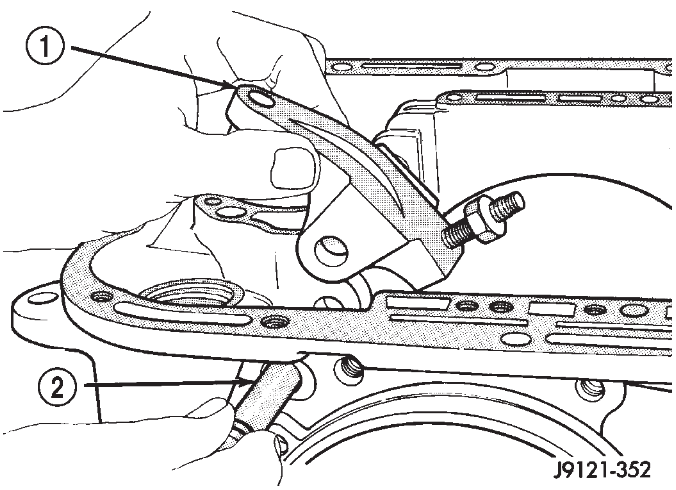


Fig. 171 Rear Band Lever And Pivot Pin Installation

1 – REAR BAND LEVER
2 – LEVER PIVOT PIN

(10) Install thrust plate on intermediate shaft hub (Fig. 173). Use petroleum jelly to hold thrust plate in place.

(11) Check seal ring on rear clutch retainer hub and seal rings on input shaft (Fig. 174). Also verify that shaft seal rings are installed in sequence shown.

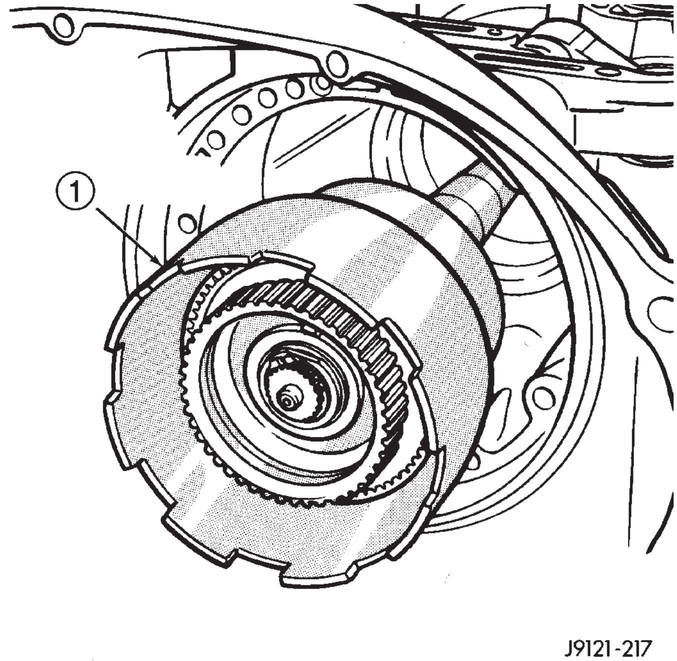


Fig. 172 Installing Planetary Geartrain

1 – PLANETARY GEARTRAIN AND INTERMEDIATE SHAFT ASSEMBLY

(12) Install rear clutch thrust washer (Fig. 175). Use additional petroleum jelly to hold washer in place if necessary.

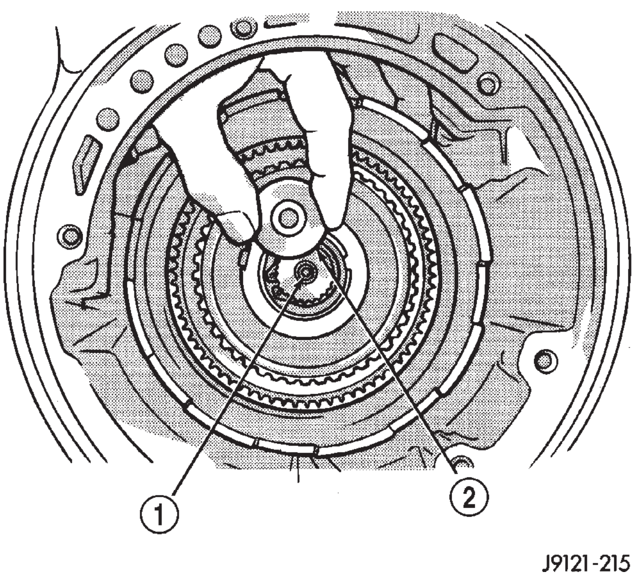


Fig. 173 Installing Intermediate Shaft Thrust Plate

1 – INTERMEDIATE SHAFT HUB
2 – INTERMEDIATE SHAFT THRUST PLATE

(13) Align clutch discs in front clutch and install front clutch on rear clutch (Fig. 176). Rotate front clutch retainer back and forth until completely seated on rear clutch retainer.

DISASSEMBLY AND ASSEMBLY (Continued)

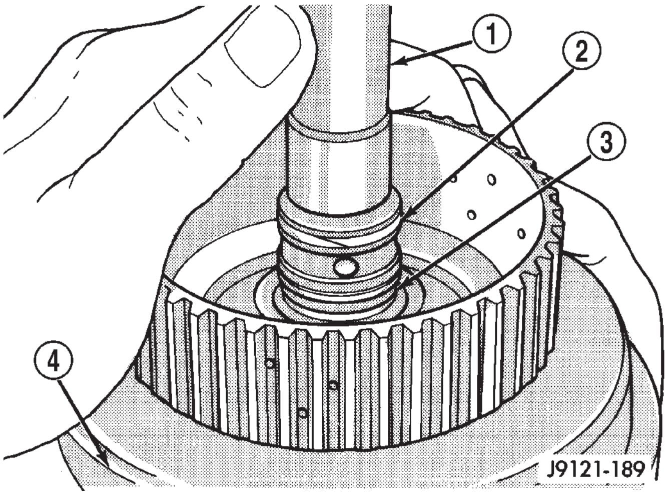


Fig. 174 Input Shaft Seal Ring Location

1 – INPUT SHAFT
2 – TEFLON SEAL RING
3 – METAL SEAL RING
4 – REAR CLUTCH RETAINER

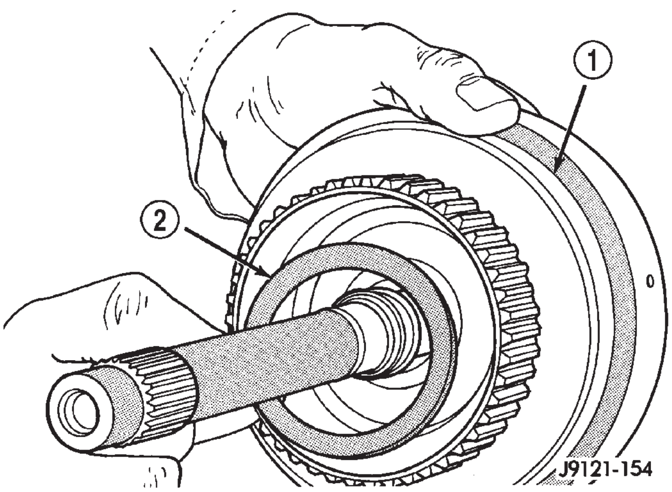


Fig. 175 Installing Rear Clutch Thrust Washer

1 – REAR CLUTCH RETAINER
2 – REAR CLUTCH THRUST WASHER (FIBER)

(14) Coat intermediate shaft thrust washer with petroleum jelly. Then install washer in rear clutch hub (Fig. 177). Use enough petroleum jelly to hold washer in place. **Be sure grooved side of washer faces rearward (toward output shaft) as shown. Also note that washer only fits one way in clutch hub.** Note thickness of this washer. It is a select fit part and is used to control transmission end play.

(15) Align drive teeth on rear clutch discs with small screwdriver (Fig. 178). This makes installation on front planetary easier.

(16) Raise front end of transmission upward as far as possible and support case with wood blocks. Front/rear clutch and oil pump assemblies are easier to install if transmission is as close to upright position as possible.

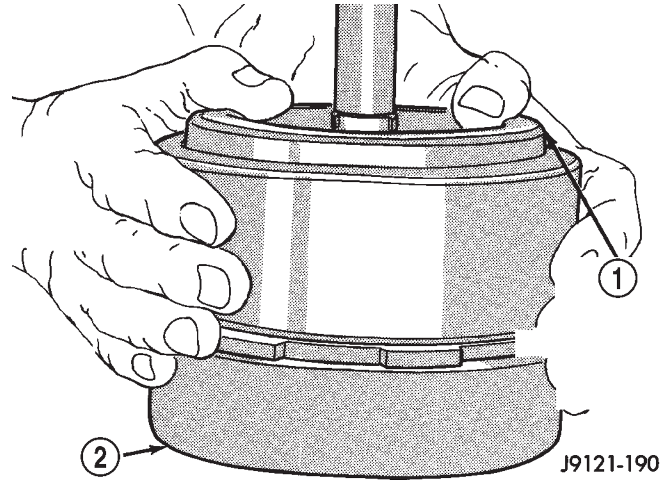


Fig. 176 Assembling Front And Rear Clutch Units

1 – TURN FRONT CLUTCH BACK & FORTH UNTIL SEATED
2 – REAR CLUTCH ASSEMBLY

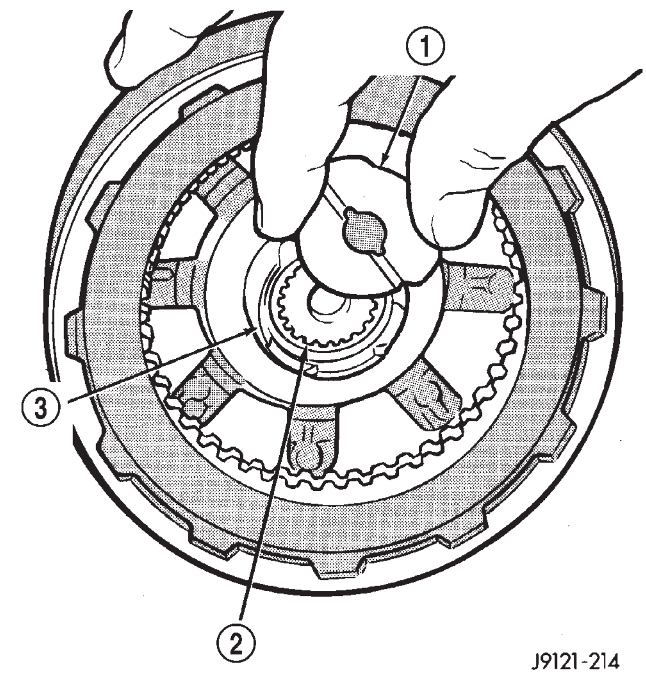


Fig. 177 Installing Intermediate Shaft Thrust Plate

1 – INTERMEDIATE SHAFT THRUST WASHER
2 – INPUT SHAFT
3 – REAR CLUTCH RETAINER HUB

(17) Slide front band into case.

(18) Install front and rear clutch units as assembly (Fig. 179). Align rear clutch with front annulus gear and install assembly in driving shell. **Be sure output shaft thrust washer and thrust plate are not displaced during installation.**

(19) Carefully work assembled clutches back and forth to engage and seat rear clutch discs on front

DISASSEMBLY AND ASSEMBLY (Continued)

annulus gear. Also be sure front clutch drive lugs are fully engaged in slots of driving shell after installation.

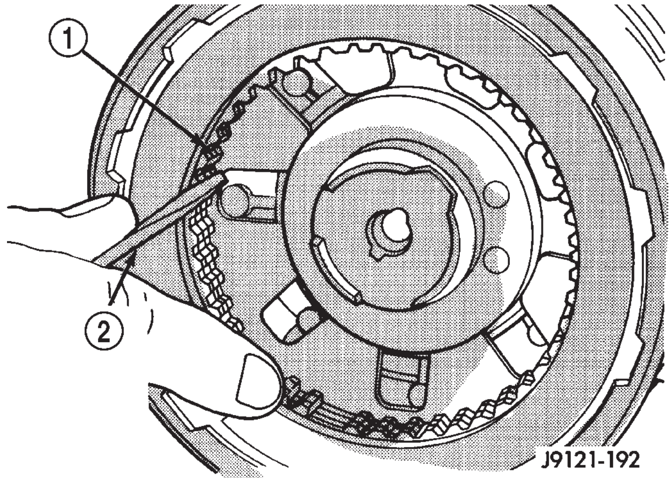


Fig. 178 Aligning Rear Clutch Disc Lugs

1 – REAR CLUTCH DISCS
2 – USE SMALL SCREWDRIVER TO ALIGN CLUTCH DISC TEETH

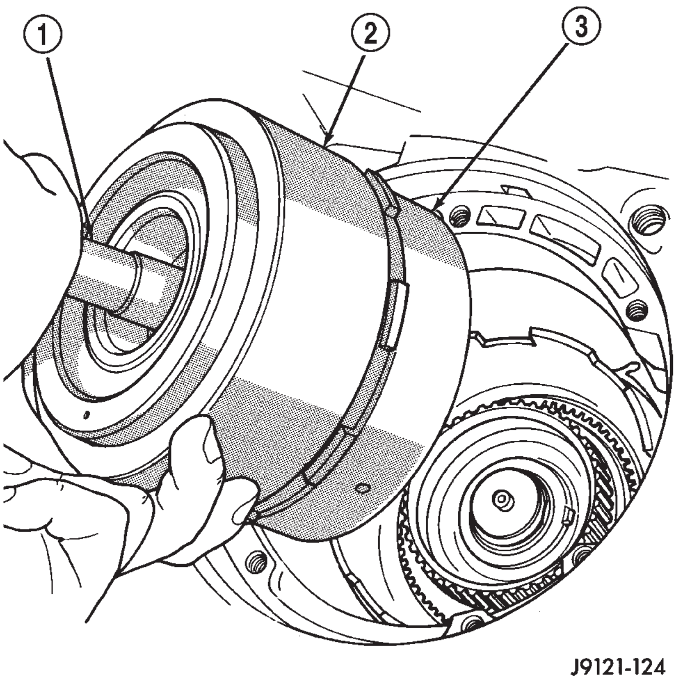


Fig. 179 Installing Front/Rear Clutch Assemblies

1 – INPUT SHAFT
2 – FRONT CLUTCH
3 – REAR CLUTCH

(20) Assemble front band strut.

(21) Install front band adjuster, strut and adjusting screw (Fig. 180).

(22) Tighten band adjusting screw until band just grips clutch retainer. Verify that front/rear clutches are still seated before continuing.

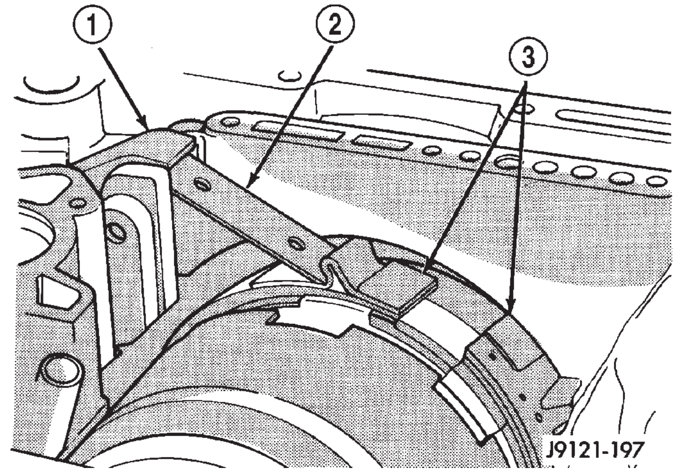


Fig. 180 Front Band Linkage Installation

1 – BAND LEVER
2 – BAND STRUT
3 – FRONT BAND

(23) Check seal rings on reaction shaft support hub. Verify that seal rings are hooked together and that front clutch thrust washer is properly positioned (Fig. 181). Use petroleum jelly to hold thrust washer in place if necessary.

(24) Lubricate oil pump body seal with petroleum jelly. Lubricate pump shaft seal lip with petroleum jelly.

(25) Thread two Pilot Stud Tools C-3288-B into bolt holes in oil pump bore flange (Fig. 182).

(26) Align and install oil pump gasket (Fig. 182).

(27) Install oil pump (Fig. 183). Align and position pump on pilot studs. Slide pump down studs and work it into front clutch hub and case by hand. Then install 2 or 3 pump bolts to hold pump in place.

(28) Remove pilot stud tools and install remaining oil pump bolts. Tighten bolts alternately in diagonal pattern to 20 N·m (15 ft. lbs.).

(29) Measure input shaft end play (Fig. 184).

NOTE: If end play is incorrect, transmission is incorrectly assembled, or the intermediate shaft thrust washer is incorrect. The intermediate shaft thrust washer is selective.

(a) Attach Adapter 8266–6 to Handle 8266–8.

(b) Attach dial indicator C-3339 to Handle 8266–8.

(c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266–6 to secure it to the input shaft.

DISASSEMBLY AND ASSEMBLY (Continued)

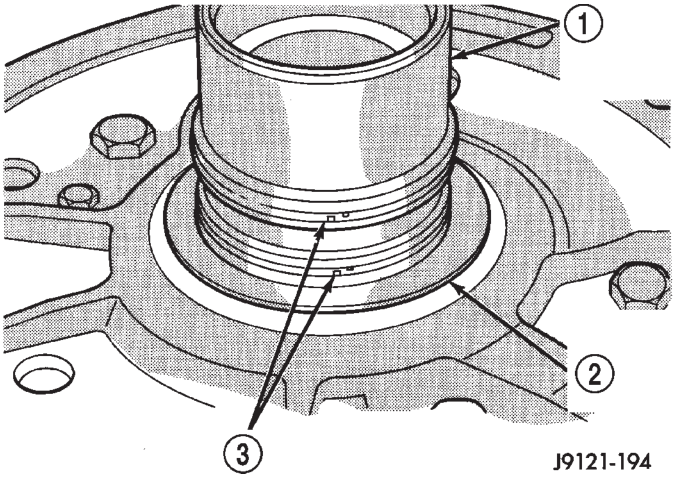


Fig. 181 Reaction Shaft Support Seal Rings And Front Clutch Thrust Washer

1 – REACTION SHAFT SUPPORT HUB
2 – FRONT CLUTCH THRUST WASHER
3 – SEAL RINGS

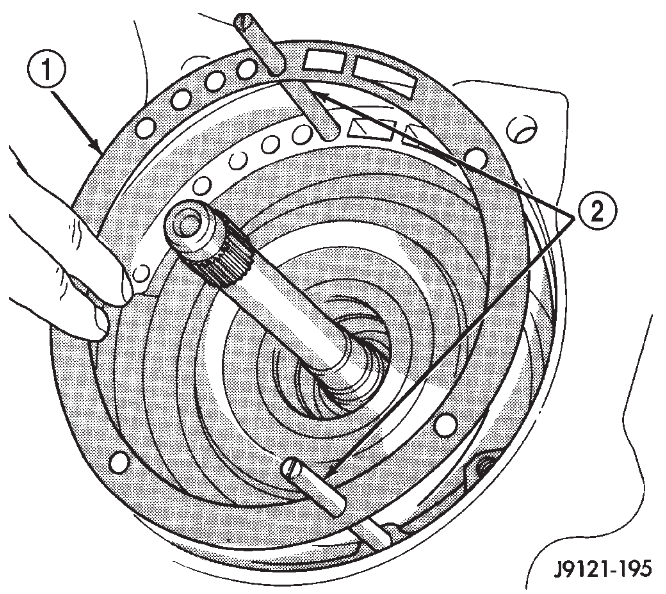


Fig. 182 Installing Pilot Studs And Oil Pump Gasket

1 – OIL PUMP GASKET
2 – PILOT STUD TOOLS C-3288–B

(d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.

(e) Move input shaft in and out and record reading. End play should be 0.56 - 2.31 mm (0.022 - 0.091 in.). Adjust as necessary.

(30) Install accumulator piston and inner and outer springs (Fig. 185).

(31) Verify that valve body solenoid harness is secured in 3-4 accumulator housing cover plate.

(32) Install valve body as follows:

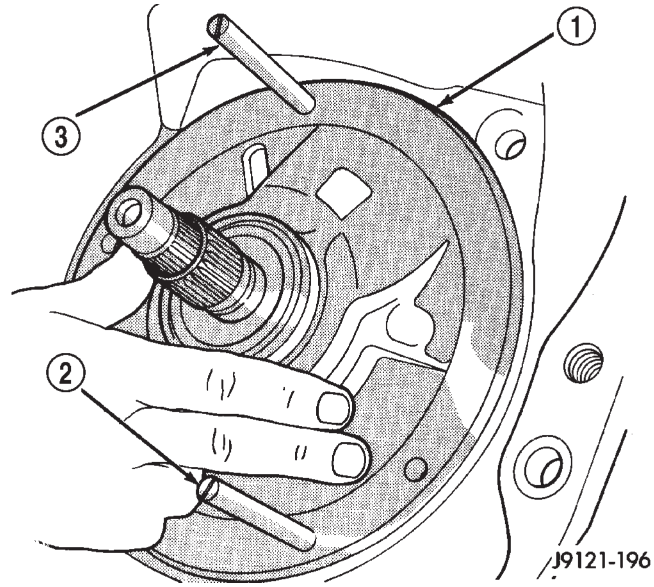


Fig. 183 Installing Oil Pump Assembly In Case

1 – OIL PUMP
2 – PILOT STUD TOOL
3 – PILOT STUD TOOL

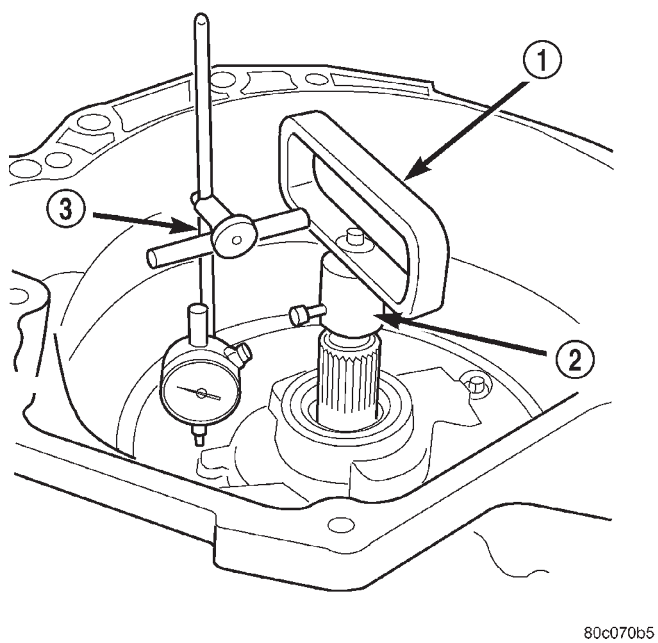


Fig. 184 Checking Input Shaft End Play

1 – TOOL 8266-8
2 – TOOL 8266-6
3 – TOOL C-3339

(a) Align and carefully insert park rod into pawl. Rod will make click noise as it enters pawl. Move rod slightly to check engagement.

(b) Align and seat valve body on case. Be sure manual lever shaft and overdrive connector are

DISASSEMBLY AND ASSEMBLY (Continued)

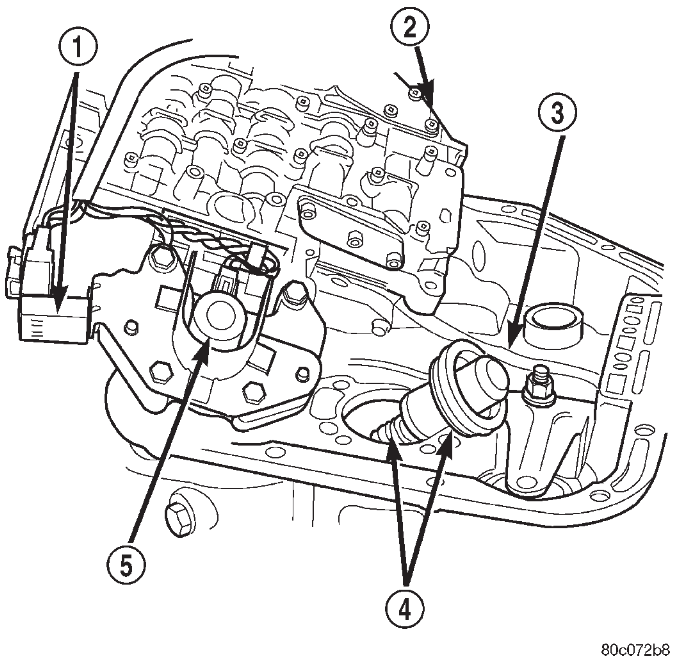


Fig. 185 Accumulator Piston And Springs

1 – GOVERNOR PRESSURE SENSOR
2 – VALVE BODY
3 – PARK ROD
4 – ACCUMULATOR PISTON
5 – GOVERNOR PRESSURE SOLENOID

fully seated in case. Also be sure valve body wiring is not pinched or kinked.

(c) Install and start all valve body attaching bolts by hand. Then tighten bolts evenly, in a diagonal pattern to 12 N·m (105 in. lbs.) torque. **Do not overtighten valve body bolts. This could result in distortion and cross leakage after installation.**.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into the cavity.

(33) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(34) Adjust front and rear bands.

(35) Install seal on park/neutral position switch. Then install and tighten switch to 34 N·m (25 ft. lbs.).

(36) Install magnet in oil pan. Magnet goes on small protrusion at corner of pan.

(37) Position new oil pan gasket on case and install oil pan. Tighten pan bolts to 17 N·m (13 ft. lbs.).

(38) Install new valve body manual shaft seal in case (Fig. 186). Lubricate seal lip and manual shaft with petroleum jelly. Start seal over shaft and into case. Seat seal with 15/16 inch, deep well socket.

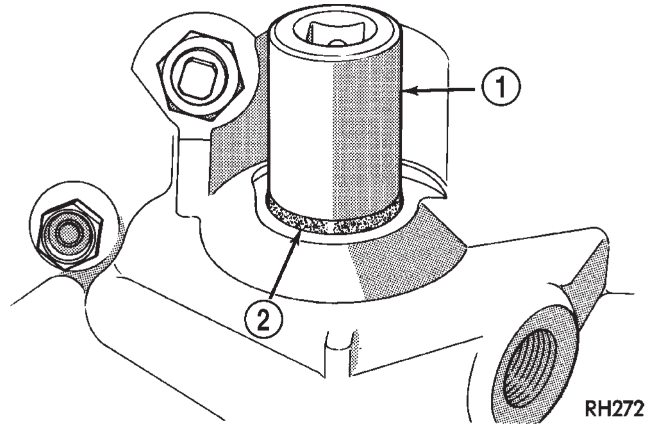


Fig. 186 Installing Manual Lever Shaft Seal

1 – 15/16′′ SOCKET
2 – SEAL

(39) Install throttle valve and shift selector levers on valve body manual lever shaft.

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER

DISASSEMBLY

NOTE: TO SERVICE THE OVERRUNNING CLUTCH CAM AND THE OVERDRIVE PISTON RETAINER, THE TRANSMISSION GEARTRAIN AND OVERDRIVE UNIT MUST BE REMOVED FROM THE TRANSMISSION.

(1) Remove the overdrive piston (Fig. 187).
(2) Remove the overdrive piston retainer bolts.
(3) Remove overdrive piston retainer.
(4) Remove case gasket.
(5) Mark the position of the overrunning clutch cam in the case (Fig. 188).
(6) Remove the overrunning clutch cam bolts.
(7) Remove the overrunning clutch cam.

ASSEMBLY

(1) Examine bolt holes in overrunning clutch cam. Note that one hole is **not threaded** (Fig. 189). This hole must align with blank area in clutch cam bolt circle (Fig. 190). Mark hole location on clutch cam and blank area in case with grease pencil, paint stripe, or scribe mark for assembly reference.

(2) Mark location of non-threaded hole in clutch cam and blank area in bolt circle with grease pencil.

(3) Align and install overrunning clutch and cam in case (Fig. 191). **Be sure cam is correctly installed. Bolt holes in cam are slightly counter-**

DISASSEMBLY AND ASSEMBLY (Continued)

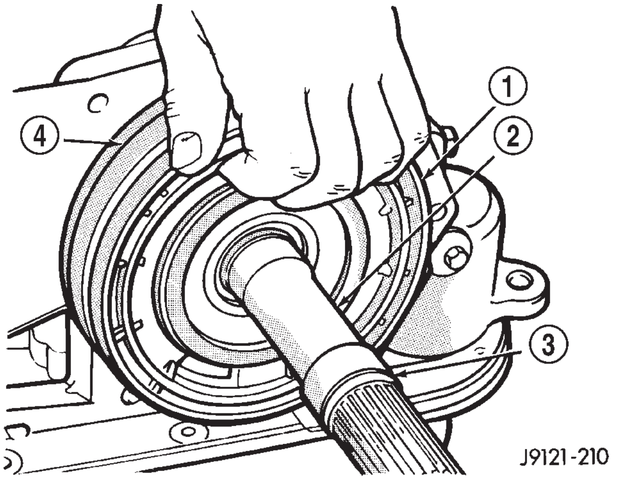


Fig. 187 Overdrive Piston Removal

1 – OVERDRIVE CLUTCH PISTON
2 – INTERMEDIATE SHAFT
3 – SELECTIVE SPACER
4 – PISTON RETAINER

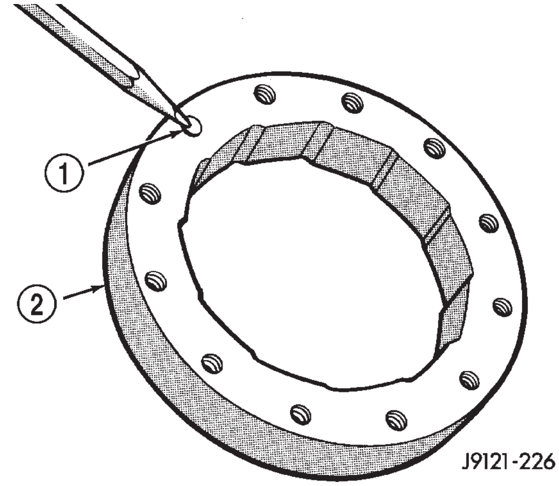


Fig. 189 Location Of Non-Threaded Hole In Clutch Cam

1 – NON-THREADED HOLE
2 – OVERRUNNING CLUTCH CAM

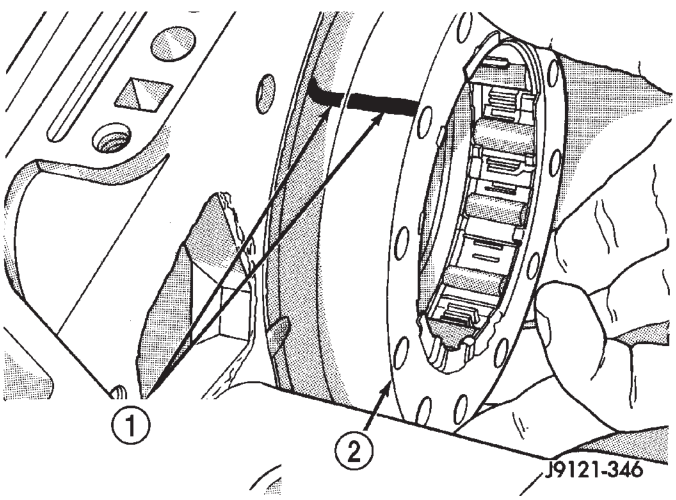


Fig. 188 Overrunning Clutch Cam Removal

1 – ALIGN MARKS IDENTIFYING NON-THREADED HOLE IN CAM AND CASE
2 – OVERRUNNING CLUTCH ASSEMBLY

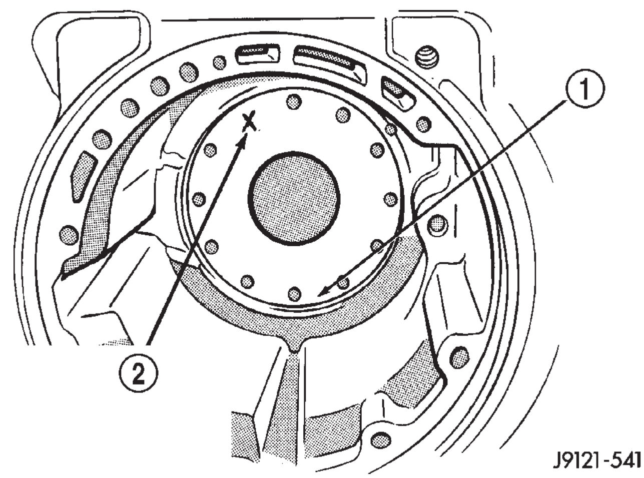


Fig. 190 Location Of Blank Area In Clutch Cam Bolt Circle

1 – OVERRUNNING CLUTCH CAM SEAT IN CASE
2 – NON-THREADED HOLE IN CLUTCH CAM ALIGNS HERE (BLANK AREA) OF SEAT

sunk on one side. Be sure this side of cam faces rearward (toward piston retainer).

(4) Verify that non-threaded hole in clutch cam is properly aligned. Check alignment by threading a bolt into each bolt hole. Adjust clutch cam position if necessary.

(5) Install and tighten overrunning clutch cam bolts to 17 N·m (13 ft. lbs.) torque. Note that clutch cam bolts are shorter than piston retainer bolts.

(6) Install new gasket at rear of transmission case. Use petroleum jelly to hold gasket in place. Be sure to align governor feed holes in gasket with feed passages in case (Fig. 192). Also install gasket before overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer.

(7) Position overdrive piston retainer on transmission case and align bolt holes in retainer, gasket and case (Fig. 193). Then install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

(8) Install new seals on over drive piston.

(9) Stand transmission case upright on bellhousing.

(10) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(11) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

DISASSEMBLY AND ASSEMBLY (Continued)

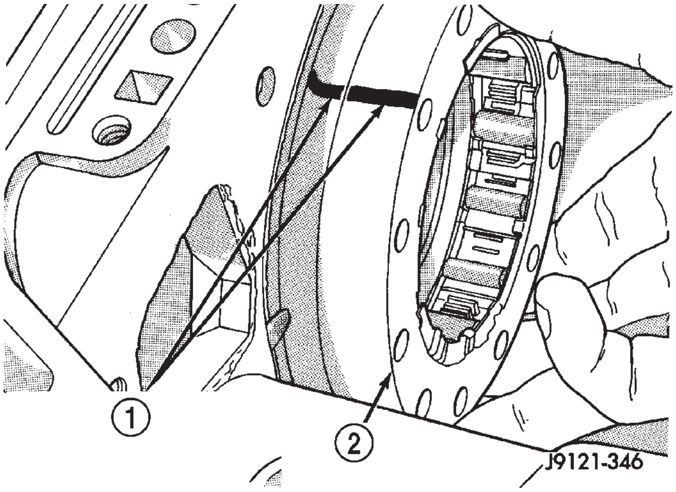


Fig. 191 Overrunning Clutch Installation

1 – ALIGN MARKS IDENTIFYING NON-THREADED HOLE IN CAM AND CASE
2 – OVERRUNNING CLUTCH ASSEMBLY

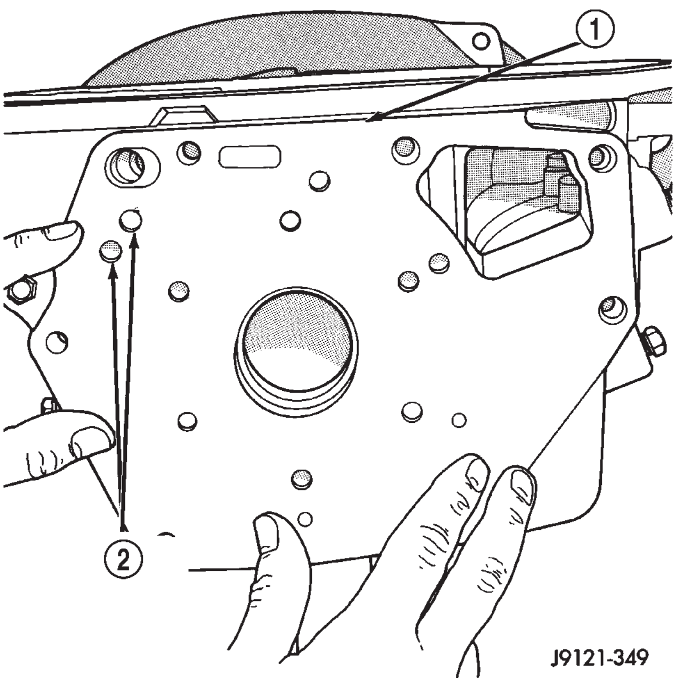


Fig. 192 Installing/Aligning Case Gasket

1 – CASE GASKET
2 – BE SURE GOVERNOR TUBE FEED HOLES IN CASE AND GASKET ARE ALIGNED

(12) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

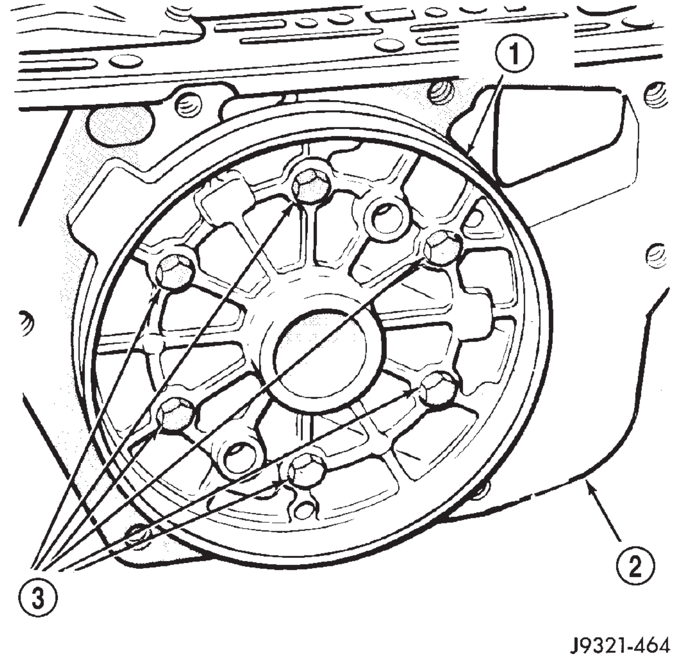


Fig. 193 Aligning Overdrive Piston Retainer

1 – PISTON RETAINER
2 – GASKET
3 – RETAINER BOLTS

(c) Install piston over Seal Guide 8114–2 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

NOTE: INSTALL THE REMAINING TRANSMISSION COMPONENTS AND OVERDRIVE UNIT.

FRONT SERVO PISTON

DISASSEMBLY

(1) Remove seal ring from rod guide (Fig. 194).

(2) Remove small snap ring from servo piston rod. Then remove piston rod, spring and washer from piston.

(3) Remove and discard servo component O-ring and seal rings.

ASSEMBLY

Clean and inspect front servo components.

(1) Lubricate new O-ring and seal rings with petroleum jelly and install them on piston, guide and rod.

(2) Install rod in piston. Install spring and washer on rod. Compress spring and install snap ring (Fig. 194).

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Set servo components aside for installation during transmission reassembly.

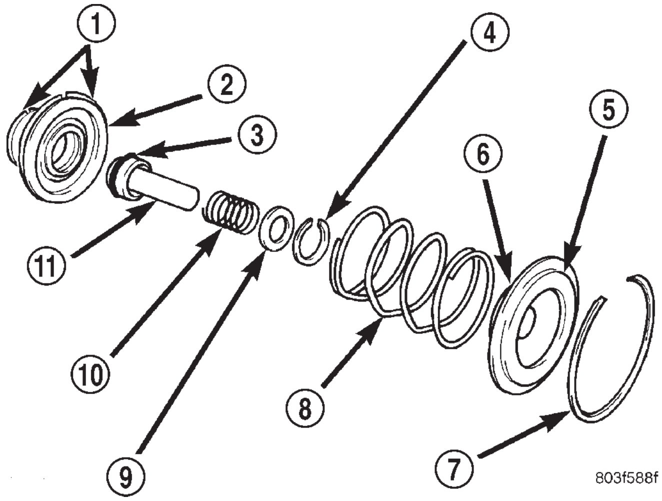


Fig. 194 Front Servo

1 – PISTON RINGS
2 – SERVO PISTON
3 – O-RING
4 – SNAP RING
5 – PISTON ROD GUIDE
6 – SEAL RING
7 – SNAP RING
8 – SERVO SPRING
9 – WASHER
10 – SPRING
11 – PISTON ROD

REAR SERVO PISTON

DISASSEMBLY

(1) Remove small snap ring and remove plug and spring from servo piston (Fig. 195).

(2) Remove and discard servo piston seal ring.

ASSEMBLY

(1) Lubricate piston and guide seals with petroleum jelly. Lubricate other servo parts with Mopar® ATF Plus 3, Type 7176, transmission fluid.

(2) Install new seal ring on servo piston.

(3) Assemble piston, plug, spring and new snap ring.

(4) Lubricate piston seal lip with petroleum jelly.

OIL PUMP AND REACTION SHAFT SUPPORT

DISASSEMBLY

(1) Remove seal ring from housing and reaction shaft support (Fig. 196).

(2) Mark pump housing and support assembly for alignment reference.

(3) Remove bolts attaching pump body to support (Fig. 197).

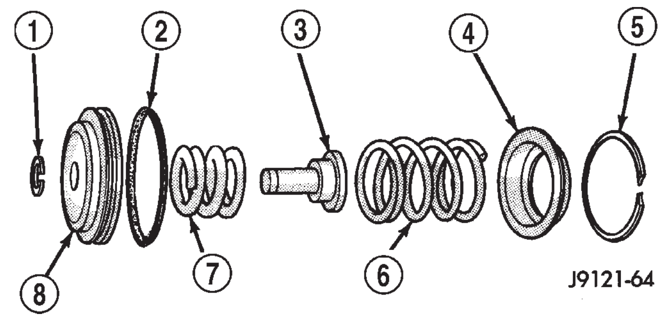


Fig. 195 Rear Servo Components

1 – SNAP RING
2 – PISTON SEAL
3 – PISTON PLUG
4 – SPRING RETAINER
5 – SNAP RING
6 – PISTON SPRING
7 – CUSHION SPRING
8 – PISTON

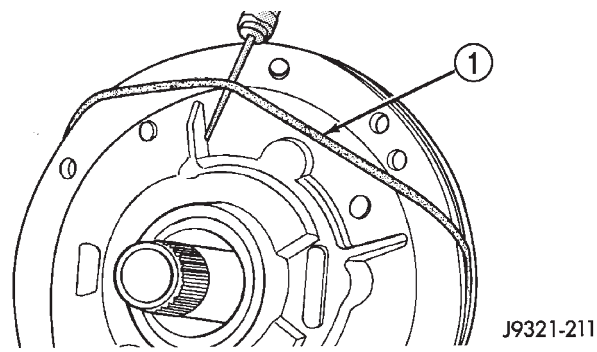


Fig. 196 Removing Pump Seal Ring

1 – PUMP HOUSING SEAL RING

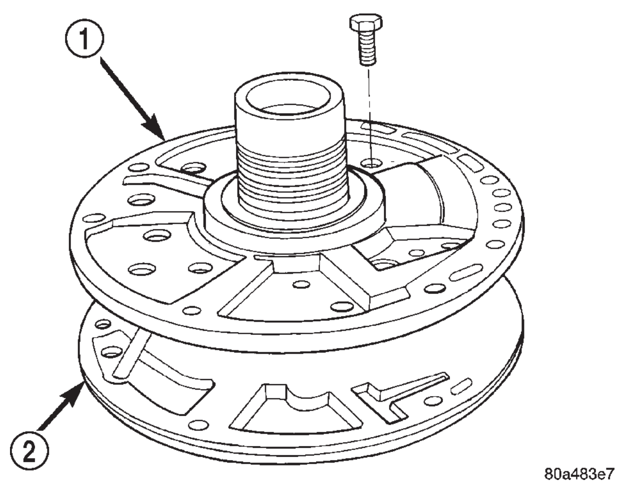


Fig. 197 Pump Support Bolts

1 – REACTION SHAFT SUPPORT
2 – PUMP

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Separate support from pump housing (Fig. 198).

(5) Remove inner and outer gears from reaction shaft support (Fig. 199).

(6) If pump seal was not removed during transmission disassembly, remove seal with punch and hammer.

(7) Remove front clutch thrust washer from support hub (Fig. 200).

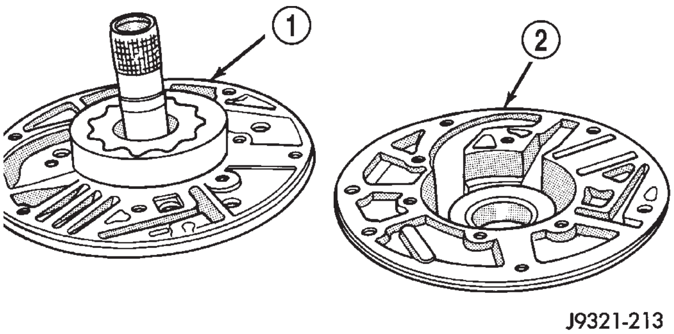


Fig. 198 Separating Pump Housing From Reaction Shaft Support

1 – REACTION SHAFT SUPPORT
2 – PUMP HOUSING

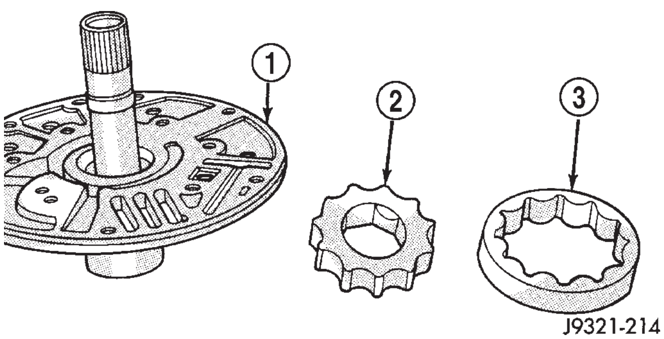


Fig. 199 Pump Gear Removal

1 – REACTION SHAFT SUPPORT
2 – INNER GEAR
3 – OUTER GEAR

OIL PUMP BUSHING REPLACEMENT

(1) Remove pump bushing with Tool Handle C-4171 and Bushing Remover SP-3551 from Tool Set C-3887-J (Fig. 201).

(2) Install new pump bushing with Tool Handle C-4171 and Bushing Installer SP-5117 (Fig. 201). Bushing should be flush with pump housing bore.

(3) Stake new pump bushing in two places with blunt punch (Fig. 202). Remove burrs from stake points with knife blade afterward.

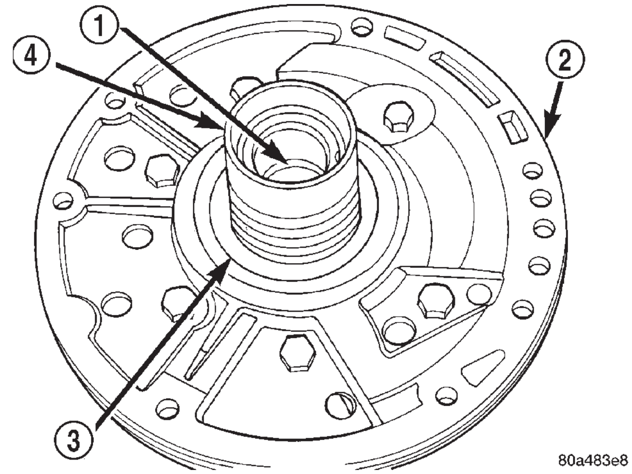


Fig. 200 Support Hub Thrust Washer

1 – BUSHING
2 – REACTION SHAFT SUPPORT
3 – THRUST WASHER
4 – HUB

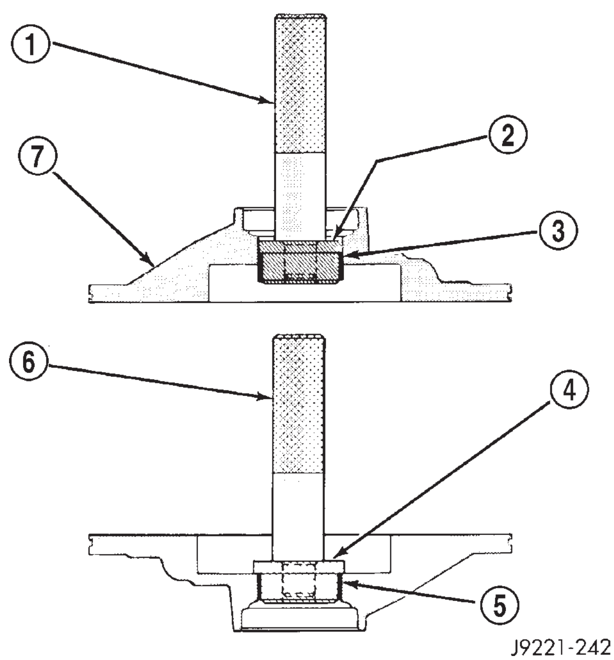


Fig. 201 Removing Oil Pump Bushing

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL SP-3551
3 – BUSHING
4 – SPECIAL TOOL SP-5117
5 – BUSHING
6 – SPECIAL TOOL C-4171
7 – PUMP HOUSING

DISASSEMBLY AND ASSEMBLY (Continued)

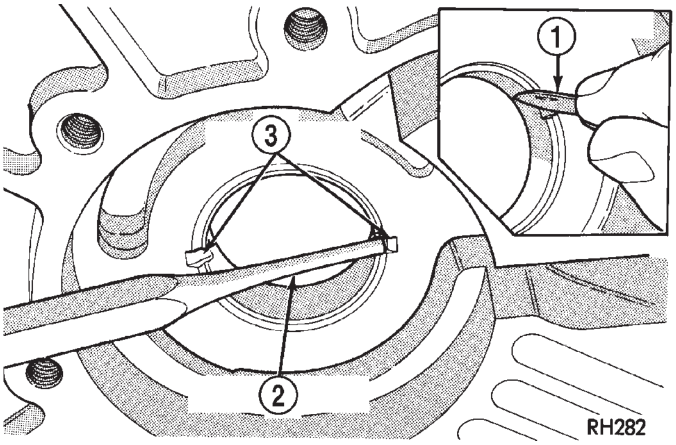


Fig. 202 Staking Oil Pump Bushing

1 – NARROW BLADE
2 – BLUNT PUNCH
3 – TWO STAKES

REACTION SHAFT SUPPORT BUSHING REMOVAL

(1) Assemble Bushing Remover Tools SP-1191, 3633 and 5324 (Fig. 203). **Do not clamp any part of reaction shaft or support in vise.**

(2) Hold Cup Tool SP-3633 firmly against reaction shaft and thread remover SP-5324 into bushing as far as possible by hand. Then thread remover tool 3-4 additional turns into bushing with a wrench.

(3) Turn remover tool hex nut down against remover cup to pull bushing from shaft. Clean all chips from shaft after bushing removal.

(4) Lightly grip old bushing in vise or with pliers and back remover tool out of bushing.

(5) Assemble Bushing Installer Tools C-4171 and SP-5325 (Fig. 203).

(6) Slide new bushing onto Installer Tool SP-5325.

(7) Position reaction shaft support upright on a clean smooth surface.

(8) Align bushing in bore. Then tap bushing into place until Bushing Installer SP-5325 bottoms.

(9) Clean reaction shaft support thoroughly after installing bushing.

ASSEMBLY

(1) Lubricate gear bore in pump housing with transmission fluid.

(2) Lubricate pump gears with transmission fluid.

(3) Support pump housing on wood blocks (Fig. 204).

(4) Install outer gear in pump housing (Fig. 204). Gear can be installed either way (it is not a one-way fit).

(5) Install pump inner gear (Fig. 205).

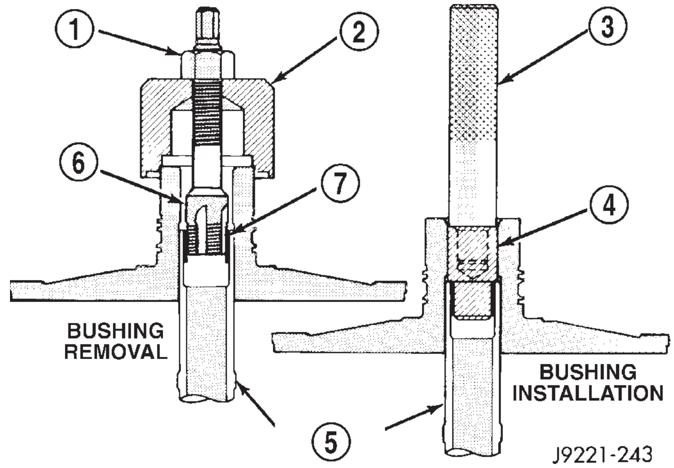


Fig. 203 Replacing Reaction Shaft Support Bushing

1 – SPECIAL TOOL SP-1191
2 – SPECIAL TOOL SP-3633
3 – SPECIAL TOOL C-4171
4 – SPECIAL TOOL SP-5325
5 – REACTION SHAFT
6 – SPECIAL TOOL SP-5324
7 – BUSHING

CAUTION: The pump inner gear is a one way fit. The bore on one side of the gear inside diameter (I.D.) is chamfered. Be sure the chamfered side faces forward (to front of pump).

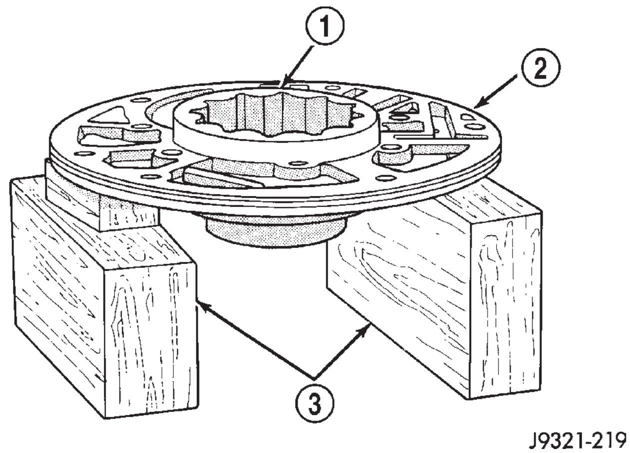


Fig. 204 Supporting Pump And Installing Outer Gear

1 – OUTER GEAR
2 – PUMP HOUSING
3 – WOOD BLOCKS

(6) Install new thrust washer on hub of reaction shaft support. Lubricate washer with transmission fluid or petroleum jelly.

DISASSEMBLY AND ASSEMBLY (Continued)

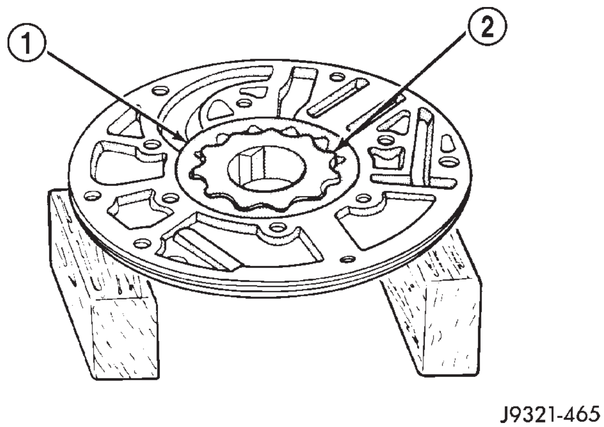


Fig. 205 Pump Inner Gear Installation

1 – OUTER GEAR
2 – INNER GEAR

(7) If reaction shaft seal rings are being replaced, install new seal rings on support hub (Fig. 206). Lubricate seal rings with transmission fluid or petroleum jelly after installation. Squeeze each ring until ring ends are securely hooked together.

CAUTION: The reaction shaft support seal rings will break if overspread, or twisted. If new rings are being installed, spread them only enough for installation. Also be very sure the ring ends are securely hooked together after installation. Otherwise, the rings will either prevent pump installation, or break during installation.

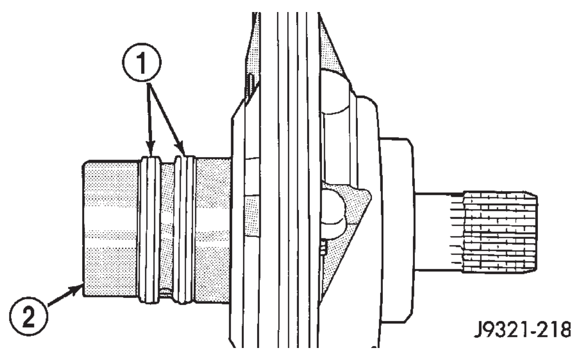


Fig. 206 Hub Seal Ring Position

1 – SEAL RINGS
2 – SUPPORT HUB

(8) Install reaction shaft support on pump housing (Fig. 207).

(9) Align reaction support on pump housing. Use alignment marks made at disassembly. Or, rotate support until bolt holes in support and pump housing are all aligned (holes are offset for one-way fit).

(10) Install all bolts that attach support to pump housing. Then tighten bolts finger tight.

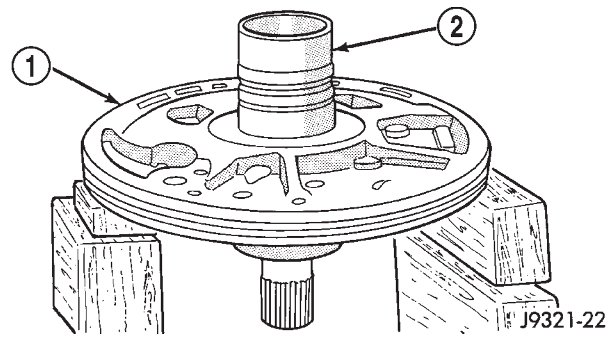


Fig. 207 Assembling Reaction Shaft Support And Pump Housing

1 – PUMP HOUSING
2 – REACTION SHAFT SUPPORT

(11) Tighten support-to-pump bolts to required torque as follows:

(a) Reverse pump assembly and install it in transmission case. Position pump so bolts are facing out and are accessible.

(b) Secure pump assembly in case with 2 or 3 bolts, or with pilot studs.

(c) Tighten support-to-pump bolts to 20 N·m (15 ft. lbs.).

(d) Remove pump assembly from transmission case.

(12) Install new oil seal in pump with Special Tool C-4193 and Tool Handle C-4171 (Fig. 208). Be sure seal lip faces inward.

(13) Install new seal ring around pump housing. Be sure seal is properly seated in groove.

(14) Lubricate lip of pump oil seal and O-ring seal with transmission fluid.

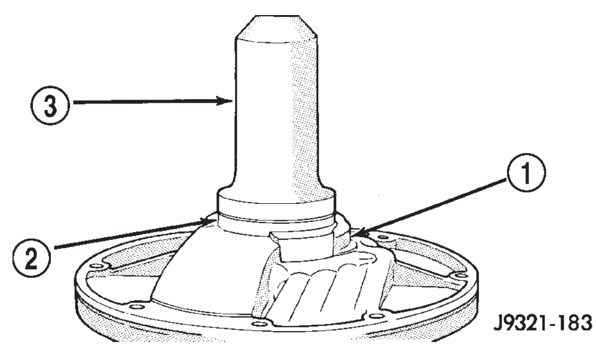


Fig. 208 Pump Oil Seal Installation

1 – PUMP BODY
2 – PUMP SEAL
3 – SPECIAL TOOL C-4193

FRONT CLUTCH

NOTE: The 42RE transmission uses four plates and discs for the front clutch.

DISASSEMBLY AND ASSEMBLY (Continued)

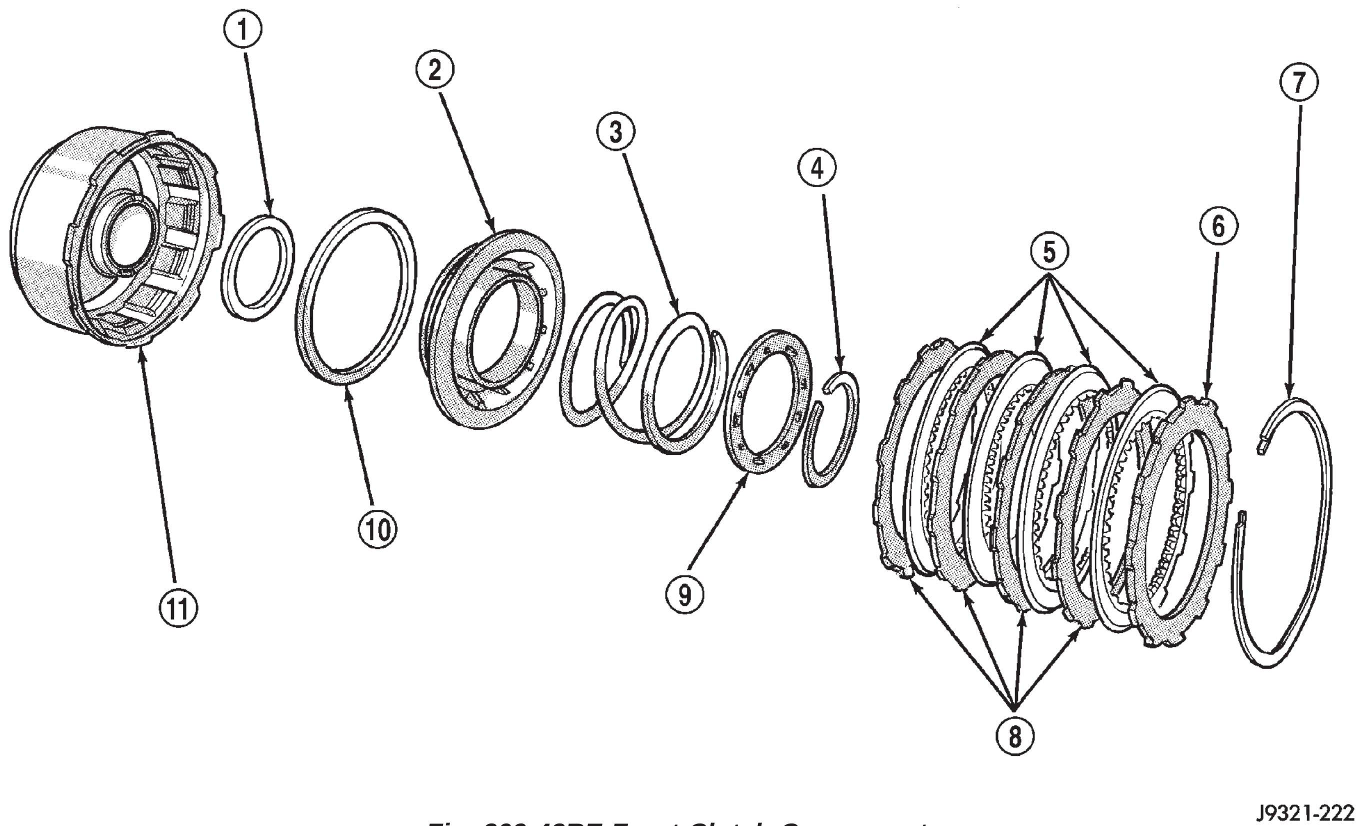


Fig. 209 42RE Front Clutch Components

1 – RETAINER HUB SEAL
2 – CLUTCH PISTON
3 – PISTON SPRING
4 – SPRING RETAINER SNAP RING
5 – CLUTCH DISCS
6 – PRESSURE PLATE
7 – SNAP RING (WAVED)
8 – CLUTCH PLATES
9 – SPRING RETAINER
10 – PISTON SEAL
11 – FRONT CLUTCH RETAINER

DISASSEMBLY

(1) Remove waved snap ring and remove pressure plate, clutch plates and clutch discs (Fig. 209).

(2) Compress clutch piston spring with Compressor Tool C-3575-A (Fig. 210). Be sure legs of tool are seated squarely on spring retainer before compressing spring.

(3) Remove retainer snap ring and remove compressor tool.

(4) Remove spring retainer and clutch spring. Note position of retainer on spring for assembly reference.

(5) Remove clutch piston from clutch retainer. Remove piston by rotating it up and out of retainer.

(6) Remove seals from clutch piston and clutch retainer hub. Discard both seals as they are not reusable.

ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seals on piston and in hub of retainer. Be sure lip of each seal faces interior of clutch retainer.

(3) Lubricate lips of piston and retainer seals with liberal quantity of Mopar® Door Ease. Then lubricate retainer hub, bore and piston with light coat of transmission fluid.

(4) Install clutch piston in retainer (Fig. 211). Use twisting motion to seat piston in bottom of retainer.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip.

(5) Position spring in clutch piston (Fig. 212).

(6) Position spring retainer on top of piston spring (Fig. 213). **Make sure retainer is properly installed. Small raised tabs should be facing upward. Semicircular lugs on underside of retainer are for positioning retainer in spring.**

DISASSEMBLY AND ASSEMBLY (Continued)

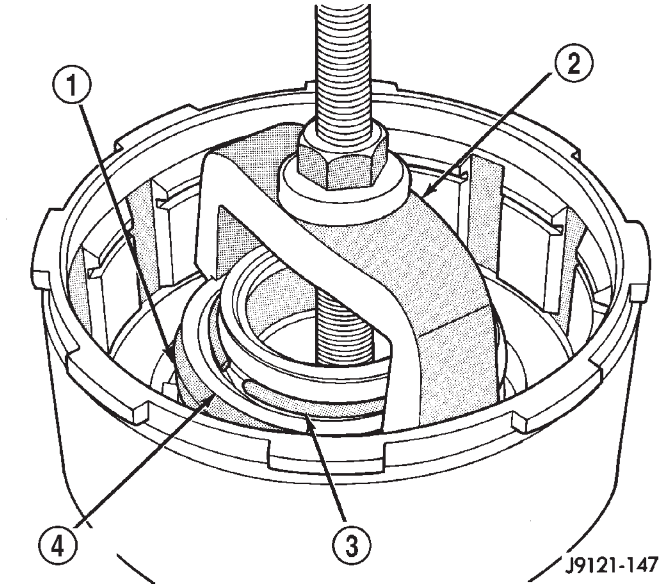


Fig. 210 Compressing Front Clutch Piston Spring

1 – FRONT CLUTCH SPRING
2 – COMPRESSOR TOOL C-3575–A
3 – RETAINER SNAP RING
4 – SPRING RETAINER

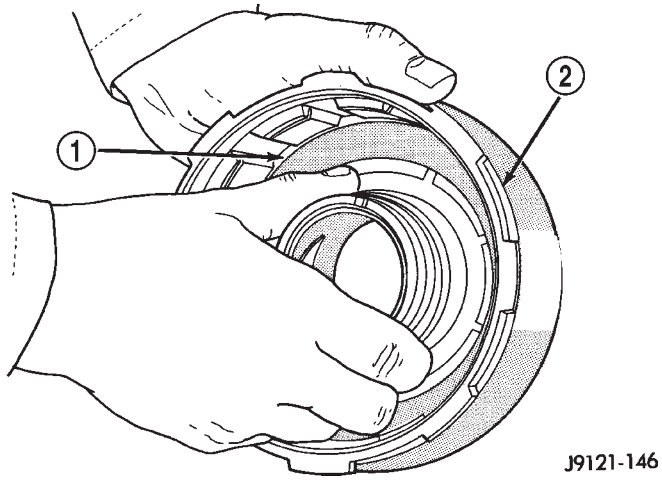


Fig. 211 Front Clutch Piston Installation

1 – CLUTCH PISTON
2 – FRONT CLUTCH RETAINER

(7) Compress piston spring and retainer with Compressor Tool C-3575-A (Fig. 210). Then install new snap ring to secure spring retainer and spring.

(8) Install clutch plates and discs (Fig. 209). Install steel plate then disc until all plates and discs are installed. The front clutch uses 4 clutch discs and plates in a 42RE transmission.

(9) Install pressure plate and waved snap ring (Fig. 209).

Clearance should be 1.70 to 3.40 mm (0.067 to 0.134 in.). If clearance is incorrect, clutch discs,

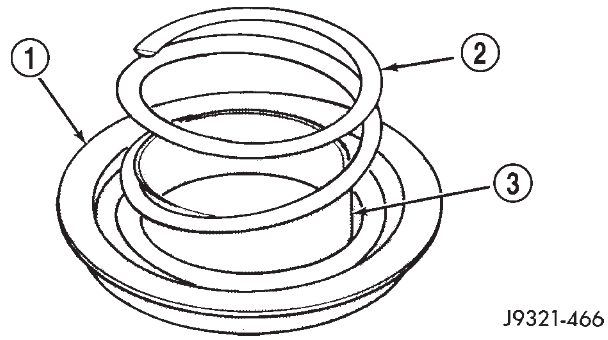


Fig. 212 Clutch Piston Spring Installation

1 – RETAINER
2 – CLUTCH SPRING
3 – PISTON

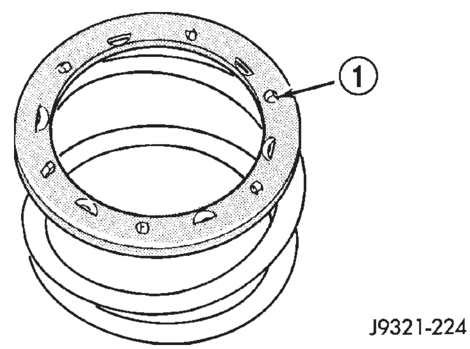


Fig. 213 Correct Spring Retainer Installed Position

1 – SMALL TABS ON RETAINER FACE UPWARD

plates, pressure plates and snap ring may have to be changed.

REAR CLUTCH

DISASSEMBLY

(1) Remove fiber thrust washer from forward side of clutch retainer.

(2) Remove input shaft front/rear seal rings.

(3) Remove selective clutch pack snap ring (Fig. 214).

(4) Remove top pressure plate, clutch discs, steel plates, bottom pressure plate and wave snap ring and wave spring (Fig. 214).

(5) Remove clutch piston with rotating motion.

(6) Remove and discard piston seals.

(7) Remove input shaft snap-ring (Fig. 215). It may be necessary to press the input shaft in slightly to relieve tension on the snap-ring

(8) Press input shaft out of retainer with shop press and suitable size press tool. Use a suitably sized press tool to support the retainer as close to the input shaft as possible.

DISASSEMBLY AND ASSEMBLY (Continued)

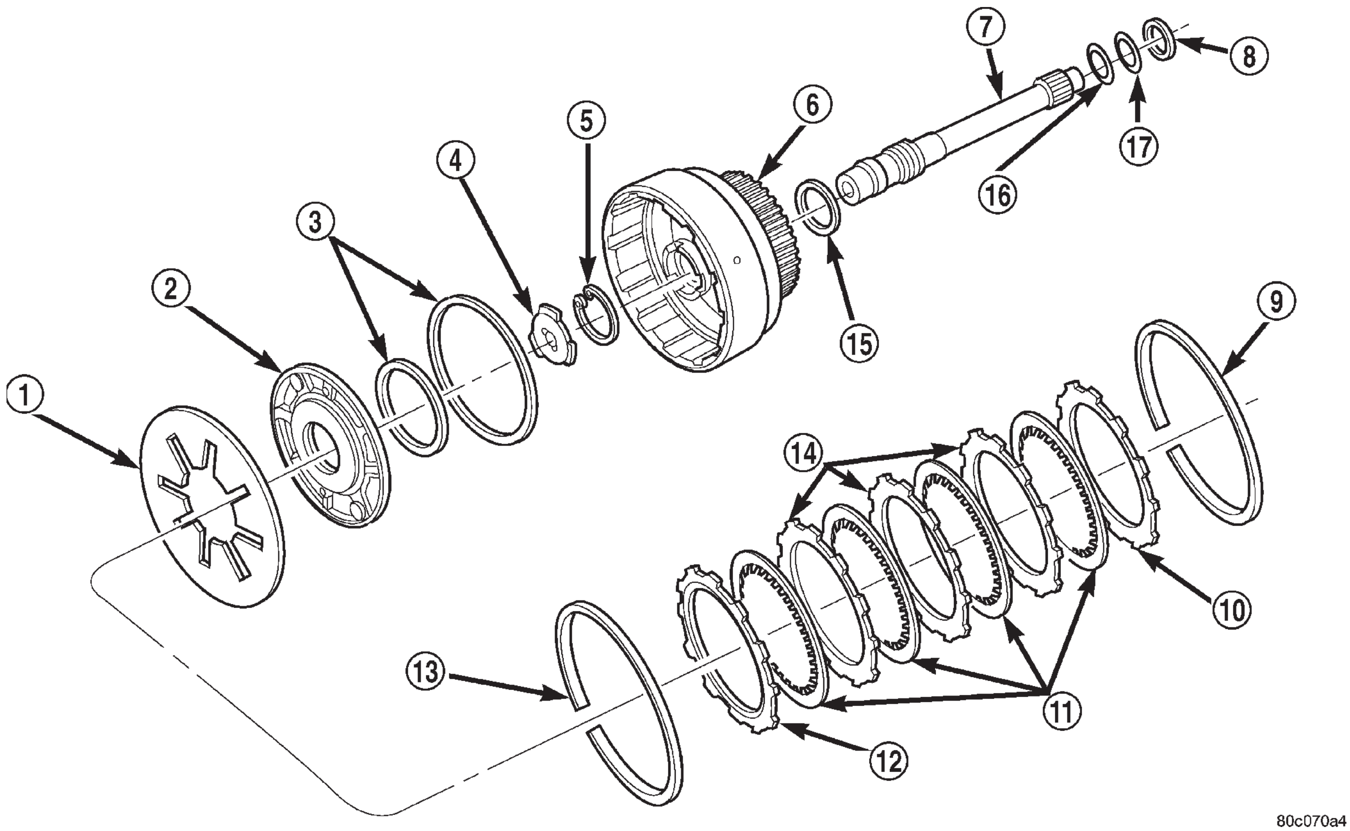


Fig. 214 Rear Clutch Components

1 – PISTON SPRING
2 – REAR CLUTCH PISTON
3 – CLUTCH PISTON SEALS
4 – OUTPUT SHAFT THRUST WASHER (METAL)
5 – INPUT SHAFT SNAP RING
6 – REAR CLUTCH RETAINER
7 – INPUT SHAFT
8 – REAR CLUTCH THRUST WASHER (FIBER)
9 – CLUTCH PACK SNAP RING (SELECTIVE)
10 – TOP PRESSURE PLATE
11 – CLUTCH DISCS (4)
12 – BOTTOM PRESSURE PLATE
13 – WAVE SPRING
14 – CLUTCH PLATES (3)
15 – RETAINER SEAL RING
16 – SHAFT REAR SEAL RING (PLASTIC)
17 – SHAFT FRONT SEAL RING (TEFLON)

DISASSEMBLY AND ASSEMBLY (Continued)

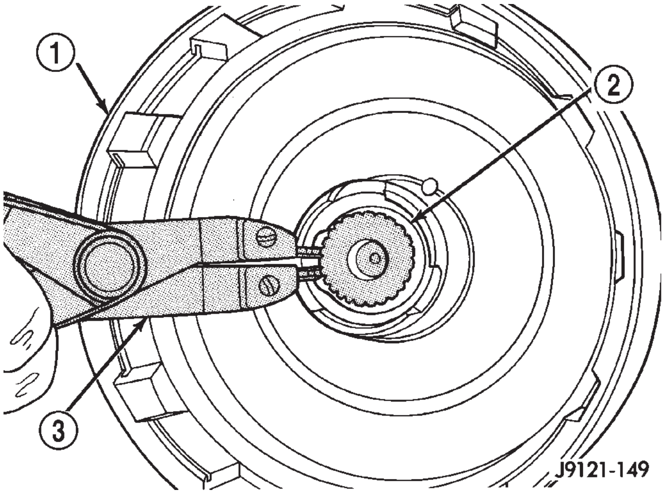


Fig. 215 Removing/Installing Input Shaft Snap-Ring

1 – REAR CLUTCH RETAINER
2 – INPUT SHAFT SNAP RING
3 – SNAP RING PLIERS

ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seal rings on clutch retainer hub and input shaft if necessary (Fig. 216).

(a) Be sure clutch hub seal ring is fully seated in groove and is not twisted.

(3) Lubricate splined end of input shaft and clutch retainer with transmission fluid. Then press input shaft into retainer. Use a suitably sized press tool to support retainer as close to input shaft as possible.

(4) Install input shaft snap-ring (Fig. 215).

(5) Invert retainer and press input shaft in opposite direction until snap-ring is seated.

(6) Install new seals on clutch piston. Be sure lip of each seal faces interior of clutch retainer.

(7) Lubricate lip of piston seals with generous quantity of Mopar® Door Ease. Then lubricate retainer hub and bore with light coat of transmission fluid.

(8) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.020” thick), can be used to guide seals into place if necessary.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

(9) Install piston spring in retainer and on top of piston (Fig. 219). Concave side of spring faces downward (toward piston).

(10) Install wave spring in retainer (Fig. 219). Be sure spring is completely seated in retainer groove.

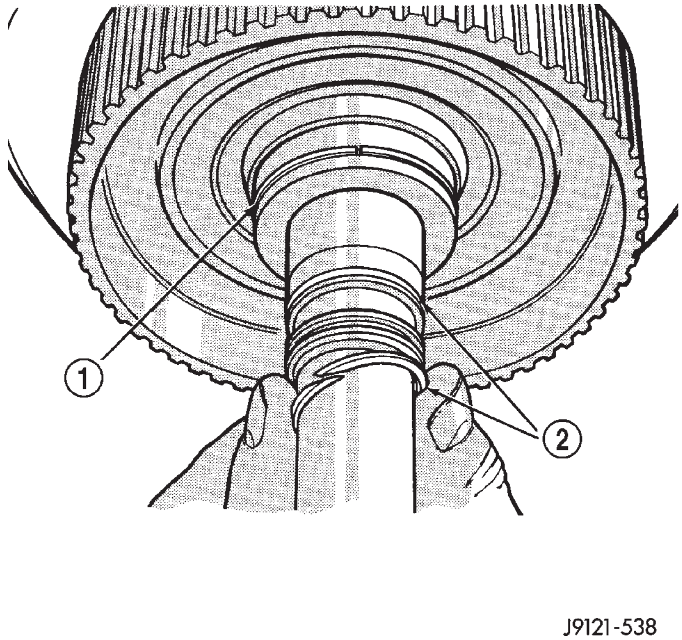


Fig. 216 Rear Clutch Retainer And Input Shaft Seal Ring Installation

1 – REAR CLUTCH RETAINER HUB SEAL RING
2 – INPUT SHAFT SEAL RINGS

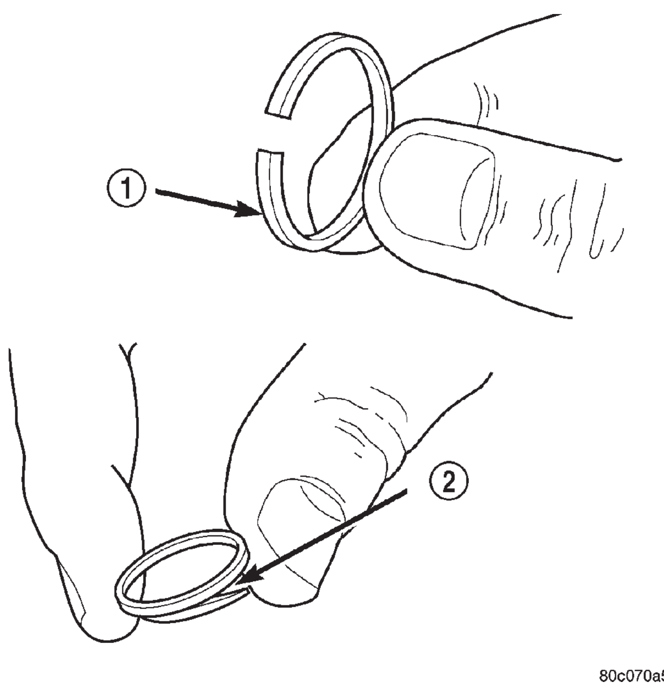


Fig. 217 Input Shaft Seal Ring Identification

1 – PLASTIC REAR SEAL RING
2 – TEFLON FRONT SEAL RING (SQUEEZE RING TOGETHER SLIGHTLY BEFORE INSTALLATION FOR BETTER FIT)

DISASSEMBLY AND ASSEMBLY (Continued)

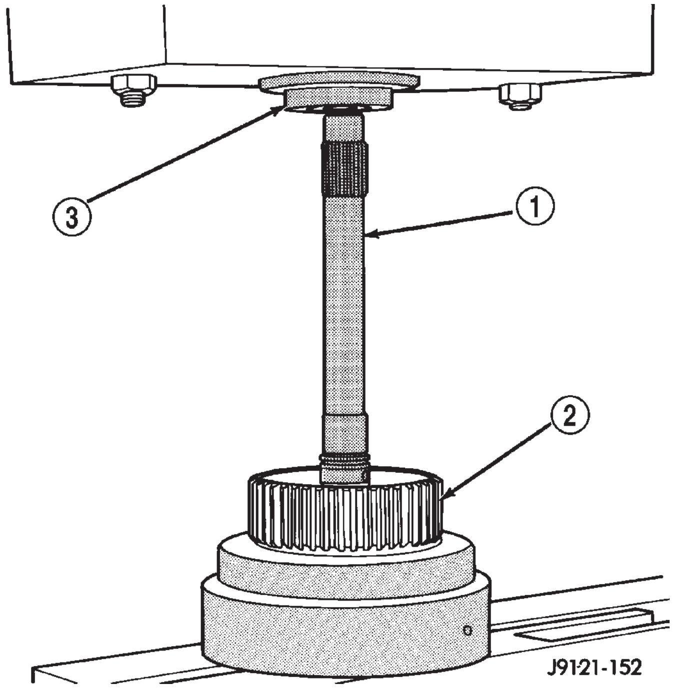


Fig. 218 Pressing Input Shaft Into Rear Clutch Retainer

1 – INPUT SHAFT
2 – REAR CLUTCH RETAINER
3 – PRESS RAM

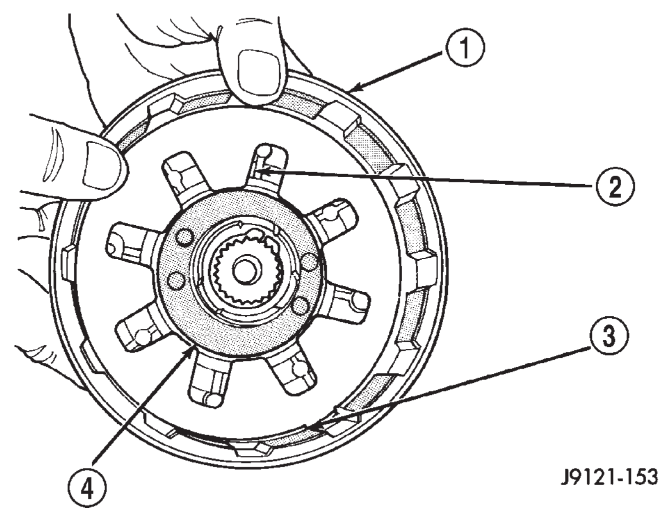


Fig. 219 Piston Spring/Wave Spring Position

1 – REAR CLUTCH RETAINER
2 – PISTON SPRING
3 – WAVE SPRING
4 – CLUTCH PISTON

(11) Install bottom pressure plate (Fig. 214). Ridged side of plate faces downward (toward piston) and flat side toward clutch pack.

(12) Install first clutch disc in retainer on top of bottom pressure plate. Then install a clutch plate followed by a clutch disc until entire clutch pack is installed (4 discs and 3 plates are required) (Fig. 214).

(13) Install top pressure plate.

(14) Install selective snap ring. Be sure snap ring is fully seated in retainer groove.

(15) Using a suitable gauge bar and dial indicator, measure clutch pack clearance (Fig. 220).

(a) Position gauge bar across the clutch drum with the dial indicator pointer on the pressure plate (Fig. 220).

(b) Using two small screw drivers, lift the pressure plate and release it.

(c) Zero the dial indicator.

(d) Lift the pressure plate until it contacts the snap-ring and record the dial indicator reading.

Clearance should be 0.559 - 0.914 mm (0.022 - 0.036 in.). If clearance is incorrect, steel plates, discs, selective snap ring and pressure plates may have to be changed.

The selective snap ring thicknesses are:

- .107–.109 in.
- .098–.100 in.
- .095–.097 in.
- .083–.085 in.
- .076–.078 in.
- .071–.073 in.
- .060–.062 in.

(16) Coat rear clutch thrust washer with petroleum jelly and install washer over input shaft and into clutch retainer (Fig. 221). Use enough petroleum jelly to hold washer in place.

(17) Set rear clutch aside for installation during final assembly.

PLANETARY GEARTRAIN/OUTPUT SHAFT

DISASSEMBLY

(1) Remove planetary snap ring (Fig. 222).

(2) Remove front annulus and planetary assembly from driving shell (Fig. 222).

(3) Remove snap ring that retains front planetary gear in annulus gear (Fig. 223).

(4) Remove tabbed thrust washer and tabbed thrust plate from hub of front annulus (Fig. 224).

(5) Separate front annulus and planetary gears (Fig. 224).

(6) Remove front planetary gear front thrust washer from annulus gear hub.

(7) Separate and remove driving shell, rear planetary and rear annulus from output shaft (Fig. 225).

(8) Remove front planetary rear thrust washer from driving shell.

(9) Remove tabbed thrust washers from rear planetary gear.

DISASSEMBLY AND ASSEMBLY (Continued)

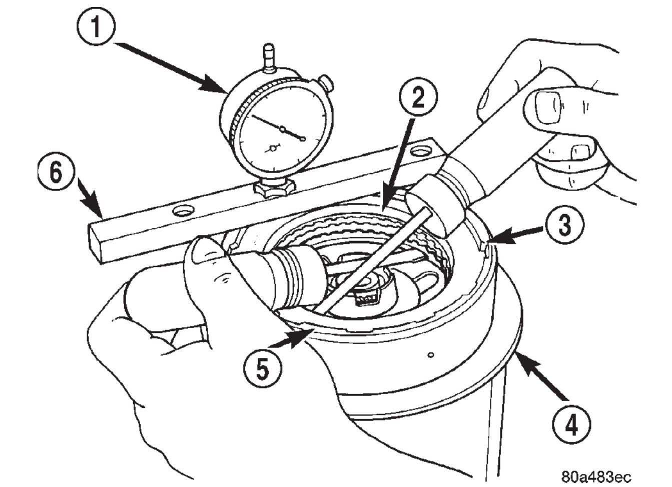


Fig. 220 Checking Rear Clutch Pack Clearance

1 – DIAL INDICATOR
2 – PRESSURE PLATE
3 – SNAP RING
4 – STAND
5 – REAR CLUTCH
6 – GAUGE BAR

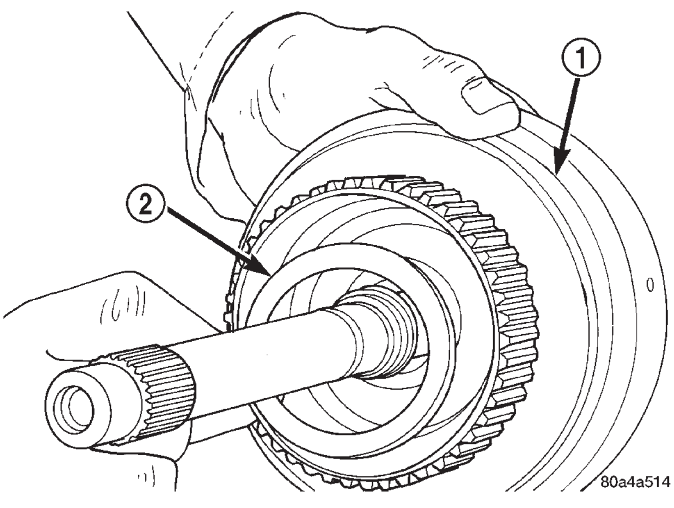


Fig. 221 Installing Rear Clutch Thrust Washer

1 – REAR CLUTCH RETAINER
2 – REAR CLUTCH THRUST WASHER

(10) Remove lock ring that retains sun gear in driving shell. Then remove sun gear, spacer and thrust plates.

ASSEMBLY

(1) Lubricate output shaft and planetary components with transmission fluid. Use petroleum jelly to lubricate and hold thrust washers and plates in position.

(2) Assemble rear annulus gear and support if disassembled. Be sure support snap ring is seated and

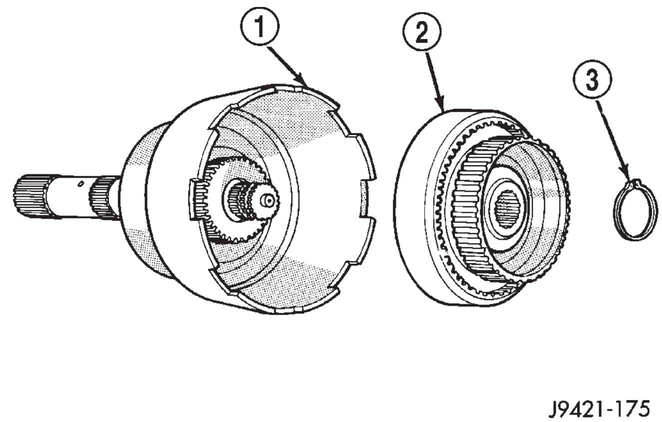


Fig. 222 Front Annulus And Planetary Assembly Removal

1 – DRIVING SHELL
2 – FRONT ANNULUS AND PLANETARY ASSEMBLY
3 – PLANETARY SNAP RING

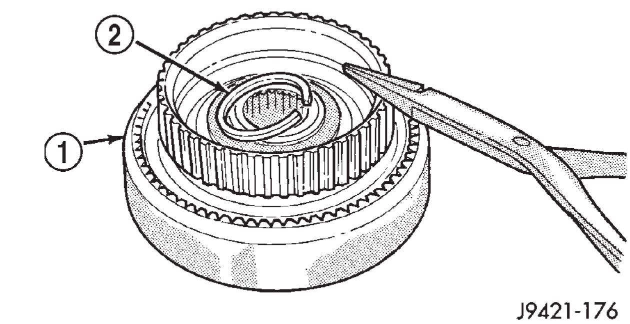


Fig. 223 Front Planetary Snap Ring Removal

1 – FRONT ANNULUS GEAR
2 – PLANETARY SNAP RING

that shoulder-side of support faces rearward (Fig. 226).

(3) Install rear thrust washer on rear planetary gear. Use enough petroleum jelly to hold washer in place. Also be sure all four washer tabs are properly engaged in gear slots.

(4) Install rear annulus over and onto rear planetary gear (Fig. 226).

(5) Install assembled rear planetary and annulus gear on output shaft (Fig. 227). Verify that assembly is fully seated on shaft.

(6) Install front thrust washer on rear planetary gear (Fig. 228). Use enough petroleum jelly to hold washer on gear. Be sure all four washer tabs are seated in slots.

(7) Install spacer on sun gear (Fig. 229).

(8) Install thrust plate on sun gear (Fig. 230). Note that driving shell thrust plates are interchangeable. Use either plate on sun gear and at front/rear of shell.

DISASSEMBLY AND ASSEMBLY (Continued)

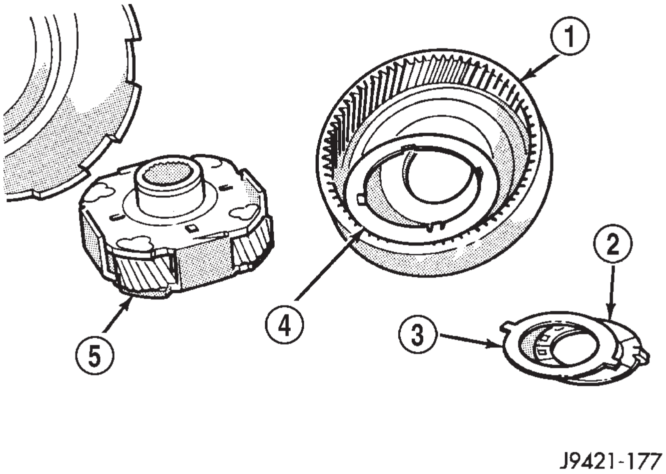


Fig. 224 Front Planetary And Annulus Gear Disassembly

1 – FRONT ANNULUS
2 – THRUST WASHER
3 – THRUST PLATE
4 – FRONT THRUST WASHER
5 – FRONT PLANETARY

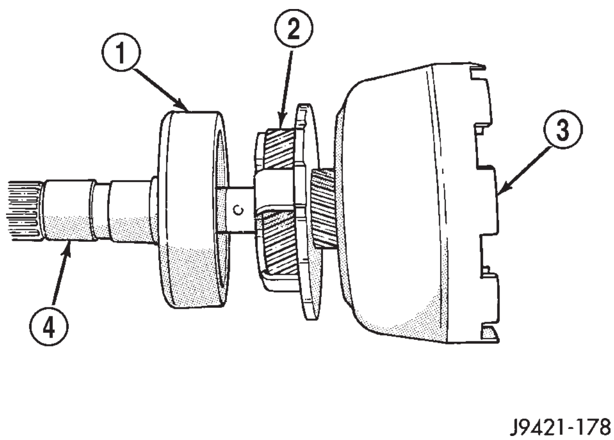


Fig. 225 Removing Driving Shell, Rear Planetary And Rear Annulus

1 – REAR ANNULUS
2 – REAR PLANETARY
3 – DRIVING SHELL
4 – OUTPUT SHAFT

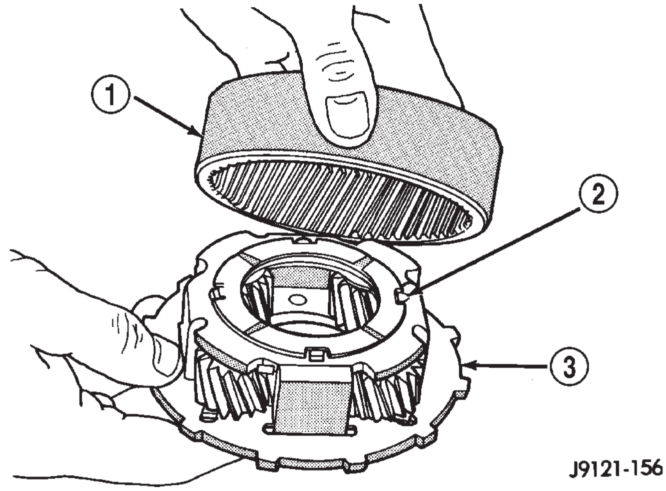


Fig. 226 Assembling Rear Annulus And Planetary Gear

1 – REAR ANNULUS GEAR
2 – TABBED THRUST WASHER
3 – REAR PLANETARY

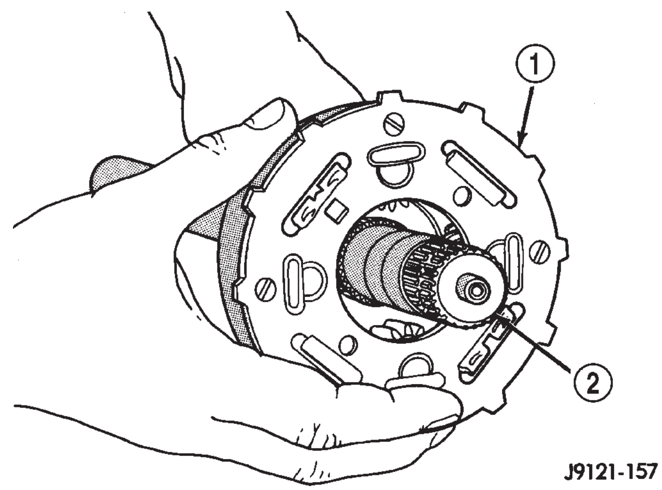


Fig. 227 Installing Rear Annulus And Planetary On Output Shaft

1 – REAR ANNULUS AND PLANETARY GEAR ASSEMBLY
2 – OUTPUT SHAFT

DISASSEMBLY AND ASSEMBLY (Continued)

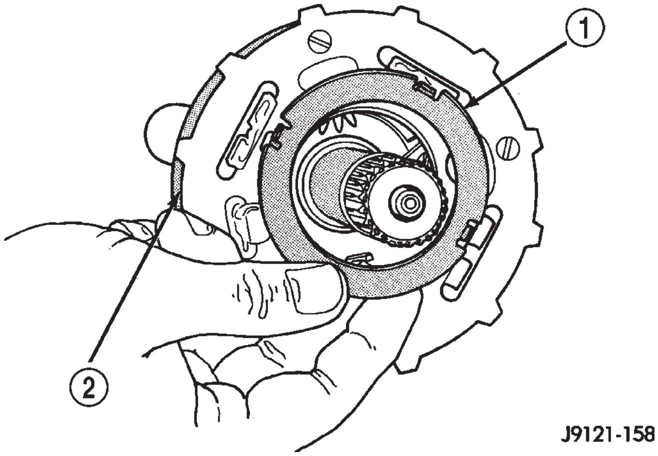


Fig. 228 Installing Rear Planetary Front Thrust Washer

1 – FRONT TABBED THRUST WASHER
2 – REAR PLANETARY GEAR

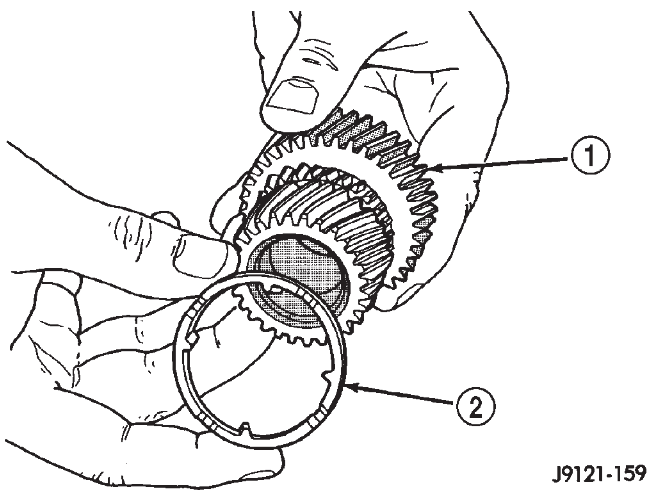


Fig. 229 Installing Spacer On Sun Gear

1 – SUN GEAR
2 – SUN GEAR SPACER

(9) Hold sun gear in place and install thrust plate over sun gear at rear of driving shell (Fig. 231).

(10) Position wood block on bench and support sun gear on block (Fig. 232). This makes it easier to align and install sun gear lock ring. Keep wood block handy as it will also be used for geartrain end play check.

(11) Align rear thrust plate on driving shell and install sun gear lock ring. Be sure ring is fully seated in sun gear ring groove (Fig. 233).

(12) Install assembled driving shell and sun gear on output shaft (Fig. 234).

(13) Install rear thrust washer on front planetary gear (Fig. 235). Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

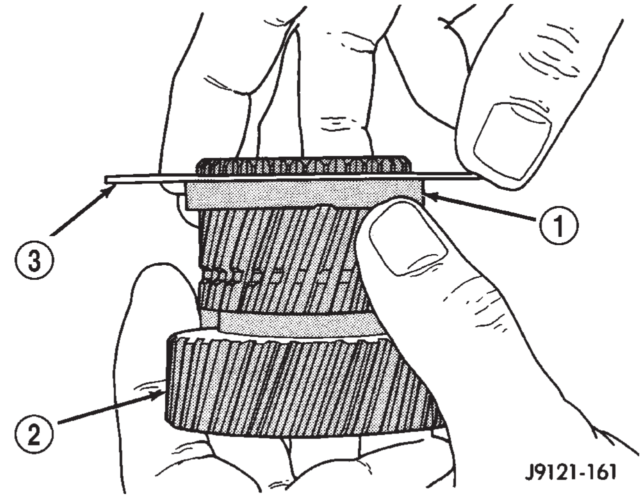


Fig. 230 Installing Driving Shell Front Thrust Plate On Sun Gear

1 – SPACER
2 – SUN GEAR
3 – THRUST PLATE

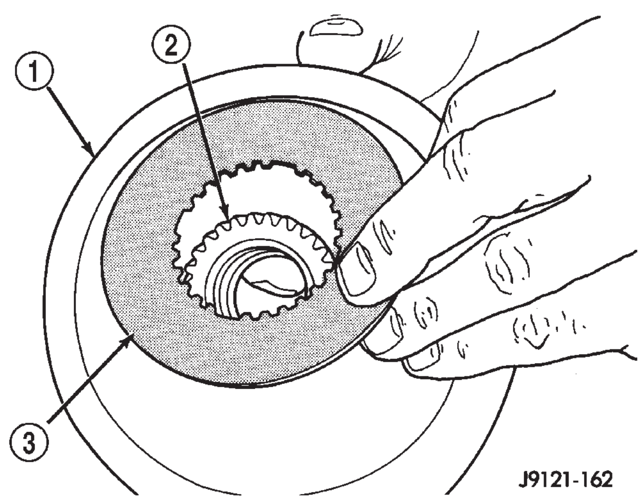


Fig. 231 Installing Driving Shell Rear Thrust Plate

1 – DRIVING SHELL
2 – SUN GEAR
3 – REAR THRUST PLATE

(14) Install front planetary gear on output shaft and in driving shell (Fig. 236).

(15) Install front thrust washer on front planetary gear. Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

(16) Assemble front annulus gear and support, if necessary. Be sure support snap ring is seated.

(17) Install front annulus on front planetary (Fig. 236).

(18) Position thrust plate on front annulus gear support (Fig. 237). **Note that plate has two tabs on it. These tabs fit in notches of annulus hub.**

DISASSEMBLY AND ASSEMBLY (Continued)

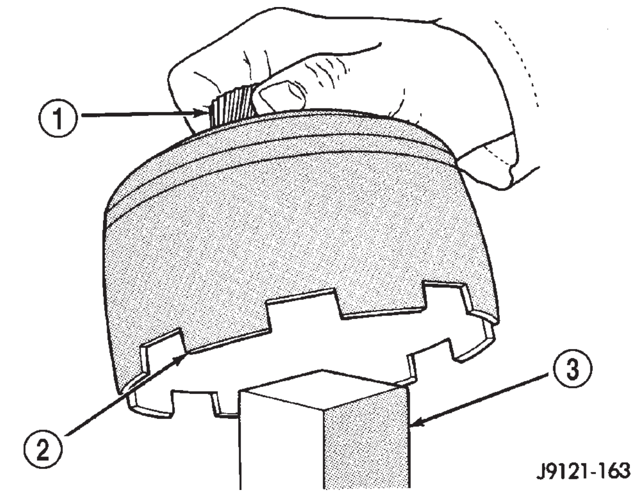


Fig. 232 Supporting Sun Gear On Wood Block

1 – SUN GEAR
2 – DRIVING SHELL
3 – WOOD BLOCK

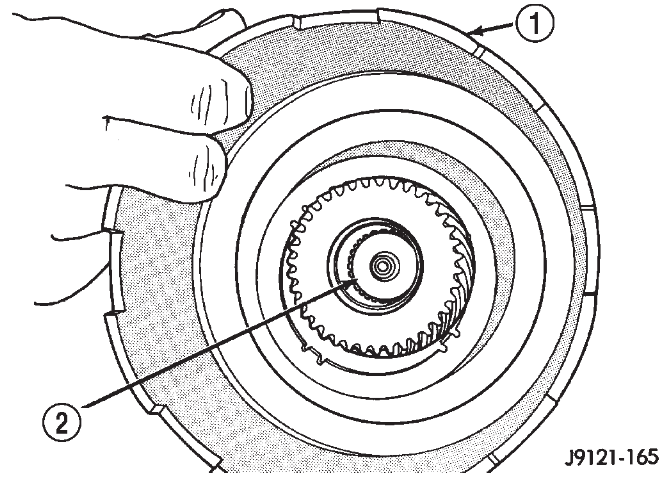


Fig. 234 Installing Assembled Sun Gear And Driving Shell On Output Shaft

1 – SUN GEAR/DRIVING SHELL ASSEMBLY
2 – OUTPUT SHAFT

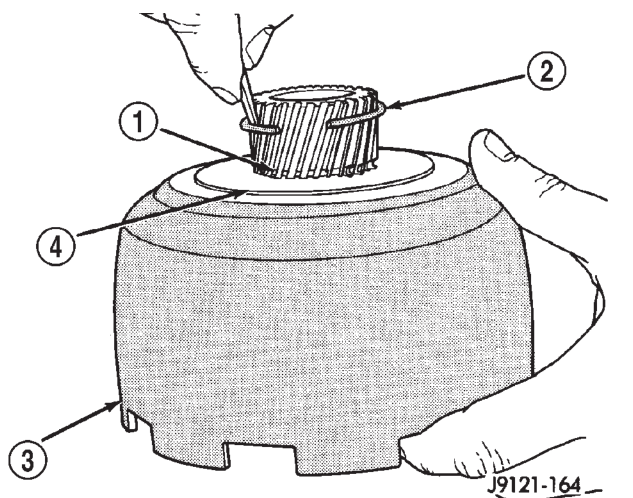


Fig. 233 Installing Sun Gear Lock Ring

1 – LOCK RING GROOVE
2 – SUN GEAR LOCK RING
3 – DRIVING SHELL
4 – REAR THRUST PLATE

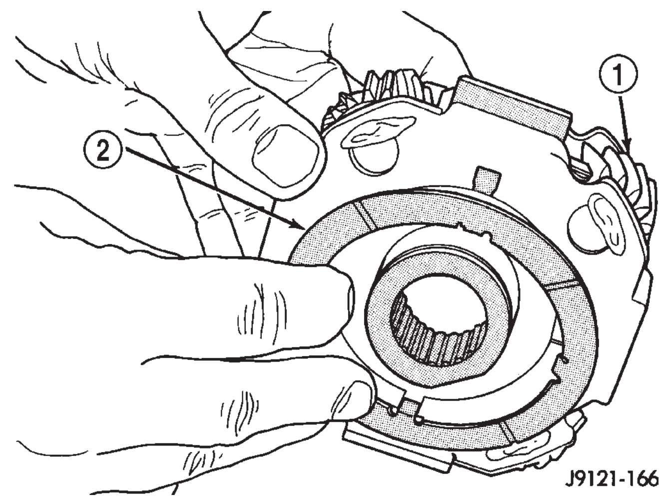


Fig. 235 Installing Rear Thrust Washer On Front Planetary Gear

1 – FRONT PLANETARY GEAR
2 – REAR TABBED THRUST WASHER

(19) Install thrust washer in front annulus (Fig. 238). **Align flat on washer with flat on planetary hub. Also be sure washer tab is facing up.**

(20) Install front annulus snap ring (Fig. 239). Use snap ring pliers to avoid distorting ring during installation. Also be sure ring is fully seated.

(21) Install planetary selective snap ring with snap ring pliers (Fig. 240). Be sure ring is fully seated.

(22) Turn planetary geartrain assembly over so driving shell is facing workbench. Then support geartrain on wood block positioned under forward end of output shaft. This allows geartrain components to move forward for accurate end play check.

(23) Check planetary geartrain end play with feeler gauge (Fig. 241). Gauge goes between shoulder on output shaft and end of rear annulus support.

(24) Geartrain end play should be 0.12 to 1.22 mm (0.005 to 0.048 in.). If end play is incorrect, snap ring (or thrust washers) may have to be replaced. Snap ring is available in three different thicknesses for adjustment purposes.

DISASSEMBLY AND ASSEMBLY (Continued)

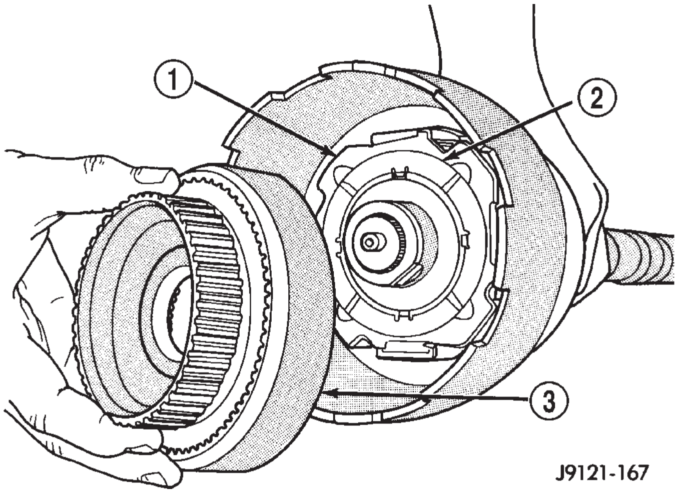


Fig. 236 Installing Front Planetary And Annulus Gears

1 – FRONT PLANETARY GEAR
2 – FRONT THRUST WASHER
3 – FRONT ANNULUS GEAR

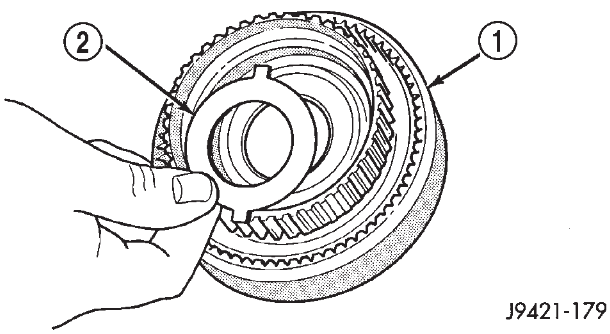


Fig. 237 Positioning Thrust Plate On Front Annulus Support

1 – FRONT ANNULUS
2 – THRUST PLATE

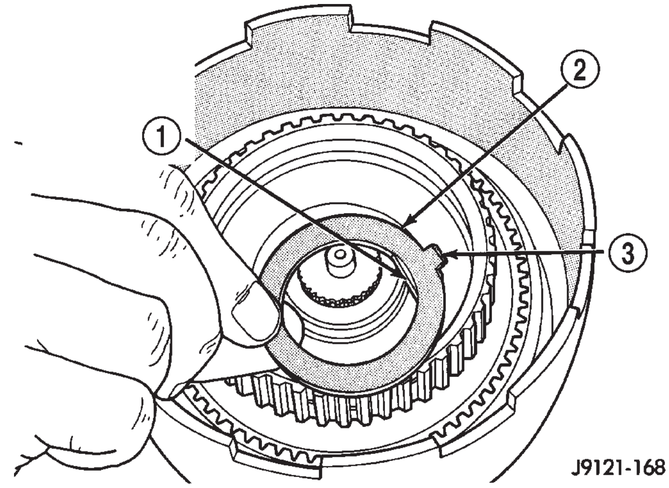


Fig. 238 Installing Front Annulus Thrust Washer

1 – WASHER FLAT ALIGNS WITH FLAT ON PLANETARY HUB
2 – FRONT ANNULUS THRUST WASHER
3 – TAB FACES FRONT

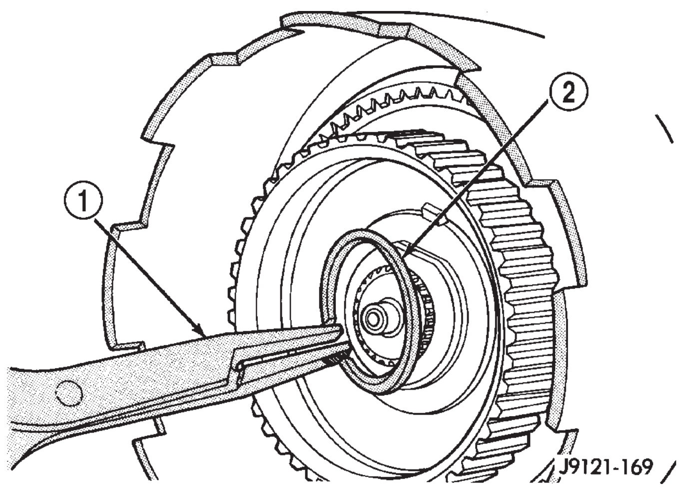


Fig. 239 Installing Front Annulus Snap Ring

1 – SNAP RING PLIERS
2 – FRONT ANNULUS SNAP RING

DISASSEMBLY AND ASSEMBLY (Continued)

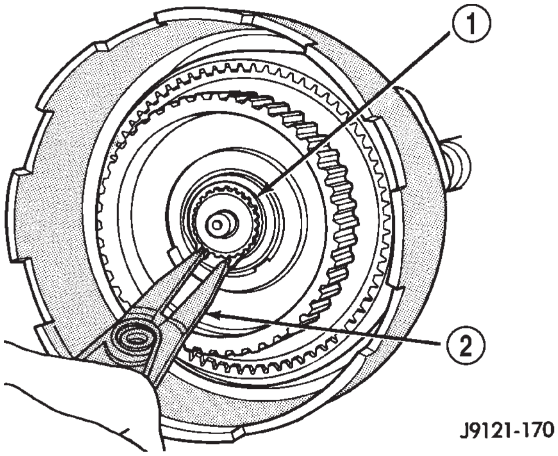


Fig. 240 Installing Planetary Selective Snap Ring

1 – SELECTIVE SNAP RING
2 – SNAP RING PLIERS

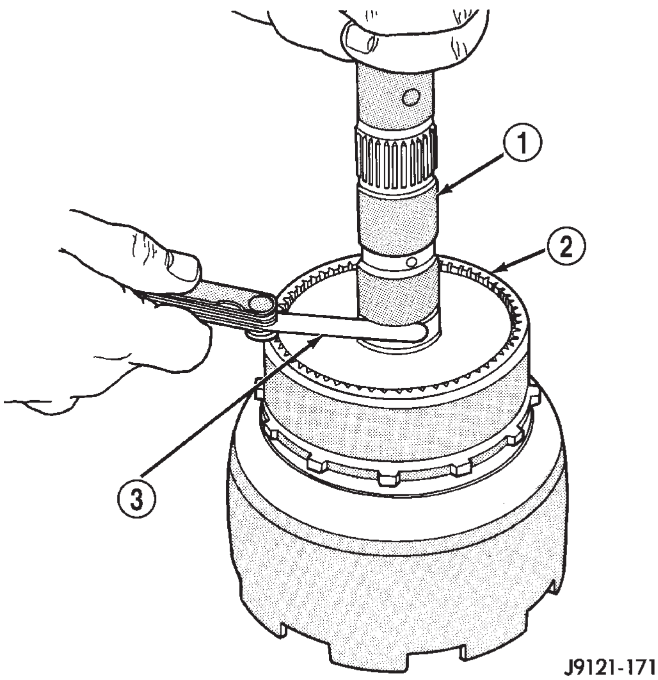


Fig. 241 Checking Planetary Geartrain End Play

1 – OUTPUT SHAFT
2 – REAR ANNULUS GEAR
3 – FEELER GAUGE

OVERDRIVE UNIT

DISASSEMBLY

(1) Remove transmission speed sensor and O-ring seal from overdrive case (Fig. 242).

(2) Remove overdrive piston thrust bearing (Fig. 243).

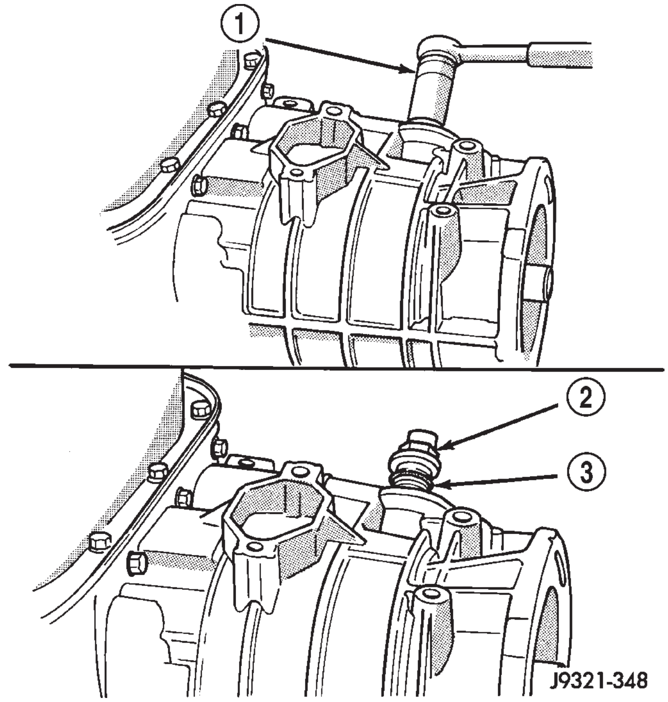


Fig. 242 Transmission Speed Sensor Removal/ Installation

1 – SOCKET AND WRENCH
2 – SPEED SENSOR
3 – O-RING

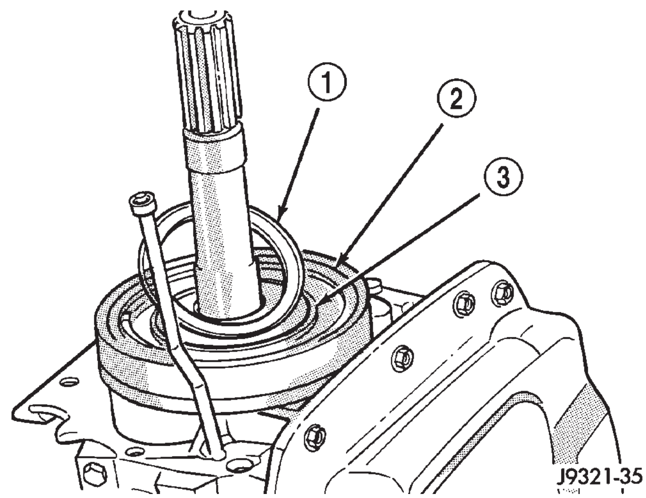


Fig. 243 Overdrive Piston Thrust Bearing Removal/ Installation

1 – THRUST BEARING
2 – OVERDRIVE PISTON
3 – THRUST PLATE

DISASSEMBLY AND ASSEMBLY (Continued)

OVERDRIVE PISTON DISASSEMBLY

(1) Remove overdrive piston thrust plate (Fig. 244). Retain thrust plate. It is a select fit part and may possibly be reused.

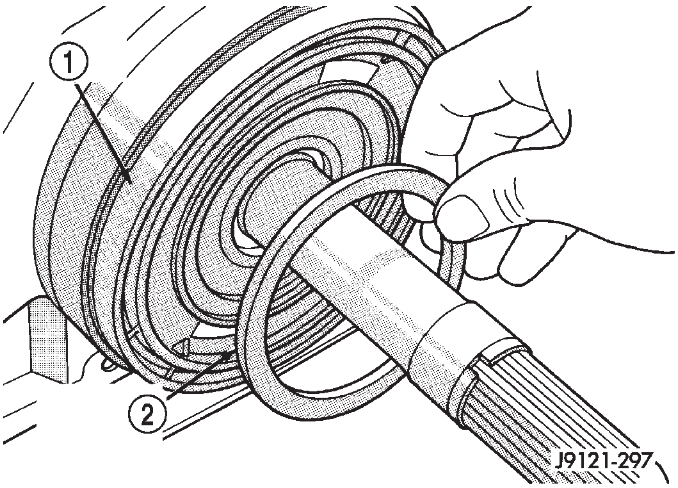


Fig. 244 Overdrive Piston Thrust Plate Removal/ Installation

1 – OVERDRIVE PISTON
2 – OVERDRIVE PISTON SPACER (SELECT FIT)

(2) Remove intermediate shaft spacer (Fig. 245). Retain spacer. It is a select fit part and may possibly be reused.

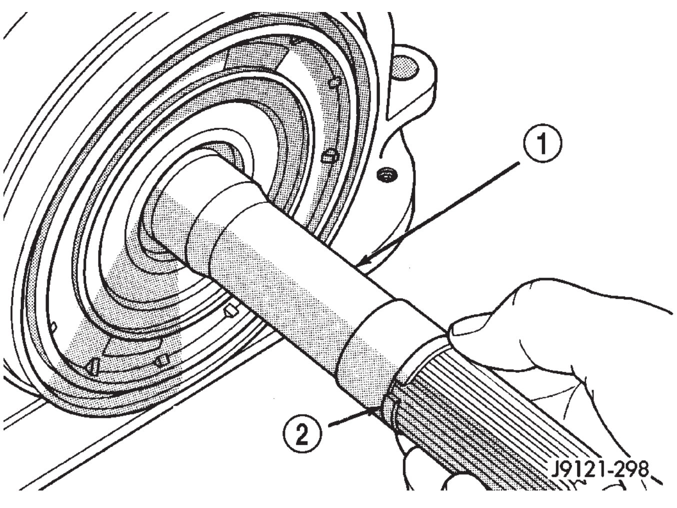


Fig. 245 Intermediate Shaft Spacer Location

1 – INTERMEDIATE SHAFT
2 – INTERMEDIATE SHAFT SPACER (SELECT FIT)

(3) Remove overdrive piston from retainer (Fig. 246).

OVERDRIVE CLUTCH PACK DISASSEMBLY

(1) Remove overdrive clutch pack wire retaining ring (Fig. 247).
(2) Remove overdrive clutch pack (Fig. 248).

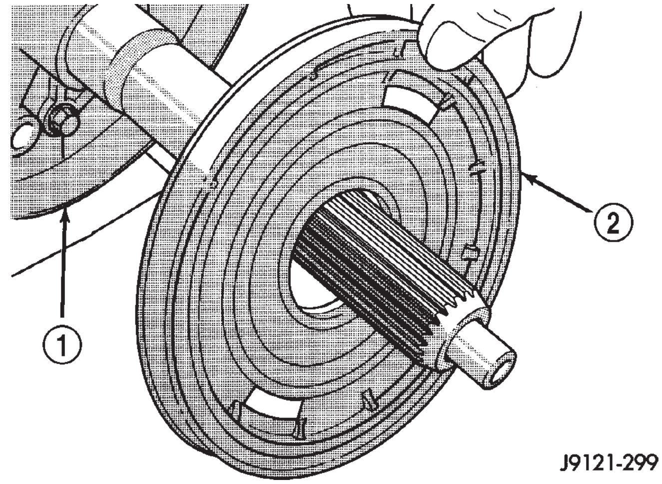


Fig. 246 Overdrive Piston Removal

1 – PISTON RETAINER
2 – OVERDRIVE PISTON

NOTE: The 42RE transmission has three clutch discs and two clutch plates.

(3) Note position of clutch pack components for assembly reference (Fig. 249).

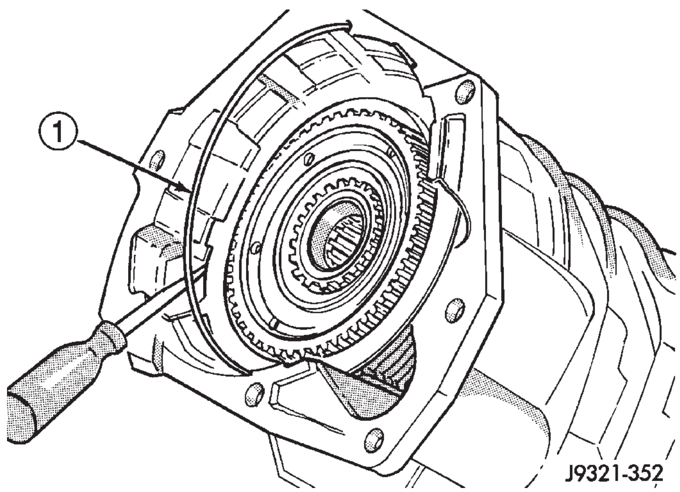


Fig. 247 Removing Overdrive Clutch Pack Retaining Ring

1 – OVERDRIVE CLUTCH PACK RETAINING RING

OVERDRIVE GEARTRAIN DISASSEMBLY

(1) Remove overdrive clutch wave spring (Fig. 250).
(2) Remove overdrive clutch reaction snap ring (Fig. 251). Note that snap ring is located in same groove as wave spring.
(3) Remove Torx head screws that attach access cover and gasket to overdrive case (Fig. 252).
(4) Remove access cover and gasket (Fig. 253).

DISASSEMBLY AND ASSEMBLY (Continued)

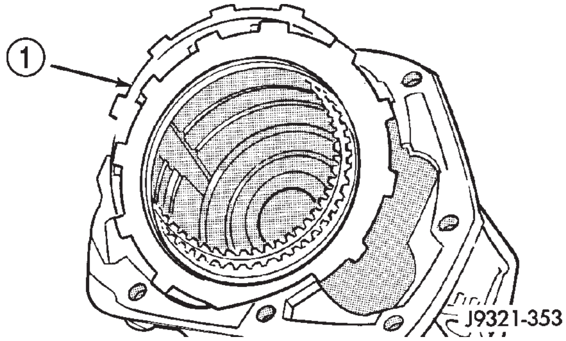


Fig. 248 Overdrive Clutch Pack Removal

1 – OVERDRIVE CLUTCH PACK

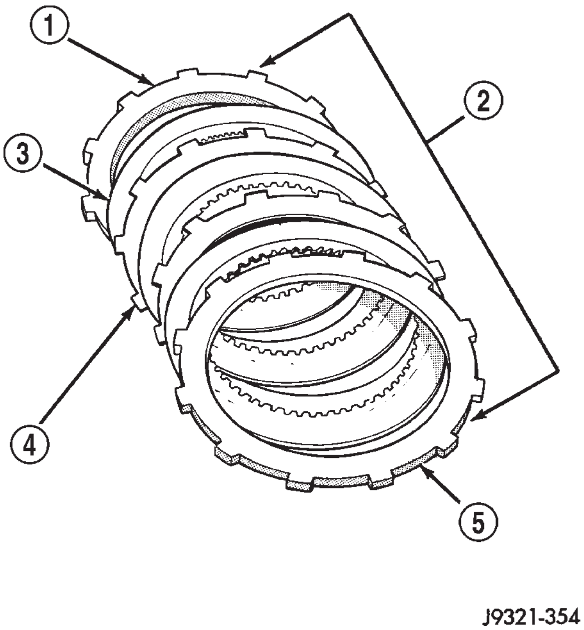


Fig. 249 42RE Overdrive Clutch Component Position

1 – PRESSURE PLATE (TO FRONT)
2 – OVERDRIVE CLUTCH PACK
3 – CLUTCH DISC (3)
4 – CLUTCH PLATE (2)
5 – REACTION PLATE (TO REAR)

(5) Expand output shaft bearing snap ring with expanding-type snap ring pliers. Then push output shaft forward to release shaft bearing from locating ring (Fig. 254).

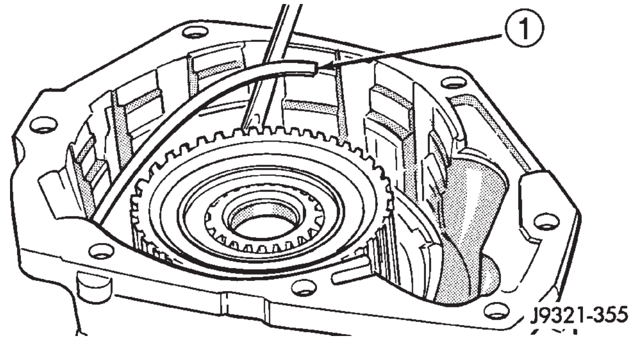


Fig. 250 Overdrive Clutch Wave Spring Removal/Installation

1 – WAVE SPRING

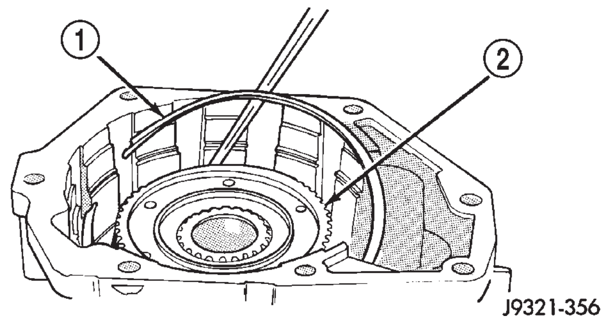


Fig. 251 Overdrive Clutch Reaction Snap Ring Removal/Installation

1 – REACTION RING
2 – CLUTCH HUB

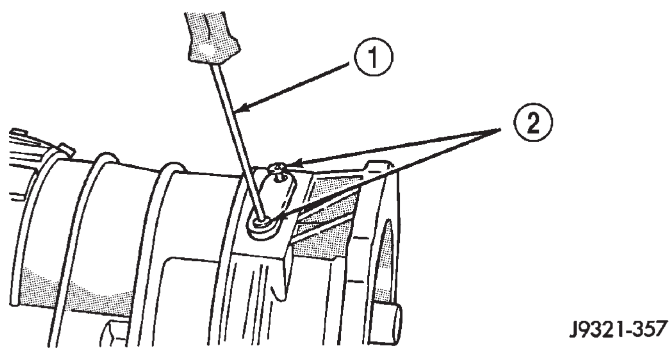


Fig. 252 Access Cover Screw Removal/Installation

1 – TORX SCREWDRIVER (T25)
2 – ACCESS COVER SCREWS

DISASSEMBLY AND ASSEMBLY (Continued)

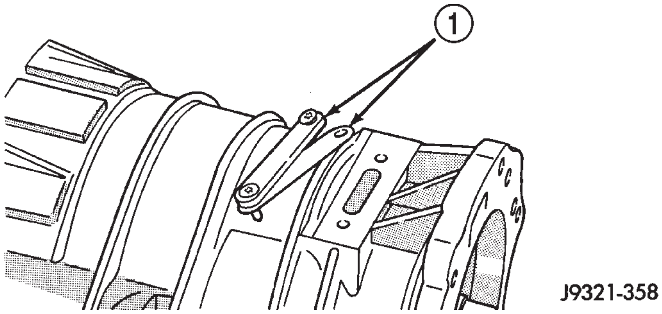


Fig. 253 Access Cover And Gasket Removal/ Installation

1 – ACCESS COVER AND GASKET

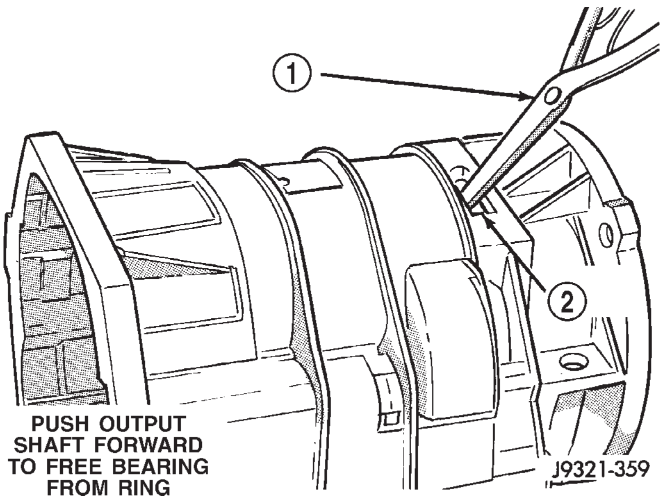


Fig. 254 Releasing Bearing From Locating Ring

1 – EXPAND BEARING LOCATING RING WITH SNAP RING PLIERS
2 – ACCESS HOLE

(6) Lift gear case up and off geartrain assembly (Fig. 255).

(7) Remove snap ring that retains rear bearing on output shaft.

(8) Remove rear bearing from output shaft (Fig. 256).

DIRECT CLUTCH, HUB AND SPRING DISASSEMBLY

WARNING: THE NEXT STEP IN DISASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE SPRING COMPRESSOR TOOL 6227-1 AND A HYDRAULIC SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 5-6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

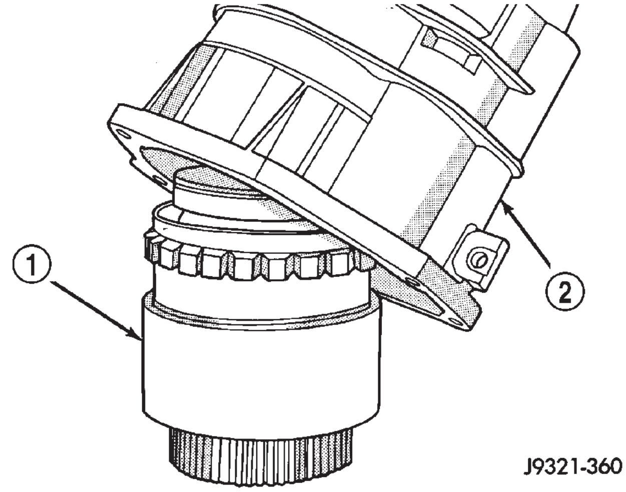


Fig. 255 Removing Gear Case From Geartrain Assembly

1 – GEARTRAIN ASSEMBLY
2 – GEAR CASE

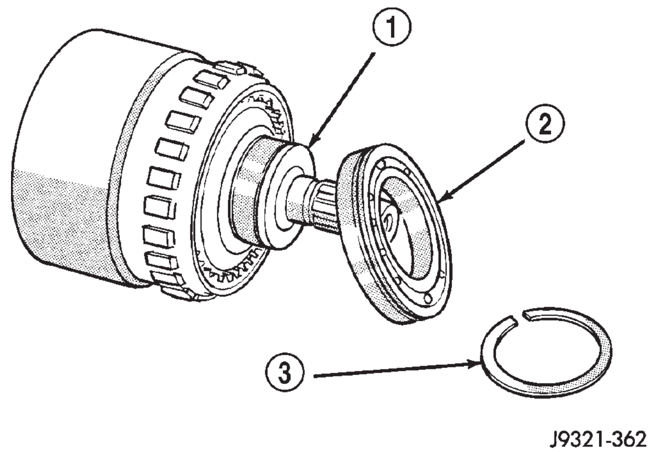


Fig. 256 Rear Bearing Removal

1 – OUTPUT SHAFT
2 – REAR BEARING
3 – SNAP RING

(1) Mount geartrain assembly in shop press (Fig. 257).

(2) Position Compressor Tool 6227-1 on clutch hub (Fig. 257). Support output shaft flange with steel press plates as shown and center assembly under press ram.

(3) Apply press pressure slowly. Compress hub and spring far enough to expose clutch hub retaining ring and relieve spring pressure on clutch pack snap ring (Fig. 257).

(4) Remove direct clutch pack snap ring (Fig. 258).

(5) Remove direct clutch hub retaining ring (Fig. 259).

(6) Release press load slowly and completely (Fig. 260).

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Remove Special Tool 6227-1. Then remove clutch pack from hub (Fig. 260).

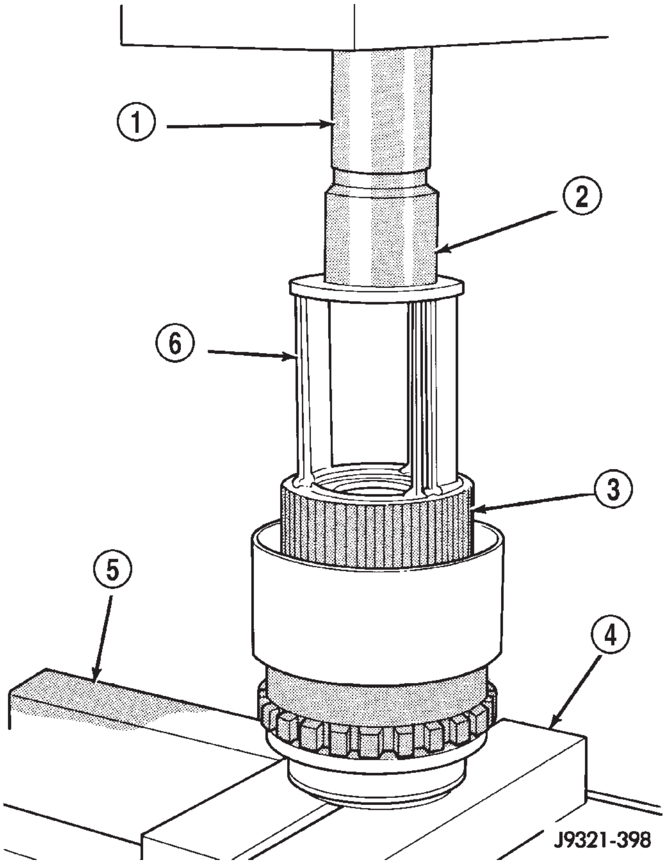


Fig. 257 Geartrain Mounted In Shop Press

1 – PRESS RAM
2 – SPECIAL TOOL C-3995–A (OR SIMILAR TOOL)
3 – CLUTCH HUB
4 – PLATES
5 – PRESS BED
6 – SPECIAL TOOL 6227–1

Geartrain Disassembly

(1) Remove direct clutch hub and spring (Fig. 261).

(2) Remove sun gear and spring plate. Then remove planetary thrust bearing and planetary gear (Fig. 262).

(3) Remove overrunning clutch assembly with expanding type snap ring pliers (Fig. 263). Insert pliers into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

(4) Remove thrust bearing from overrunning clutch hub.

(5) Remove overrunning clutch from hub.

(6) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 264). Use small center punch or scriber to make alignment marks.

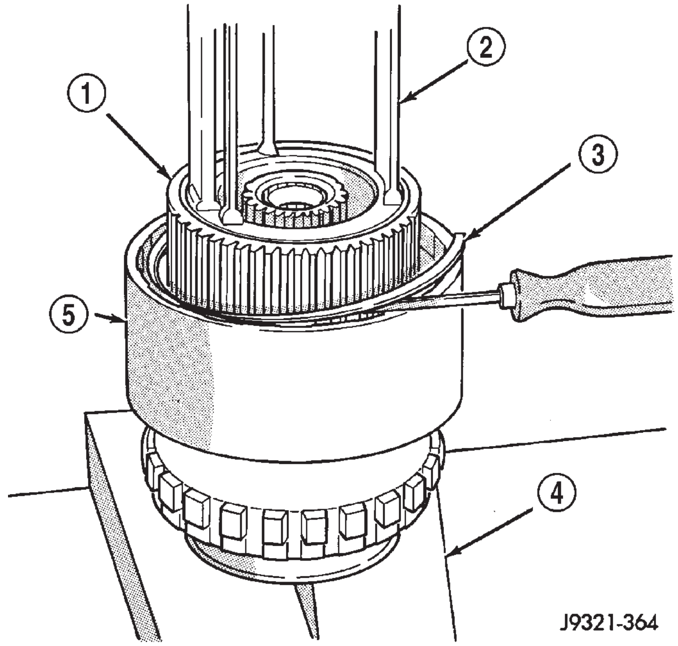


Fig. 258 Direct Clutch Pack Snap Ring Removal

1 – CLUTCH HUB
2 – SPECIAL TOOL 6227–1
3 – DIRECT CLUTCH PACK SNAP RING
4 – PRESS PLATES
5 – CLUTCH DRUM

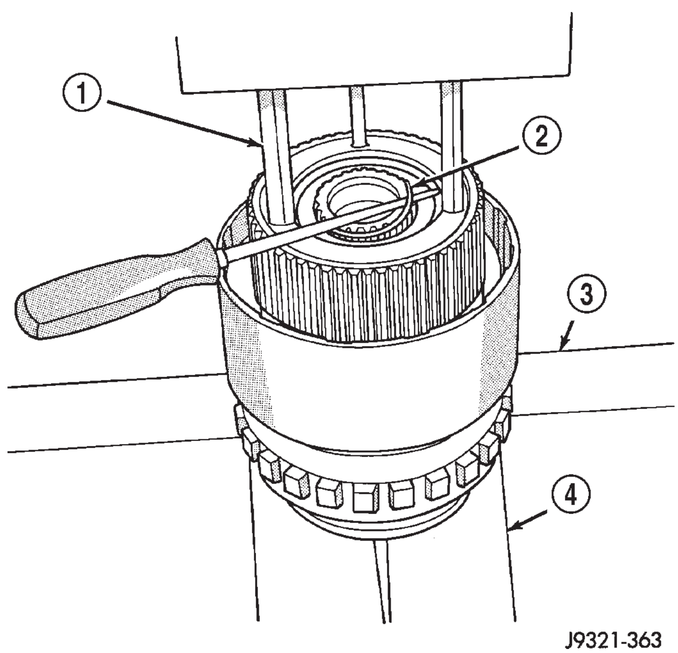


Fig. 259 Direct Clutch Hub Retaining Ring Removal

1 – SPECIAL TOOL 6227–1
2 – CLUTCH HUB RETAINING RING
3 – PRESS BED
4 – PRESS PLATES

DISASSEMBLY AND ASSEMBLY (Continued)

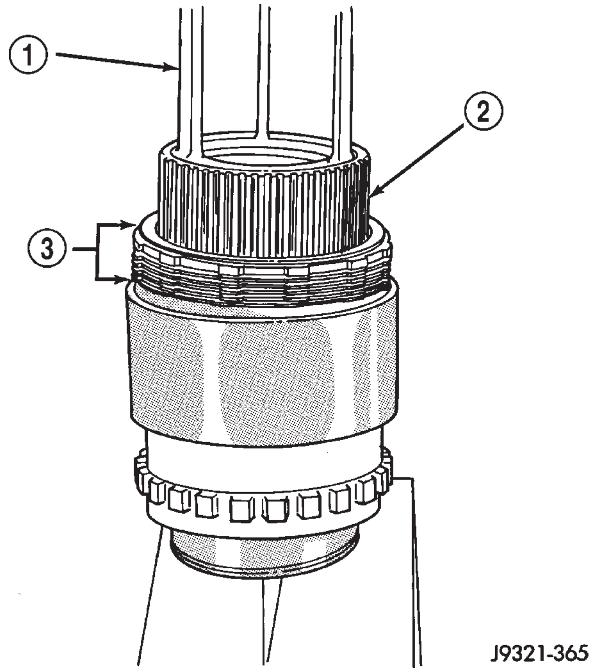


Fig. 260 Direct Clutch Pack Removal

1 – SPECIAL TOOL 6227–1
2 – DIRECT CLUTCH HUB
3 – DIRECT CLUTCH PACK

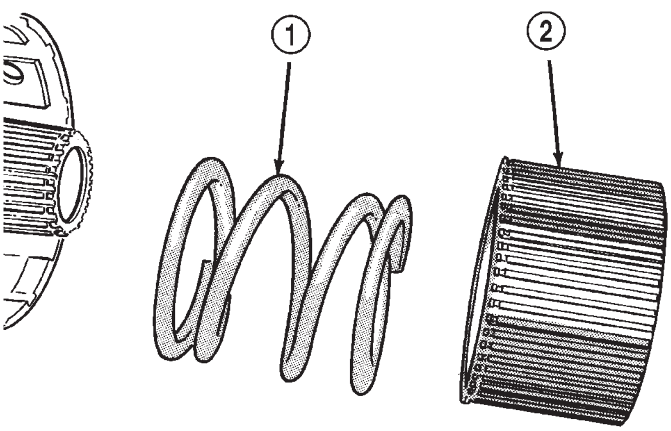


Fig. 261 Direct Clutch Hub And Spring Removal

1 – DIRECT CLUTCH SPRING
2 – DIRECT CLUTCH HUB

(7) Remove direct clutch drum rear retaining ring (Fig. 265).

(8) Remove direct clutch drum outer retaining ring (Fig. 266).

(9) Mark annulus gear and output shaft for assembly alignment reference (Fig. 267). Use punch or scriber to mark gear and shaft.

(10) Remove snap ring that secures annulus gear on output shaft (Fig. 268). Use two screwdrivers to unseat and work snap ring out of groove as shown.

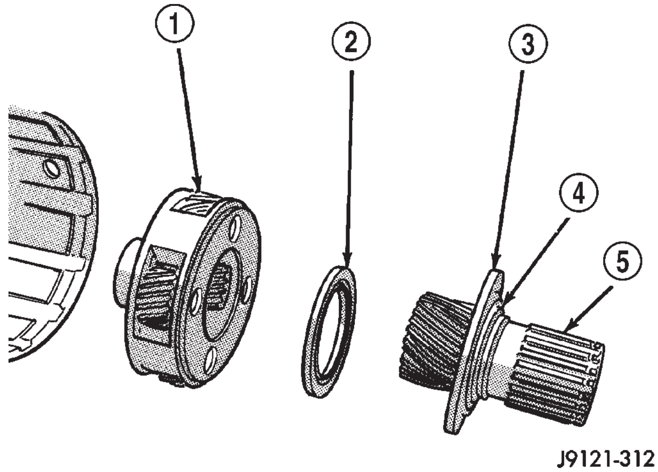


Fig. 262 Removing Sun Gear, Thrust Bearing And Planetary Gear

1 – PLANETARY GEAR
2 – PLANETARY THRUST BEARING
3 – CLUTCH SPRING PLATE
4 – SPRING PLATE SNAP RING
5 – SUN GEAR

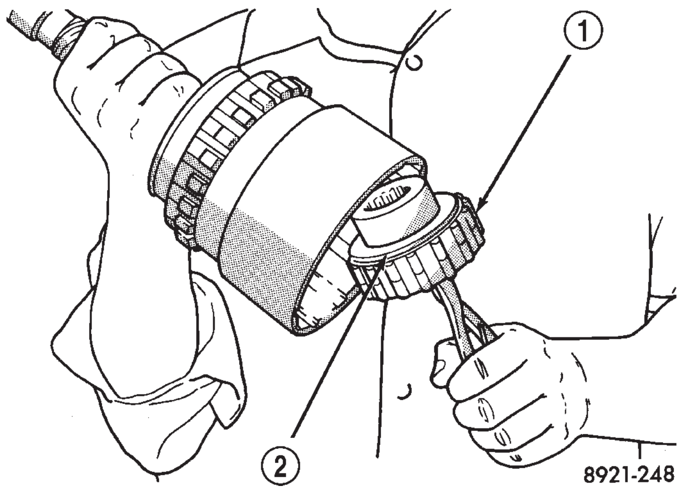


Fig. 263 Overrunning Clutch Assembly Removal/ Installation

1 – OVERRUNNING CLUTCH
2 – NEEDLE BEARING

(11) Remove annulus gear from output shaft (Fig. 269). Use rawhide or plastic mallet to tap gear off shaft.

GEAR CASE AND PARK LOCK DISASSEMBLY

(1) Remove locating ring from gear case.

(2) Remove park pawl shaft retaining bolt and remove shaft, pawl and spring.

(3) Remove reaction plug snap ring and remove reaction plug.

(4) Remove output shaft seal.

DISASSEMBLY AND ASSEMBLY (Continued)

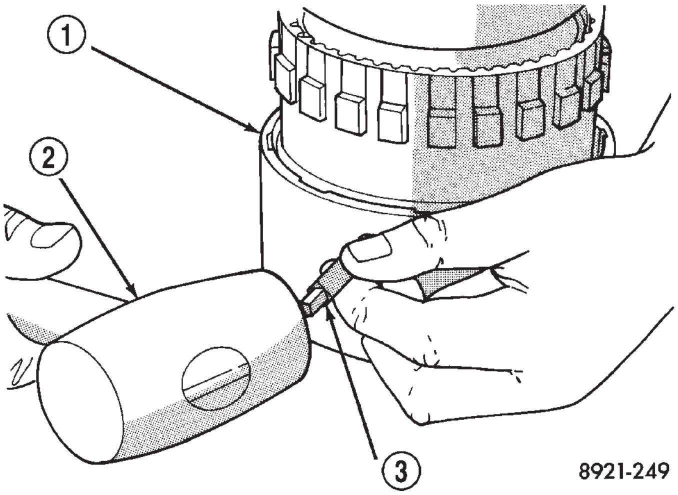


Fig. 264 Marking Direct Clutch Drum And Annulus Gear For Assembly Alignment

1 – DIRECT CLUTCH DRUM
2 – HAMMER
3 – PUNCH

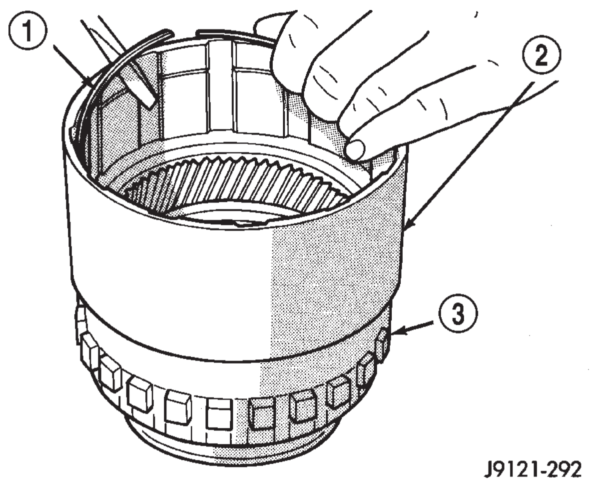


Fig. 265 Clutch Drum Inner Retaining Ring Removal

1 – INNER RETAINING RING
2 – DIRECT CLUTCH DRUM
3 – ANNULUS GEAR

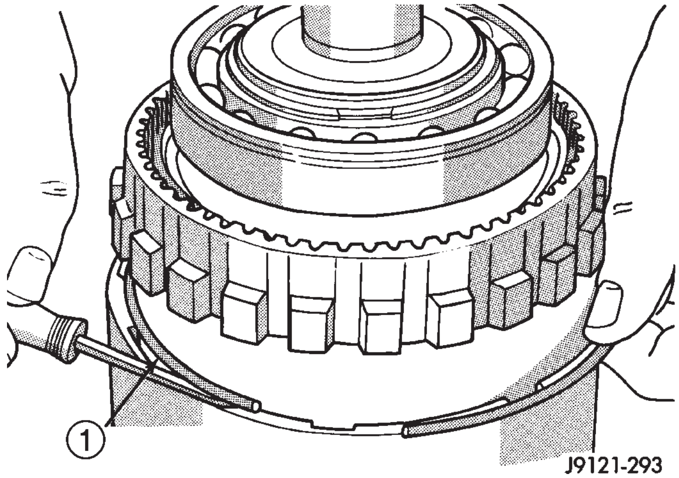


Fig. 266 Clutch Drum Outer Retaining Ring Removal

1 – OUTER RETAINING RING

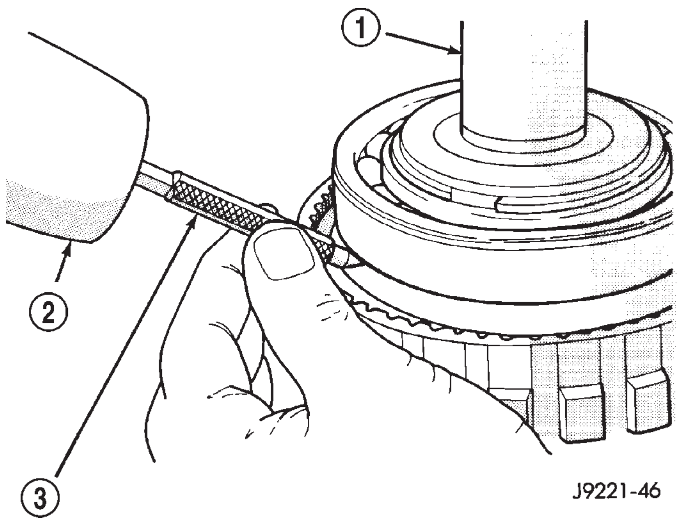


Fig. 267 Marking Annulus Gear And Output Shaft For Assembly Alignment

1 – OUTPUT SHAFT
2 – HAMMER
3 – PUNCH

DISASSEMBLY AND ASSEMBLY (Continued)

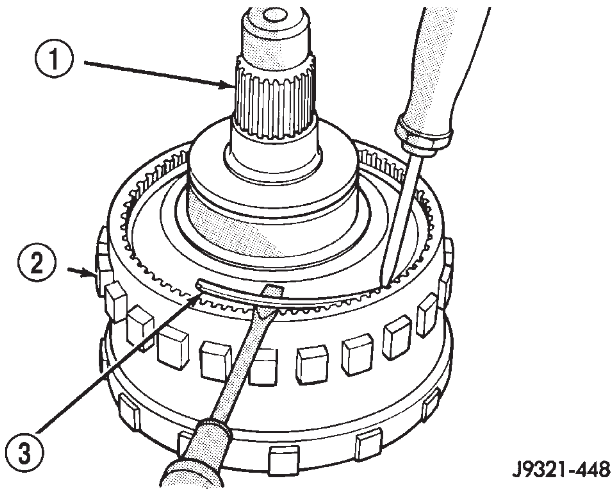


Fig. 268 Annulus Gear Snap Ring Removal

1 – OUTPUT SHAFT
2 – ANNULUS GEAR
3 – SNAP RING

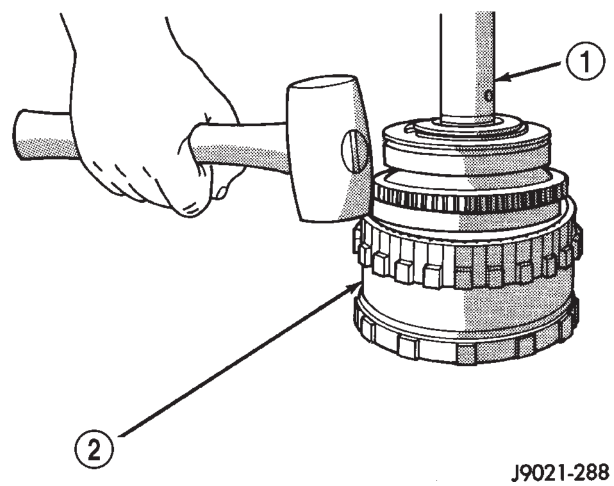


Fig. 269 Annulus Gear Removal

1 – OUTPUT SHAFT
2 – ANNULUS GEAR

ASSEMBLY

GEARTRAIN AND DIRECT CLUTCH ASSEMBLY

(1) Soak direct clutch and overdrive clutch discs in Mopar® ATF Plus 3, type 7176, transmission fluid. Allow discs to soak for 10-20 minutes.

(2) Install new pilot bushing and clutch hub bushing in output shaft if necessary (Fig. 270). Lubricate bushings with petroleum jelly, or transmission fluid.

(3) Install annulus gear on output shaft, if removed. Then install annulus gear retaining snap ring (Fig. 271).

(4) Align and install clutch drum on annulus gear (Fig. 272). Be sure drum is engaged in annulus gear lugs.

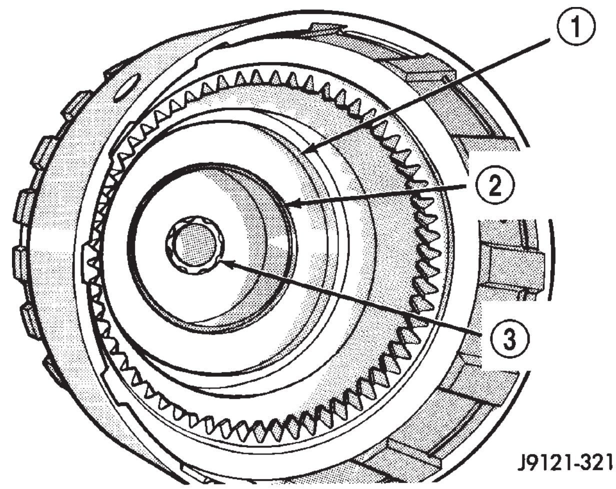


Fig. 270 Output Shaft Pilot Bushing

1 – OUTPUT SHAFT HUB
2 – OVERRUNNING CLUTCH HUB BUSHING
3 – INTERMEDIATE SHAFT PILOT BUSHING

(5) Install clutch drum outer retaining ring (Fig. 272).

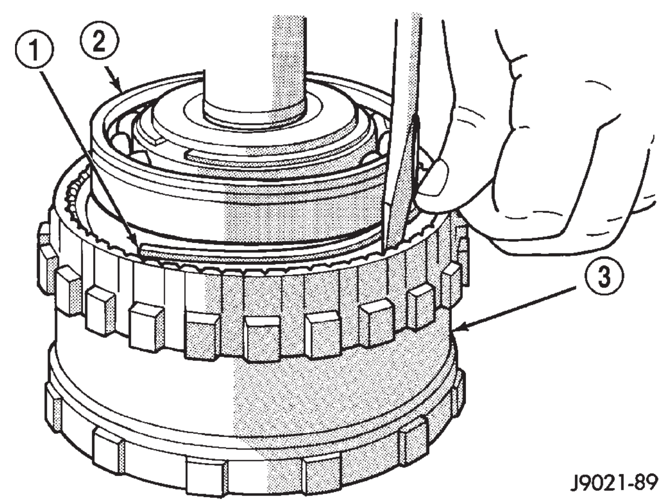


Fig. 271 Annulus Gear Installation

1 – SNAP RING
2 – OUTPUT SHAFT FRONT BEARING
3 – ANNULUS GEAR

(6) Slide clutch drum forward and install inner retaining ring (Fig. 273).

(7) Install rear bearing and snap ring on output shaft (Fig. 274). Be sure locating ring groove in bearing is toward rear.

(8) Install overrunning clutch on hub (Fig. 275). **Note that clutch only fits one way. Shoulder on clutch should seat in small recess at edge of hub.**

(9) Install thrust bearing on overrunning clutch hub. Use generous amount of petroleum jelly to hold

DISASSEMBLY AND ASSEMBLY (Continued)

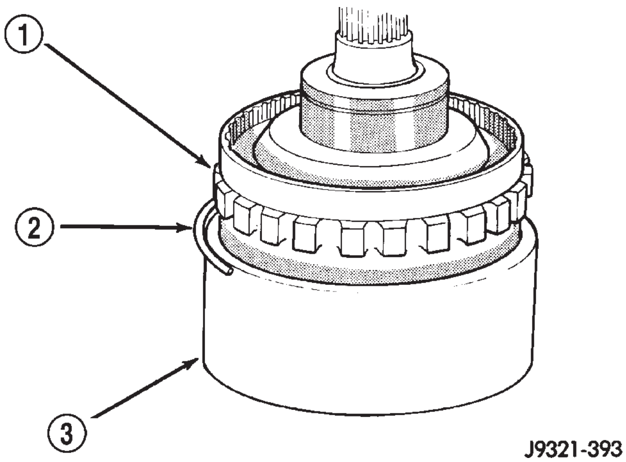


Fig. 272 Clutch Drum And Outer Retaining Ring Installation

1 – ANNULUS GEAR
2 – OUTER SNAP RING
3 – CLUTCH DRUM

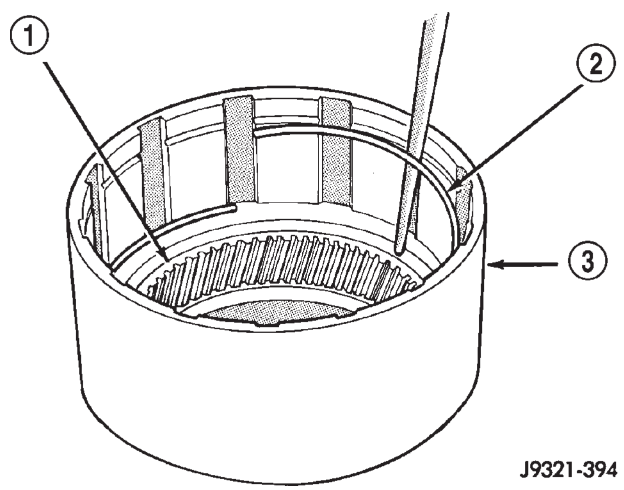


Fig. 273 Clutch Drum Inner Retaining Ring Installation

1 – ANNULUS GEAR
2 – INNER SNAP RING
3 – CLUTCH DRUM

bearing in place for installation. **Bearing fits one way only. Be sure bearing is seated squarely against hub. Reinstall bearing if it does not seat squarely.**

(10) Install overrunning clutch in output shaft (Fig. 276). Insert snap ring pliers in hub splines. Expand pliers to grip hub. Then install assembly with counterclockwise, twisting motion.

(11) Install planetary gear in annulus gear (Fig. 277). **Be sure planetary pinions are fully seated in annulus gear before proceeding.**

(12) Coat planetary thrust bearing and bearing contact surface of spring plate with generous amount

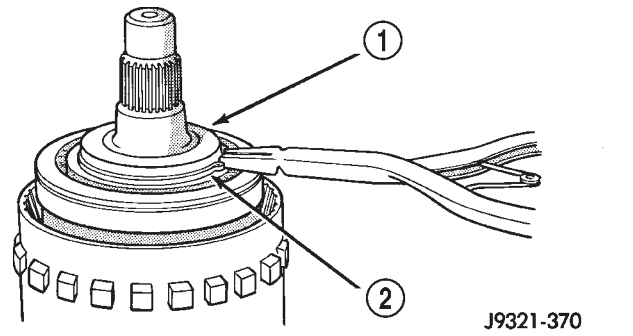


Fig. 274 Rear Bearing And Snap Ring Installation

1 – REAR BEARING
2 – SNAP RING

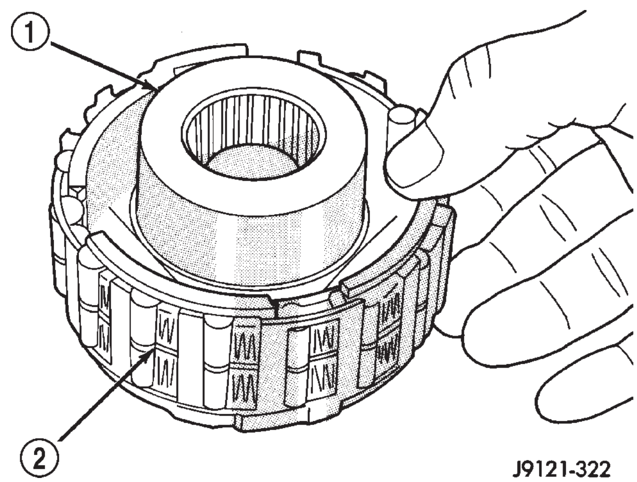


Fig. 275 Assembling Overrunning Clutch And Hub

1 – CLUTCH HUB
2 – OVERRUNNING CLUTCH

of petroleum jelly. This will help hold bearing in place during installation.

(13) Install planetary thrust bearing on sun gear (Fig. 278). Slide bearing onto gear and seat it against spring plate as shown. **Bearing fits one way only. If it does not seat squarely against spring plate, remove and reposition bearing.**

(14) Install assembled sun gear, spring plate and thrust bearing (Fig. 279). Be sure sun gear and thrust bearing are fully seated before proceeding.

(15) Mount assembled output shaft, annulus gear, and clutch drum in shop press. Direct clutch spring, hub and clutch pack are easier to install with assembly mounted in press.

(16) Align splines in hubs of planetary gear and overrunning clutch with Alignment tool 6227-2 (Fig. 280). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.

(17) Install direct clutch spring (Fig. 281). Be sure spring is properly seated on spring plate.

DISASSEMBLY AND ASSEMBLY (Continued)

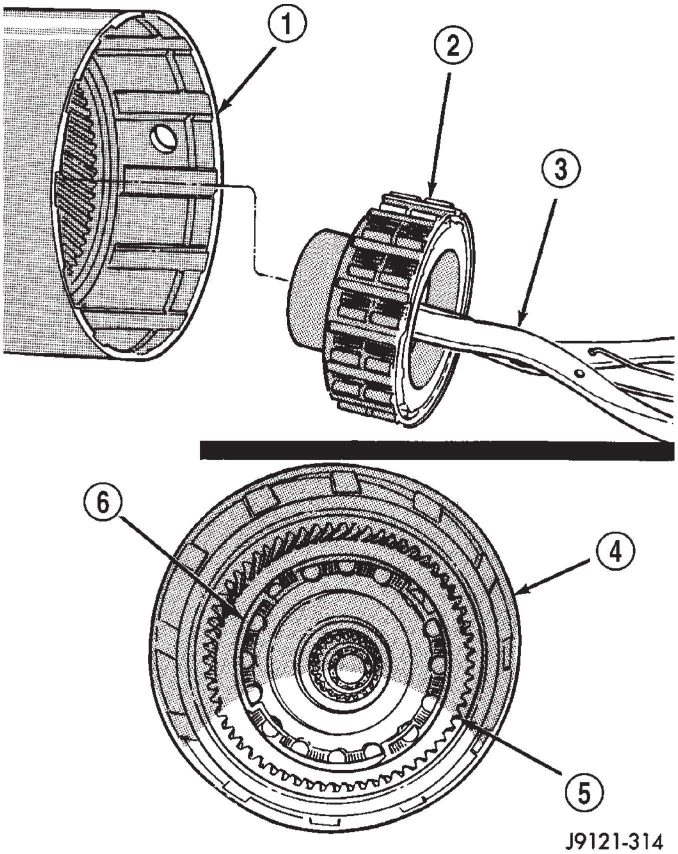


Fig. 276 Overrunning Clutch Installation

1 – CLUTCH DRUM
2 – OVERRUNNING CLUTCH ASSEMBLY
3 – EXPANDING-TYPE SNAP RING PLIERS
4 – CLUTCH DRUM
5 – ANNULUS GEAR
6 – OVERRUNNING CLUTCH ASSEMBLY SEATED IN OUTPUT SHAFT

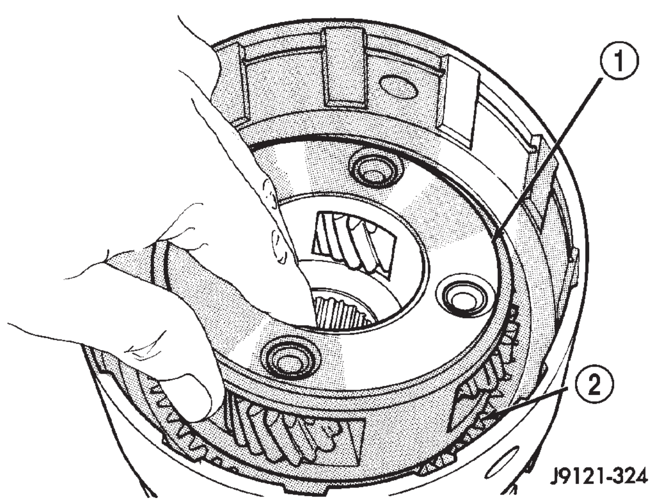


Fig. 277 Planetary Gear Installation

1 – PLANETARY GEAR
2 – ANNULUS GEAR

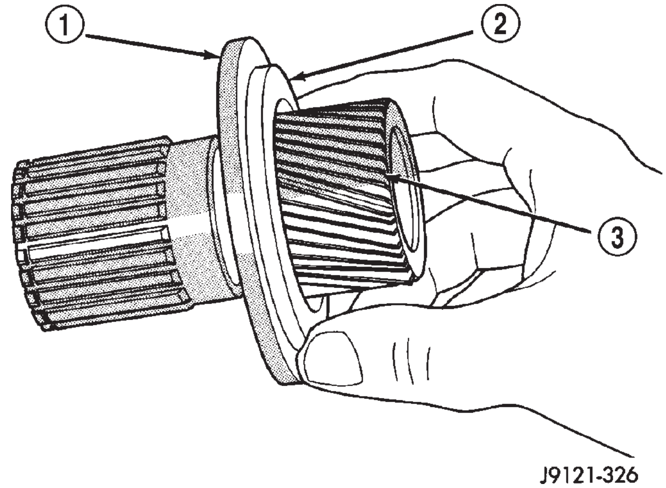


Fig. 278 Planetary Thrust Bearing Installation

1 – SPRING PLATE
2 – PLANETARY THRUST BEARING
3 – SUN GEAR

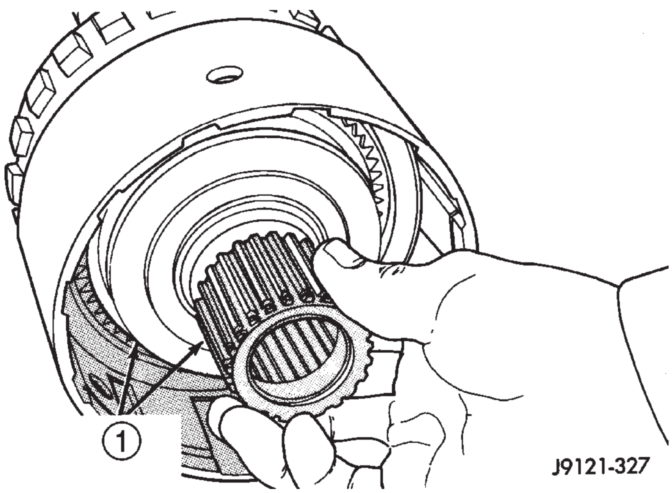


Fig. 279 Sun Gear Installation

1 – SUN GEAR AND SPRING PLATE ASSEMBLY

NOTE: The 42RE transmission has 6 direct clutch discs and 5 clutch plates.

(18) Assemble and install direct clutch pack on hub as follows:

(a) Assemble clutch pack components (Fig. 282).

(b) Install direct clutch reaction plate on clutch hub first. **Note that one side of reaction plate is counterbored. Be sure this side faces rearward. Splines at rear of hub are raised slightly. Counterbore in plate fits over raised splines. Plate should be flush with this end of hub (Fig. 283).**

(c) Install first clutch disc followed by a steel plate until all discs and plates have been installed.

DISASSEMBLY AND ASSEMBLY (Continued)

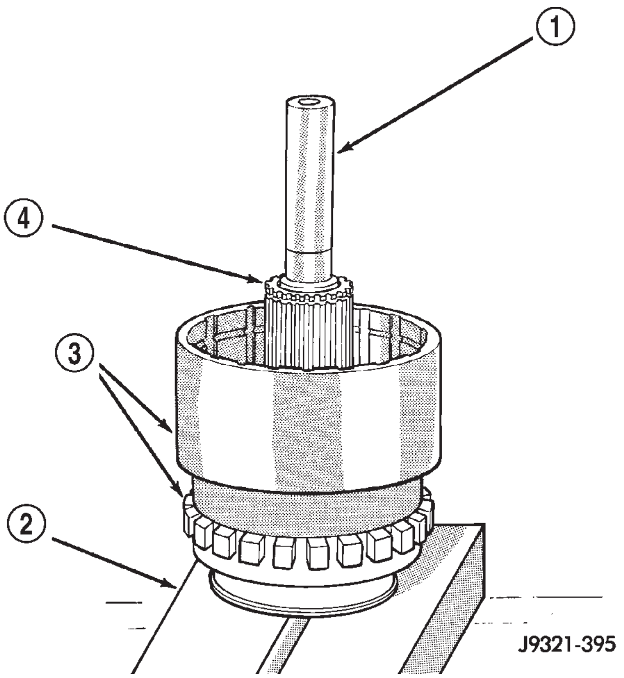


Fig. 280 Alignment Tool Installation

1 – SPECIAL TOOL 6227–2
2 – PRESS PLATES
3 – ASSEMBLED DRUM AND ANNULUS GEAR
4 – SUN GEAR

(d) Install pressure plate. This is last clutch pack item to be installed. **Be sure plate is installed with shoulder side facing upward (Fig. 284).**

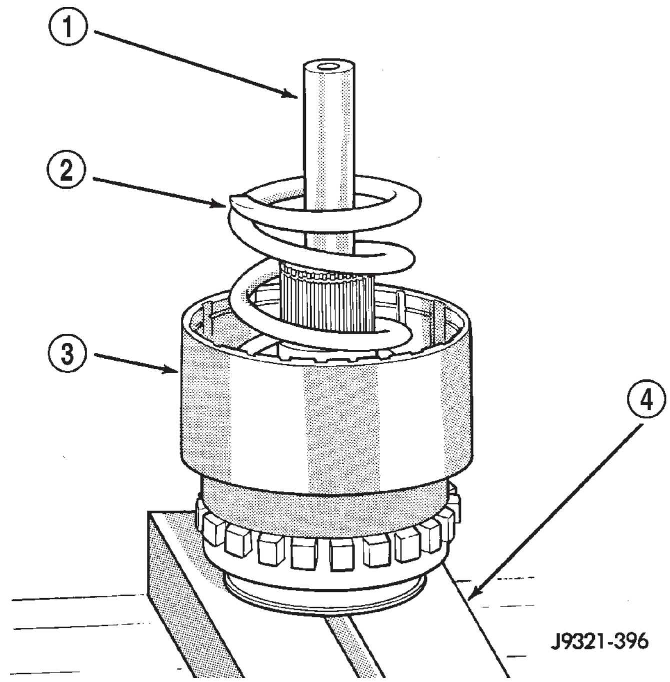


Fig. 281 Direct Clutch Spring Installation

1 – SPECIAL TOOL 6227–2
2 – DIRECT CLUTCH SPRING
3 – CLUTCH HUB
4 – PRESS PLATES

(19) Install clutch hub and clutch pack on direct clutch spring (Fig. 285). **Be sure hub is started on sun gear splines before proceeding.**

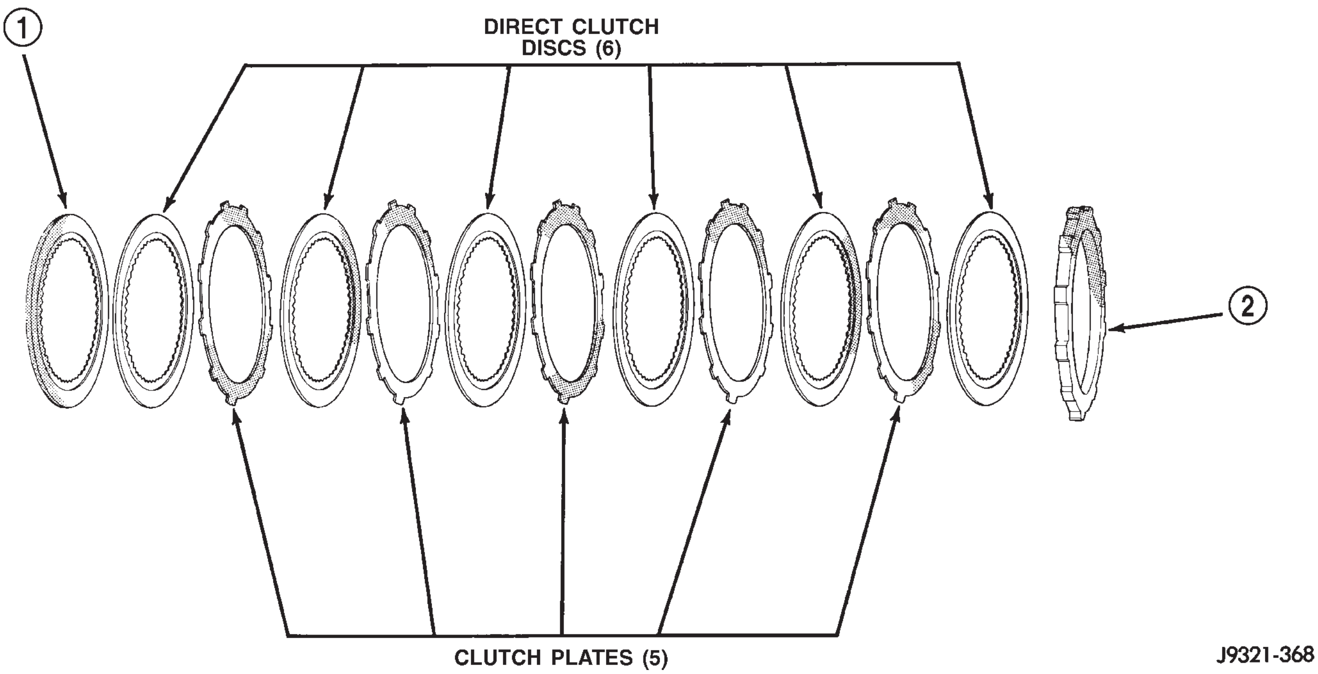


Fig. 282 42RE Direct Clutch Pack Components

1 – REACTION PLATE
2 – PRESSURE PLATE

DISASSEMBLY AND ASSEMBLY (Continued)

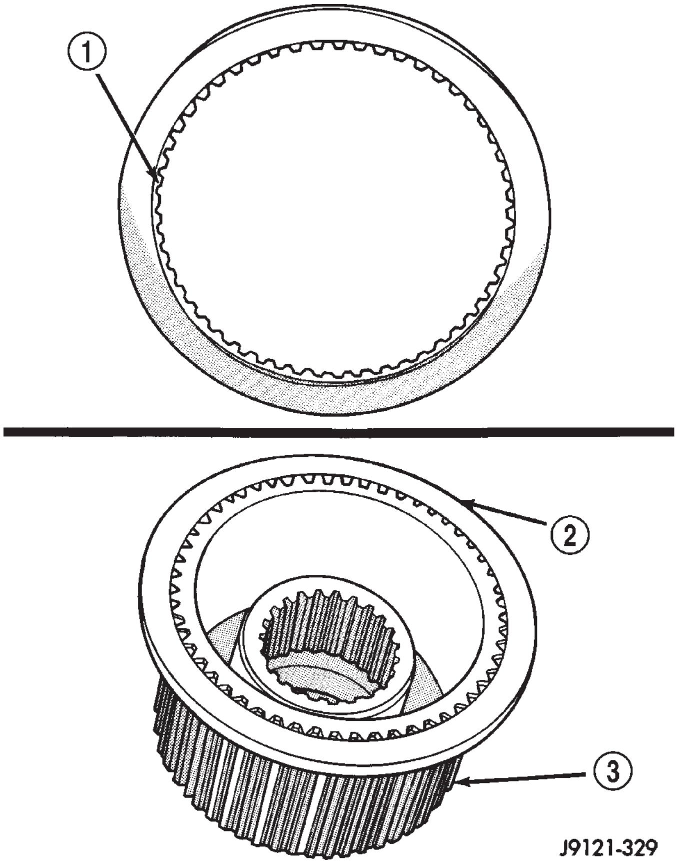


Fig. 283 Correct Position Of Direct Clutch Reaction Plate

1 – REACTION PLATE COUNTERBORE
2 – DIRECT CLUTCH REACTION PLATE (FLUSH WITH END OF HUB)
3 – CLUTCH HUB

WARNING: THE NEXT STEP IN GEARTRAIN ASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH HUB AND SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE COMPRESSOR TOOL C-6227-1 AND A HYDRAULIC-TYPE SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

(20) Position Compressor Tool 6227-1 on clutch hub.

(21) Compress clutch hub and spring just enough to place tension on hub and hold it in place.

(22) Slowly compress clutch hub and spring. Compress spring and hub only enough to expose ring grooves for clutch pack snap ring and clutch hub retaining ring.

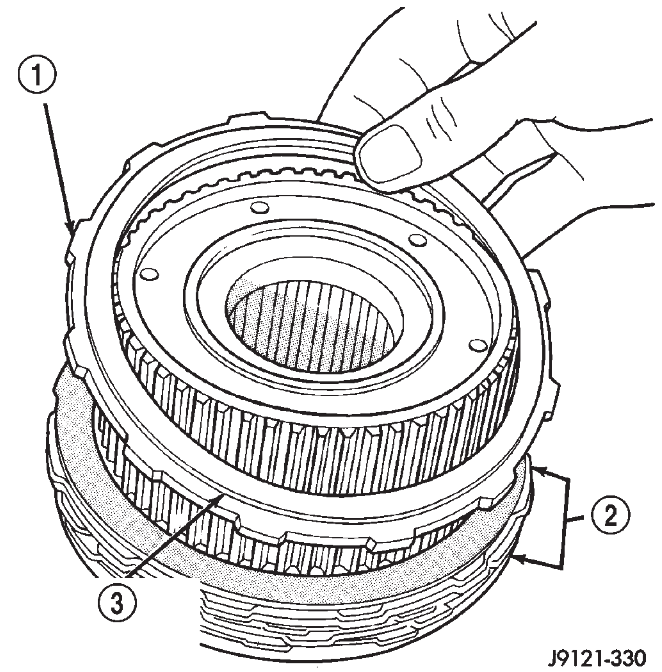


Fig. 284 Correct Position Of Direct Clutch Pressure Plate

1 – DIRECT CLUTCH PRESSURE PLATE
2 – CLUTCH PACK
3 – BE SURE SHOULDER SIDE OF PLATE FACES UPWARD

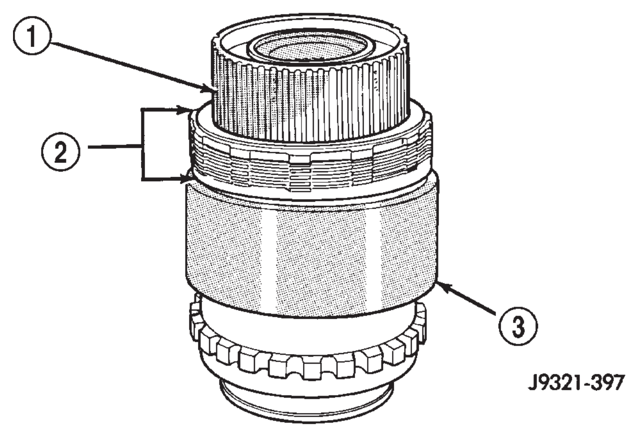


Fig. 285 Direct Clutch Pack And Clutch Hub Installation

1 – CLUTCH HUB
2 – DIRECT CLUTCH PACK
3 – CLUTCH DRUM

(23) Realign clutch pack on hub and seat clutch discs and plates in clutch drum.

(24) Install direct clutch pack snap ring (Fig. 286). **Be very sure snap ring is fully seated in clutch drum ring groove.**

DISASSEMBLY AND ASSEMBLY (Continued)

(25) Install clutch hub retaining ring (Fig. 287). **Be very sure retaining ring is fully seated in sun gear ring groove.**

(26) Slowly release press ram, remove compressor tools and remove geartrain assembly.

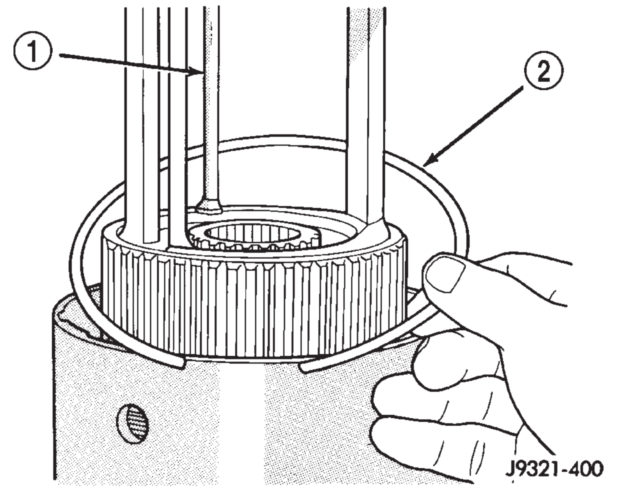


Fig. 286 Direct Clutch Pack Snap Ring Installation

1 – SPECIAL TOOL 6227–1
2 – DIRECT CLUTCH PACK SNAP RING

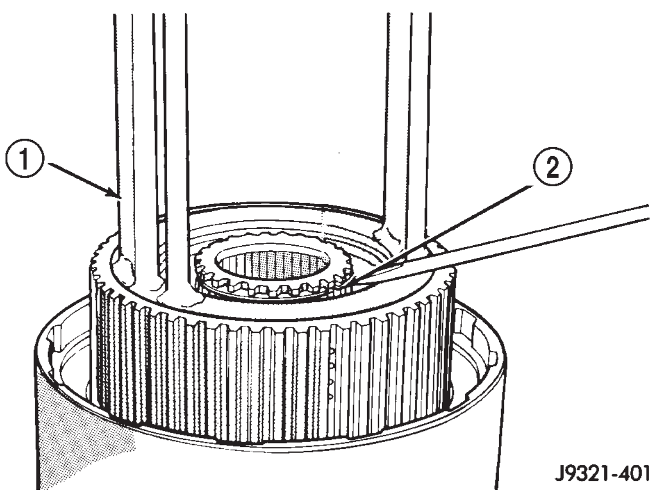


Fig. 287 Clutch Hub Retaining Ring Installation

1 – SPECIAL TOOL 6227–1
2 – CLUTCH HUB RETAINING RING

GEAR CASE ASSEMBLY

(1) Position park pawl and spring in case and install park pawl shaft. Verify that end of spring with 90° bend is hooked to pawl and straight end of spring is seated against case.

(2) Install pawl shaft retaining bolt. Tighten bolt to 27 N·m (20 ft. lbs.) torque.

(3) Install park lock reaction plug. **Note that plug has locating pin at rear (Fig. 288). Be sure pin is seated in hole in case before installing snap ring.**

(4) Install reaction plug snap-ring (Fig. 289). **Compress snap ring only enough for installation; do not distort it.**

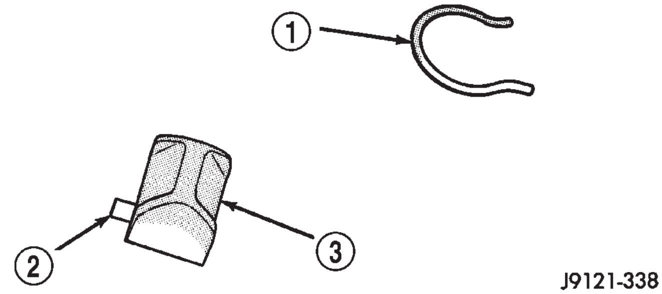


Fig. 288 Reaction Plug Locating Pin And Snap-Ring

1 – REACTION PLUG SNAP RING (DO NOT OVERCOMPRESS TO INSTALL)
2 – LOCATING PIN
3 – PARK LOCK REACTION PLUG

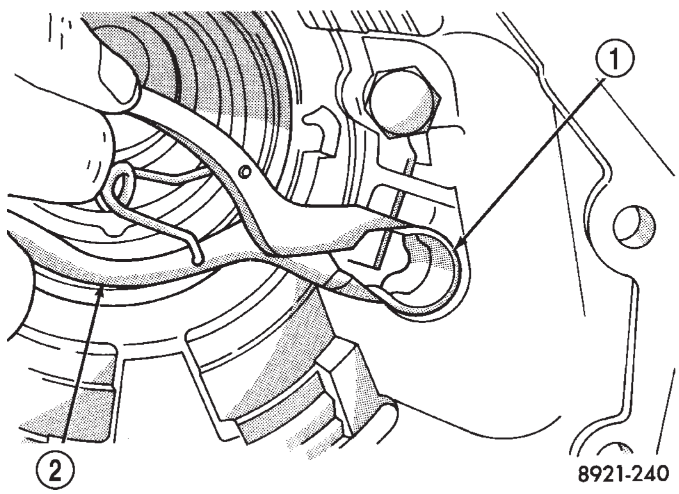


Fig. 289 Reaction Plug And Snap-Ring Installation

1 – REACTION PLUG SNAP RING
2 – SNAP RING PLIERS

(5) Install new seal in gear case. On 4x4 gear case, use Tool Handle C-4171 and Installer C-3860-A to seat seal in case. On 4 x 2 gear case, use same Handle C-4171 and Installer C-3995-A to seat seal in case.

(6) Verify that tab ends of rear bearing locating ring extend into access hole in gear case (Fig. 290).

(7) Support geartrain on Tool 6227-1 (Fig. 291). Be sure tool is securely seated in clutch hub.

(8) Install overdrive gear case on geartrain (Fig. 291).

(9) Expand front bearing locating ring with snap ring pliers (Fig. 292). Then slide case downward until locating ring locks in bearing groove and release snap ring.

(10) Install locating ring access cover and gasket in overdrive unit case (Fig. 293).

DISASSEMBLY AND ASSEMBLY (Continued)

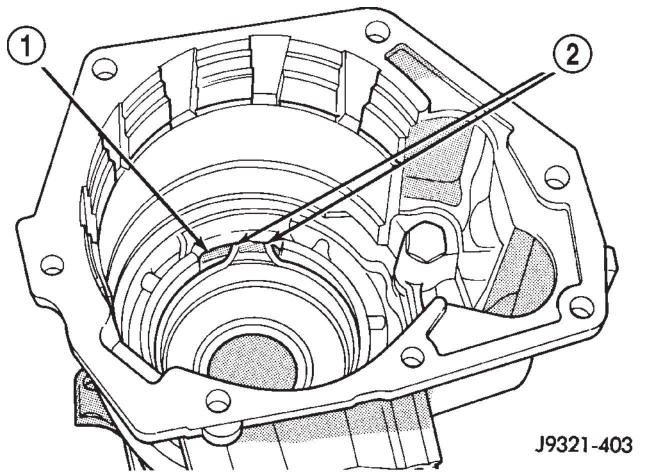


Fig. 290 Correct Rear Bearing Locating Ring Position

1 – CASE ACCESS HOLE
2 – TAB ENDS OF LOCATING RING

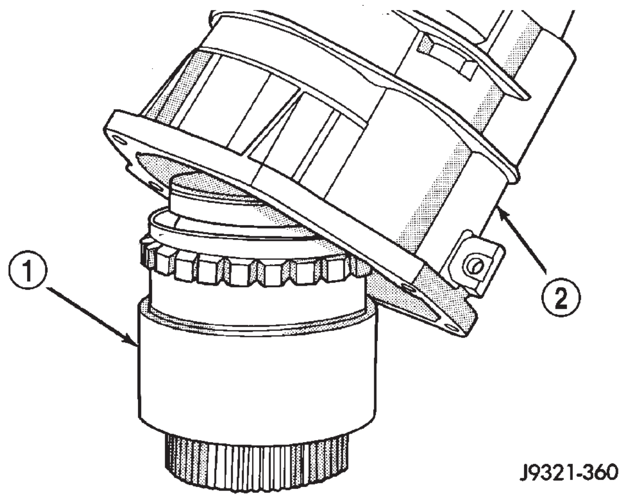


Fig. 291 Overdrive Gear Case Installation

1 – GEARTRAIN ASSEMBLY
2 – GEAR CASE

OVERDRIVE CLUTCH ASSEMBLY

(1) Install overdrive clutch reaction ring first. Reaction ring is flat with notched ends (Fig. 294).

(2) Install wave spring on top of reaction ring (Fig. 295). **Reaction ring and wave ring both fit in same ring groove.** Use screwdriver to seat each ring securely in groove. Also ensure that the ends of the two rings are offset from each other.

NOTE: The 42RE transmission has 3 overdrive clutch discs and 2 plates.

(3) Assemble overdrive clutch pack (Fig. 296).
(4) Install overdrive clutch reaction plate first.

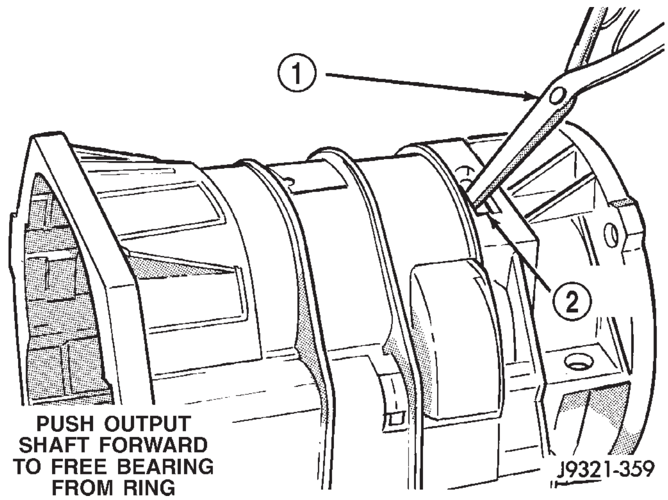


Fig. 292 Seating Locating Ring In Rear Bearing

1 – EXPAND BEARING LOCATING RING WITH SNAP RING PLIERS
2 – ACCESS HOLE

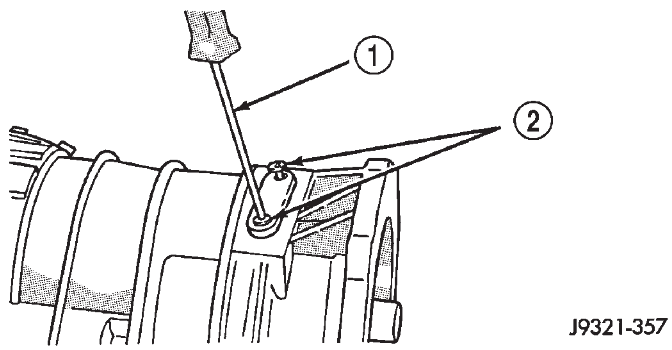


Fig. 293 Locating Ring Access Cover And Gasket Installation

1 – TORX SCREWDRIVER (T25)
2 – ACCESS COVER SCREWS

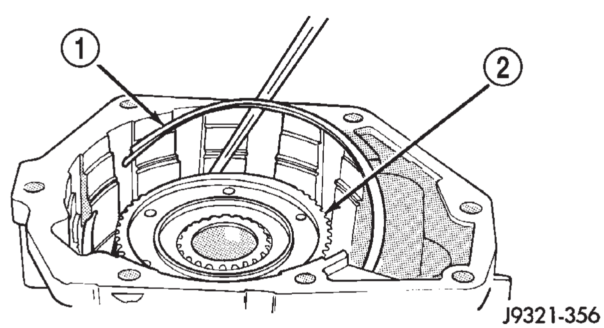


Fig. 294 Overdrive Clutch Reaction Ring Installation

1 – REACTION RING
2 – CLUTCH HUB

(5) Install first clutch disc followed by first clutch plate. Then install remaining clutch discs and plates in same order.

DISASSEMBLY AND ASSEMBLY (Continued)

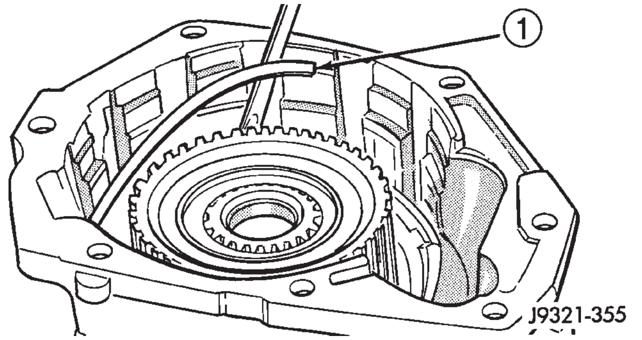


Fig. 295 Overdrive Clutch Wave Spring Installation

1 – WAVE SPRING

(6) Install clutch pack pressure plate.

(7) Install clutch pack wire-type retaining ring (Fig. 297).

INTERMEDIATE SHAFT SPACER SELECTION

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness intermediate shaft spacer as follows:

(a) Insert Special Tool 6312 through sun gear, planetary gear and into pilot bushing in output shaft. Be sure tool bottoms against planetary shoulder.

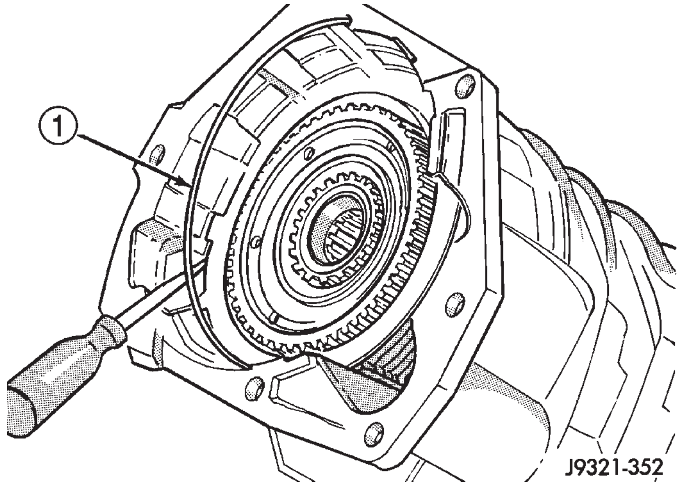


Fig. 297 Overdrive Clutch Pack Retaining Ring Installation

1 – OVERDRIVE CLUTCH PACK RETAINING RING

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 298). Then position Dial Caliper C-4962 over gauge tool.

(c) Extend sliding scale of dial caliper downward through gauge tool slot until scale contacts end of Gauge Alignment Tool 6312. Lock scale in place.

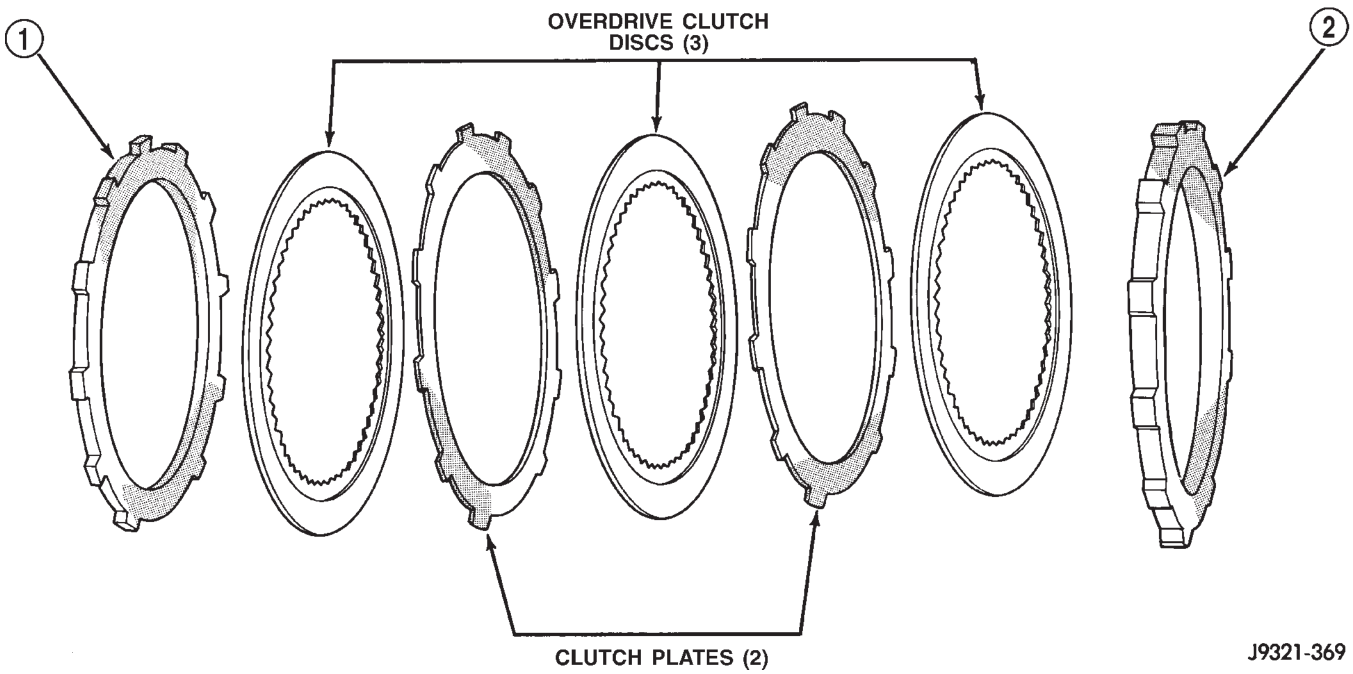


Fig. 296 42RE Overdrive Clutch Components

1 – REACTION PLATE
2 – PRESSURE PLATE

DISASSEMBLY AND ASSEMBLY (Continued)

Remove dial caliper tool and note distance measured (Fig. 298).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 299).

(e) Remove Gauge Alignment Tool 6312.

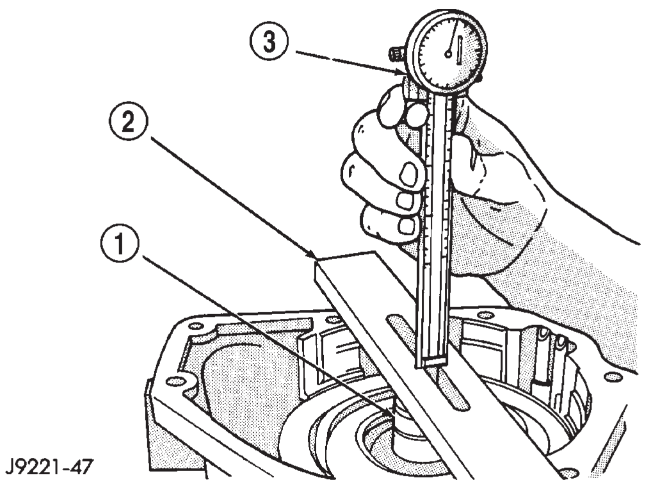


Fig. 298 Shaft End Play Measurement

1 – SPECIAL TOOL 6312
2 – SPECIAL TOOL 6311
3 – SPECIAL TOOL C-4962

End Play Measurement (Inches)	Spacer Thickness (Inches)
.7336 - .7505	.158 - .159
.7506 - .7675	.175 - .176
.7676 - .7855	.193 - .194
.7856 - .8011	.211 - .212

J9121-341

Fig. 299 Intermediate Shaft End Play Spacer Selection

OD THRUST PLATE SELECTION

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness overdrive piston thrust plate as follows:

(a) Position Gauge Tool 6311 across face of overdrive case. Then position Dial Caliper C-4962 over gauge tool (Fig. 300).

(b) Measure distance to clutch hub thrust bearing seat at four points 90° apart. Then average measurements by adding them and dividing by 4.

(c) Select and install required thrust plate from information in thrust plate chart (Fig. 301).

(3) Leave Alignment Tool 6227-2 in place. Tool will keep planetary and clutch hub splines in alignment until overdrive unit is ready for installation on transmission.

(4) Transmission speed sensor can be installed at this time if desired. However, it is recommended that sensor not be installed until after overdrive unit is secured to transmission.

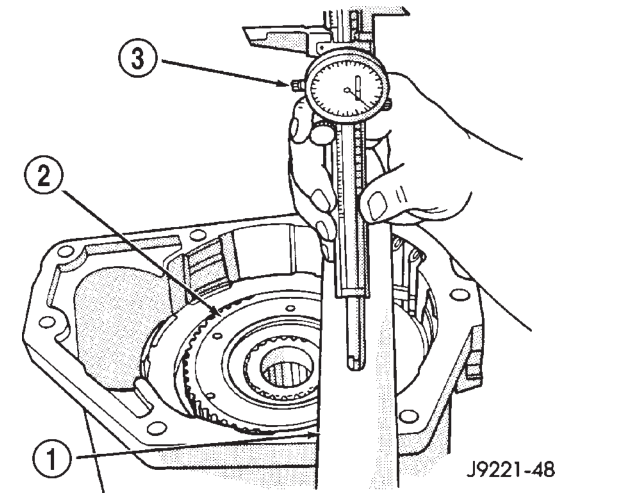


Fig. 300 Overdrive Piston Thrust Plate Measurement

1 – SPECIAL TOOL 6311
2 – DIRECT CLUTCH HUB THRUST BEARING SEAT
3 – SPECIAL TOOL C-4962

End Play Measurement (Inches)	Spacer Thickness (Inches)
1.7500 - 1.7649	.108 - .110
1.7650 - 1.7799	.123 - .125
1.7800 - 1.7949	.138 - .140
1.7950 - 1.8099	.153 - .155
1.8100 - 1.8249	.168 - .170
1.8250 - 1.8399	.183 - .185
1.8400 - 1.8549	.198 - .200
1.8550 - 1.8699	.213 - .215
1.8700 - 1.8849	.228 - .230
1.8850 - 1.8999	.243 - .245

J9121-342

Fig. 301 Overdrive Piston Thrust Plate Selection

OVERDRIVE PISTON ASSEMBLY

(1) Install new seals on over drive piston.

(2) Stand transmission case upright on bellhousing.

(3) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(4) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

(5) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

DISASSEMBLY AND ASSEMBLY (Continued)

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114–2 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

(6) Install intermediate shaft spacer on intermediate shaft.

(7) Install overdrive piston thrust plate on overdrive piston.

(8) Install overdrive piston thrust bearing on overdrive piston.

(9) Install transmission speed sensor and O-ring seal in overdrive case (Fig. 242).

CLEANING AND INSPECTION

VALVE BODY

Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the governor solenoid and sensor and the dual solenoid and harness assembly by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

Wipe the governor pressure sensor and solenoid valve with dry, lint free shop towels only. The O-rings on the sensor and solenoid valve are the only serviceable components. Be sure the vent ports in the solenoid valve are open and not blocked by dirt or debris. Replace the valve and/or sensor only when DRB scan tool diagnosis indicates this is necessary. Or, if either part has sustained physical damage (dented, deformed, broken, etc.).

CAUTION: Do not turn the small screw at the end of the solenoid valve for any reason. Turning the screw in either direction will ruin solenoid calibration and result in solenoid failure. In addition, the filter on the solenoid valve is NOT serviceable. Do not try to remove the filter as this will damage the valve housing.

Inspect the throttle and manual valve levers and shafts. Do not attempt to straighten a bent shaft or correct a loose lever. Replace these components if worn, bent, loose or damaged in any way.

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

CAUTION: Many of the valves and plugs, such as the throttle valve, shuttle valve plug, 1-2 shift valve and 1-2 governor plug, are made of coated aluminum. Aluminum components are identified by the dark color of the special coating applied to the surface (or by testing with a magnet). Do not sand aluminum valves or plugs under any circumstances. This practice could damage the special coating causing the valves/plugs to stick and bind.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Check the two separator plates for distortion or damage of any kind. Inspect the upper housing, lower housing, 3-4 accumulator housing, and transfer plate carefully. Be sure all fluid passages are clean and clear. Check condition of the upper housing and transfer plate check balls as well. The check balls and ball seats must not be worn or damaged.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

CLEANING AND INSPECTION (Continued)

The only serviceable valve body components are listed below. The remaining valve body components are serviced only as part of a complete valve body assembly. Serviceable parts are:

- dual solenoid and harness assembly
- solenoid gasket
- solenoid case connector O-rings and shoulder bolt
- switch valve and spring
- pressure adjusting screw and bracket assembly
- throttle lever
- manual lever and shaft seal
- throttle lever shaft seal, washer, and E-clip
- fluid filter and screws
- detent ball and spring
- valve body screws
- governor pressure solenoid
- governor pressure sensor and retaining clip
- park lock rod and E-clip

TRANSMISSION

GENERAL INFORMATION

Inspect the transmission bushings during overhaul. Bushing condition is important as worn, scored bushings contribute to low pressures, clutch slip and accelerated wear of other components. However, do not replace bushings as a matter of course. Replace bushings only when they are actually worn, or scored.

Use recommended tools to replace bushings. The tools are sized and designed to remove, install, and seat bushings correctly. The bushing replacement tools are included in Bushing Tool Set C-3887-B.

Pre-sized service bushings are available for replacement purposes. Only the sun gear bushings are not serviced. Low cost of the sun gear assembly makes it easier to simply replace the gear and bushings as an assembly.

Heli-Coil inserts can be used to repair damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive parts suppliers. Stainless steel inserts are recommended.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

Lubricate transmission parts with Mopar® ATF Plus 3, Type 7176, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

TRANSMISSION CASE CLEANING AND INSPECTION

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

Lubricate the front band adjusting screw threads with petroleum jelly and thread the screw part-way into the case. Be sure the screw turns freely.

OVERRUNNING CLUTCH/LOW-REVERSE DRUM/OVERDRIVE PISTON RETAINER

Clean the overrunning clutch assembly, clutch cam, low-reverse drum, and overdrive piston retainer in solvent. Dry them with compressed air after cleaning.

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse drum if the clutch race, roller surface or inside diameter is scored, worn or damaged. **Do not remove the clutch race from the low-reverse drum under any circumstances. Replace the drum and race as an assembly if either component is damaged.**

Examine the overdrive piston retainer carefully for wear, cracks, scoring or other damage. Be sure the retainer hub is a snug fit in the case and drum. Replace the retainer if worn or damaged.

ACCUMULATOR

Inspect the accumulator piston and seal rings (Fig. 302). Replace the seal rings if worn or cut. Replace the piston if chipped or cracked.

CLEANING AND INSPECTION (Continued)

Check condition of the accumulator inner and outer springs (Fig. 302). Replace the springs if the coils are cracked, distorted or collapsed.

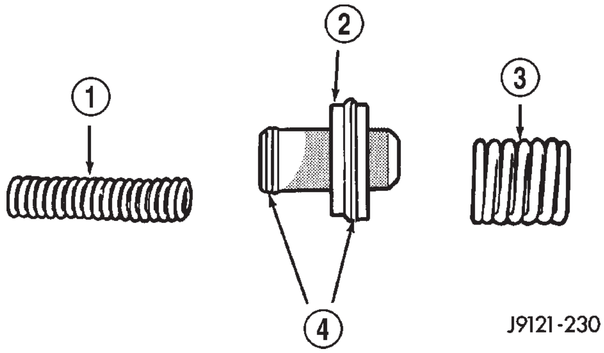


Fig. 302 Accumulator Components

1 – INNER SPRING
2 – ACCUMULATOR PISTON
3 – OUTER SPRING
4 – SEAL RINGS

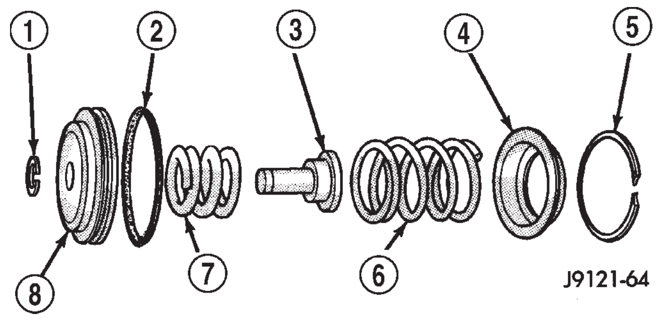


Fig. 303 Rear Servo Components

1 – SNAP RING
2 – PISTON SEAL
3 – PISTON PLUG
4 – SPRING RETAINER
5 – SNAP RING
6 – PISTON SPRING
7 – CUSHION SPRING
8 – PISTON

FRONT SERVO

Clean the servo piston components with solvent and dry them with compressed air. Wipe the band clean with lint free shop towels.

Replace the front band if distorted, lining is burned, flaking off, or worn to the point where the grooves in the lining material are no longer visible.

Inspect the servo components. Replace the springs if collapsed, distorted or broken. Replace the guide, rod and piston if cracked, bent, or worn. Discard the servo snap ring if distorted or warped.

Check the servo piston bore for wear. If the bore is severely scored, or damaged, it will be necessary to replace the case.

Replace any servo component if doubt exists about condition. Do not reuse suspect parts.

REAR SERVO

Remove and discard the servo piston seal ring (Fig. 303). Then clean the servo components with solvent and dry with compressed air. Replace either spring if collapsed, distorted or broken. Replace the plug and piston if cracked, bent, or worn. Discard the servo snap rings and use a new ones at assembly.

OIL PUMP AND REACTION SHAFT SUPPORT

(1) Clean pump and support components with solvent and dry them with compressed air.

(2) Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

(3) Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

(4) Inspect the pump bushing. Then check the reaction shaft support bushing. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

(5) Install the gears in the pump body and measure pump component clearances as follows:

(a) Clearance between outer gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Clearance between inner gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Both clearances can be measured at the same time by:

(I) Installing the pump gears in the pump housing.

(II) Position an appropriate piece of Plastigage™ across both gears.

(III) Align the plastigage to a flat area on the reaction shaft housing.

(IV) Install the reaction shaft to the pump housing.

(V) Separate the reaction shaft housing from the pump housing and measure the Plastigage™ following the instructions supplied with it.

(b) Clearance between inner gear tooth and outer gear should be 0.08 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

(c) Clearance between outer gear and pump housing should also be 0.010 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

CLEANING AND INSPECTION (Continued)

FRONT CLUTCH

Clean and inspect the front clutch components. Replace the clutch discs if warped, worn, scored, burned or charred, or if the facing is flaking off. Replace the steel plates if heavily scored, warped, or broken. Be sure the driving lugs on the plates are in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the clutch spring and spring retainer if either is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The steel plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged.

Check action of the check ball in the retainer (Fig. 304). The ball must move freely and not stick.

NOTE: Inspect the clutch retainer bushings carefully (Fig. 305). The retainer bushings are NOT serviceable. It will be necessary to replace the retainer if either bushing is scored, or worn.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

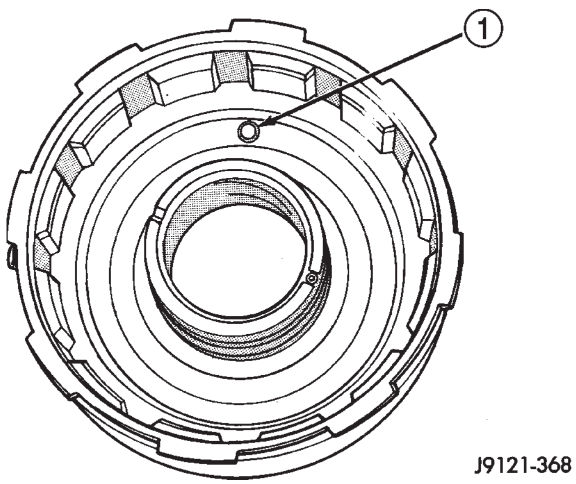


Fig. 304 Front Clutch Piston Retainer Check Ball Location

1 – RETAINER CHECK BALL

REAR CLUTCH

Clean the clutch components with solvent and dry them with compressed air. Do not use rags or shop towels to dry any of the clutch parts. Lint from such materials will adhere to component surfaces and could restrict or block fluid passages after assembly.

Replace the clutch discs if warped, worn, scored, burned/charred, the lugs are damaged, or if the facing is flaking off. Replace the top and bottom pressure plates if scored, warped, or cracked. Be sure the driving lugs on the pressure and clutch plates are

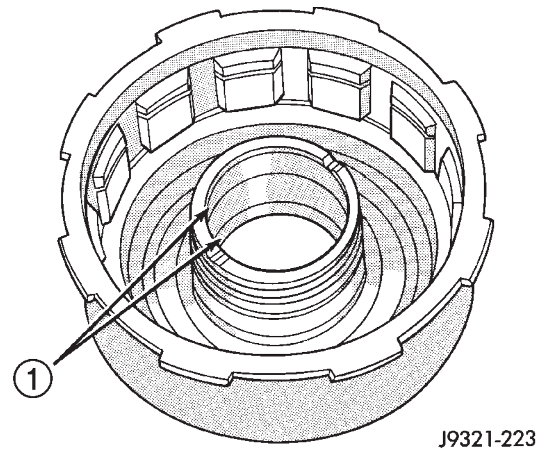


Fig. 305 Retainer Bushing Location/Inspection

1 – FRONT CLUTCH RETAINER BUSHINGS (NON-SERVICEABLE)

also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston spring and wave spring if either part is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The clutch and pressure plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged. Also check action of the check balls in the retainer and piston. Each check ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or doubt exists about bushing condition.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

Check condition of the fiber thrust washer and metal output shaft thrust washer. Replace either washer if worn or damaged.

Check condition of the seal rings on the input shaft and clutch retainer hub. Replace the seal rings only if worn, distorted, or damaged. The input shaft front seal ring is teflon with chamfered ends. The rear ring is metal with interlocking ends.

Check the input shaft for wear, or damage. Replace the shaft if worn, scored or damaged in any way.

PLANETARY GEARTRAIN

Clean the planetary components in solvent and dry them with compressed air.

Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable. Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus

CLEANING AND INSPECTION (Continued)

gears and supports if either component is worn or damaged.

Inspect the geartrain spacers, thrust plates, snap rings, and thrust washers. Replace any of these parts that are worn, distorted or damaged. Do not attempt to reuse these parts.

The planetary gear thrust washers are different sizes. The large diameter washers go on the front planetary and the smaller washers go on the rear planetary. All the washers have four locating tabs on them. These tabs fit in the holes or slots provided in each planetary gear.

Inspect the output shaft carefully. Pay particular attention to the machined bushing/bearing surfaces on the shaft and the governor valve shaft bore at the shaft rear.

Replace the output shaft if the machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location (especially at the governor valve shaft bore).

The annulus gears can be removed from their supports if necessary. Just remove the snap rings and separate the two parts when replacement is necessary. In addition, the annulus gear bushings can be replaced if severely worn, or scored. However it is not necessary to replace the bushings if they only exhibit normal wear. Check bushing fit on the output shaft to be sure.

OVERDRIVE UNIT

Clean the geartrain and case components with solvent. Dry all parts except the bearings with compressed air. Allow bearings to air dry.

Do not use shop towels for wiping parts dry unless the towels are made from a lint-free material. A sufficient quantity of lint (from shop towels, cloths, rags, etc.) could plug the transmission filter and fluid passages.

Discard the old case gasket and seals. Do not attempt to salvage these parts. They are not reusable. Replace any of the overdrive unit snap rings if distorted or damaged.

Minor nicks or scratches on components can be smoothed with crocus cloth. However, do not attempt to reduce severe scoring on any components with abrasive materials. Replace severely scored components; do not try to salvage them.

Check condition of the park lock components and the overdrive case.

Replace the case if cracked, scored, or damaged. Replace the park lock pawl, plug, or spring if worn or damaged. Be sure the bullet at the end of the park lock rod is in good condition. Replace the rod if the bullet is worn or the rod itself is bent or distorted. Do not attempt to straighten the rod.

Check the bushings in the overdrive case. Replace the bushings if severely scored or worn. Also replace the case seal if loose, distorted, or damaged.

Examine the overdrive and direct clutch discs and plates. Replace the discs if the facing is worn, severely scored, or burned and flaking off. Replace the clutch plates if worn, heavily scored, or cracked. Check the lugs on the clutch plates for wear. The plates should slide freely in the drum. Replace the plates or drum if binding occurs.

Check condition of the annulus gear, direct clutch hub, clutch drum and clutch spring. Replace the gear, hub and drum if worn or damaged. Replace the spring if collapsed, distorted, or cracked.

Be sure the splines and lugs on the gear, drum and hub are in good condition. The clutch plates and discs should slide freely in these components.

Inspect the thrust bearings and spring plate. Replace the plate if worn or scored. Replace the bearings if rough, noisy, brinnelled, or worn.

Inspect the planetary gear assembly and the sun gear and bushings. If either the sun gear or the bushings are damaged, replace the gear and bushings as an assembly. The gear and bushings are not serviced separately.

The planetary carrier and pinions must be in good condition. Also be sure the pinion pins are secure and in good condition. Replace the carrier if worn or damaged.

Inspect the overrunning clutch and race. The race surface should be smooth and free of scores. Replace the overrunning clutch assembly or the race if either assembly is worn or damaged in any way.

Inspect the output shaft and governor components. Replace the shaft pilot bushing and inner bushing if damaged. Replace either shaft bearing if rough or noisy. Replace the bearing snap rings if distorted or cracked.

Check the machined surfaces on the output shaft. These surfaces should clean and smooth. Very minor nicks or scratches can be smoothed with crocus cloth. Replace the shaft if worn, scored or damaged in any way.

Inspect the output shaft bushings. The small bushing is the intermediate shaft pilot bushing. The large bushing is the overrunning clutch hub bushing. Replace either bushing if scored, pitted, cracked, or worn.

ADJUSTMENTS

TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT

The transmission throttle valve is operated by a cam on the valve body throttle lever. The throttle

ADJUSTMENTS (Continued)

lever is actuated by a cable connected to the engine throttle body lever (Fig. 306). A retaining clip at the engine-end of the cable is removed to provide for cable adjustment. The retaining clip is then installed back onto the throttle valve cable to lock in the adjustment.

A correctly adjusted throttle valve cable, will cause the throttle lever on the transmission to move simultaneously with the throttle body lever from the idle position. Proper adjustment allows simultaneous movement without causing the transmission throttle lever to move ahead of, or lag behind the throttle body lever.

THROTTLE VALVE CABLE ADJUSTMENT CHECK

(1) Turn ignition key to OFF position.

(2) Remove air cleaner.

(3) Slide cable off attachment stud on throttle body lever (Fig. 306).

(4) Verify that throttle body lever is at curb idle position. Then verify that transmission throttle lever is also at idle (full forward) position.

(5) Compare position of cable end to attachment stud on throttle body lever:

(a) Cable end and attachment stud should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction.

(b) If cable end and attachment stud are misaligned (off center), cable will have to be adjusted as described in following procedure.

(6) Reconnect cable end to attachment stud. Then with aid of a helper, observe movement of transmission throttle lever and lever on throttle body.

(a) If both levers move simultaneously from idle to half-throttle and back to idle position, adjustment is correct.

(b) If transmission throttle lever moves ahead of, or lags behind throttle body lever, cable adjustment will be necessary. Or, if throttle body lever prevents transmission lever from returning to closed position, cable adjustment will be necessary.

THROTTLE VALVE CABLE ADJUSTMENT PROCEDURE

(1) Turn ignition switch to OFF position and shift into Park.

(2) Remove air cleaner.

(3) Disconnect cable end from attachment stud on throttle body. **Carefully slide cable off stud. Do not pull or pry cable off.**

(4) Verify that transmission throttle lever is in idle (full forward) position. Then be sure lever on throttle body is at curb idle position.

(5) Insert a small screwdriver under edge of retaining clip and remove retaining clip.

(6) Center cable end on attachment stud to within 1 mm (0.039 in.).

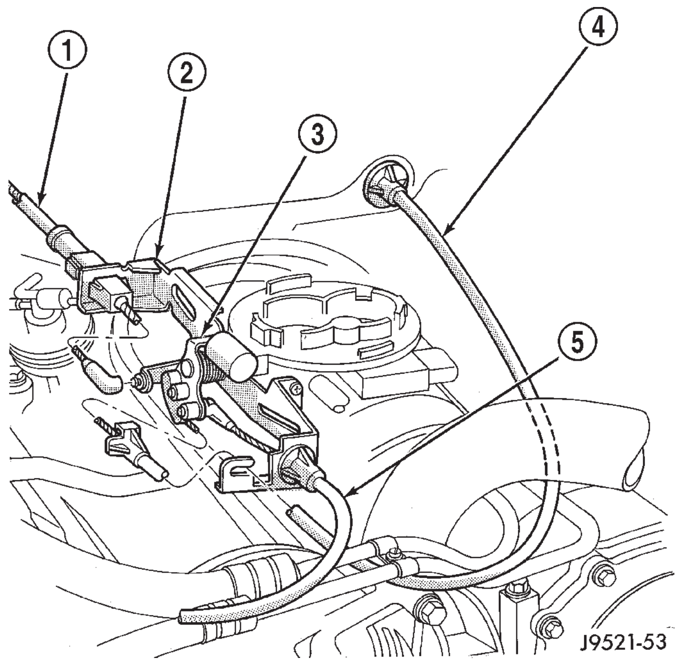


Fig. 306 Throttle Valve Cable Attachment —At Engine

1 – THROTTLE VALVE CABLE
2 – CABLE BRACKET
3 – THROTTLE BODY LEVER
4 – ACCELERATOR CABLE
5 – SPEED CONTROL CABLE

NOTE: Be sure that as the cable is pulled forward and centered on the throttle lever stud, the cable housing moves smoothly with the cable. Due to the angle at which the cable housing enters the spring housing, the cable housing may bind slightly and create an incorrect adjustment.

(7) Install retaining clip onto cable housing.

(8) Check cable adjustment. Be sure transmission throttle lever and lever on throttle body move simultaneously and as described in cable adjustment checking procedure.

GEARSHIFT CABLE

Check adjustment by starting the engine in Park and Neutral. Adjustment is OK if the engine starts only in these positions. Adjustment is incorrect if the engine starts in one but not both positions. If the engine starts in any position other than Park or Neutral, or if the engine will not start at all, the park/neutral position switch may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into Park.

(2) Release cable adjuster lock (underneath the power brake booster) (Fig. 307) to unlock cable.

(3) Raise vehicle.

ADJUSTMENTS (Continued)

(4) Slide cable eyelet off transmission shift lever.

(5) Verify transmission shift lever is in Park detent by moving lever fully rearward. Last rearward detent is Park position.

(6) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(7) Slide cable eyelet onto transmission shift lever.

(8) Lower vehicle and check engine starting. Engine should start only in Park and Neutral.

(9) Lock shift cable by pressing cable adjuster clamp down until it snaps into place.

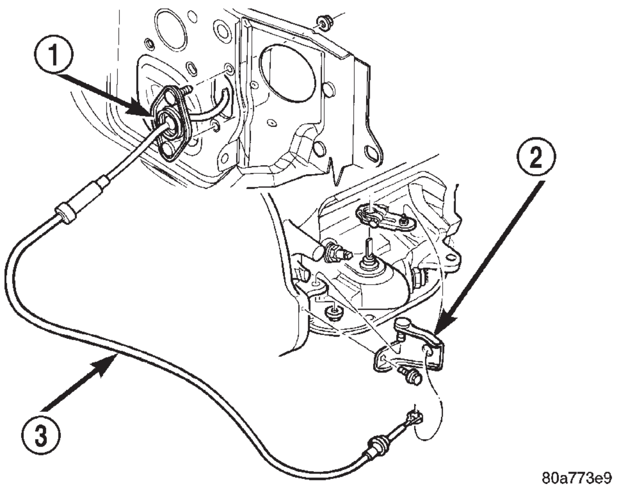


Fig. 307 Gearshift Cable Routing

1 – CABLE MOUNTING
2 – CABLE BRACKET AT TRANS.
3 – GEARSHIFT CABLE

BAND ADJUSTMENTS

FRONT BAND ADJUSTMENT

The front (kickdown) band adjusting screw is located on the left side of the transmission case above the manual valve and throttle valve levers.

(1) Raise vehicle.

(2) Loosen band adjusting screw locknut (Fig. 308). Then back locknut off 3-5 turns. Be sure adjusting screw turns freely in case. Apply lubricant to screw threads if necessary.

(3) Tighten band adjusting screw to 8 N·m (72 in. lbs.) torque with Inch Pound Torque Wrench C-3380-A, a 3-in. extension and appropriate Torx™ socket.

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw, tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

(4) Back off front band adjusting screw 3 turns.

(5) Hold adjuster screw in position and tighten locknut to 41 N·m (30 ft. lbs.) torque.

(6) Lower vehicle.

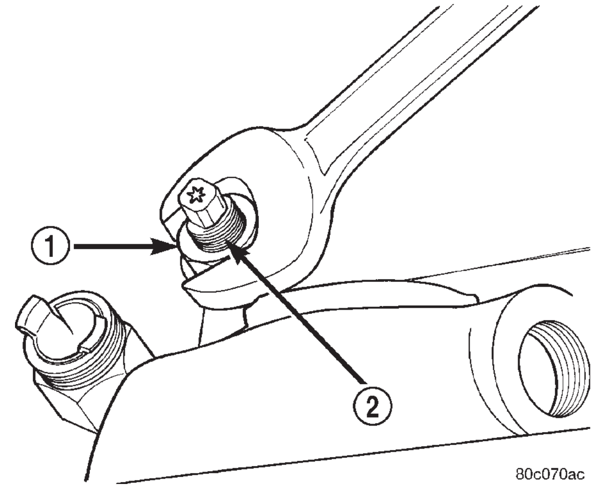


Fig. 308 Front Band Adjustment Screw Location

1 – LOCK-NUT
2 – FRONT BAND ADJUSTER

REAR BAND ADJUSTMENT

The transmission oil pan must be removed for access to the rear band adjusting screw.

(1) Raise vehicle.

(2) Remove transmission oil pan and drain fluid.

(3) Loosen band adjusting screw locknut 5-6 turns (Fig. 309). Be sure adjusting screw turns freely in lever.

(4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque.

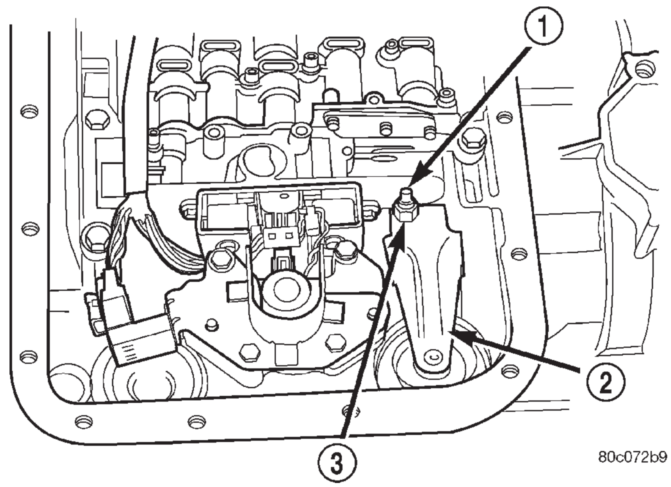


Fig. 309 Rear Band Adjusting Screw Location

1 – ADJUSTING SCREW
2 – REAR BAND LEVER
3 – LOCKNUT

(5) Back off adjusting screw 4 turns.

(6) Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.

ADJUSTMENTS (Continued)

(7) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(8) Lower vehicle and refill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

VALVE BODY

CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body;

- Line Pressure
- Throttle Pressure

Line and throttle pressures are interdependent because each affects shift quality and timing. As a result, both adjustments must be performed properly and in the correct sequence. Adjust line pressure first and throttle pressure last.

LINE PRESSURE ADJUSTMENT

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 310).

Distance should be 33.4 mm (1-5/16 in.).

If adjustment is required, turn the adjusting screw in, or out, to obtain required distance setting.

NOTE: The 33.4 mm (1-5/16 in.) setting is an approximate setting. Manufacturing tolerances may make it necessary to vary from this dimension to obtain desired pressure.

One complete turn of the adjusting screw changes line pressure approximately 1-2/3 psi (9 kPa).

Turning the adjusting screw counterclockwise increases pressure while turning the screw clockwise decreases pressure.

THROTTLE PRESSURE ADJUSTMENT

Insert Gauge Tool C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 311).

Push the gauge tool inward to compress the kickdown valve against the spring and bottom the throttle valve.

Maintain pressure against kickdown valve spring. Turn throttle lever stop screw until the screw head touches throttle lever tang and the throttle lever cam touches gauge tool.

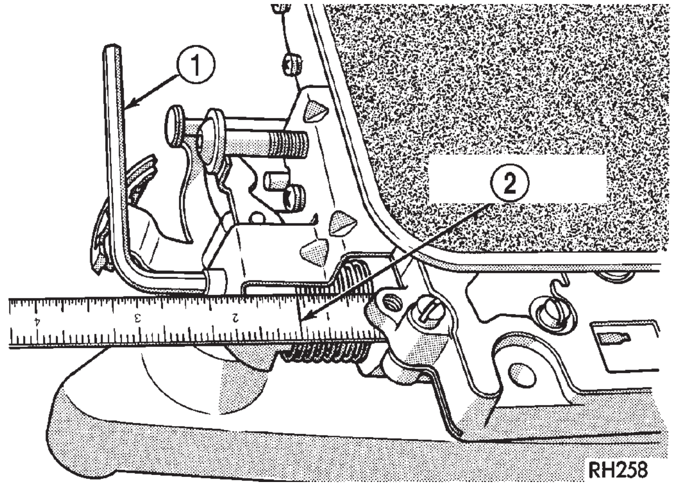


Fig. 310 Line Pressure Adjustment

1 – WRENCH
2 – 1–5/16 INCH

NOTE: The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.

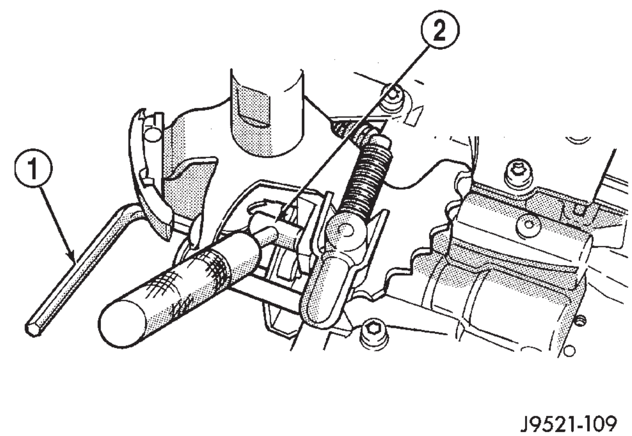


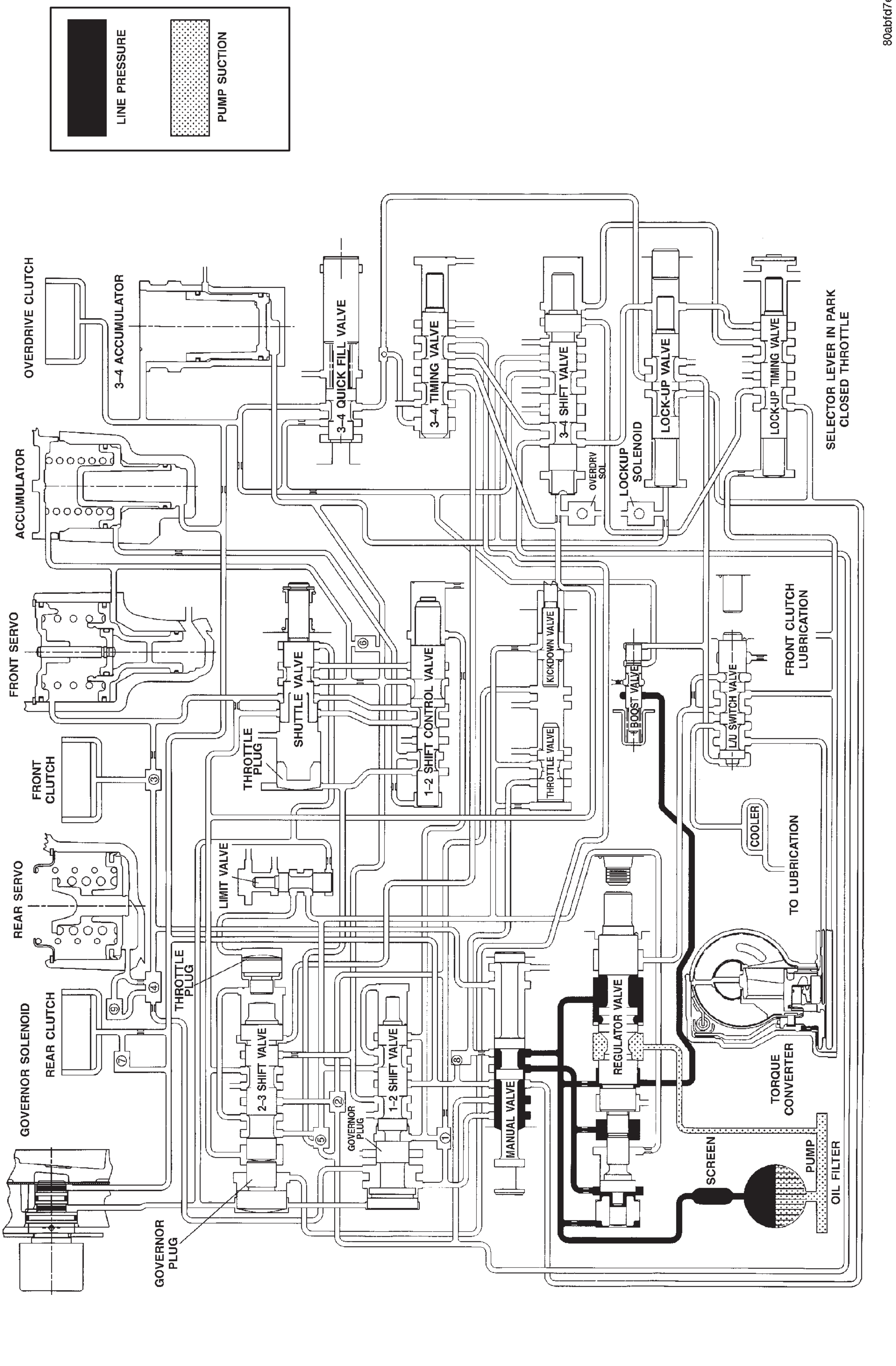
Fig. 311 Throttle Pressure Adjustment

1 – HEX WRENCH (IN THROTTLE LEVER ADJUSTING SCREW)
2 – SPECIAL TOOL C-3763 (POSITIONED BETWEEN THROTTLE LEVER AND KICKDOWN VALVE)

SCHEMATICS AND DIAGRAMS

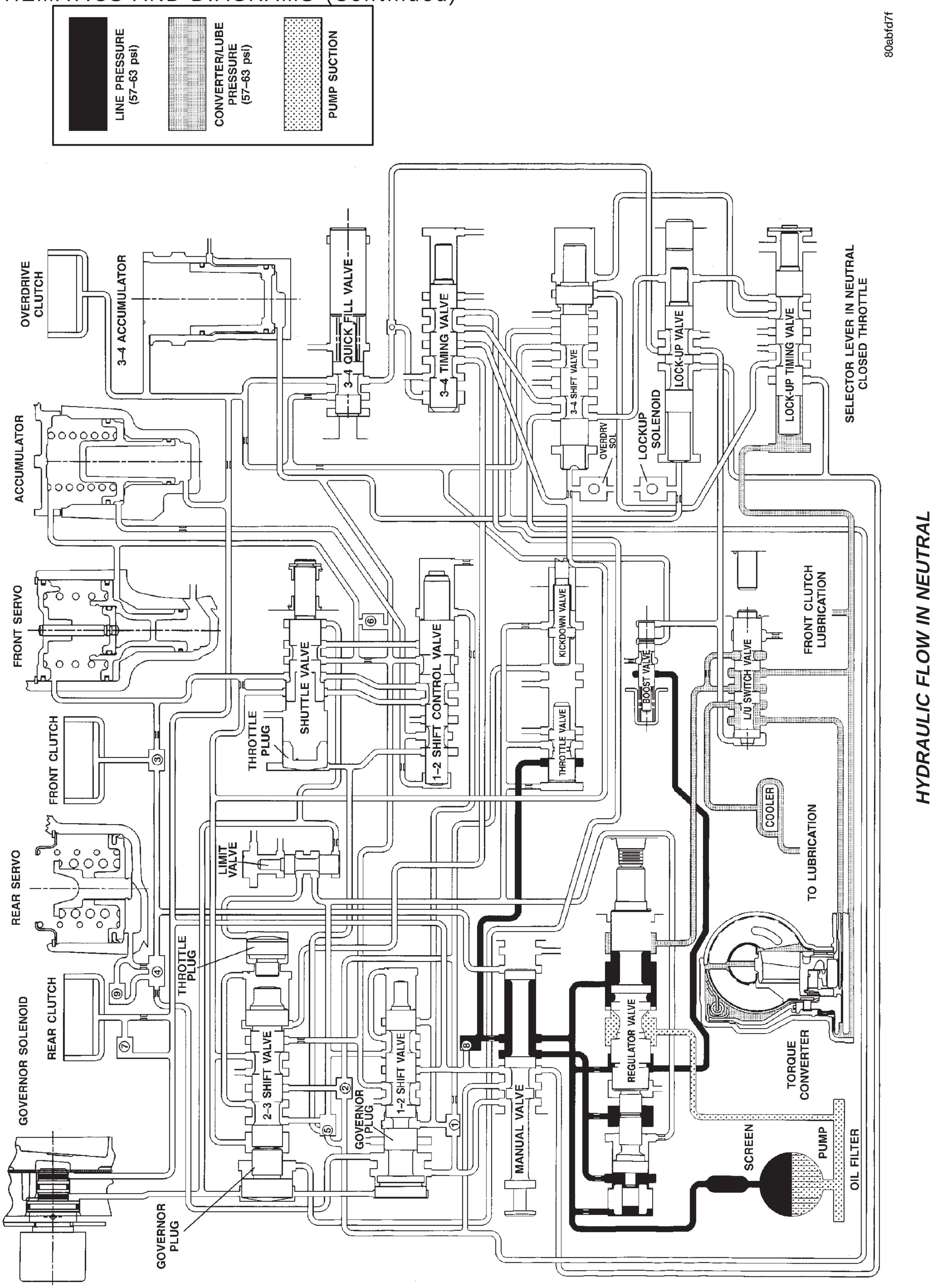
HYDRAULIC SCHEMATICS

SCHEMATICS AND DIAGRAMS (Continued)

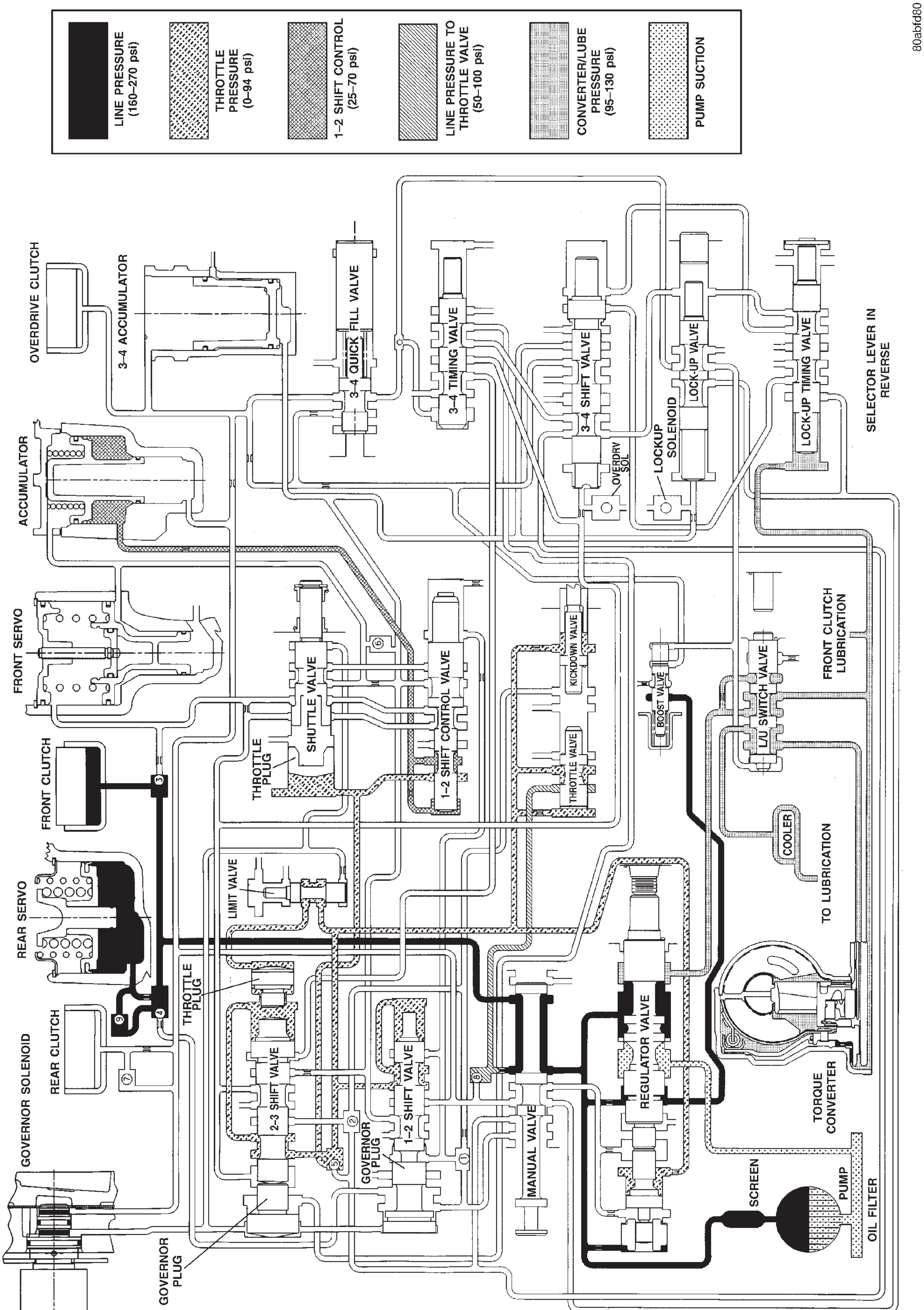


HYDRAULIC FLOW IN PARK

SCHEMATICS AND DIAGRAMS (Continued)

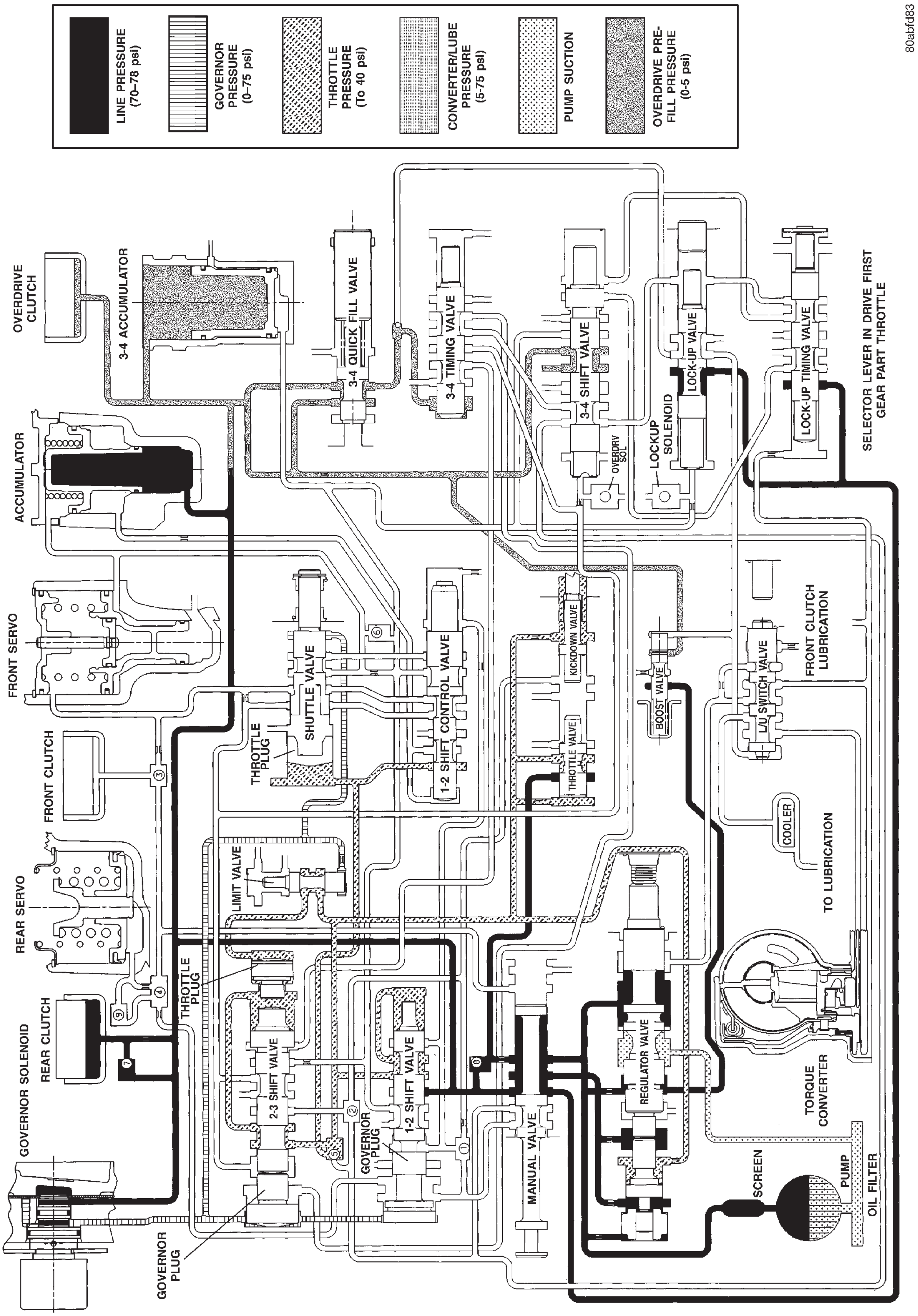


SCHEMATICS AND DIAGRAMS (Continued)



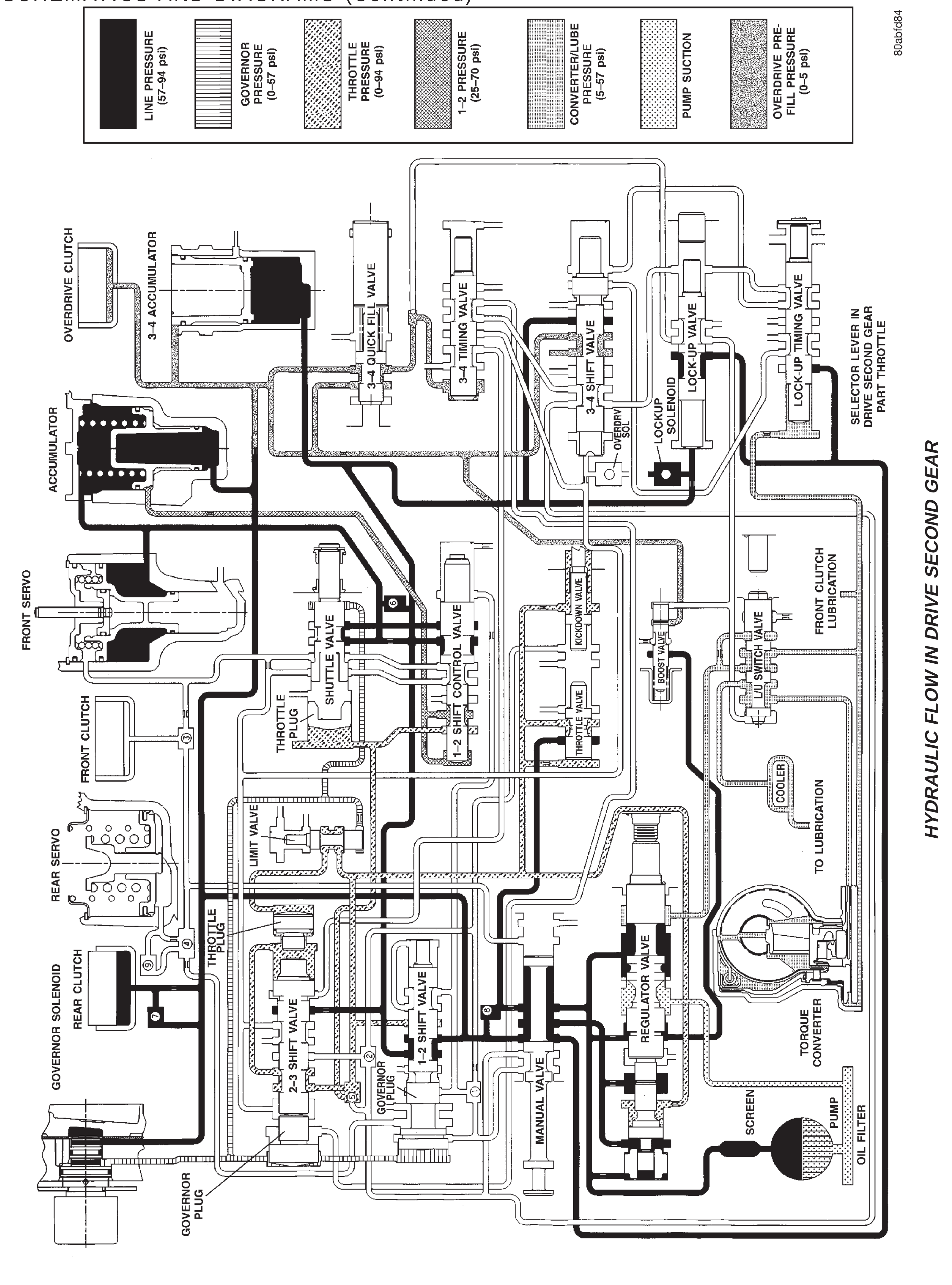
HYDRAULIC FLOW IN REVERSE

SCHEMATICS AND DIAGRAMS (Continued)



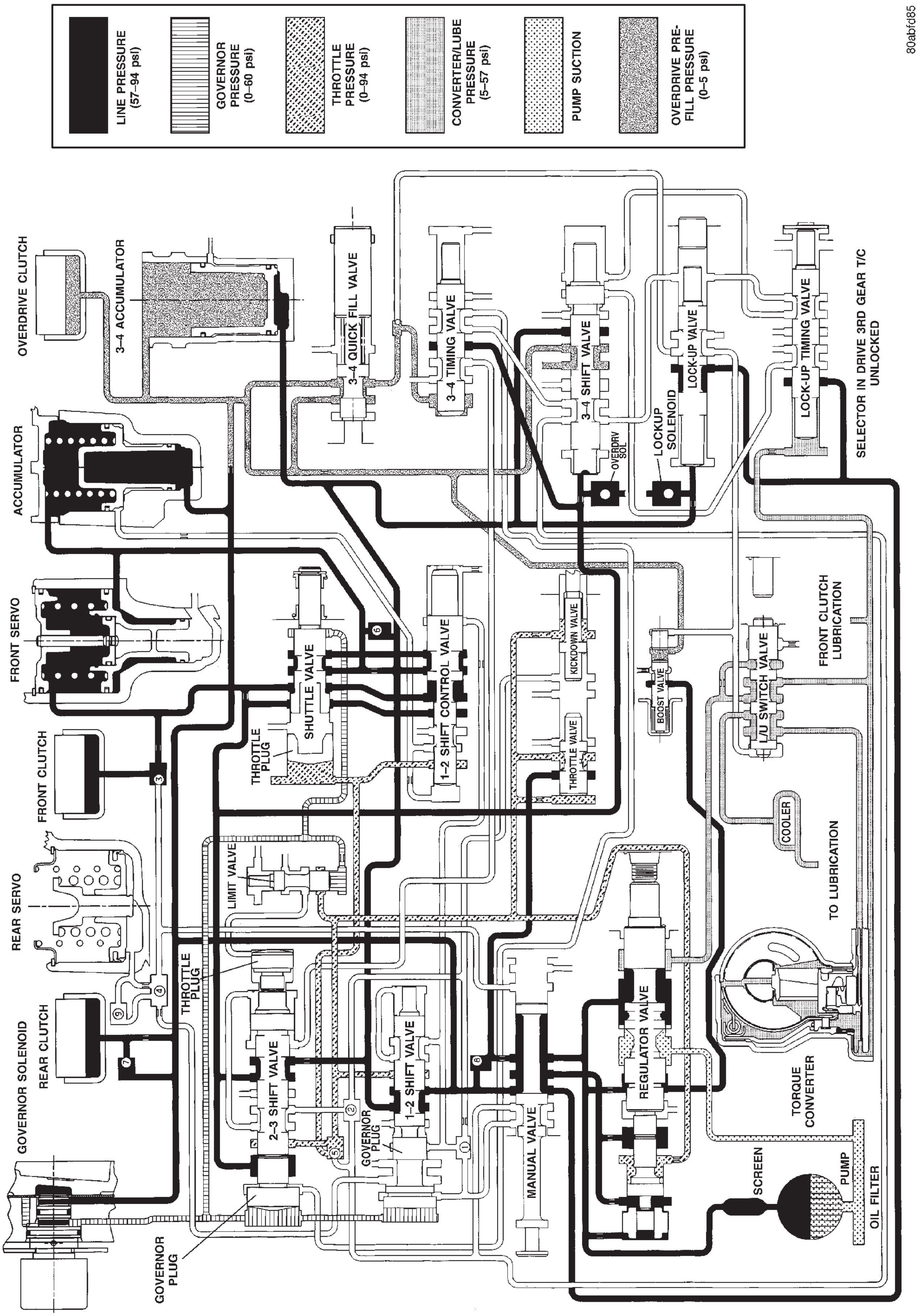
HYDRAULIC FLOW IN DRIVE FIRST GEAR

SCHEMATICS AND DIAGRAMS (Continued)



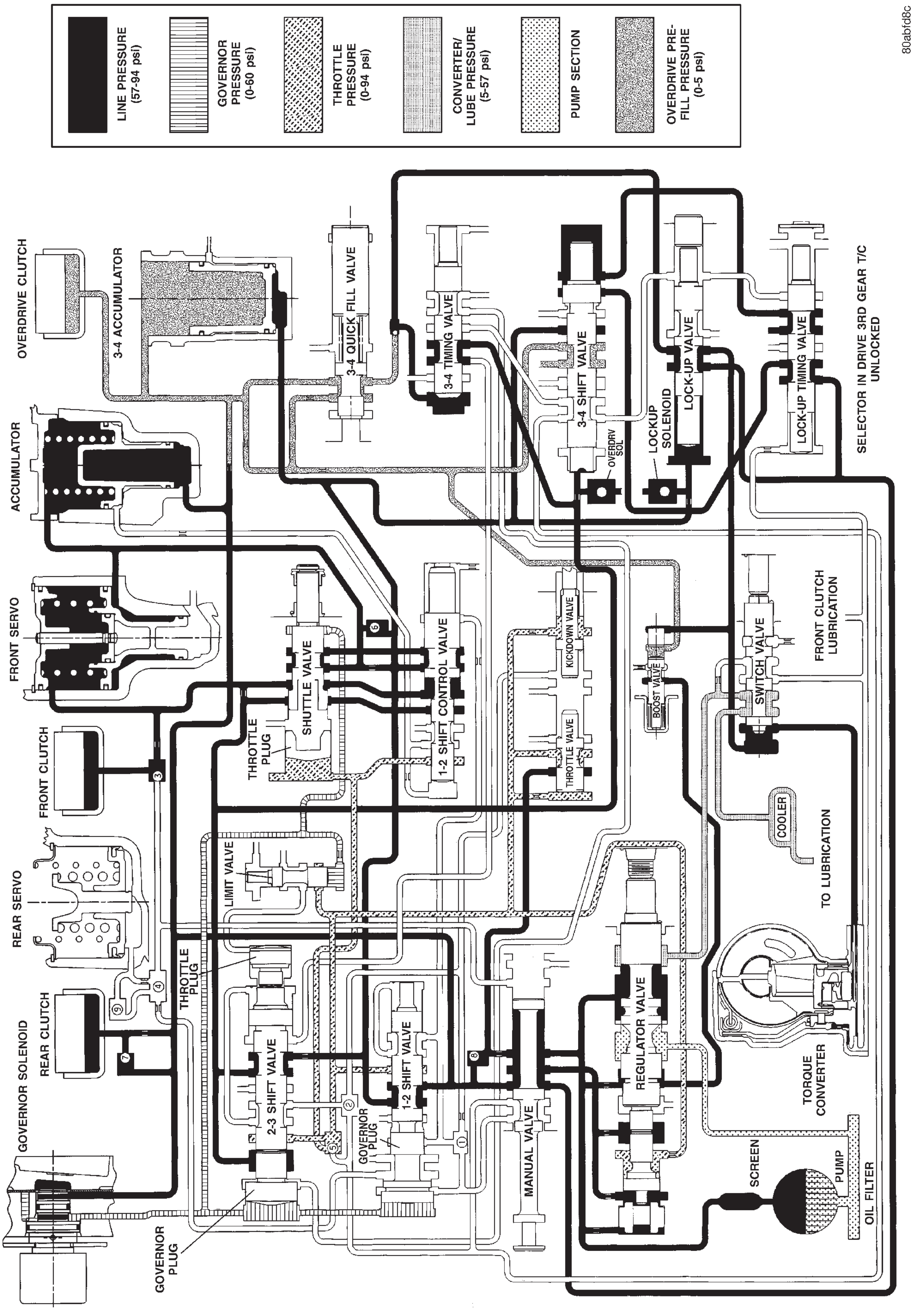
HYDRAULIC FLOW IN DRIVE SECOND GEAR

SCHEMATICS AND DIAGRAMS (Continued)



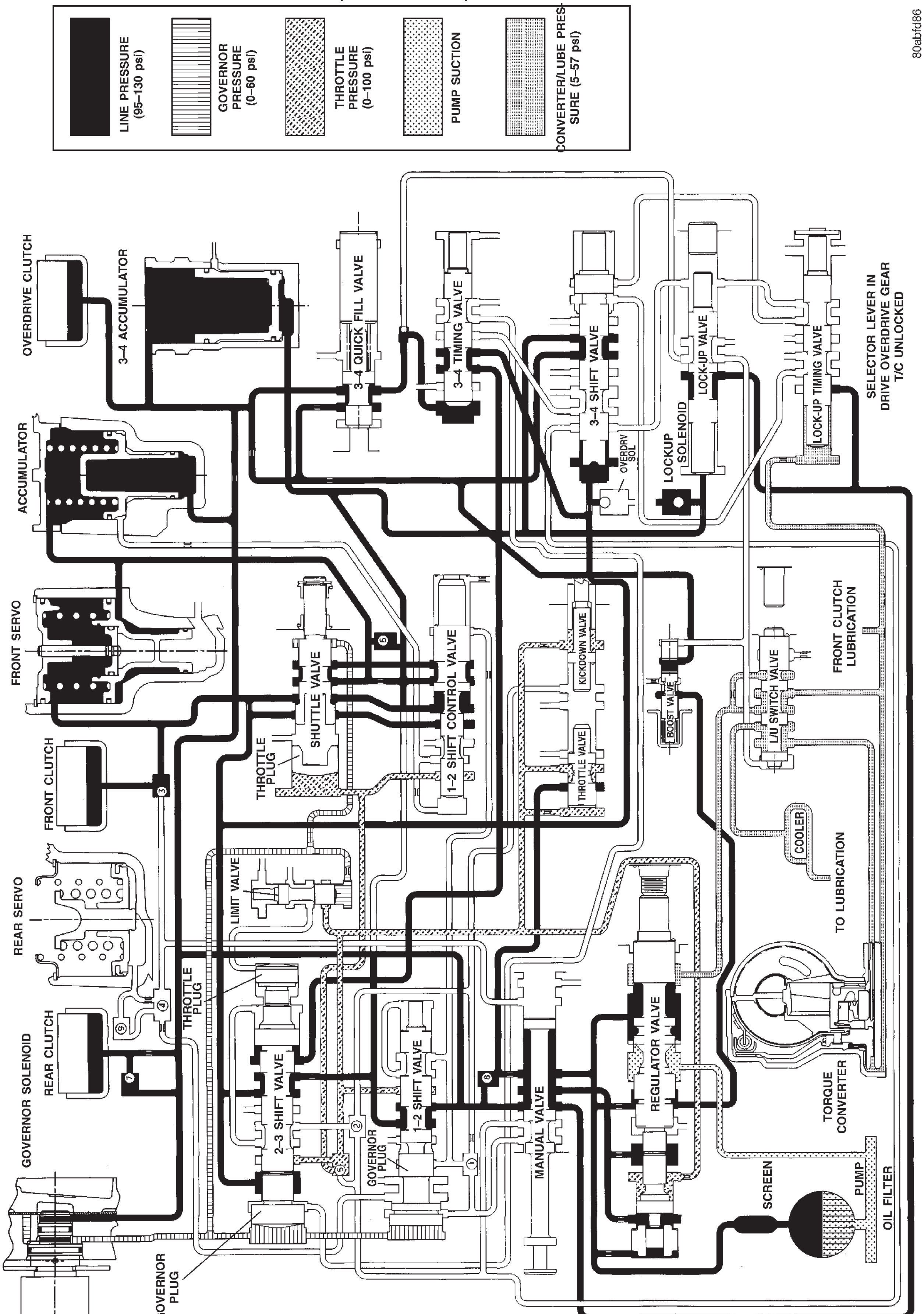
HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH NOT APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



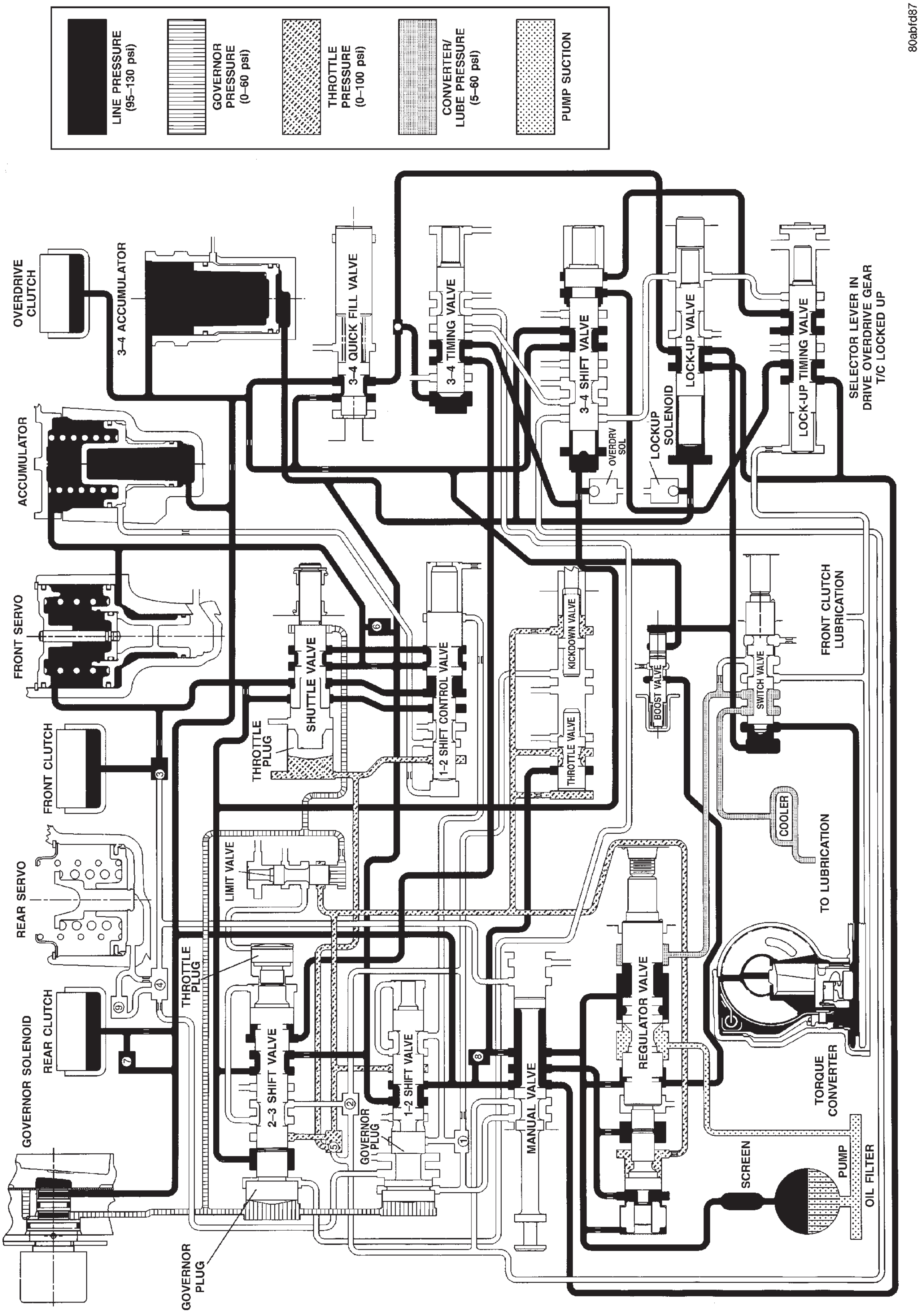
HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



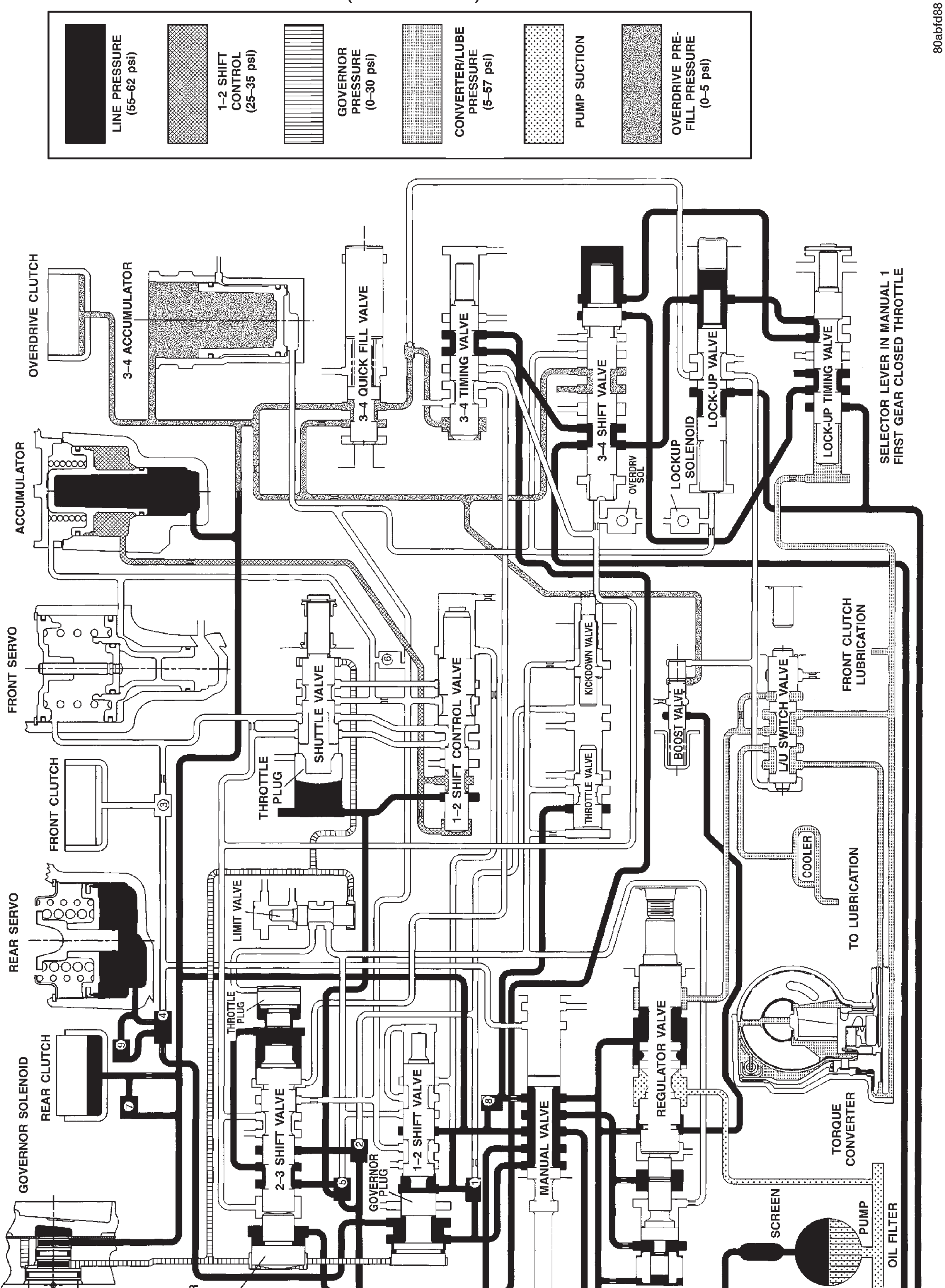
HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH NOT APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



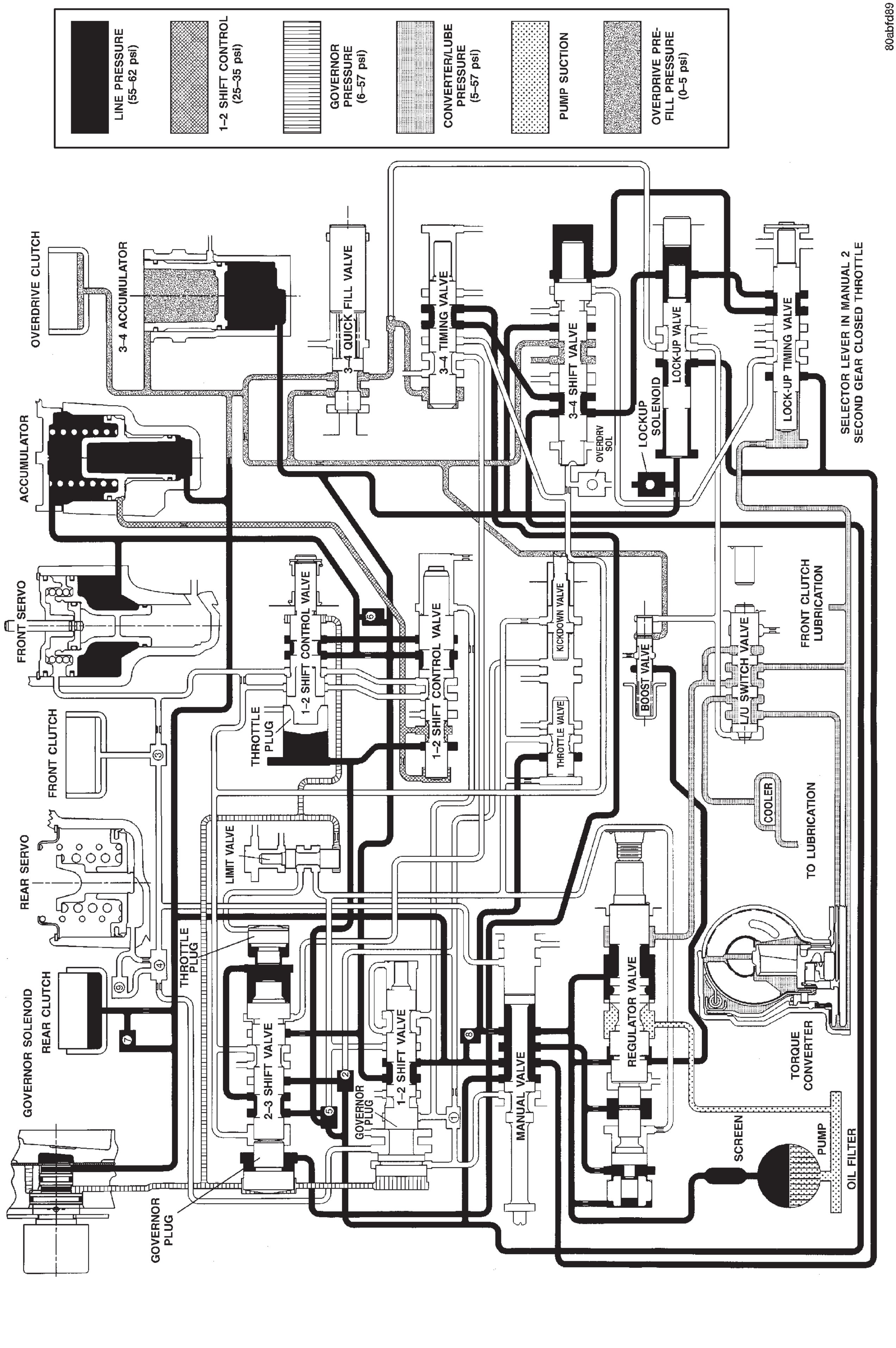
HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



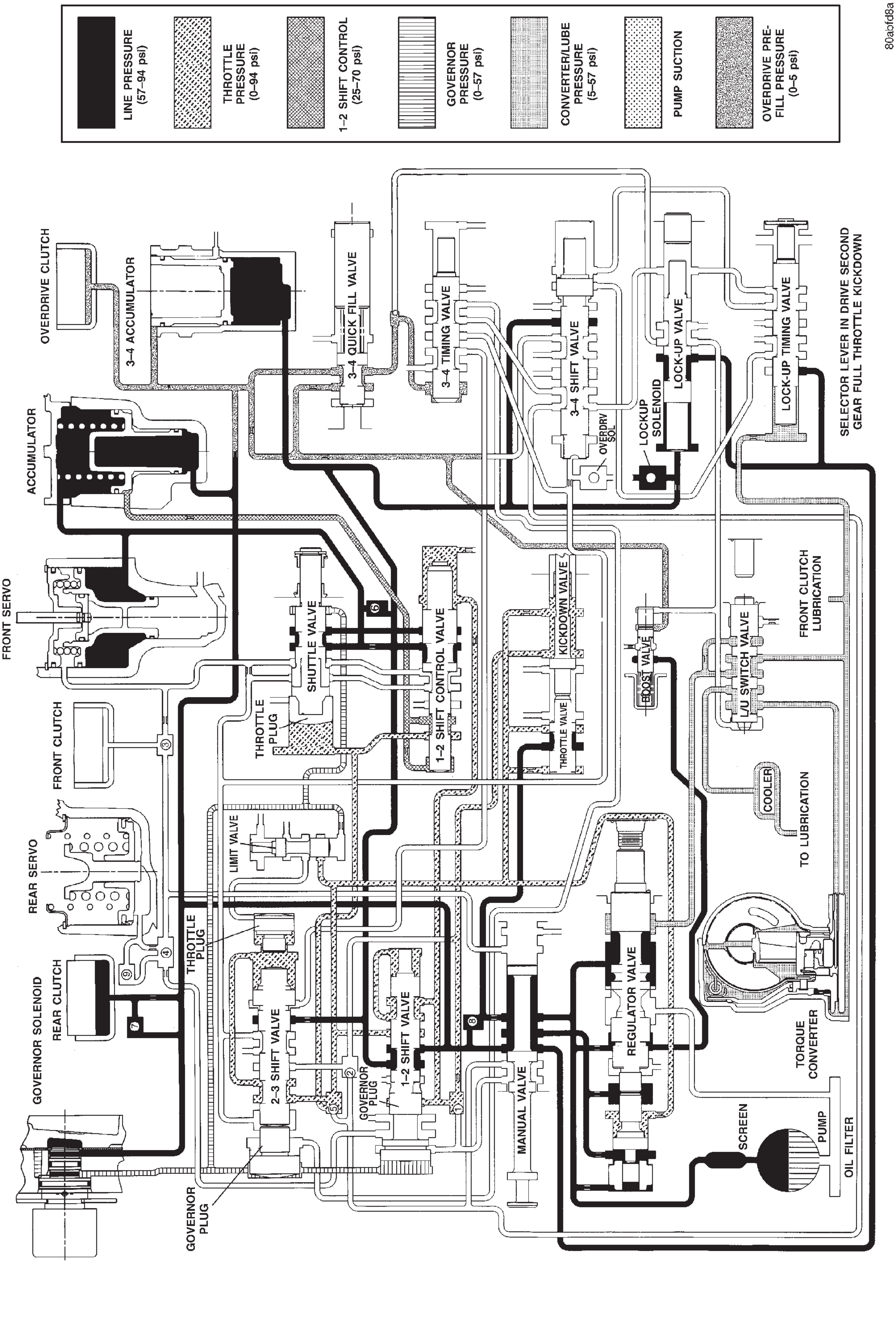
HYDRAULIC FLOW IN MANUAL LOW (1)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW IN MANUAL SECOND (2)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW DURING FULL THROTTLE 3–2 DOWNSHIFT (PASSING GEAR)

SPECIFICATIONS

TRANSMISSION

GENERAL

Component	Metric	Inch
Planetary end play	0.127-1.22 mm	0.005-0.048 in.
Input shaft end play	0.56-2.31 mm	0.022-0.091 in.
Clutch pack clearance/ Front.	1.70-3.40mm	0.067-0.134 in.
Clutch pack clearance/ Rear.	0.559-0.914 mm	0.022-0.036 in.
Front clutch	4 discs	
Rear clutch	4 discs	
Overdrive clutch	3 discs	
Direct clutch	6 discs	
42RE Band adjustment from 72 in. lbs.		
Front band	Back off 3 turns	
Rear band	Back off 4 turns	
Recommended fluid	Mopar® ATF Plus 3,type 7176	

GEAR RATIOS

- 1ST GEAR-2.74
- 2ND GEAR-1.54
- 3RD GEAR-1.00
- 4TH GEAR-0.69
- REV.GEAR-2.21

TORQUE

DESCRIPTION	TORQUE
Fitting, cooler line at trans	18 N·m (13 ft. lbs.)
Bolt, torque convertor	31 N·m (23 ft. lbs.)
Bolt/nut, crossmember	68 N·m (50 ft. lbs.)
Bolt, driveplate to crankshaft	75 N·m (55 ft. lbs.)
Plug, front band reaction	17 N·m (13 ft. lbs.)
Locknut, front band adj.	34 N·m (25 ft. lbs.)
Switch, park/neutral	34 N·m (25 ft. lbs.)
Bolt, fluid pan	17 N·m (13 ft. lbs.)
Screws, fluid filter	4 N·m (35 in. lbs.)
Bolt, oil pump	20 N·m (15 ft. lbs.)
Bolt, overrunning clutch cam	17 N·m (13 ft. lbs.)
Bolt, O/D to trans.	34 N·m (25 ft. lbs.)
Bolt, O/D piston retainer	17 N·m (13 ft. lbs.)
Plug, pressure test port	14 N·m (10 ft. lbs.)
Bolt, reaction shaft support	20 N·m (15 ft. lbs.)
Locknut, rear band	41 N·m (30 ft. lbs.)
Bolt. speedometer adapter	11 N·m (8 ft. lbs.)
Bolt, valve body to case	12 N·m (100 in. lbs.)
Sensor, trans speed	27 N·m (20 ft. lbs.)
Screw, solenoid wiring connector	4 N·m (35 in. lbs.)
Screw, solenoid to transfer plate	4 N·m (35 in. lbs.)

SPECIFICATIONS (Continued)

THRUST WASHER/SPACER/SNAP RING DIMENSIONS

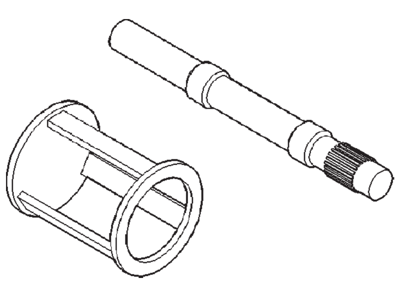
Component	Metric	Inch
Front clutch thrust washer (reaction shaft support hub)	1.55 mm	0.061 in.
Rear clutch thrust washer (clutch retainer)	1.55 mm	0.061 in.
Intermediate shaft thrust plate (shaft hub pilot)	1.5-1.6 mm	0.060-0.063 in.
Output shaft thrust washer (rear clutch hub)	Select fit to set end play	
Rear clutch pack snap ring	1.5 mm 1.95 mm 2.45 mm	0.060 in. 0.076 in. 0.098 in.
Planetary geartrain snap ring (at front of output shaft)	Select fit (three thicknesses avalible)	
Overdrive piston thrust plate	Thrust plate and spacer are select fit. Refer to size charts and selection procedures in Overdrive Unit D&A procedures	
Intermiediate shaft spacer		

PRESSURE TEST

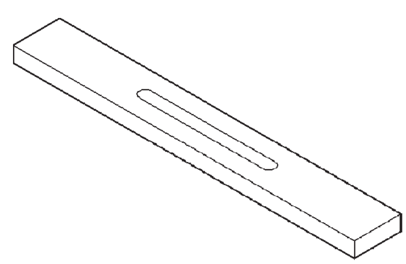
Overdrive clutch	Fourth gear only	Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-896 kPa (90-130 psi) at 1/2 to 3/4 throttle.
Line pressure (at accumulator)	Closed throttle	372-414 kPa (54-60 psi).
Front servo	Third gear only	No more than 21 kPa (3 psi) lower than line pressure.
Rear servo	1 range R range	No more than 21 kPa (3 psi) lower than line pressure. 1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 rpm.
Governor	D range closed throttle	Pressure should respond smoothly to changes in mph and return to 0-7 kPa (0-1.5 psi) when stopped with transmission in D, 1, 2. Pressure above 7 kPa (1.5 psi) at stand still will prevent transmission from downshifting.

SPECIAL TOOLS

RE TRANSMISSIONS

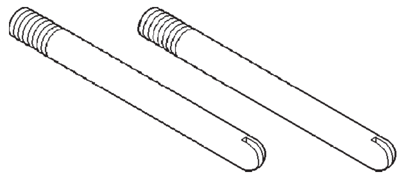


Spring Compressor and Alignment Shaft—6227

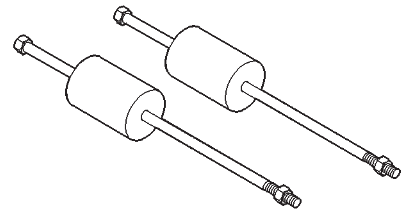


Gauge Bar—6311

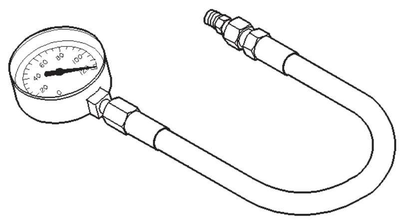
SPECIAL TOOLS (Continued)



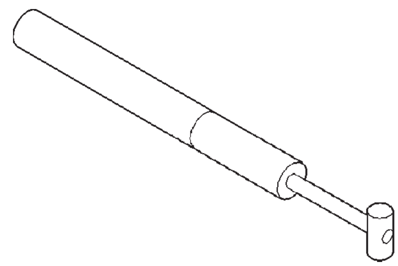
Extension Housing Pilot—C-3288-B



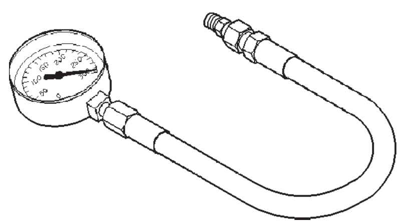
Puller, Slide Hammer—C-3752



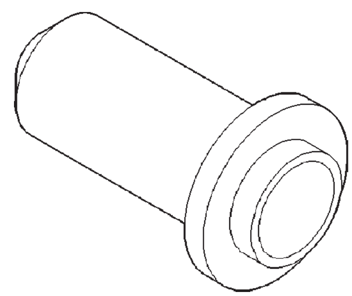
Pressure Gauge—C-3292



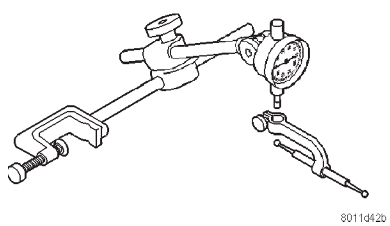
Gauge, Throttle Setting—C-3763



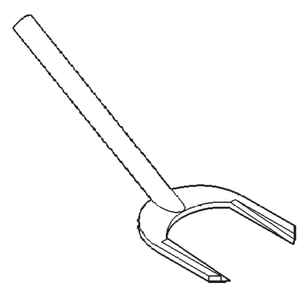
Pressure Gauge—C-3293SP



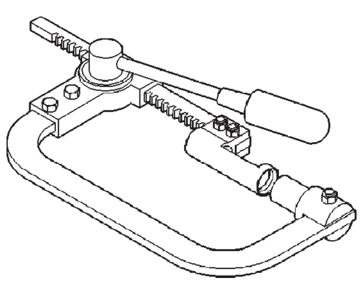
Seal Installer—C-3860–A



Dial Indicator—C-3339

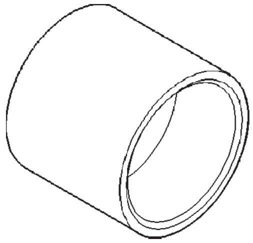


Seal Remover—C-3985-B

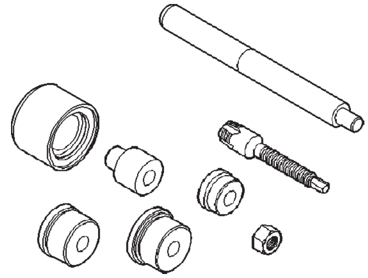


Spring Compressor—C-3422-B

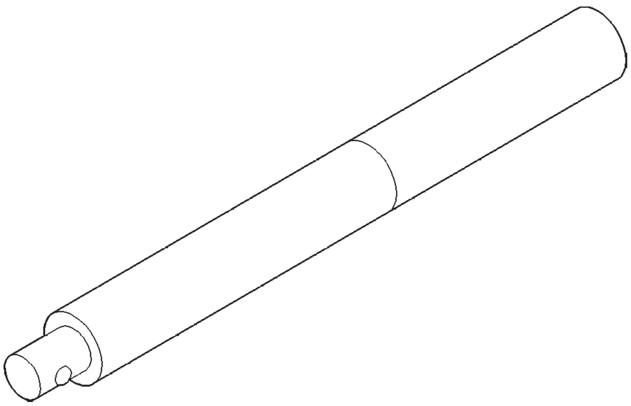
SPECIAL TOOLS (Continued)



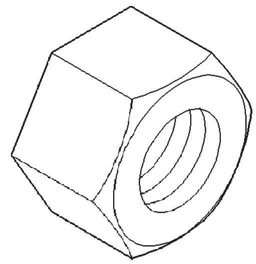
Installer—C-3995-A



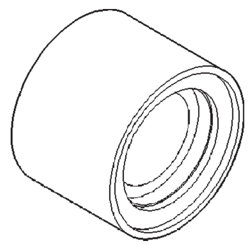
Bushing Remover/Installer Set—C-3887-J



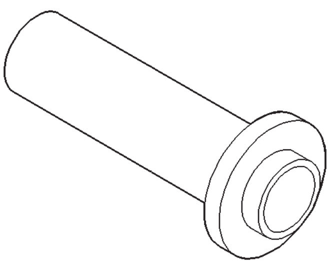
Universal Handle—C-4171



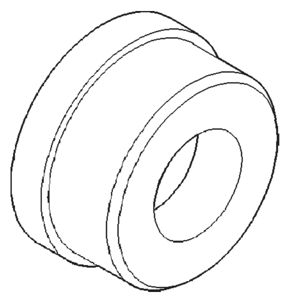
Nut, Bushing Remover—SP-1191, From kit C-3887-J



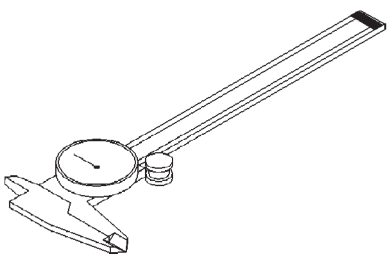
Cup, Bushing Remover—SP-3633, From kit C-3887-J



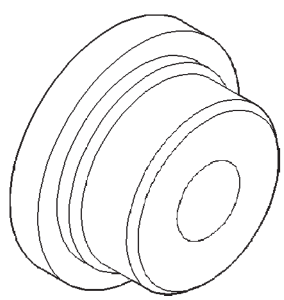
Seal Installer—C-4193-A



Remover, Bushing—SP-3551

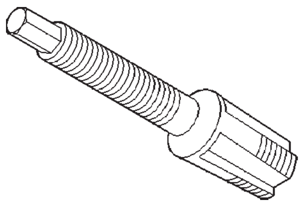


Dial Caliper—C-4962

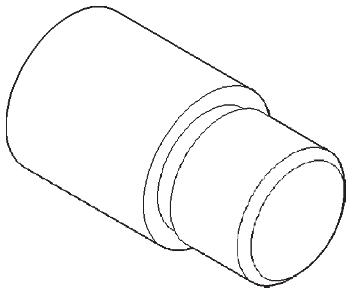


Installer, Bushing—SP-5117

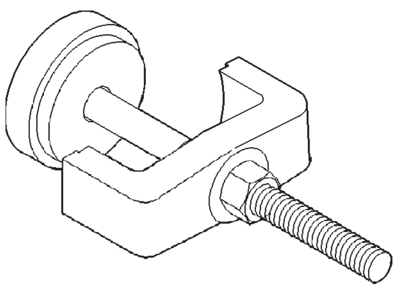
SPECIAL TOOLS (Continued)



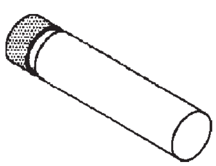
Remover, Bushing—SP-5324



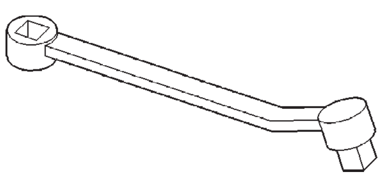
Installer, Bushing—SP-5325



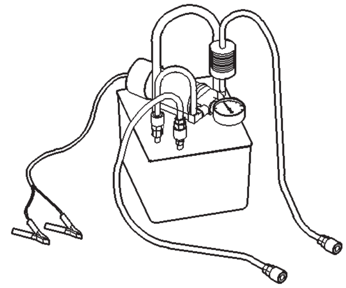
Compressor, Spring—C-3575-A



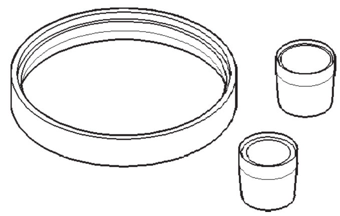
Gauge—6312



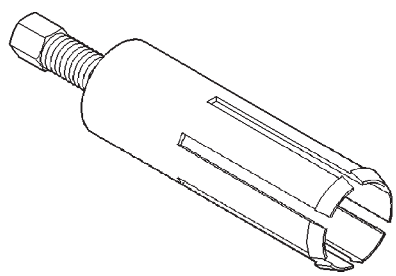
Adapter—C-3705



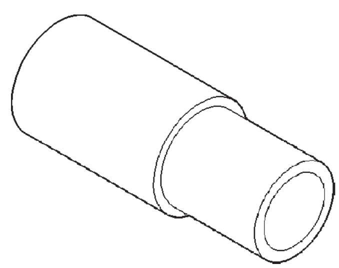
Flusher—6906



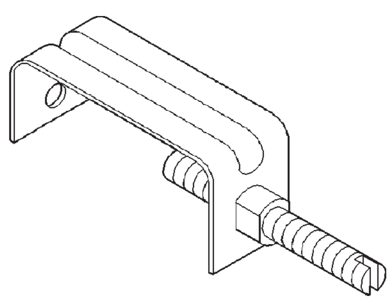
Installer—8114



Remover—6957



Installer—6951



Retainer—6583

46RE AUTOMATIC TRANSMISSION

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
46RE TRANSMISSION	248
FLUID	255
TORQUE CONVERTER	256
OIL PUMP	261
VALVE BODY	261
ACCUMULATOR	278
PISTONS	280
FRONT CLUTCH	281
REAR CLUTCH	282
OVERDRIVE CLUTCH	284
OVERRUNNING CLUTCH	284
PLANETARY GEARSET	285
BANDS	285
SERVOS	286
GEARSHIFT MECHANISM	287
CONVERTER DRAINBACK VALVE	287
POWERTRAIN CONTROL MODULE (PCM)	287
ELECTRONIC GOVERNOR	288
GOVERNOR PRESSURE CURVES	290
OVERDRIVE OFF SWITCH	291
DIAGNOSIS AND TESTING	
AUTOMATIC TRANSMISSION DIAGNOSIS	291
EFFECTS OF INCORRECT FLUID LEVEL	291
CAUSES OF BURNT FLUID	291
FLUID CONTAMINATION	291
PRELIMINARY DIAGNOSIS	292
PARK/NEUTRAL POSITION SWITCH	292
OVERDRIVE ELECTRICAL CONTROLS	292
GEARSHIFT CABLE	292
ROAD TESTING	293
ANALYZING ROAD TEST	293
HYDRAULIC PRESSURE TEST	294
AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION	296
CONVERTER HOUSING FLUID LEAK DIAGNOSIS	297
DIAGNOSIS TABLES AND CHARTS—RE TRANSMISSION	298
SERVICE PROCEDURES	
FLUID LEVEL CHECK	309
FLUID AND FILTER REPLACEMENT	309
TRANSMISSION FILL PROCEDURE	310
CONVERTER DRAINBACK CHECK VALVE SERVICE	310
OIL PUMP VOLUME CHECK	311
FLUSHING COOLERS AND TUBES	311
ALUMINUM THREAD REPAIR	312
REMOVAL AND INSTALLATION	
TRANSMISSION	312
TORQUE CONVERTER	314
YOKE SEAL REPLACEMENT	315
PARK/NEUTRAL POSITION SWITCH	315
GEARSHIFT CABLE	316
GOVERNOR SOLENOID AND PRESSURE SENSOR	317
VALVE BODY	317
OVERDRIVE UNIT	319
OVERDRIVE HOUSING BUSHING	321
OUTPUT SHAFT REAR BEARING	321
OUTPUT SHAFT FRONT BEARING	322
DISASSEMBLY AND ASSEMBLY	
VALVE BODY	322
TRANSMISSION	341
OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER	355
FRONT SERVO PISTON	357
REAR SERVO PISTON	358
OIL PUMP AND REACTION SHAFT SUPPORT	358
FRONT CLUTCH	362
REAR CLUTCH	364
PLANETARY GEARTRAIN/OUTPUT SHAFT	368
OVERDRIVE UNIT	372
CLEANING AND INSPECTION	
VALVE BODY	388
TRANSMISSION	391
OVERRUNNING CLUTCH/LOW-REVERSE DRUM/OVERDRIVE PISTON RETAINER	391
ACCUMULATOR	392
FRONT SERVO	392
REAR SERVO	392
OIL PUMP AND REACTION SHAFT SUPPORT	392
FRONT CLUTCH	393
REAR CLUTCH	393
PLANETARY GEARTRAIN/OUTPUT SHAFT	393
OVERDRIVE UNIT	394
ADJUSTMENTS	
TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT	394
GEARSHIFT CABLE	395
FRONT BAND ADJUSTMENT	396
REAR BAND ADJUSTMENT	396
VALVE BODY	396
SCHEMATICS AND DIAGRAMS	
HYDRAULIC SCHEMATICS	397
SPECIFICATIONS	
RE TRANSMISSION	410
SPECIAL TOOLS	
RE TRANSMISSION	412

DESCRIPTION AND OPERATION

46RE TRANSMISSION

DESCRIPTION

The 46RE (Fig. 1) is a four speed fully automatic transmissions with an electronic governor. The 46RE is equipped with a lock-up clutch in the torque converter. First through third gear ranges are provided by the clutches, bands, overrunning clutch, and planetary gear sets in the transmission. Fourth gear range is provided by the overdrive unit that contains an overdrive clutch, direct clutch, planetary gear set, and overrunning clutch.

The transmission contains a front, rear, and direct clutch which function as the input driving components. They also contain the kickdown (front) and the low/reverse (rear) bands which, along with the overrunning clutch and overdrive clutch, serve as the holding components. The driving and holding components combine to select the necessary planetary gear components, in the front, rear, or overdrive planetary gear set, transfer the engine power from the input shaft through to the output shaft.

The valve body is mounted to the lower side of the transmission and contains the valves to control pressure regulation, fluid flow control, and clutch/band application. The oil pump is mounted at the front of the transmission and is driven by the torque converter hub. The pump supplies the oil pressure necessary for clutch/band actuation and transmission lubrication.

The 46RE transmission is cooled by an integral fluid cooler inside the radiator.

DESCRIPTION AND OPERATION (Continued)

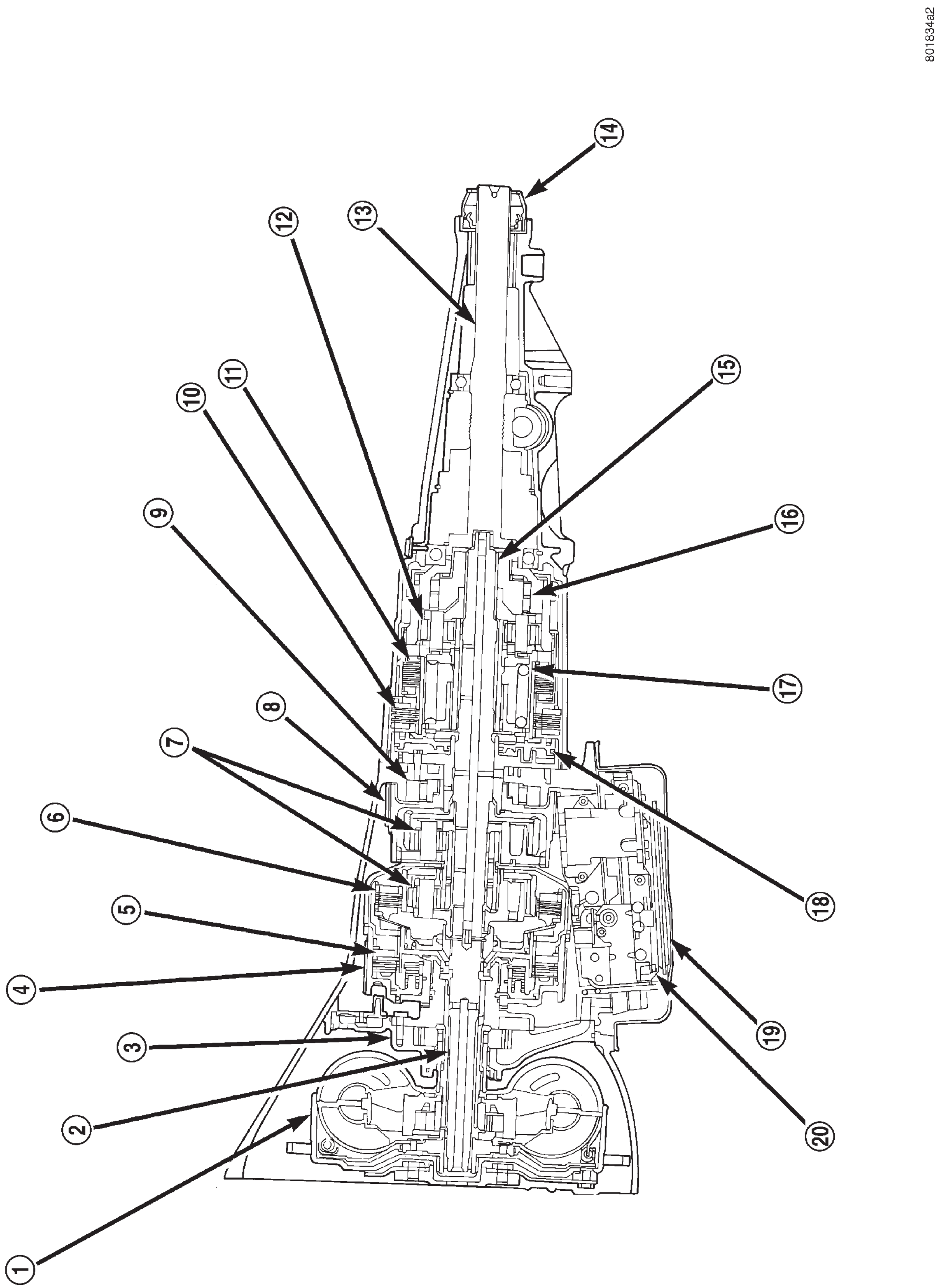


Fig. 1 46RE Transmission

DESCRIPTION AND OPERATION (Continued)

1 – TORQUE CONVERTER
2 – INPUT SHAFT
3 – OIL PUMP
4 – FRONT BAND
5 – FRONT CLUTCH
6 – REAR CLUTCH
7 – PLANETARIES
8 – REAR BAND
9 – OVERRUNNING CLUTCH
10 – OVERDRIVE CLUTCH
11 – DIRECT CLUTCH
12 – PLANETARY GEAR
13 – OUTPUT SHAFT
14 – SEAL
15 – INTERMEDIATE SHAFT
16 – OVERDRIVE OVERRUNNING CLUTCH
17 – DIRECT CLUTCH SPRING
18 – OVERDRIVE PISTON RETAINER
19 – FILTER
20 – VALVE BODY

IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2). Refer to this information when ordering replacement parts.

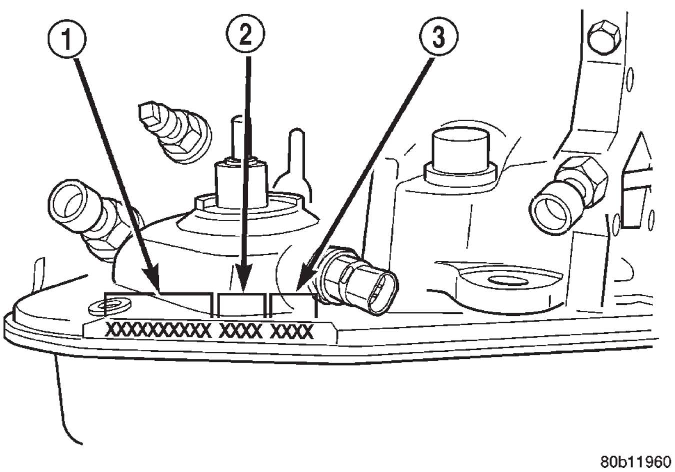


Fig. 2 Transmission Part And Serial Number Location

1 – PART NUMBER
2 – BUILD DATE
3 – SERIAL NUMBER

GEAR RATIOS

The 46RE gear ratios are:
- **1st** 2.45:1
- **2nd** 1.45:1
- **3rd** 1.00:1
- **4th** 0.69:1
- **Rev.** 2.21

OPERATION

The application of each driving or holding component is controlled by the valve body based upon the manual lever position and governor pressure. The governor pressure is a variable pressure input to the valve body and is one of the signals that a shift is necessary. First through fourth gear are obtained by selectively applying and releasing the different clutches and bands. Engine power is thereby routed to the various planetary gear assemblies which combine with the overrunning clutch assemblies to generate the different gear ratios. The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch engages in fourth gear, and in third gear when the O/D switch is OFF, when the vehicle is cruising on a level plane after the vehicle has warmed up. The torque converter clutch will disengage momentarily when an increase in engine load is sensed by the PCM, such as when the vehicle begins to go uphill or the throttle pressure is increased. The torque converter clutch feature increases fuel economy and reduces the transmission fluid temperature.

Since the overdrive clutch is applied in fourth gear only and the direct clutch is applied in all ranges except fourth gear, the transmission operation for park, neutral, and first through third gear will be described first. Once these powerflows are described, the third to fourth shift sequence will be described.

PARK POWERFLOW

As the engine is running and the crankshaft is rotating, the flexplate and torque converter, which are also bolted to it, are all rotating in a clockwise direction as viewed from the front of the engine. The notched hub of the torque converter is connected to the oil pump's internal gear, supplying the transmission with oil pressure. As the converter turns, it turns the input shaft in a clockwise direction. As the input shaft is rotating, the front clutch hub-rear clutch retainer and all their associated parts are also rotating, all being directly connected to the input shaft. The power flow from the engine through the front-clutch-hub and rear-clutch-retainer stops at the rear-clutch-retainer. Therefore, no power flow to the output shaft occurs because no clutches are applied. The only mechanism in use at this time is the parking sprag (Fig. 3), which locks the parking gear on the output shaft to the transmission case.

DESCRIPTION AND OPERATION (Continued)

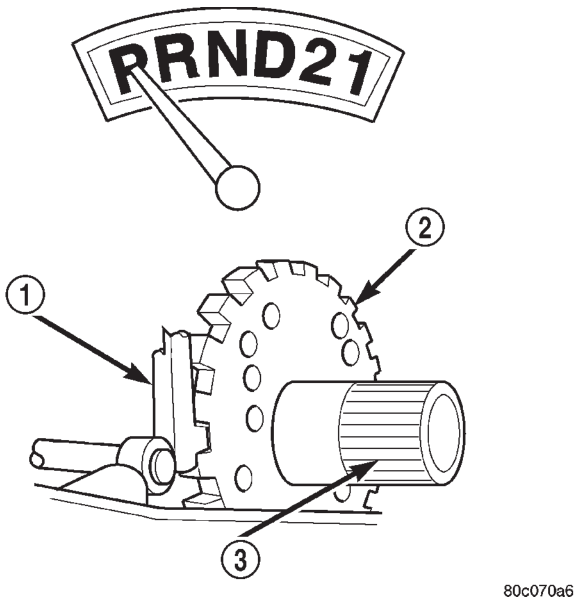


Fig. 3 Park Powerflow

1 – LEVER ENGAGED FOR PARK
2 – PARK SPRAG
3 – OUTPUT SHAFT

NEUTRAL POWERFLOW

With the gear selector in the neutral position (Fig. 4), the power flow of the transmission is essentially the same as in the park position. The only operational difference is that the parking sprag has been disengaged, unlocking the output shaft from the transmission case and allowing it to move freely.

REVERSE POWERFLOW

When the gear selector is moved into the reverse position (Fig. 5), the front clutch and the rear band are applied. With the application of the front clutch, engine torque is applied to the sun gear, turning it in a clockwise direction. The clockwise rotation of the sun gear causes the rear planet pinions to rotate against engine rotation in a counterclockwise direction. The rear band is holding the low reverse drum,

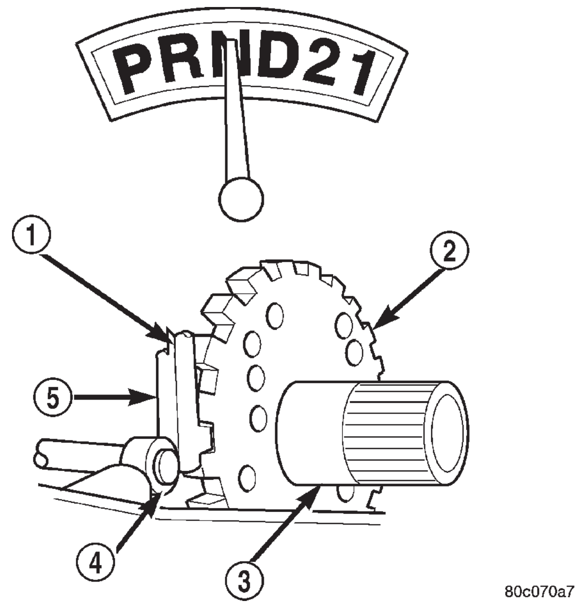


Fig. 4 Neutral Powerflow

1 – LEVER DISENGAGED FOR NEUTRAL
2 – PARK SPRAG
3 – OUTPUT SHAFT
4 – CAM
5 – LEVER

which is splined to the rear carrier. Since the rear carrier is being held, the torque from the planet pinions is transferred to the rear annulus gear, which is splined to the output shaft. The output shaft in turn rotates with the annulus gear in a counterclockwise direction giving a reverse gear output. The entire transmission of torque is applied to the rear planetary gearset only. Although there is torque input to the front gearset through the sun gear, no other member of the gearset is being held. During the entire reverse stage of operation, the front planetary gears are in an idling condition.

DESCRIPTION AND OPERATION (Continued)

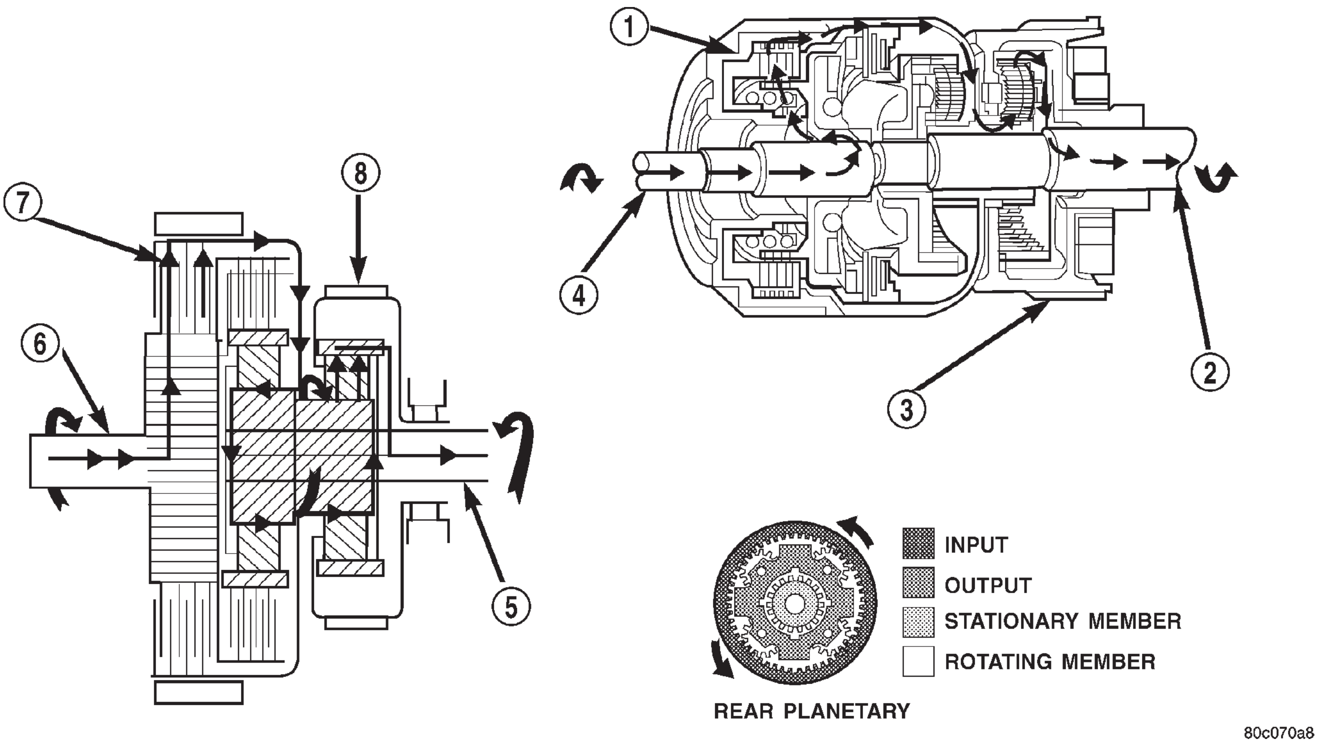


Fig. 5 Reverse Powerflow

1 – FRONT CLUTCH ENGAGED
2 – OUTPUT SHAFT
3 – LOW/REVERSE BAND APPLIED
4 – INPUT SHAFT
5 – OUTPUT SHAFT
6 – INPUT SHAFT
7 – FRONT CLUTCH ENGAGED
8 – LOW/REVERSE BAND APPLIED

FIRST GEAR POWERFLOW

When the gearshift lever is moved into the drive position the transmission goes into first gear (Fig. 6). As soon as the transmission is shifted from park or neutral to drive, the rear clutch applies, applying the rear clutch pack to the front annulus gear. Engine torque is now applied to the front annulus gear turning it in a clockwise direction. With the front annulus gear turning in a clockwise direction, it causes the front planets to turn in a clockwise direction. The rotation of the front planets cause the sun to revolve in a counterclockwise direction. The sun gear now transfers its counterclockwise rotation to the rear planets which rotate back in a clockwise direction. With the rear annulus gear stationary, the rear planet rotation on the annulus gear causes the rear planet carrier to revolve in a counterclockwise direction. The rear planet carrier is splined into the low-reverse drum, and the low reverse drum is splined to the inner race of the over-running clutch. With the over-running clutch locked, the planet carrier is held, and the resulting torque provided by the planet pinions is transferred to the rear annulus gear. The rear annulus gear is splined to the output shaft and rotated along with it (clockwise) in an underdrive gear reduction mode.

DESCRIPTION AND OPERATION (Continued)

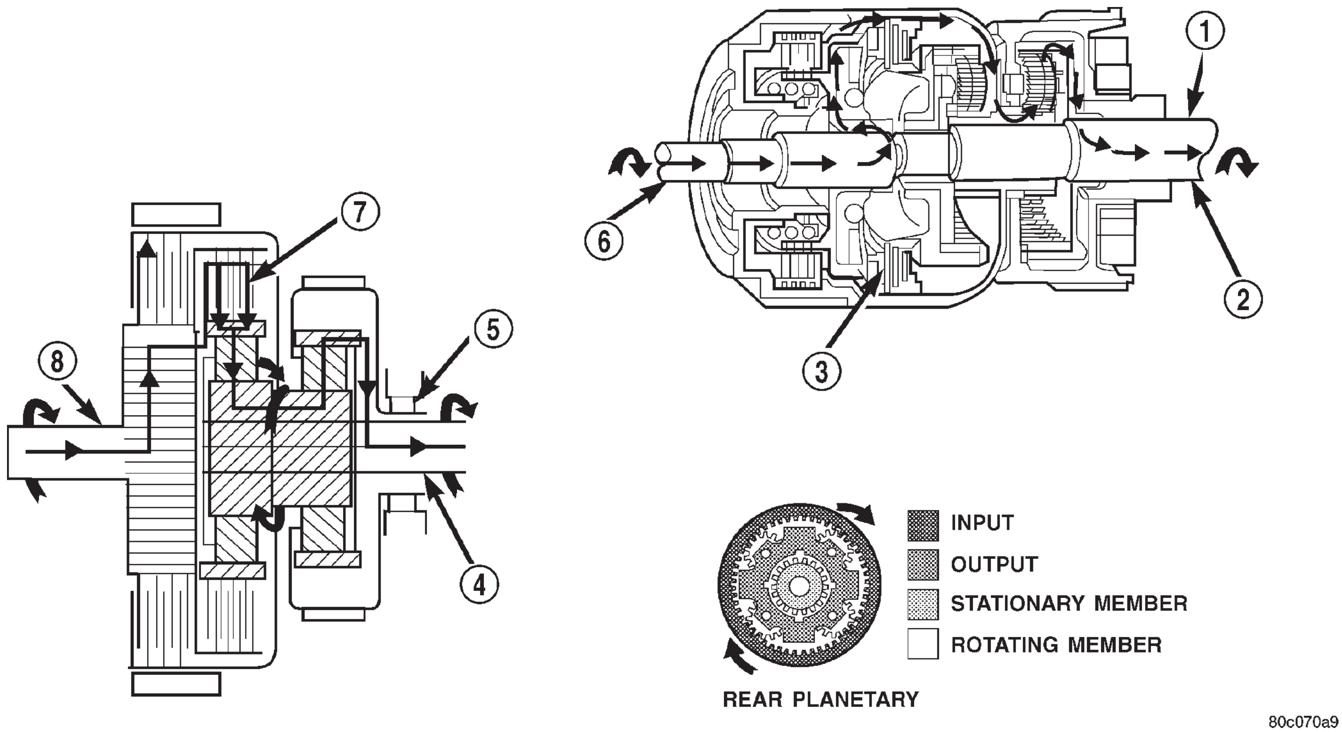


Fig. 6 First Gear Powerflow

1 – OUTPUT SHAFT
2 – OVER-RUNNING CLUTCH HOLDING
3 – REAR CLUTCH APPLIED
4 – OUTPUT SHAFT
5 – OVER-RUNNING CLUTCH HOLDING
6 – INPUT SHAFT
7 – REAR CLUTCH APPLIED
8 – INPUT SHAFT

SECOND GEAR POWERFLOW

In drive-second (Fig. 7), the same elements are applied as in manual-second. Therefore, the power flow will be the same, and both gears will be discussed as one in the same. In drive-second, the transmission has proceeded from first gear to its shift point, and is shifting from first gear to second. The second gear shift is obtained by keeping the rear clutch applied and applying the front (kickdown) band. The front band holds the front clutch retainer that is locked to the sun gear driving shell. With the rear clutch still applied, the input is still on the front annulus gear turning it clockwise at engine speed. Now that the front band is holding the sun gear stationary, the annulus rotation causes the front planets to rotate in a clockwise direction. The front carrier is then also made to rotate in a clockwise direction but at a reduced speed. This will transmit the torque to the output shaft, which is directly connected to the front planet carrier. The rear planetary annulus gear will also be turning because it is directly splined to the output shaft. All power flow has occurred in the front planetary gear set during the drive-second stage of operation, and now the over-running clutch, in the rear of the transmission, is disengaged and freewheeling on its hub.

DESCRIPTION AND OPERATION (Continued)

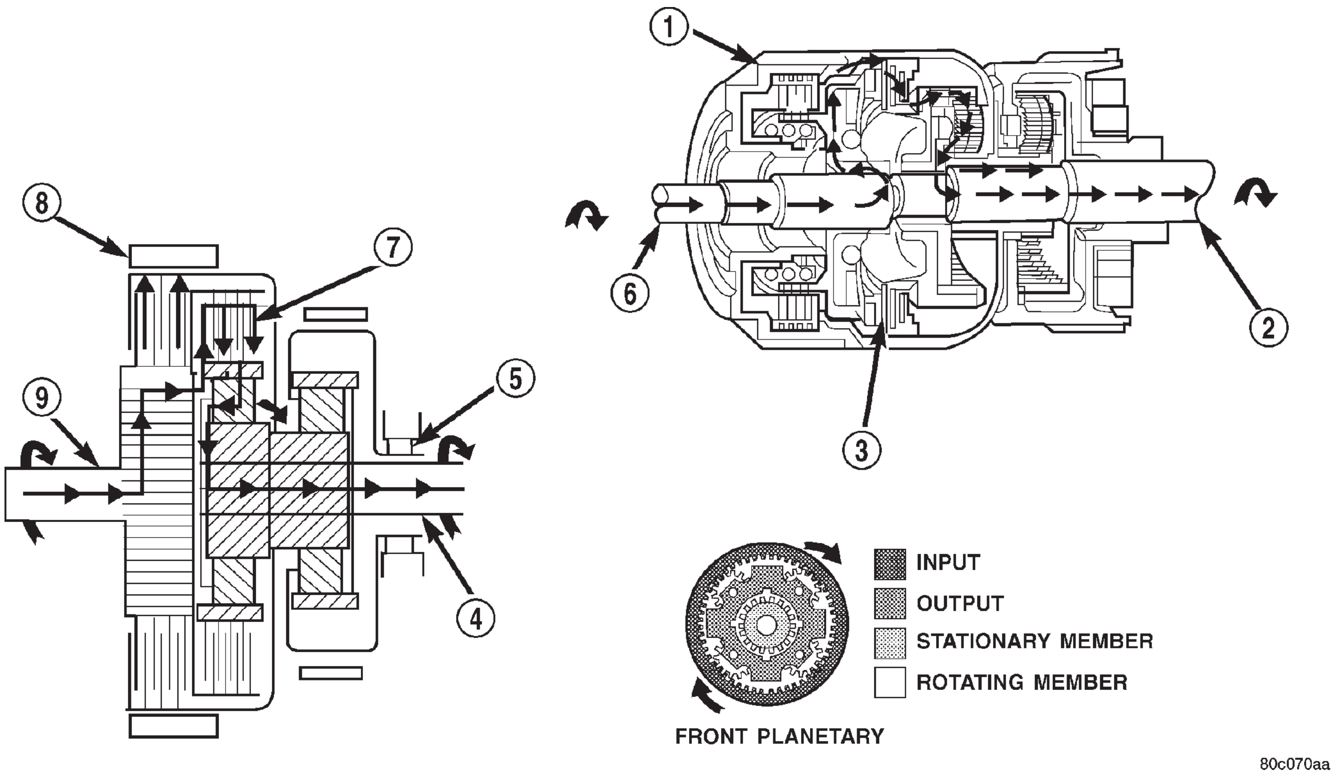


Fig. 7 Second Gear Powerflow

1 – KICKDOWN BAND APPLIED
2 – OUTPUT SHAFT
3 – REAR CLUTCH ENGAGED
4 – OUTPUT SHAFT
5 – OVER-RUNNING CLUTCH FREE-WHEELING
6 – INPUT SHAFT
7 – REAR CLUTCH APPLIED
8 – KICKDOWN BAND APPLIED
9 – INPUT SHAFT

DIRECT DRIVE POWERFLOW

The vehicle has accelerated and reached the shift point for the 2–3 upshift into direct drive (Fig. 8). When the shift takes place, the front band is released, and the front clutch is applied. The rear clutch stays applied as it has been in all the forward gears. With the front clutch now applied, engine torque is now on the front clutch retainer, which is locked to the sun gear driving shell. This means that the sun gear is now turning in engine rotation (clockwise) and at engine speed. The rear clutch is still applied so engine torque is also still on the front annulus gear. If two members of the same planetary set are driven, direct drive results. Therefore, when two members are rotating at the same speed and in the same direction, it is the same as being locked up. The rear planetary set is also locked up, given the sun gear is still the input, and the rear annulus gear must turn with the output shaft. Both gears are turning in the same direction and at the same speed. The front and rear planet pinions do not turn at all in direct drive. The only rotation is the input from the engine to the connected parts, which are acting as one common unit, to the output shaft.

DESCRIPTION AND OPERATION (Continued)

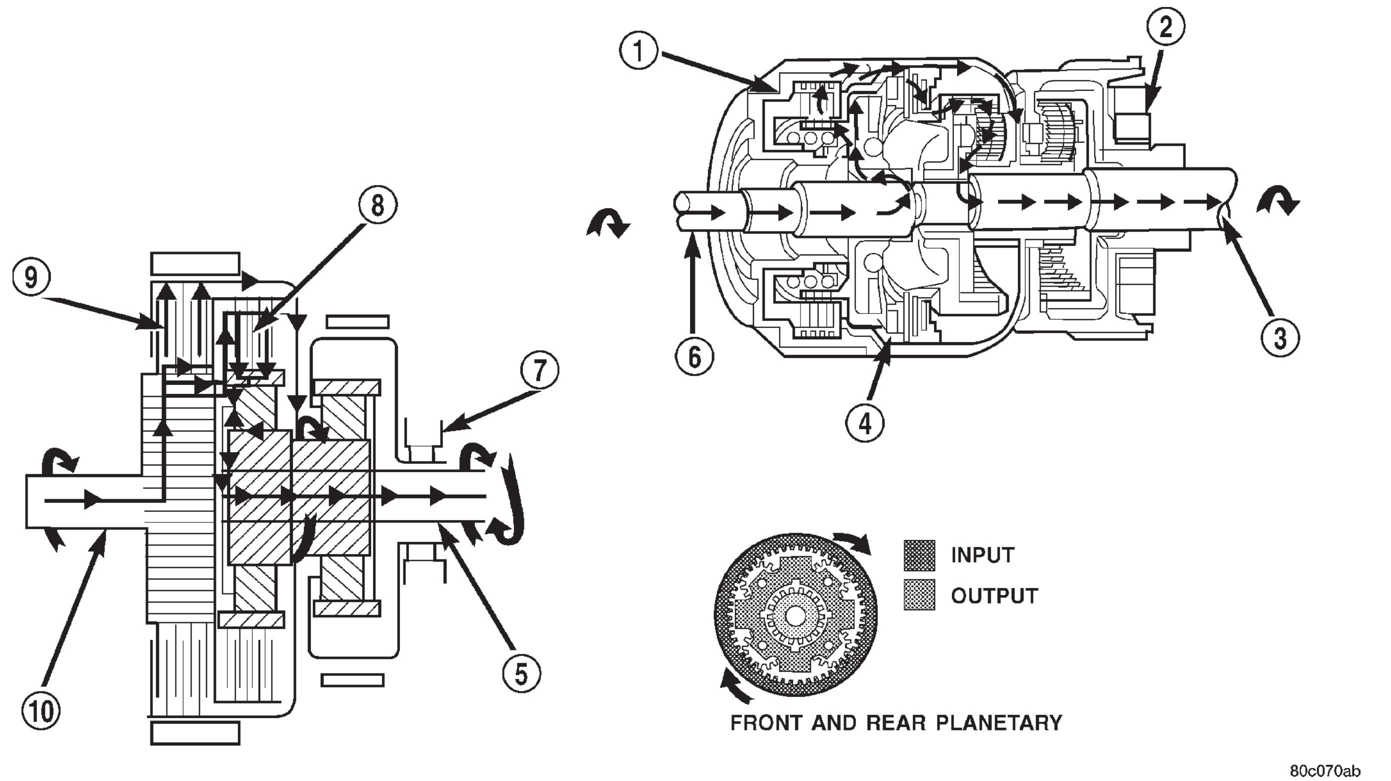


Fig. 8 Direct Drive Powerflow

1 – FRONT CLUTCH APPLIED
2 – OVER-RUNNING CLUTCH FREE-WHEELING
3 – OUTPUT SHAFT
4 – REAR CLUTCH APPLIED
5 – OUTPUT SHAFT
6 – INPUT SHAFT
7 – OVER-RUNNING CLUTCH FREE-WHEELING
8 – REAR CLUTCH APPLIED
9 – FRONT CLUTCH APPLIED
10 – INPUT SHAFT

FOURTH GEAR POWERFLOW

Fourth gear overdrive range is electronically controlled and hydraulically activated. Various sensor inputs are supplied to the powertrain control module to operate the overdrive solenoid on the valve body. The solenoid contains a check ball that opens and closes a vent port in the 3-4 shift valve feed passage. The overdrive solenoid (and check ball) are not energized in first, second, third, or reverse gear. The vent port remains open, diverting line pressure from the 2-3 shift valve away from the 3-4 shift valve. The overdrive control switch must be in the ON position to transmit overdrive status to the PCM. A 3-4 upshift occurs only when the overdrive solenoid is energized by the PCM. The PCM energizes the overdrive solenoid during the 3-4 upshift. This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position. This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston. Line pressure through the timing valve moves the overdrive piston into contact with the overdrive clutch. The direct clutch is disengaged before the overdrive clutch is engaged. The boost valve provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts, and when accelerating in fourth gear. The 3-4 accumulator cushions overdrive clutch engagement to smooth 3-4 upshifts. The accumulator is charged at the same time as apply pressure acts against the overdrive piston.

FLUID

NOTE: Refer to the maintenance schedules in Group 0, Lubrication and Maintenance for the recommended maintenance (fluid/filter change) intervals for this transmission.

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

DESCRIPTION AND OPERATION (Continued)

DESCRIPTION

Mopar® ATF Plus 3, Type 7176, automatic transmission fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Mopar® ATF Plus 3, Type 7176, automatic transmission fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** A dark brown/black fluid accompanied with a burnt odor and/or deterioration in shift quality may indicate fluid deterioration or transmission component failure.

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

OPERATION

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 9) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The converter clutch engages in third gear. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid. If the fluid is contaminated, flush the fluid cooler and lines.

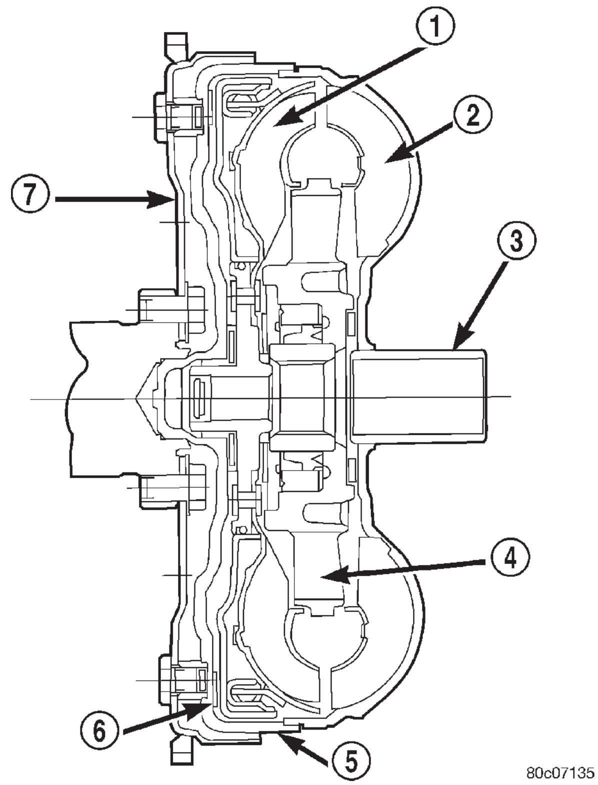


Fig. 9 Torque Converter Assembly

1 – TURBINE
2 – IMPELLER
3 – HUB
4 – STATOR
5 – FRONT COVER
6 – CONVERTER CLUTCH DISC
7 – DRIVE PLATE

IMPELLER

The impeller (Fig. 10) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the

DESCRIPTION AND OPERATION (Continued)

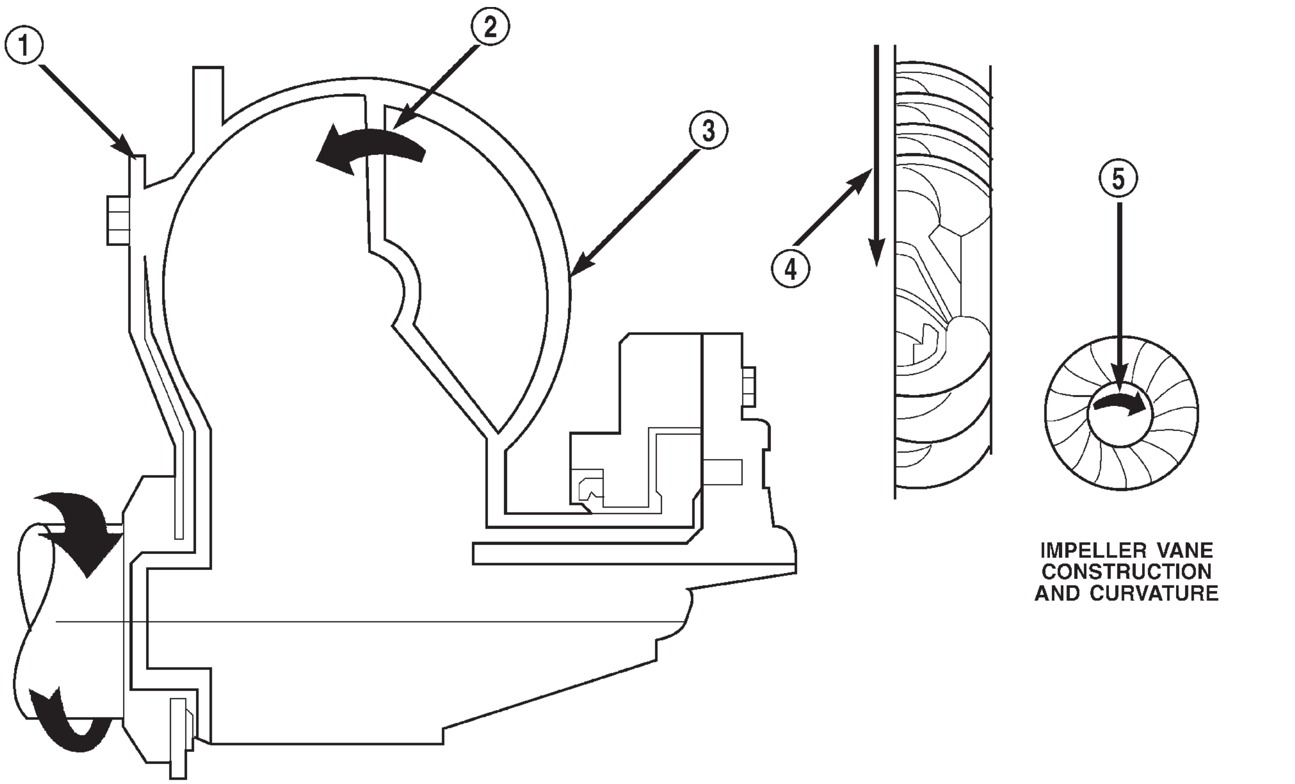


Fig. 10 Impeller

1 – ENGINE FLEXPLATE
2 – OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 – IMPELLER VANES AND COVER ARE INTEGRAL
4 – ENGINE ROTATION
5 – ENGINE ROTATION

impeller, because they are one and the same and are the driving member of the system.

TURBINE

The turbine (Fig. 11) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

DESCRIPTION AND OPERATION (Continued)

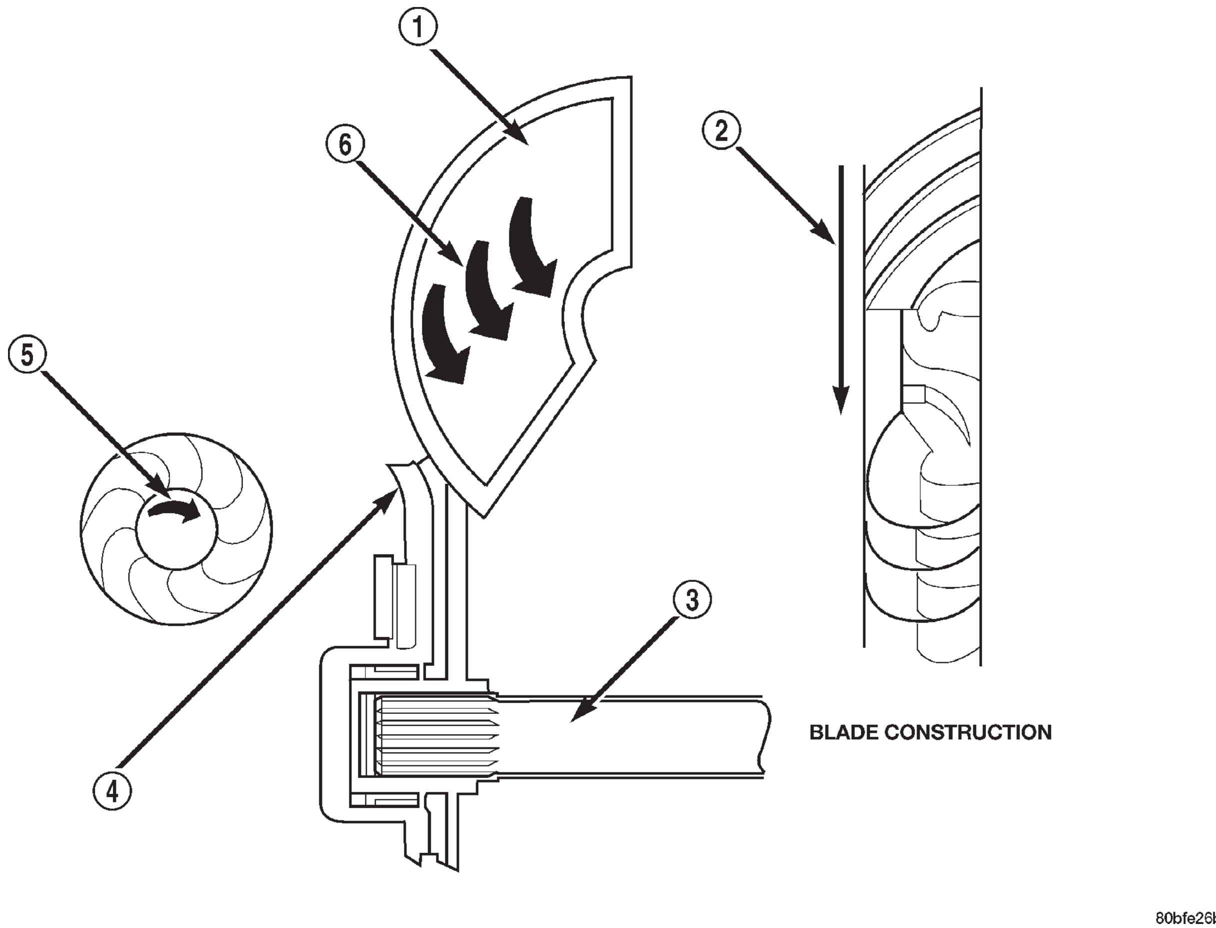


Fig. 11 Turbine

1 – TURBINE VANE
2 – ENGINE ROTATION
3 – INPUT SHAFT
4 – PORTION OF TORQUE CONVERTER COVER
5 – ENGINE ROTATION
6 – OIL FLOW WITHIN TURBINE SECTION

STATOR

The stator assembly (Fig. 12) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 13). The stator contains an over-running clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 14) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock–free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston was added to the turbine, and a friction material was added to the inside of the front cover to provide this mechanical lock-up.

DESCRIPTION AND OPERATION (Continued)

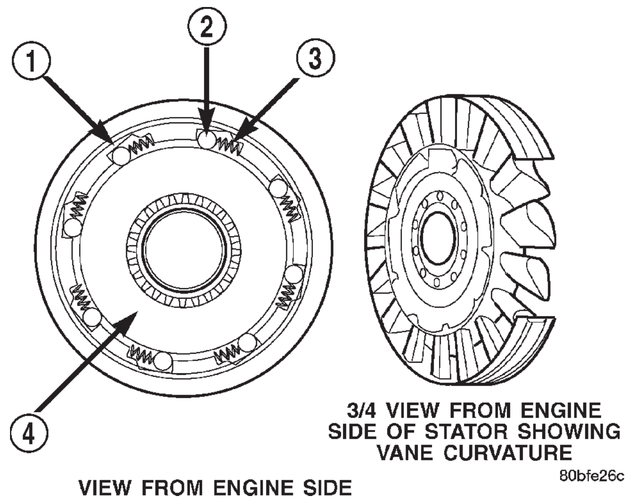


Fig. 12 Stator Components

1 – CAM (OUTER RACE)
2 – ROLLER
3 – SPRING
4 – INNER RACE

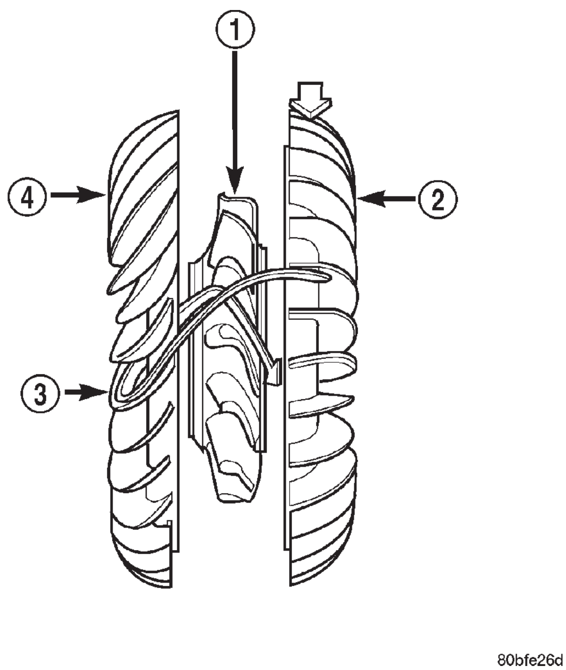


Fig. 13 Stator Location

1 – STATOR
2 – IMPELLER
3 – FLUID FLOW
4 – TURBINE

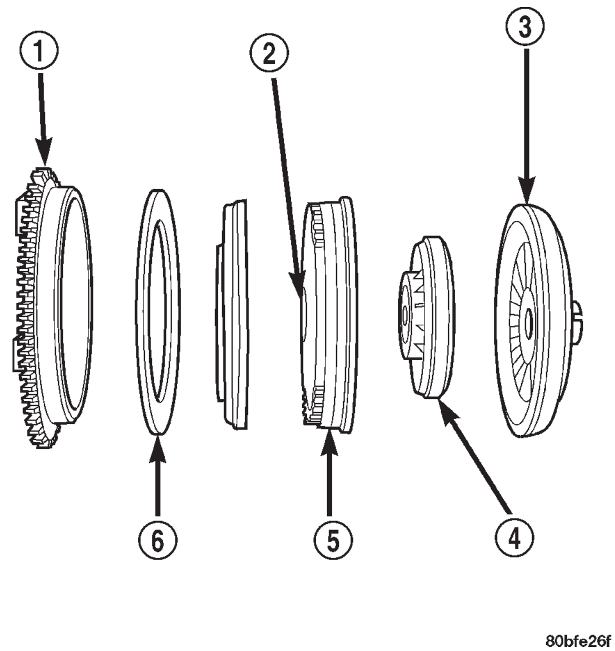


Fig. 14 Torque Converter Clutch (TCC)

1 – IMPELLER FRONT COVER
2 – THRUST WASHER ASSEMBLY
3 – IMPELLER
4 – STATOR
5 – TURBINE
6 – FRICTION DISC

OPERATION

The converter impeller (Fig. 15) (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a “hindering” direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

DESCRIPTION AND OPERATION (Continued)

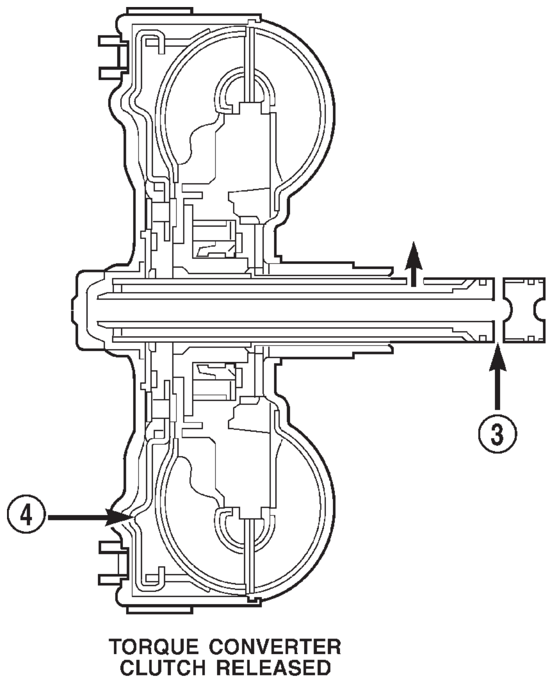


Fig. 15 Torque Converter Fluid Operation

1 – APPLY PRESSURE
2 – THE PISTON MOVES SLIGHTLY FORWARD
3 – RELEASE PRESSURE
4 – THE PISTON MOVES SLIGHTLY REARWARD

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 16). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counter-clockwise direction. When this happens the over–running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock–up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

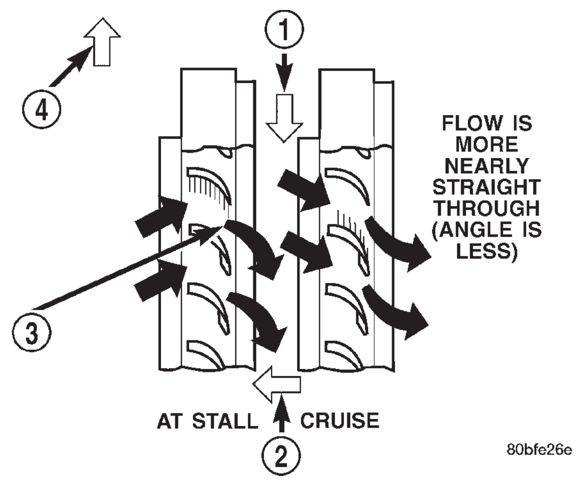


Fig. 16 Stator Operation

1 – DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 – FRONT OF ENGINE
3 – INCREASED ANGLE AS OIL STRIKES VANES
4 – DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston to the front cover's friction material, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

Converter clutch engagement in third or fourth gear range is controlled by sensor inputs to the powertrain control module. Inputs that determine clutch

DESCRIPTION AND OPERATION (Continued)

engagement are: coolant temperature, engine rpm, vehicle speed, throttle position, and manifold vacuum. The torque converter clutch is engaged by the clutch solenoid on the valve body. The clutch can be engaged in third and fourth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear, and above approximately 72 km/h (45 mph). If the control switch is in the OFF position, the clutch will engage after the shift to third gear, at approximately 56 km/h (35 mph) at light throttle.

OIL PUMP

DESCRIPTION

The oil pump (Fig. 17) is located in the pump housing inside the bell housing of the transmission case. The oil pump consists of an inner and outer gear, a housing, and a cover that also serves as the reaction shaft support.

OPERATION

As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

VALVE BODY

DESCRIPTION

The valve body consists of a cast aluminum valve body, a separator plate, and transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components (Fig. 18), (Fig. 19), (Fig. 20), and (Fig. 21):

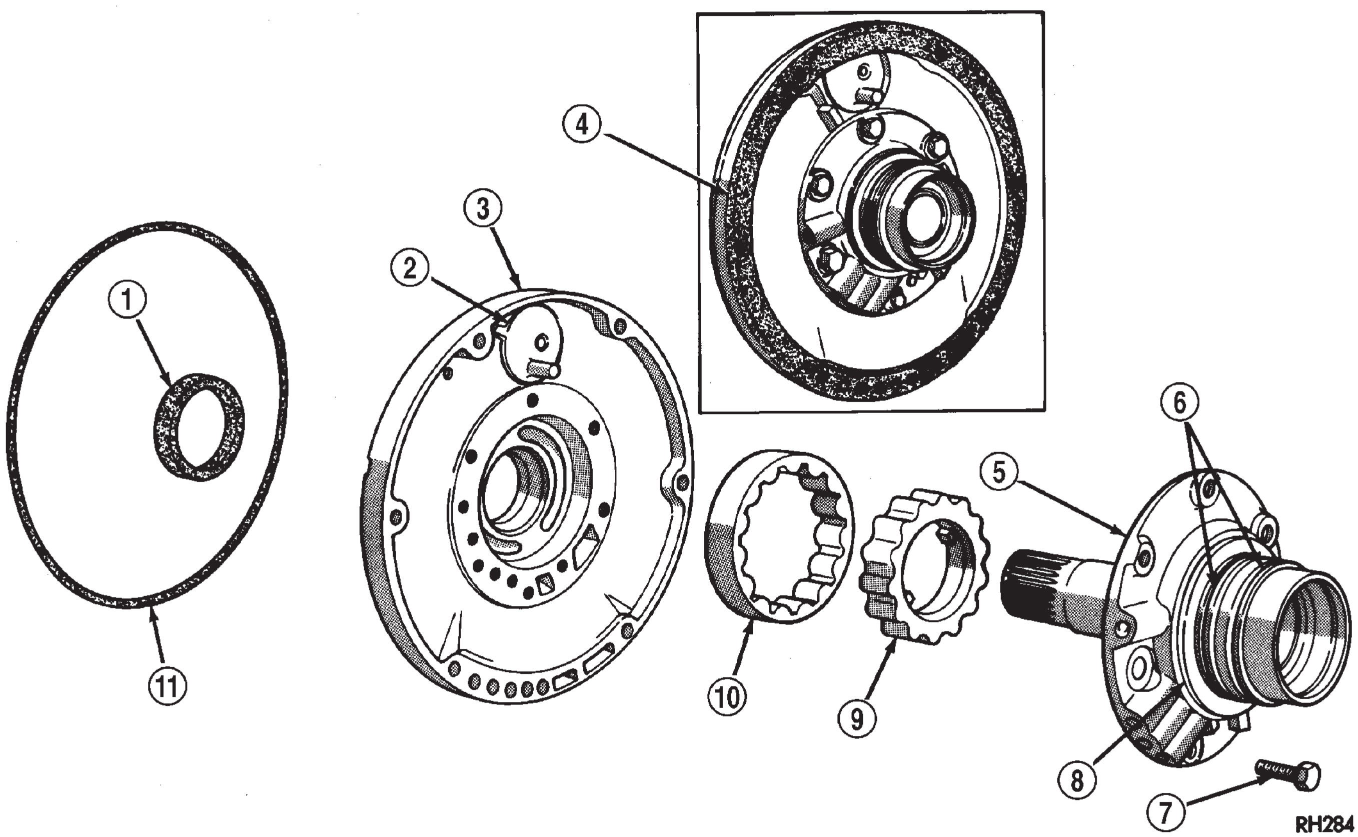


Fig. 17 Oil Pump Assembly

1 – OIL SEAL
2 – VENT BAFFLE
3 – OIL PUMP BODY
4 – GASKET
5 – REACTION SHAFT SUPPORT
6 – SEAL RINGS
7 – BOLTS (6)
8 – #1 THRUST WASHER (SELECTIVE)
9 – INNER GEAR
10 – OUTER GEAR
11 – “O” RING

DESCRIPTION AND OPERATION (Continued)

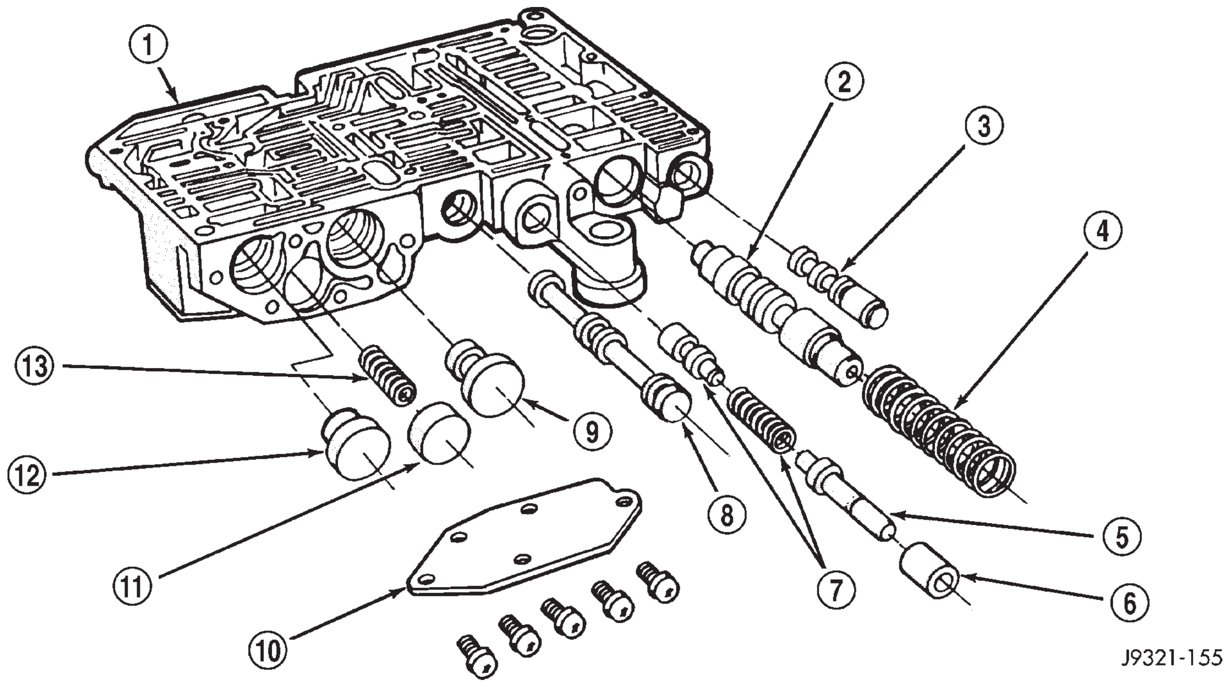


Fig. 18 Upper Housing Control Valve Locations

1 – UPPER HOUSING
2 – REGULATOR VALVE
3 – SWITCH VALVE
4 – REGULATOR VALVE SPRING
5 – KICKDOWN VALVE
6 – KICKDOWN DETENT
7 – THROTTLE VALVE AND SPRING
8 – MANUAL VALVE
9 – 1–2 GOVERNOR PLUG
10 – GOVERNOR PLUG COVER
11 – THROTTLE PLUG
12 – 2–3 GOVERNOR PLUG
13 – SHUTTLE VALVE PRIMARY SPRING

- Regulator valve
- Regulator valve throttle pressure plug
- Line pressure plug and sleeve
- Kickdown valve
- Kickdown limit valve
- 1–2 shift valve
- 1–2 control valve
- 2–3 shift valve
- 2–3 governor plug
- 3–4 shift valve
- 3–4 timing valve
- 3–4 quick fill valve
- 3–4 accumulator
- Throttle valve
- Throttle pressure plug
- Switch valve
- Manual valve
- Converter clutch lock-up valve
- Converter clutch lock-up timing Valve
- Shuttle valve
- Shuttle valve throttle plug
- Boost Valve
- 10 check balls

By adjusting the spring pressure acting on the regulator valve, transmission line pressure can be adjusted.

DESCRIPTION AND OPERATION (Continued)

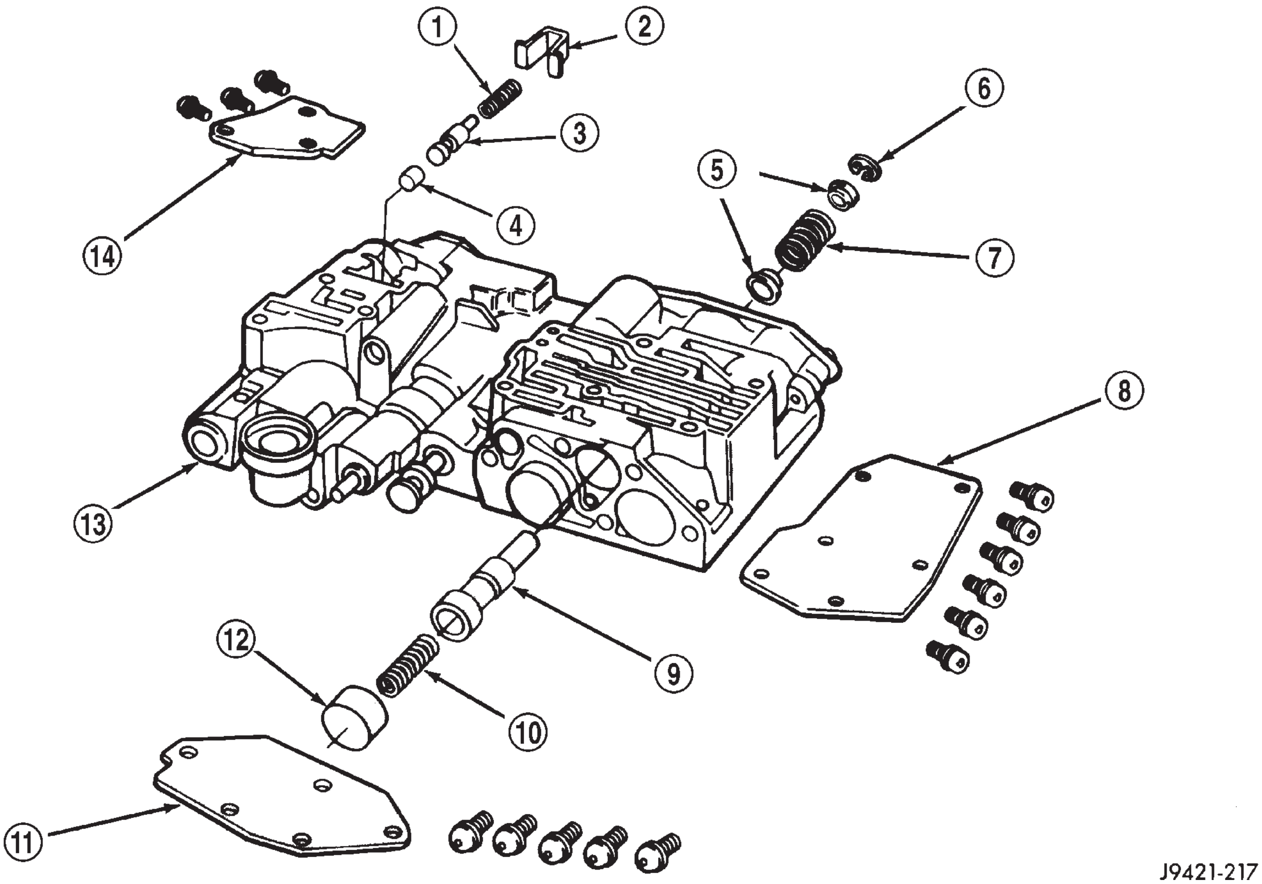


Fig. 19 Shuttle and Boost Valve Locations

1 – SPRING
2 – RETAINER
3 – BOOST VALVE
4 – BOOST VALVE PLUG
5 – SPRING GUIDES
6 – E-CLIP
7 – SHUTTLE VALVE SECONDARY SPRING
8 – SHUTTLE VALVE COVER
9 – SHUTTLE VALVE
10 – SHUTTLE VALVE PRIMARY SPRING
11 – GOVERNOR PLUG COVER
12 – THROTTLE PLUG
13 – UPPER HOUSING
14 – BOOST VALVE COVER

DESCRIPTION AND OPERATION (Continued)

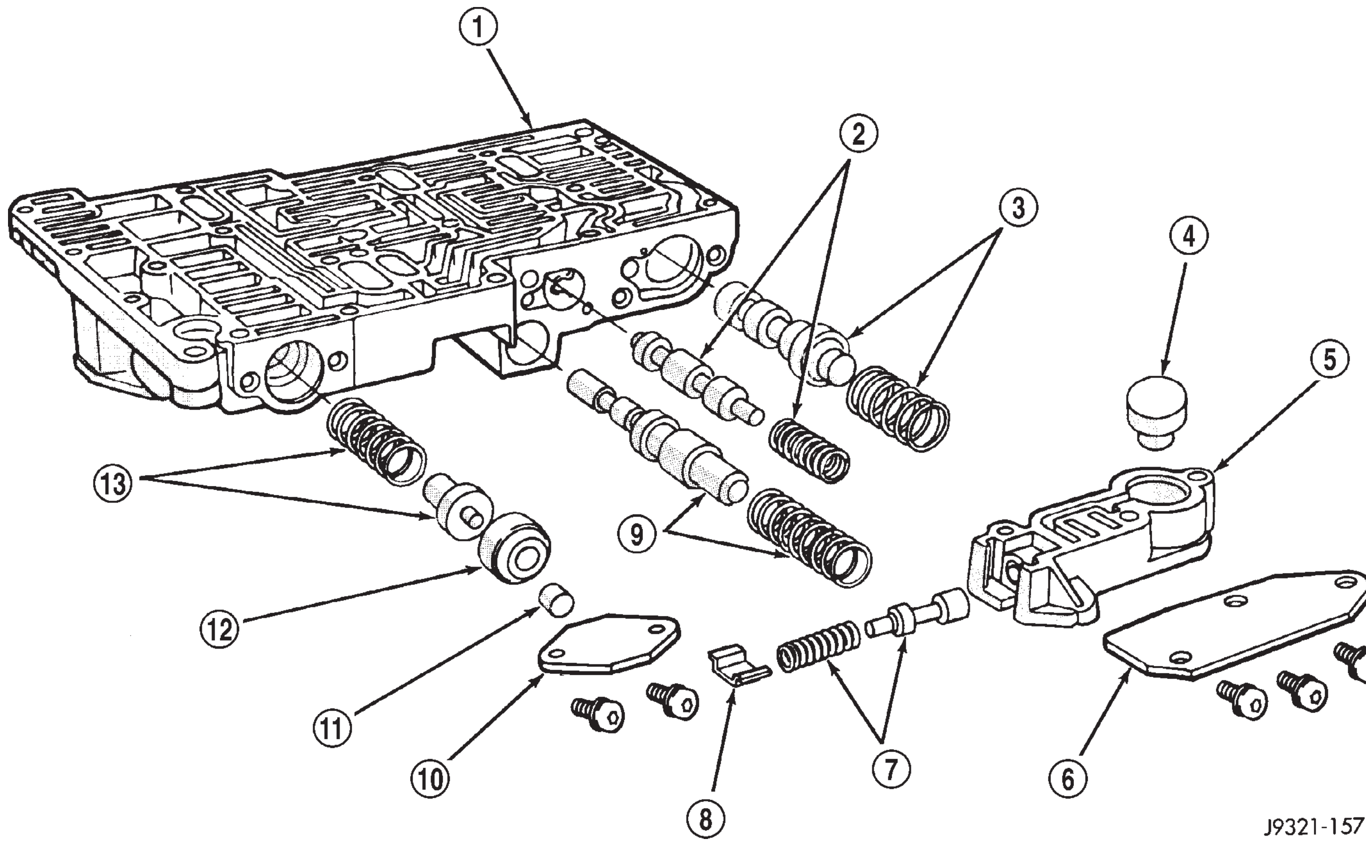


Fig. 20 Upper Housing Shift Valve and Pressure Plug Locations

1 – UPPER HOUSING
2 – 1–2 SHIFT VALVE AND SPRING
3 – 2–3 SHIFT VALVE AND SPRING
4 – 2–3 THROTTLE PLUG
5 – LIMIT VALVE HOUSING
6 – LIMIT VALVE COVER
7 – LIMIT VALVE AND SPRING
8 – RETAINER
9 – 1–2 SHIFT CONTROL VALVE AND SPRING
10 – PRESSURE PLUG COVER
11 – LINE PRESSURE PLUG
12 – PLUG SLEEVE
13 – THROTTLE PRESSURE SPRING AND PLUG

OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

REGULATOR VALVE

The pressure regulator valve is needed to control the hydraulic pressure within the system and reduce the amount of heat produced in the fluid. The pressure regulator valve is located in the valve body near the manual valve. The pressure regulator valve train controls the maximum pressure in the lines by metering the dumping of fluid back into the sump. Regulated pressure is referred to as “line pressure.”

The regulator valve (Fig. 22) has a spring on one end that pushes the valve to the left. This closes a dump (vent) that is used to lower pressure. The closing of the dump will cause the oil pressure to increase. Oil pressure on the opposite end of the valve pushes the valve to the right, opening the dump and lowering oil pressure. The result is spring pressure working against oil pressure to maintain the oil at specific pressures. With the engine running, fluid flows from the pump to the pressure regulator valve, manual valve, and the interconnected circuits. As fluid is sent through passages to the regulator valve, the pressure pushes the valve to the right against the large spring. It is also sent to the reaction areas on the left side of the throttle pressure plug and the line pressure plug. With the gear selector in the park position, fluid recirculates through the regulator and manual valves back to the sump.

Meanwhile, the torque converter is filled slowly. In all other gear positions (Fig. 23), fluid flows between two right side lands to the switch valve and torque converter. At low pump speeds, the flow is controlled by the pressure valve groove to reduce pressure to the torque converter. After the torque converter and

DESCRIPTION AND OPERATION (Continued)

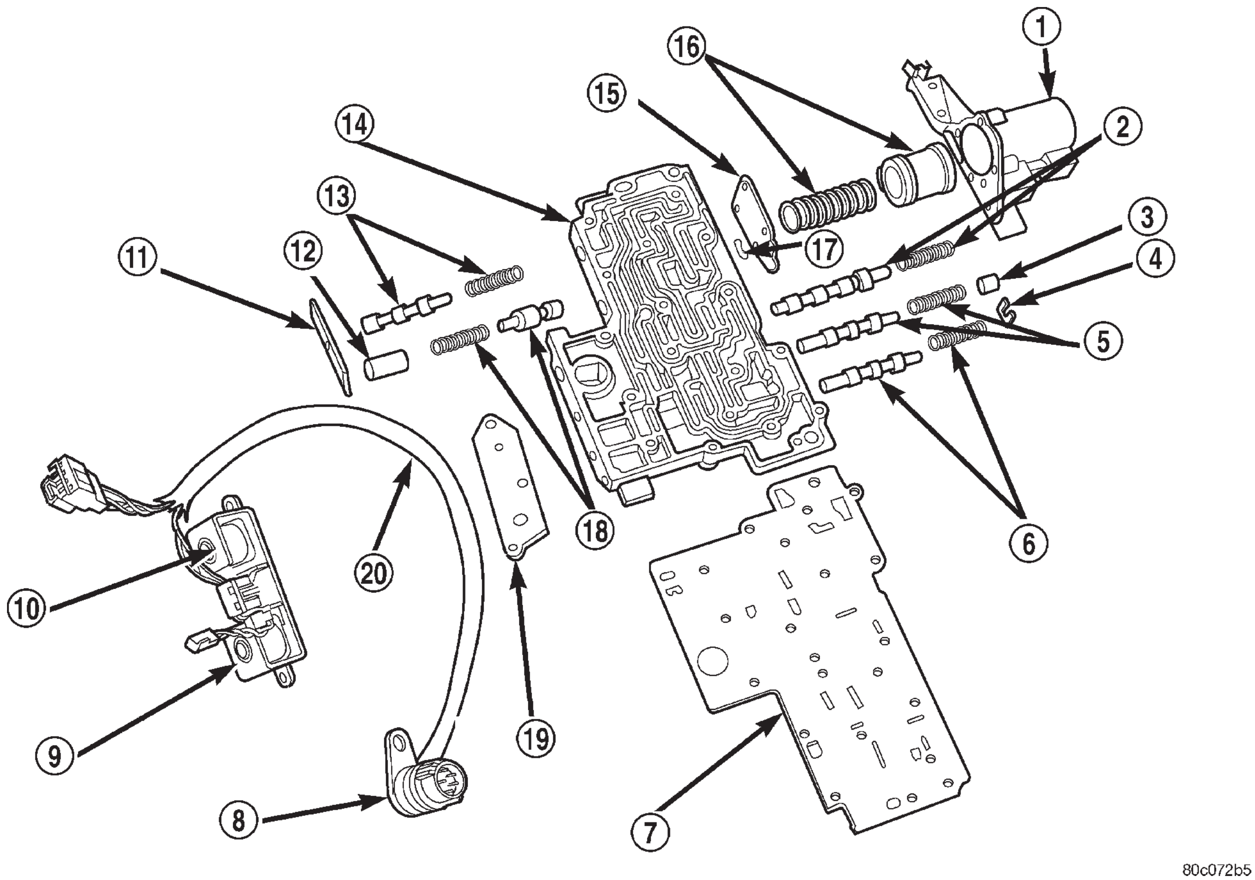


Fig. 21 Lower Housing Shift Valves And Springs

1 – 3-4 ACCUMULATOR HOUSING
2 – 3-4 SHIFT VALVE AND SPRING
3 – PLUG
4 – SPRING RETAINER
5 – CONVERTER CLUTCH VALVE AND SPRING
6 – CONVERTER CLUTCH TIMING VALVE AND SPRING
7 – OVERDRIVE SEPARATOR PLATE
8 – CASE CONNECTOR
9 – CONVERTER CLUTCH SOLENOID
10 – OVERDRIVE SOLENOID
11 – TIMING VALVE COVER
12 – PLUG
13 – 3-4 TIMING VALVE AND SPRING
14 – LOWER HOUSING
15 – ACCUMULATOR END PLATE
16 – 3-4 ACCUMULATOR PISTON AND SPRING
17 – E-CLIP
18 – 3-4 QUICK FILL SPRING AND VALVE
19 – SOLENOID GASKET
20 – HARNESS

switch valve fill with fluid, the switch valve becomes the controlling metering device for torque converter pressure. The regulator valve then begins to control the line pressure for the other transmission circuits. The balance of the fluid pressure pushing the valve to the right and the spring pressure pushing to the left determines the size of the metering passage at land #2 (land #1 being at the far right of the valve in the diagram). As fluid leaks past the land, it moves into a groove connected to the filter or sump. As the land meters the fluid to the sump, it causes the pressure to reduce and the spring decreases the size of the metering passage. When the size of the metering passage is reduced, the pressure rises again and the size of the land is increased again. Pressure is regulated by this constant balance of hydraulic and spring pressure.

The metering at land #2 establishes the line pressure throughout the transmission. It is varied according to changes in throttle position, engine speed, and transmission condition within a range of 57–94 psi (except in reverse) (Fig. 24). The regulated line pressure in reverse (Fig. 25) is held at much higher pressures than in the other gear positions: 145–280 psi. The higher pressure for reverse is achieved by the manual valve blocking the supply of line pressure to the reaction area left of land #4. With this pressure blocked, there is less area for pressure to act on to balance the force of the spring on the right. This allows line pressure to push the valve train to the right, reducing the amount of fluid returned to the pump's inlet, increasing line pressure.

DESCRIPTION AND OPERATION (Continued)

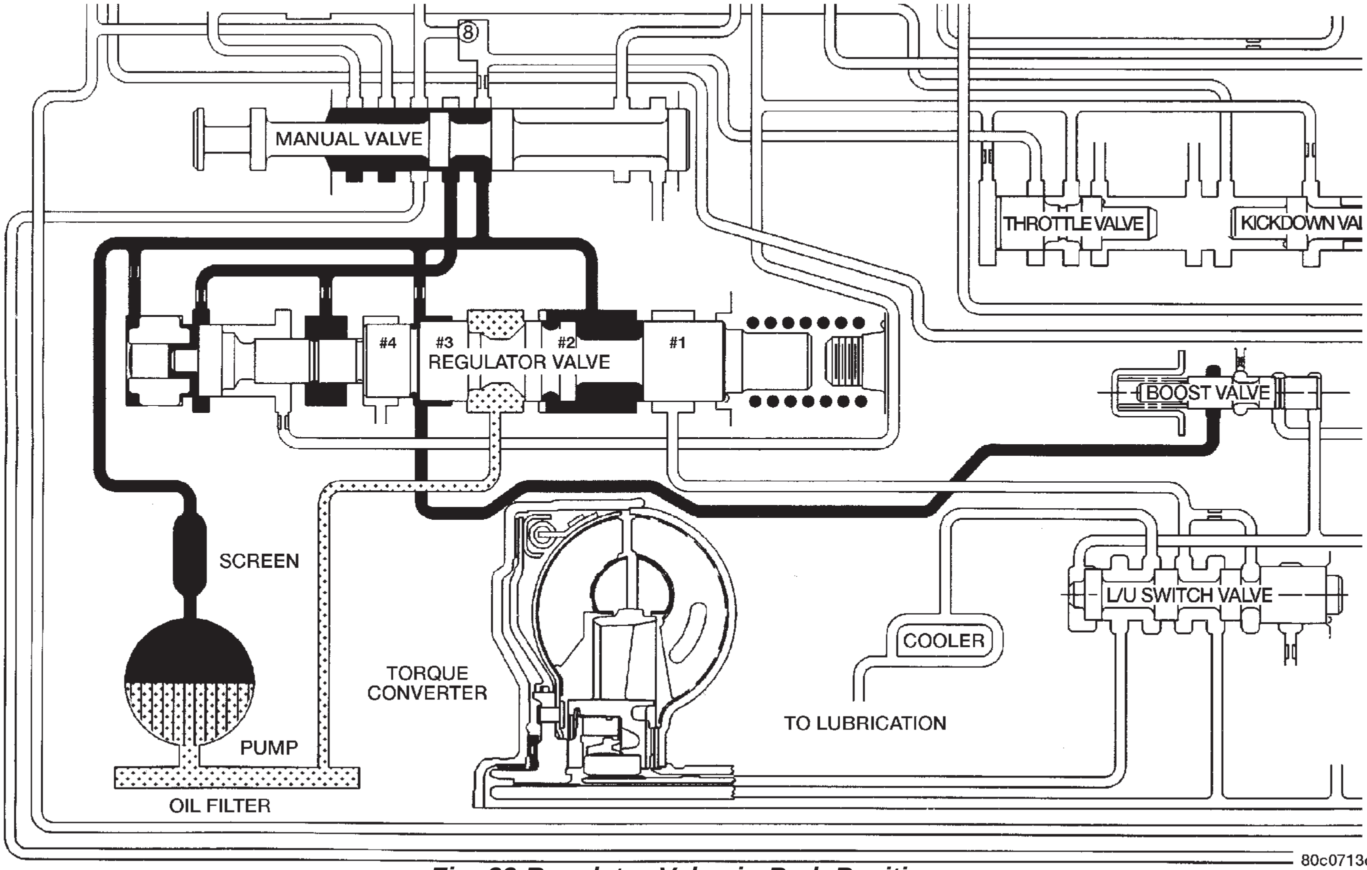


Fig. 22 Regulator Valve in Park Position

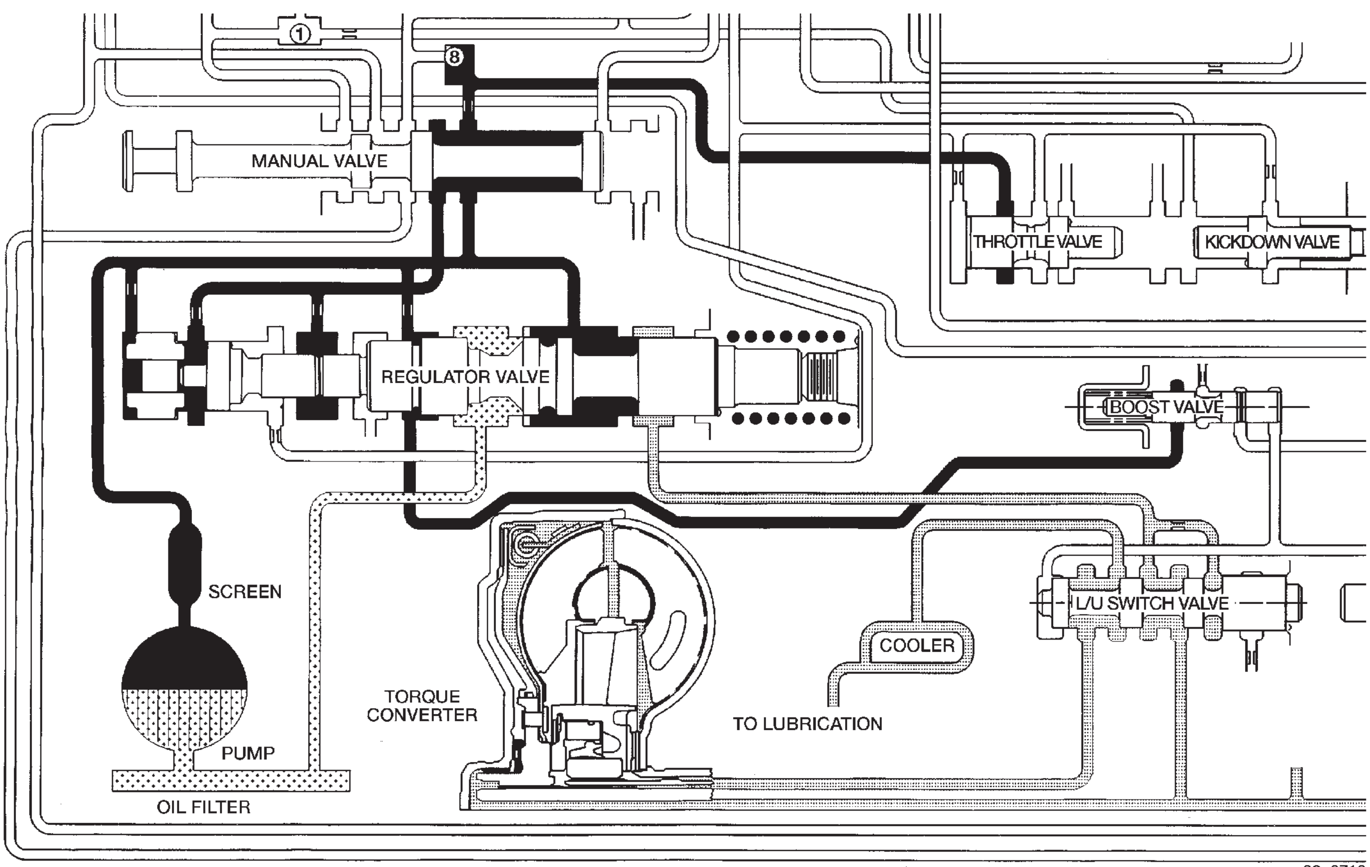


Fig. 23 Regulator Valve in Neutral Position

DESCRIPTION AND OPERATION (Continued)

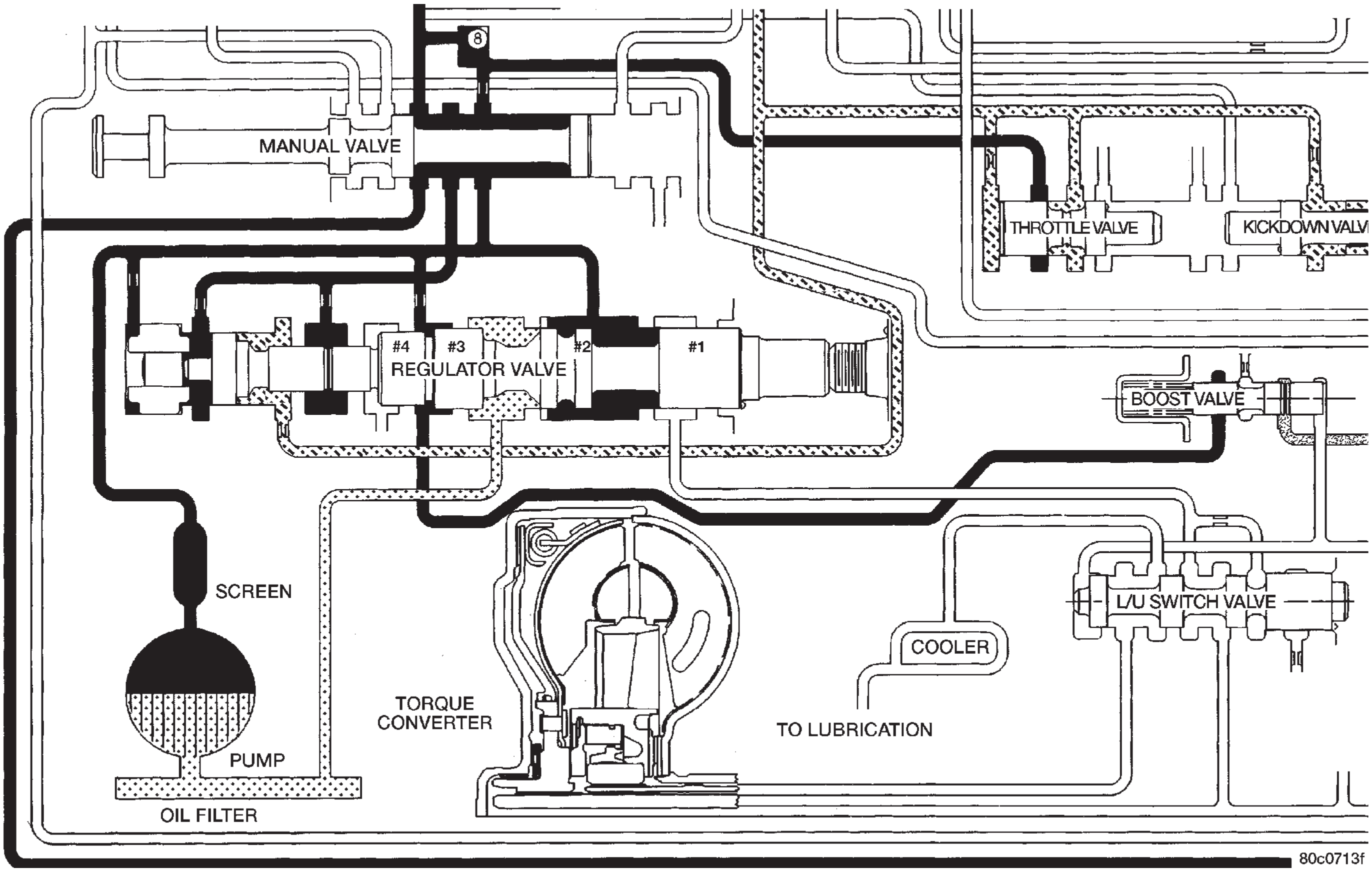


Fig. 24 Regulator Valve in Drive Position

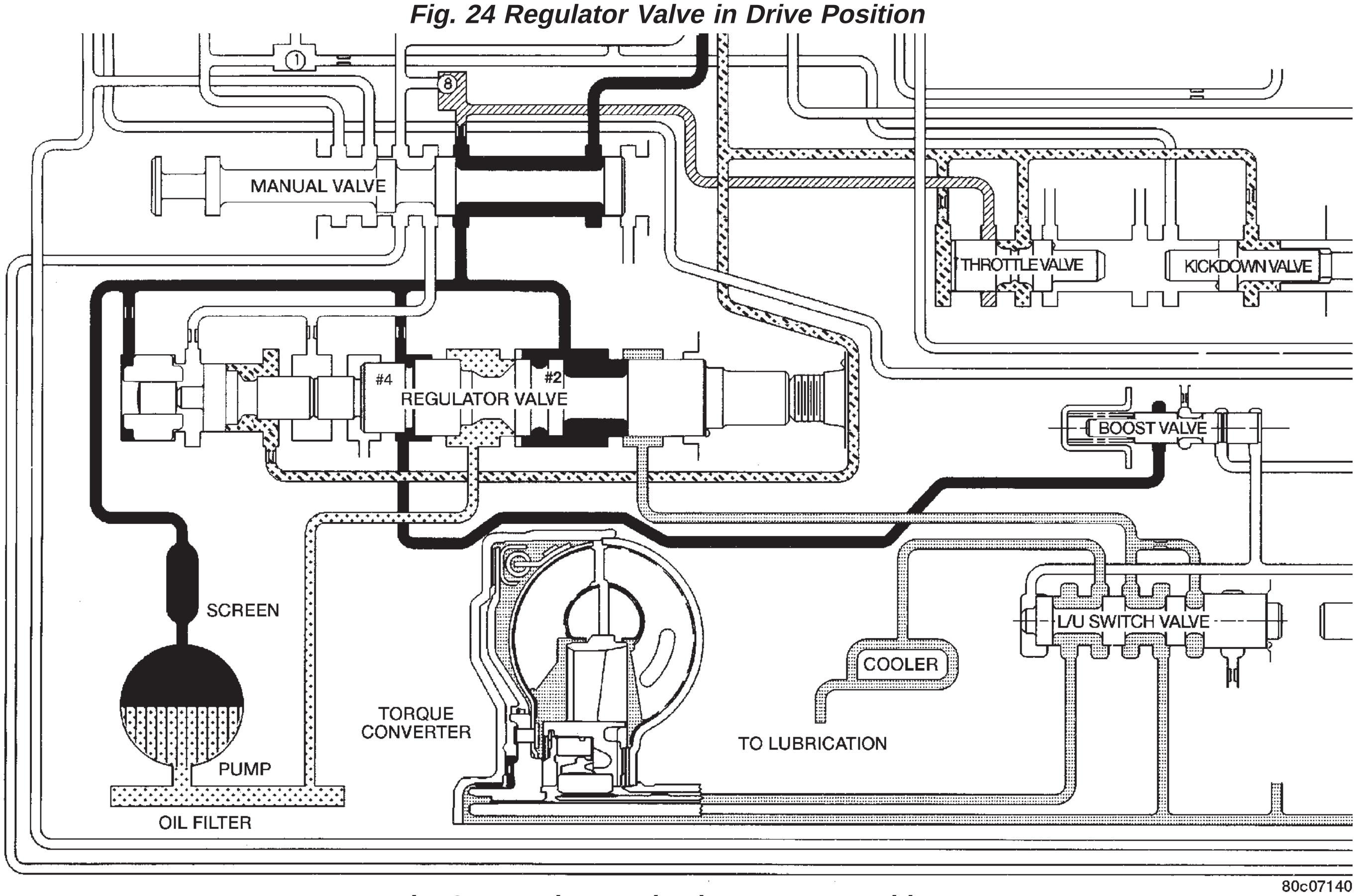


Fig. 25 Regulator Valve in Reverse Position

DESCRIPTION AND OPERATION (Continued)

KICKDOWN VALVE

When the throttle valve is as far over to the left as it can go, the maximum line pressure possible will enter the throttle pressure circuit. In this case, throttle pressure will equal line pressure. With the kickdown valve (Fig. 26) pushed into the bore as far as it will go, fluid initially flows through the annular groove of the 2–3 shift valve (which will be in the direct drive position to the right).

After passing the annular groove, the fluid is routed to the spring end of the 2–3 shift valve. Fluid pressure reacting on the area of land #1 overcomes governor pressure, downshifting the 2–3 shift valve into the kickdown, or second gear stage of operation. The valve is held in the kickdown position by throttle pressure routed from a seated check ball (#2). Again, if vehicle speed is low enough, throttle pressure will also push the 1–2 shift valve left to seat its governor plug, and downshift to drive breakaway.

KICKDOWN LIMIT VALVE

The purpose of the limit valve is to prevent a 3–2 downshift at higher speeds when a part–throttle downshift is not desirable. At these higher speeds only a full throttle 3–2 downshift will occur. At low road speeds (Fig. 27) the limit valve does not come into play and does not affect the downshifts. As the vehicle's speed increases (Fig. 28), the governor pressure also increases. The increased governor pressure acts on the reaction area of the bottom land of the limit valve overcoming the spring force trying to push the valve toward the bottom of its bore. This pushes the valve upward against the spring and bottoms the valve against the top of the housing. With the valve bottomed against the housing, the throttle pressure supplied to the valve will be closed off by the bottom land of the limit valve. When the supply of throttle pressure has been shut off, the 3–2 part throttle downshift plug becomes inoperative, because no pressure is acting on its reaction area.

1–2 SHIFT VALVE

The 1–2 shift valve assembly (Fig. 29), or mechanism, consists of: the 1–2 shift valve, governor plug, and a spring on the end of the valve. After the manual valve has been placed into a forward gear range, line pressure is directed to the 1–2 shift valve. As the throttle is depressed, throttle pressure is applied to the right side of the 1–2 shift valve assembly. With throttle pressure applied to the right side of the valve, there is now both spring pressure and throttle pressure acting on the valve, holding it against the governor plug. As the vehicle begins to move and build speed, governor pressure is created and is applied to the left of the valve at the governor plug.

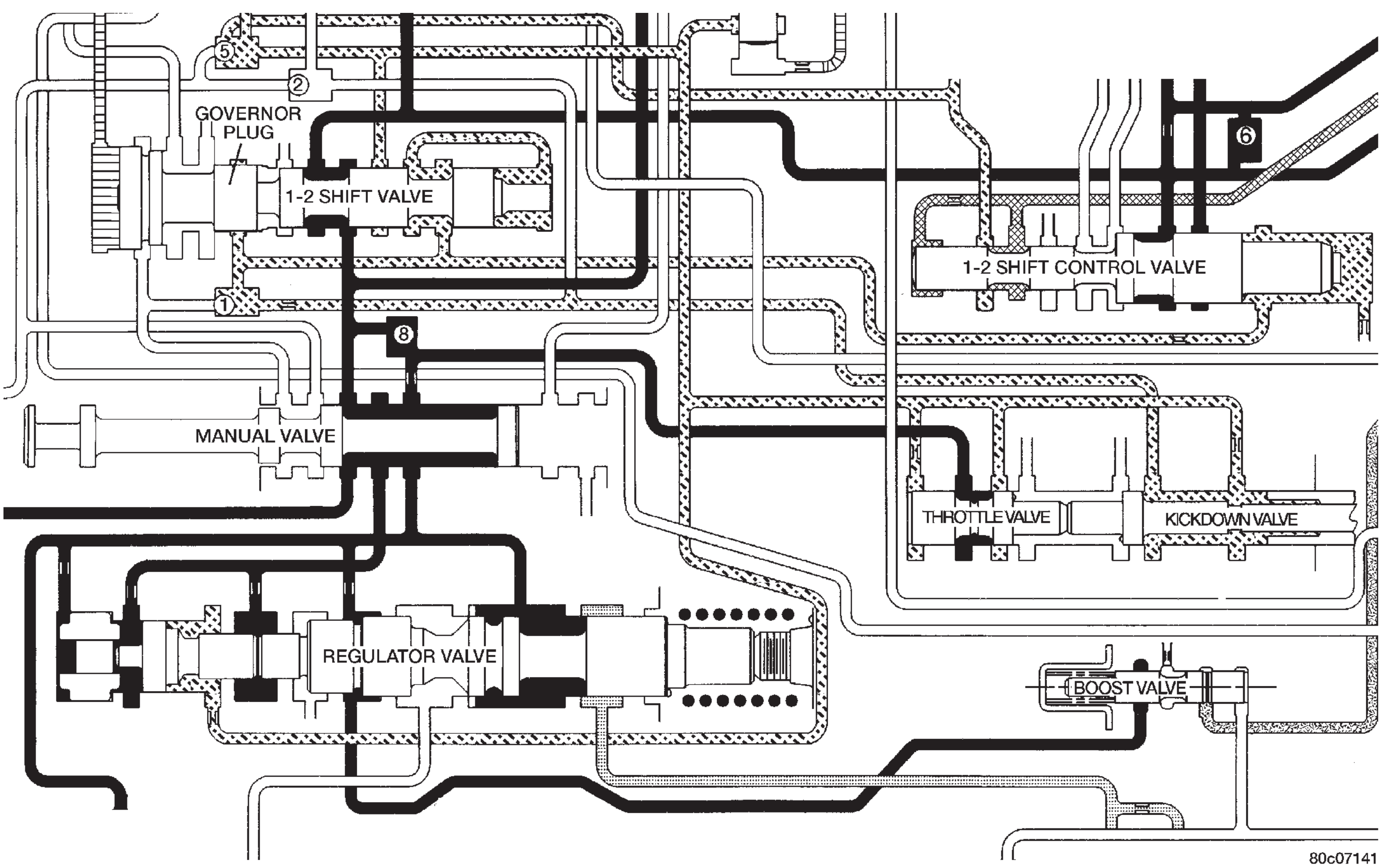


Fig. 26 Kickdown Valve–Wide Open Throttle

DESCRIPTION AND OPERATION (Continued)

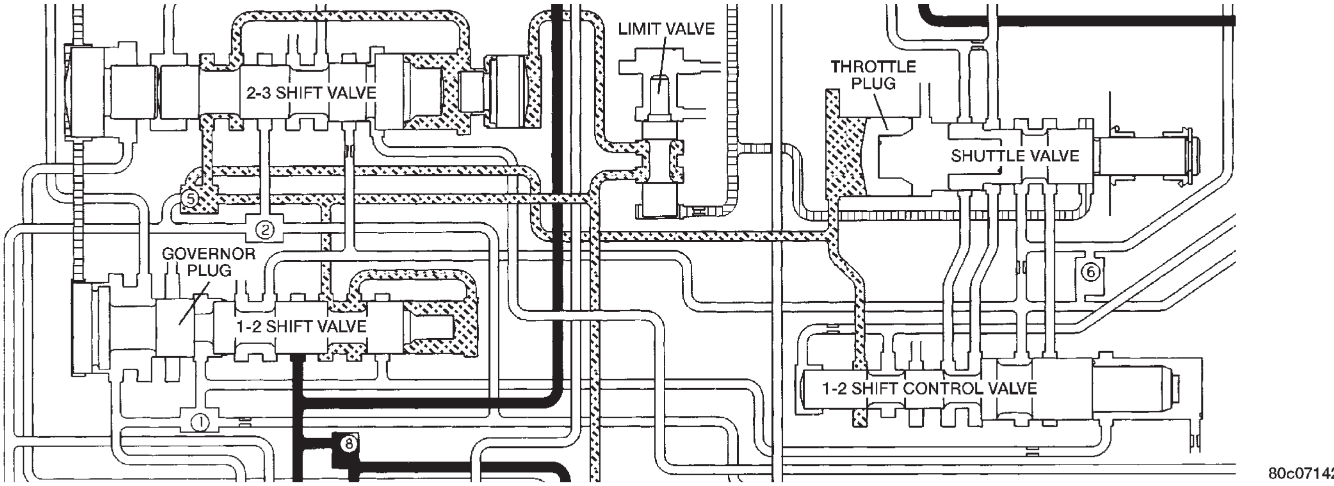


Fig. 27 Kickdown Limit Valve-Low Speeds

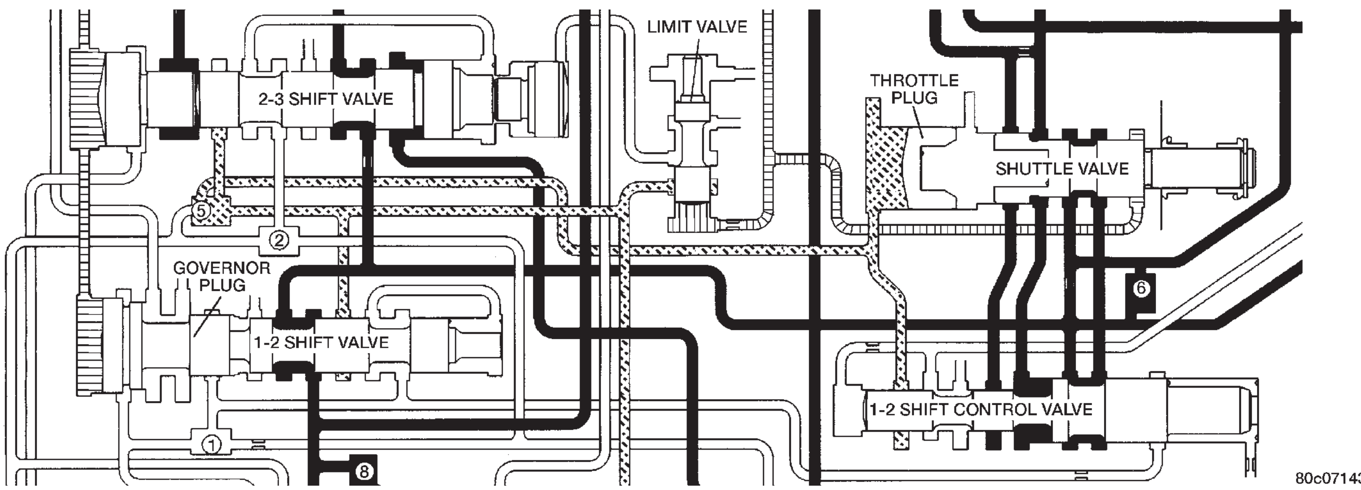


Fig. 28 Kickdown Limit Valve-High Speeds

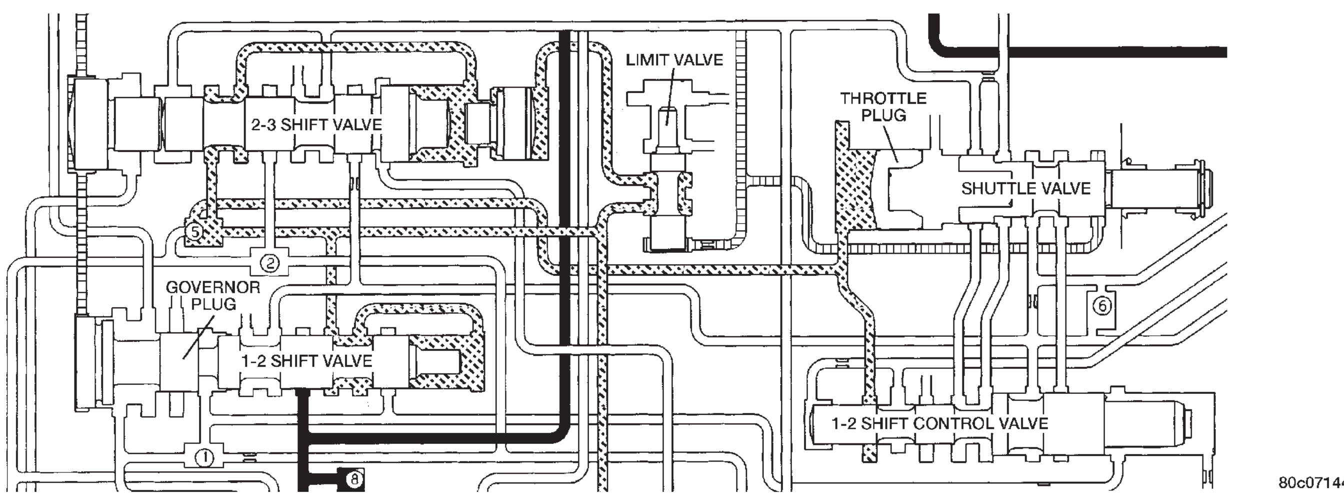


Fig. 29 1–2 Shift Valve-Before Shift

When governor pressure builds to a point where it can overcome the combined force of the spring and throttle pressure on the other side of the valve, the valve will begin to move over to the right. As the valve moves to the right, the middle land of the valve will close off the circuit supplying the throttle pressure to the right side of the valve. When the throttle pressure is closed off, the valve will move even far-

DESCRIPTION AND OPERATION (Continued)

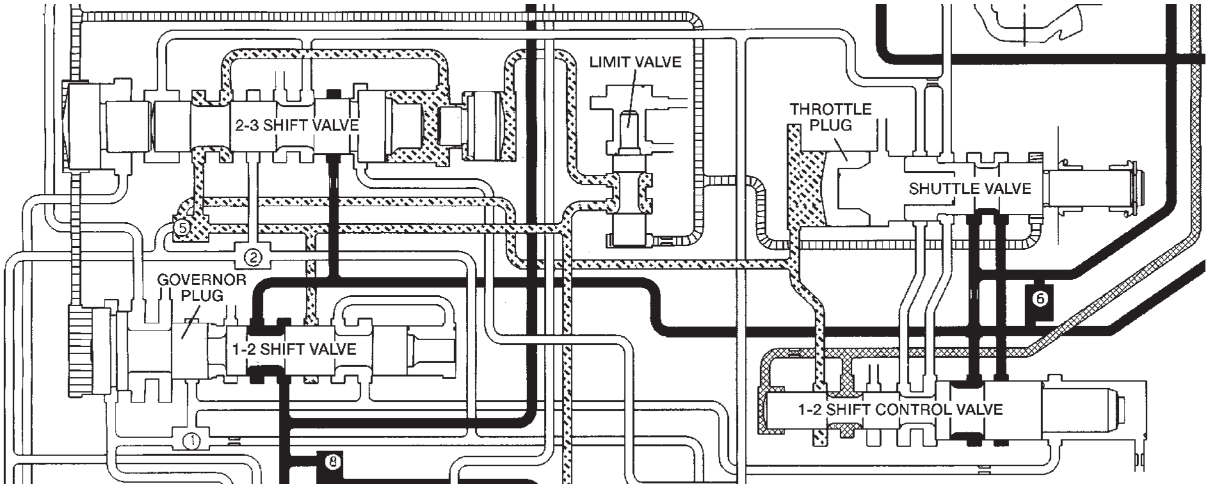


Fig. 30 1–2 Shift Valve-After Shift

ther to the right, allowing line pressure to enter another circuit and energize the front servo, applying the front band (Fig. 30).

The governor plug serves a dual purpose:

• It allows the shift valves to move either left or right, allowing both upshifts and downshifts.

• When in a manual selection position, it will be hydraulically “blocked” into position so no upshift can occur.

The physical blocking of the upshift while in the manual “1” position is accomplished by the directing of line pressure between both lands of the governor plug. The line pressure reacts against the larger land of the plug, pushing the plug back against the end plate overcoming governor pressure. With the combination of the line pressure and spring pressure, the valve cannot move, preventing any upshift.

1–2 SHIFT CONTROL VALVE

It contains a valve with four lands and a spring. It is used as both a “relay” and “balanced” valve.

The valve has two specific operations (Fig. 31):

• Aid in quality of the 1–2 upshift.

• Aid in the quality and timing of the 3–2 kickdown ranges.

When the manual valve is set to the Drive position and the transmission is in the first or second gear range, 1–2 shift control or “modulated throttle pressure” is supplied to the middle of the accumulator piston by the 1–2 shift control valve. During the 1–2 upshift, this pressure is used to control the kickdown servo apply pressure that is needed to apply the kickdown and accumulator pistons. Thus, the 1–2 shift point is “cushioned” and the quality is improved. During a WOT kickdown, kickdown pressure is applied between the kickdown valve and the 1–2 shift control valve. This additional pressure is directed to the 1–2 shift control’s spring cavity, adding to the spring load on the valve. The result of this increased “modulated” throttle pressure is a firmer WOT upshift.

2–3 SHIFT VALVE

The 2–3 shift valve mechanism (Fig. 32) consists of the 2–3 shift valve, governor plug and spring, and a throttle plug. After the 1–2 shift valve has completed its operation and applied the front band, line pressure is directed to the 2–3 shift valve through the connecting passages from the 1–2 shift valve. The line pressure will then dead–end at land #2 until the 2–3 valve is ready to make its shift. Now that the vehicle is in motion and under acceleration, there is throttle pressure being applied to the spring side of the valve and between lands #3 and #4.

As vehicle speed increases, governor pressure increases proportionately, until it becomes great enough to overcome the combined throttle and spring pressure on the right side of the valve. When this happens, the governor plug is forced against the shift valve moving it to the right. The shift valve causes land #4 to close the passage supplying throttle pressure to the 2–3 shift valve. Without throttle pressure present in the circuit now, the governor plug will push the valve over far enough to bottom the valve in its bore. This allows land #2 to direct line pressure to the front clutch.

After the shift (Fig. 33), line pressure is directed to the land between the shift valve and the governor plug, and to the release side of the kickdown servo. This releases the front band and applies the front clutch, shifting into third gear or direct drive. The rear clutch remains applied, as it has been in the other gears. During a manual “1” or manual “2” gear selection, line pressure is sent between the two lands of the 2–3 governor plug. This line pressure at the governor plug locks the shift valve into the second gear position, preventing an upshift into direct drive. The theory for the blocking of the valve is the same as that of the 1–2 shift valve.

DESCRIPTION AND OPERATION (Continued)

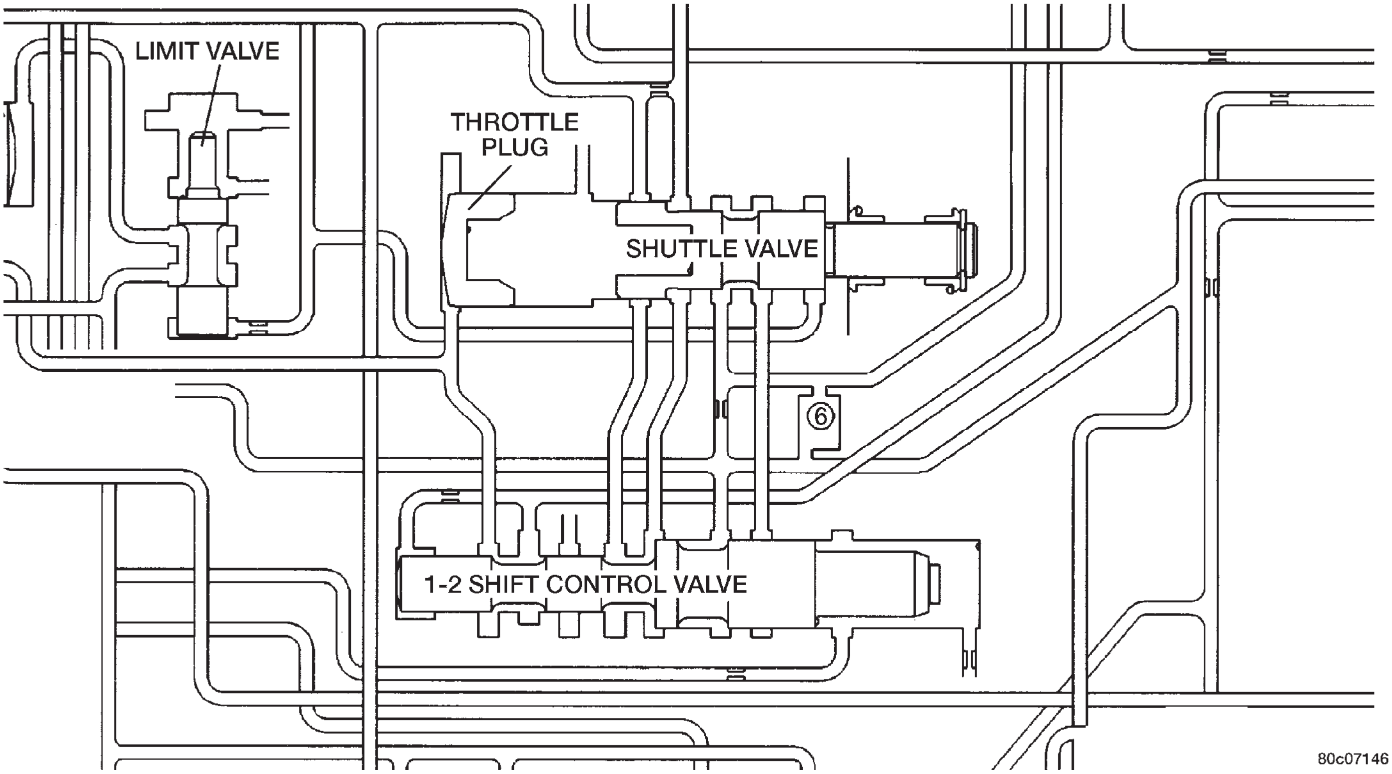


Fig. 31 1–2 Shift Control Valve

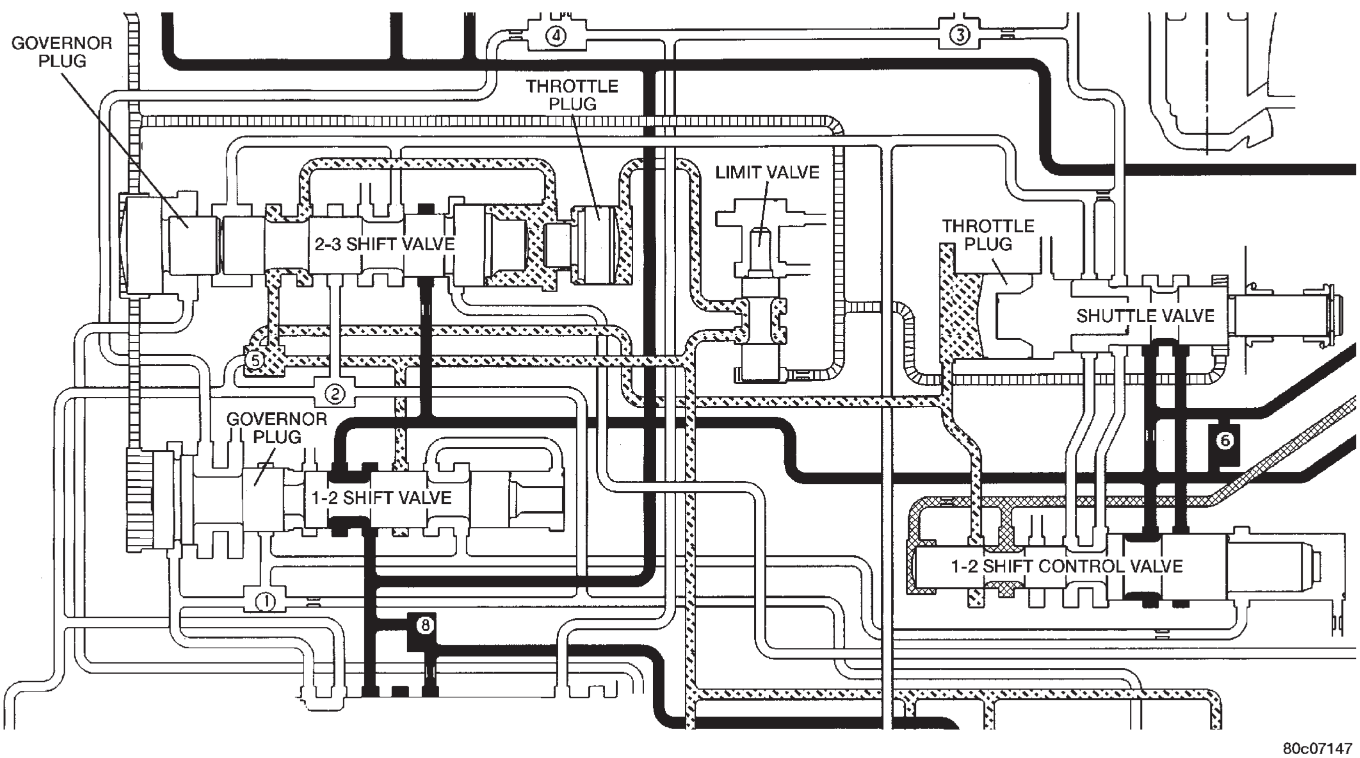


Fig. 32 2–3 Shift Valve-Before Shift

DESCRIPTION AND OPERATION (Continued)

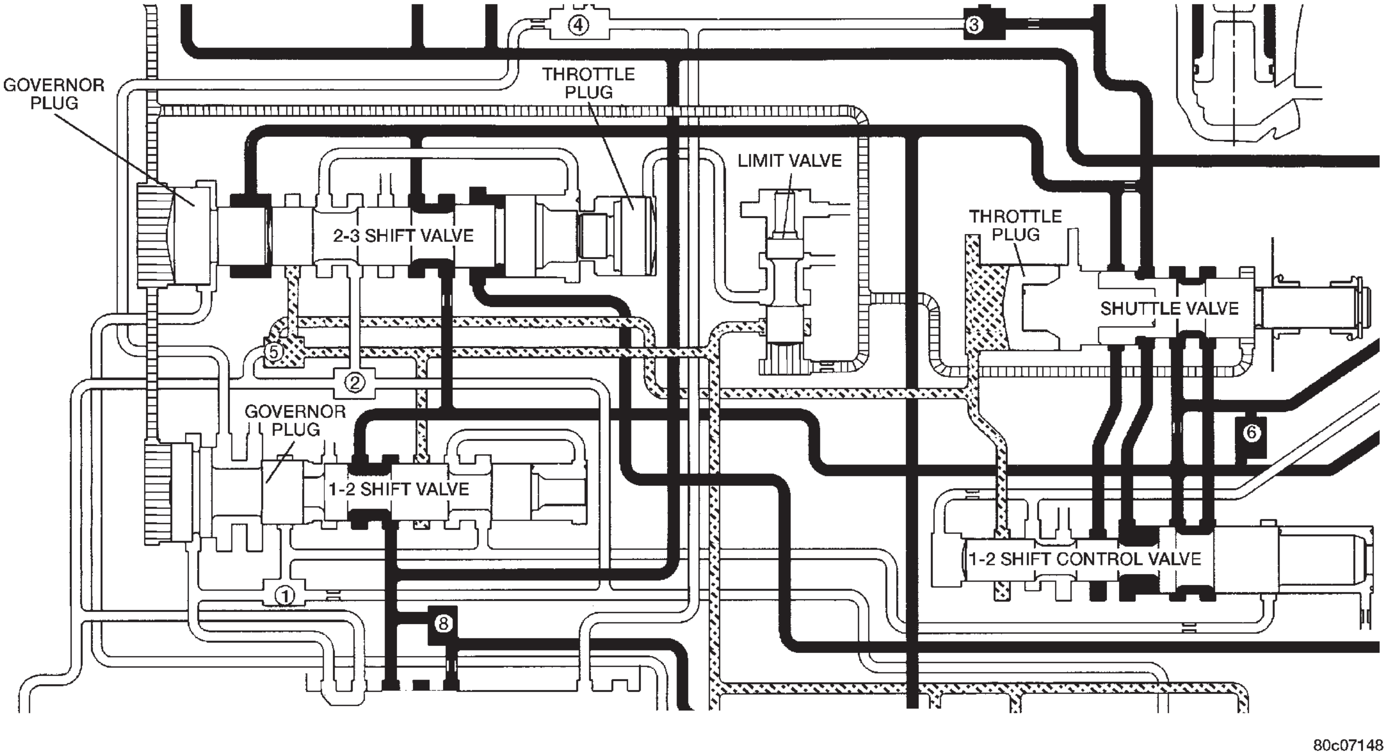


Fig. 33 2–3 Shift Valve-After Shift

3–4 SHIFT VALVE

The PCM energizes the overdrive solenoid during the 3-4 upshift (Fig. 34). This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure moving the valve to the upshift position (Fig. 35). This action exposes the feed passages to the 3-4 timing valve, 3-4 quick fill valve, 3-4 accumulator, and ultimately to the overdrive piston.

3–4 TIMING VALVE

The 3-4 timing valve is moved by line pressure coming through the 3-4 shift valve (Fig. 36). The timing valve holds the 2-3 shift valve in an upshift position. The purpose is to prevent the 2-3 valve from up or downshifting before the 3-4 valve (Fig. 37).

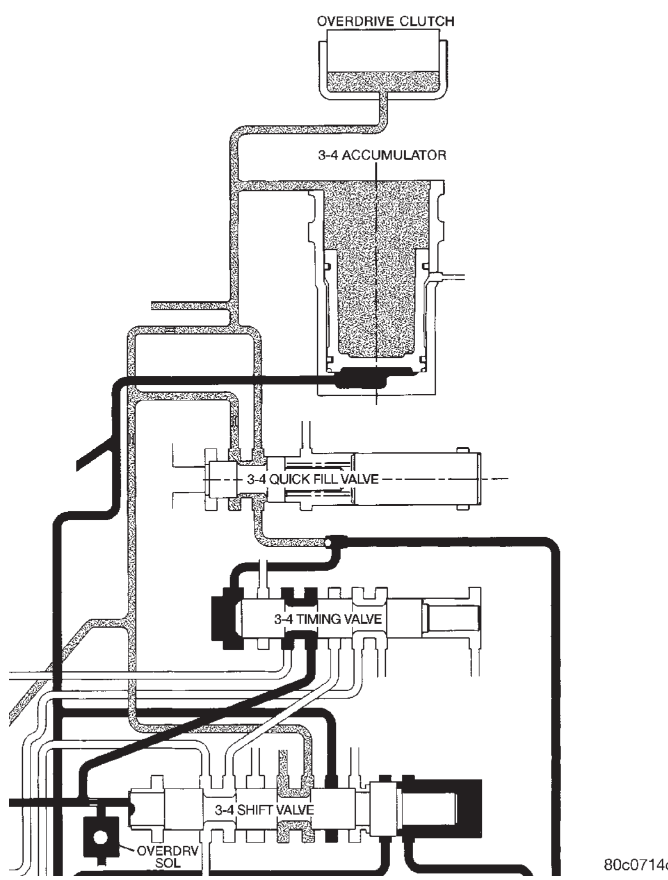


Fig. 34 3–4 Shift Valve Before Shift

DESCRIPTION AND OPERATION (Continued)

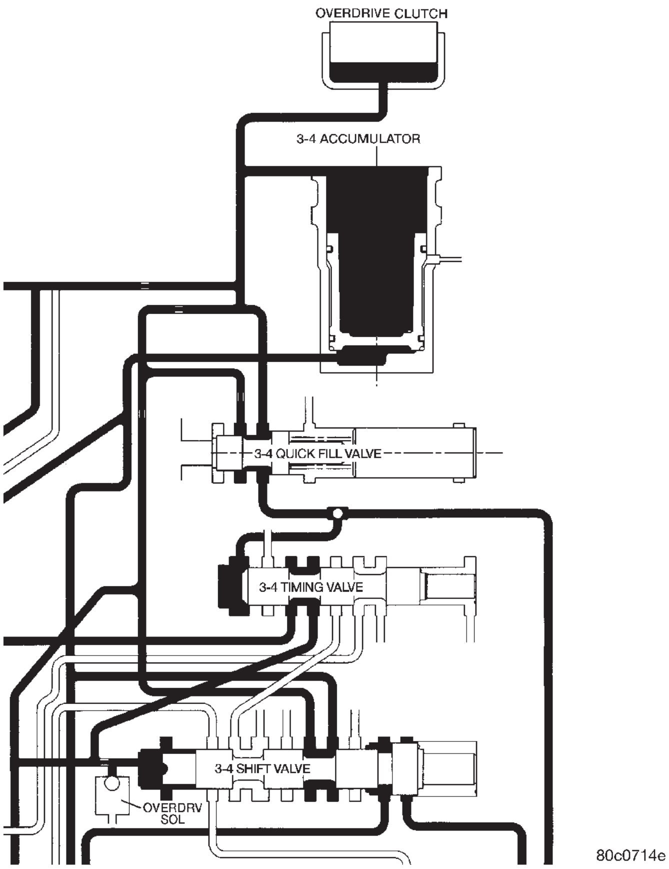


Fig. 35 3–4 Shift Valve After Shift

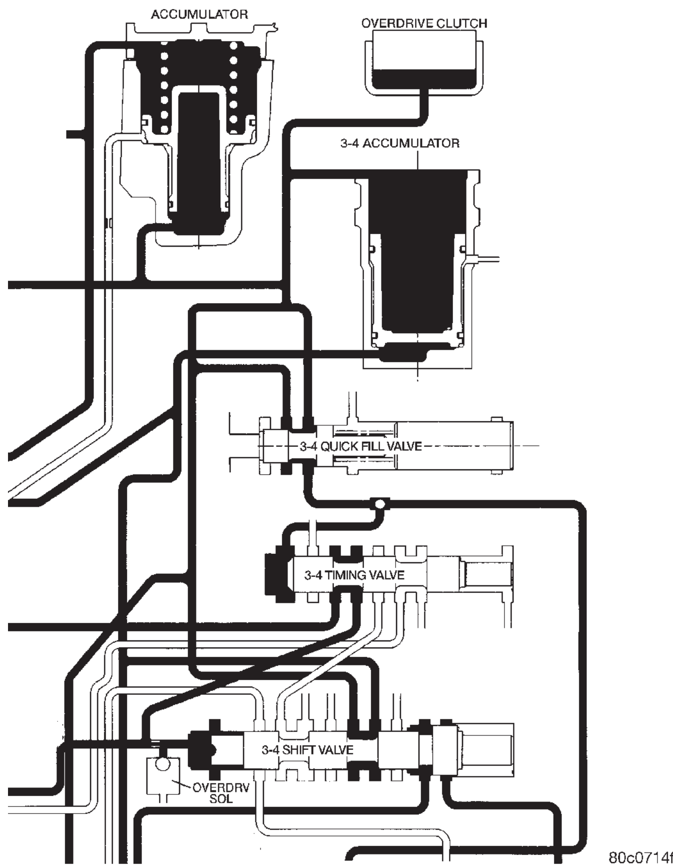


Fig. 36 3–4 Timing Valve Allowing 4–3 Shift

DESCRIPTION AND OPERATION (Continued)

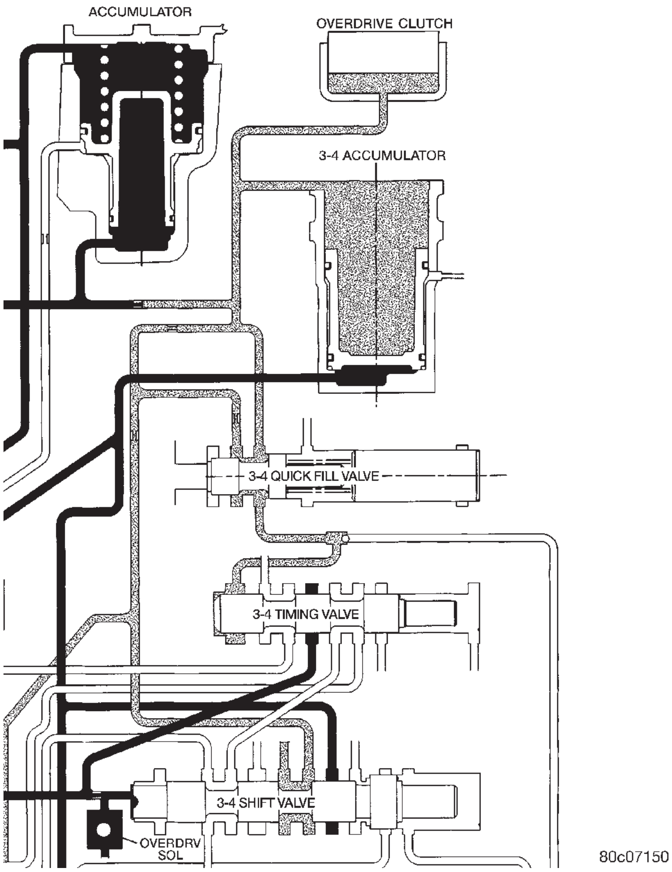


Fig. 37 3–4 Timing Valve Allowing 3–2 Shift

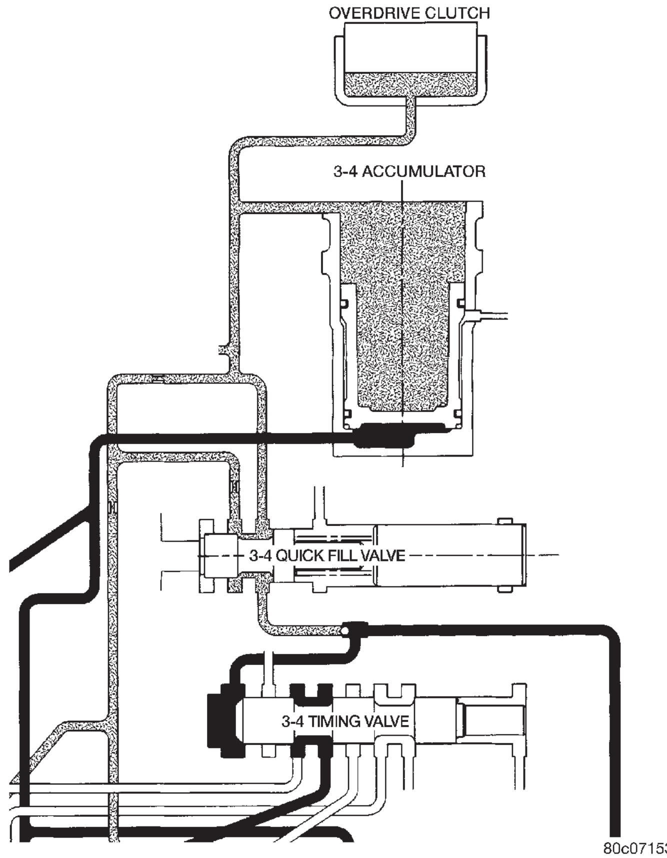


Fig. 38 3–4 Quick Fill Valve Before Shift

3–4 QUICK FILL VALVE

The 3-4 quick fill valve provides faster engagement of the overdrive clutch during 3-4 upshifts. The valve temporarily bypasses the clutch piston feed orifice at the start of a 3-4 upshift (Fig. 39). This exposes a larger passage into the piston retainer resulting in a much faster clutch fill and apply sequence. The quick fill valve does not bypass the regular clutch feed orifice throughout the 3-4 upshift. Instead, once a predetermined pressure develops within the clutch, the valve closes the bypass. Clutch fill is then completed through the regular feed orifice.

THROTTLE VALVE

In all gear positions the throttle valve (Fig. 40) is being supplied with line pressure. The throttle valve meters and reduces the line pressure that now becomes throttle pressure. The throttle valve is moved by a spring and the kickdown valve, which is mechanically connected to the throttle. The larger the throttle opening, the higher the throttle pressure (to a maximum of line pressure). The smaller the throttle opening, the lower the throttle pressure (to a minimum of zero at idle). As engine speed increases, the increase in pump speed increases pump output. The increase in pressure and volume must be regulated to maintain the balance within the transmission. To do this, throttle pressure is routed to the reaction area on the right side of the throttle pressure plug (in the regulator valve).

DESCRIPTION AND OPERATION (Continued)

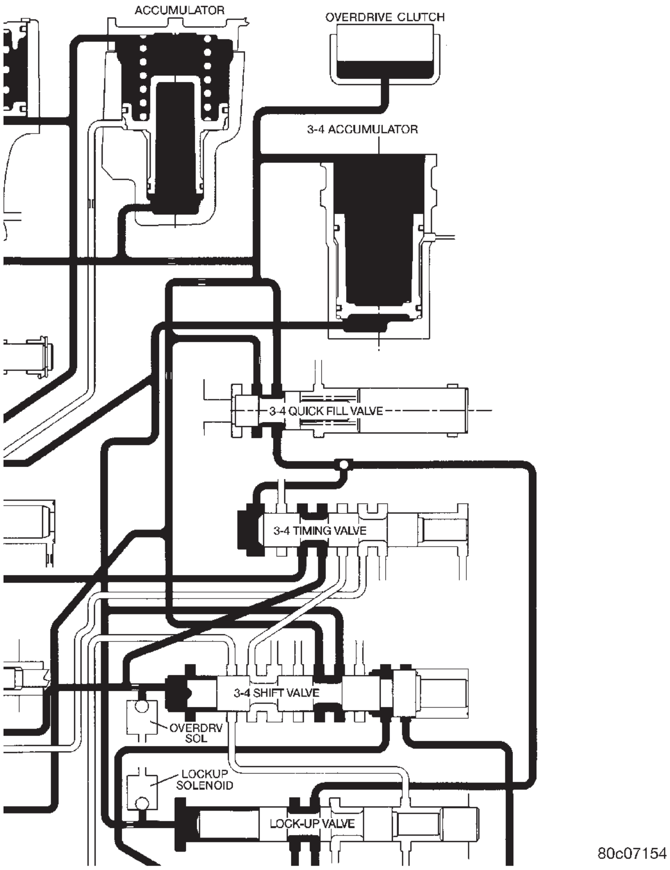


Fig. 39 3–4 Quick Fill Valve After Shift

The higher engine speed and line pressure would open the vent too far and reduce line pressure too much. Throttle pressure, which increases with engine speed (throttle opening), is used to oppose the movement of the pressure valve to help control the metering passage at the vent. The throttle pressure is combined with spring pressure to reduce the force of the throttle pressure plug on the pressure valve. The larger spring at the right closes the regulator valve passage and maintains or increases line pressure. The increased line pressure works against the reaction area of the line pressure plug and the reaction area left of land #3 simultaneously moves the regulator valve train to the right and controls the metering passage.

The kickdown valve, along with the throttle valve, serve to delay upshifts until the correct vehicle and engine speed have been reached. It also controls downshifts upon driver demand, or increased engine load. If these valves were not in place, the shift points would be at the same speed for all throttle positions. The kickdown valve is actuated by a cam connected to the throttle. This is accomplished through either a linkage or a cable. The cam forces the kickdown valve toward the throttle valve compressing the spring between them and moving the throttle valve. As the throttle valve land starts to uncover its port, line pressure is “metered” out into the circuits and viewed as throttle pressure. This

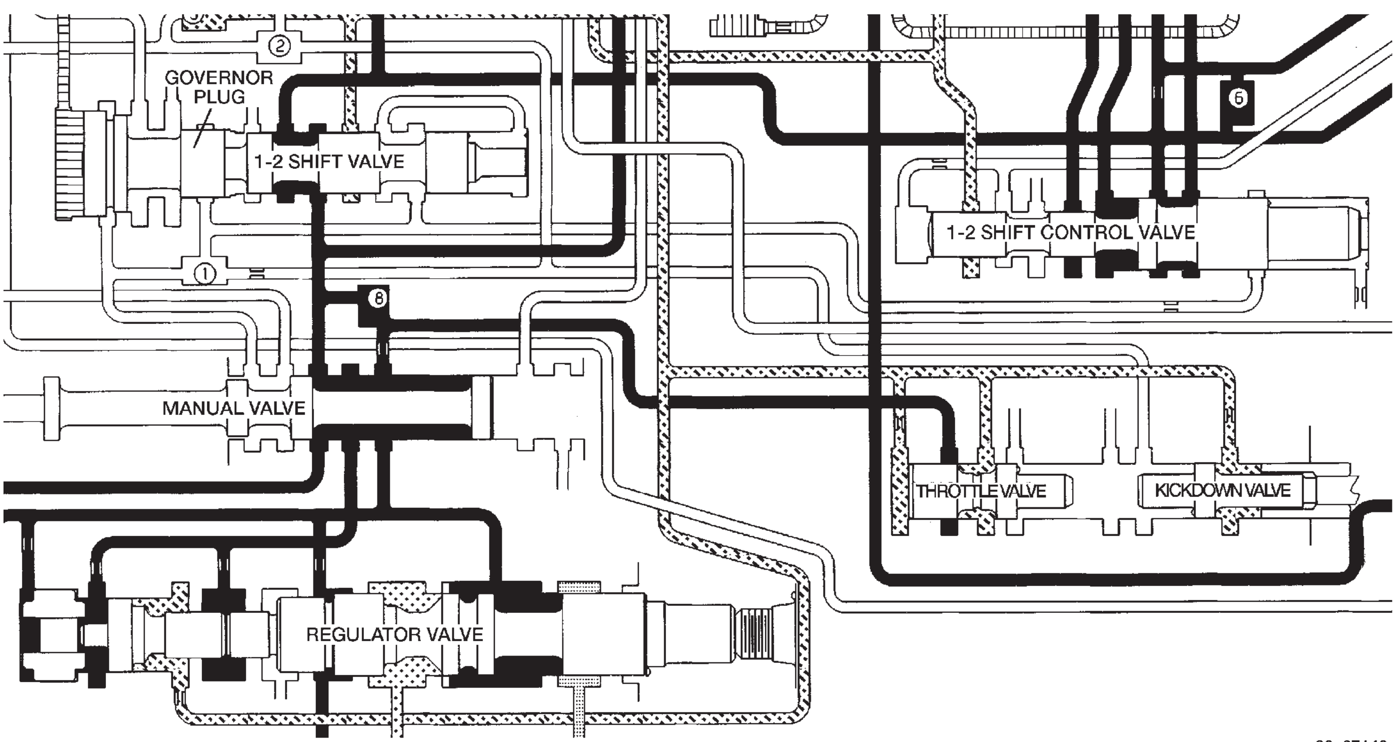


Fig. 40 Throttle Valve

DESCRIPTION AND OPERATION (Continued)

increased throttle pressure is metered out into the circuits it is applied to: the 1–2 and 2–3 shift valves. When the throttle pressure is high enough, a 3–2 downshift will occur. If the vehicle speed is low enough, a 2–1 downshift will occur.

SWITCH VALVE

When the transmission is in Drive Second just before the TCC application occurs (Fig. 41), the pressure regulator valve is supplying torque converter pressure to the switch valve. The switch valve directs this pressure through the transmission input shaft, into the converter, through the converter, back out between the input shaft and the reaction shaft, and back up to the switch valve. From the switch valve, the fluid pressure is directed to the transmission cooler, and lubrication pressure returns from the cooler to lubricate different portions of the transmission.

Once the TCC control valve has moved to the left (Fig. 42), line pressure is directed to the tip of the switch valve, forcing the valve to the right. The

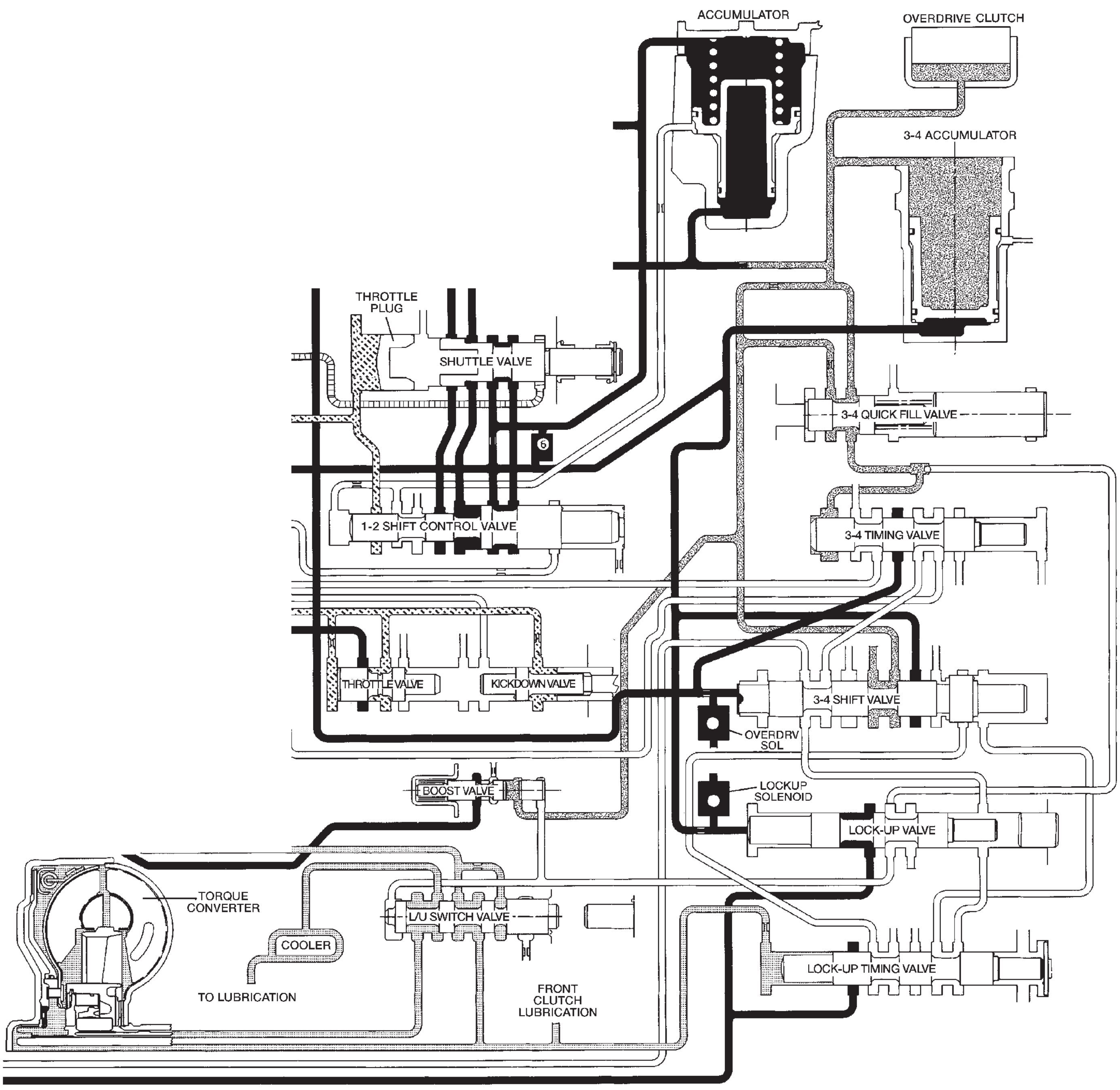


Fig. 41 Switch Valve-Torque Converter Unlocked

DESCRIPTION AND OPERATION (Continued)

switch valve now vents oil from the front of the piston in the torque converter, and supplies line pressure to the (rear) apply side of the torque converter piston. This pressure differential causes the piston to apply against the friction material, cutting off any further flow of line pressure oil. After the switch valve is shuttled right allowing line pressure to engage the TCC, torque converter pressure is directed past the switch valve into the transmission cooler and lubrication circuits.

MANUAL VALVE

The manual valve (Fig. 43) is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the side of the valve body. The valve is connected mechanically by either a cable or linkage to the gearshift mechanism. The valve is held in each of its

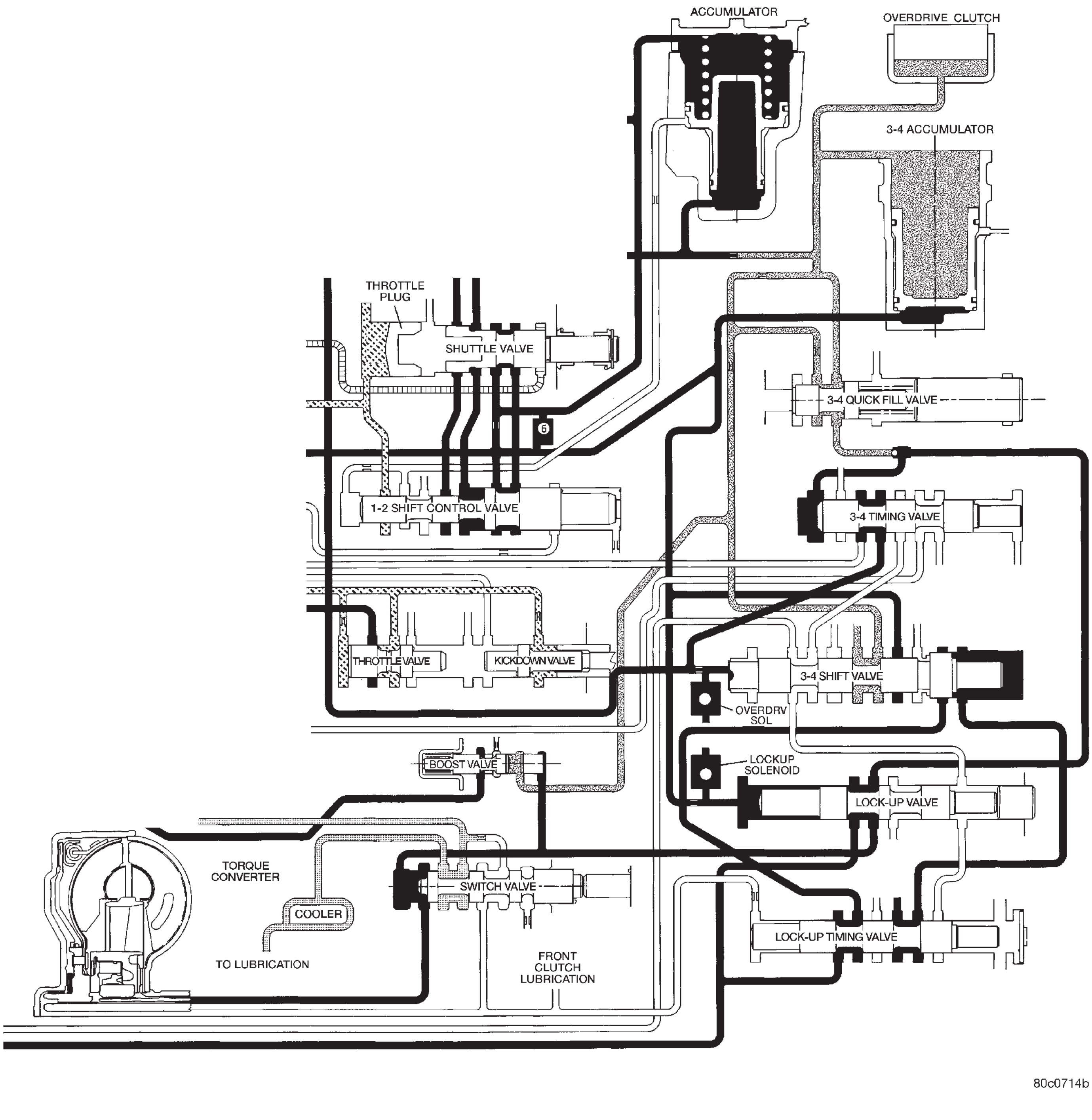


Fig. 42 Switch Valve-Torque Converter Locked

DESCRIPTION AND OPERATION (Continued)

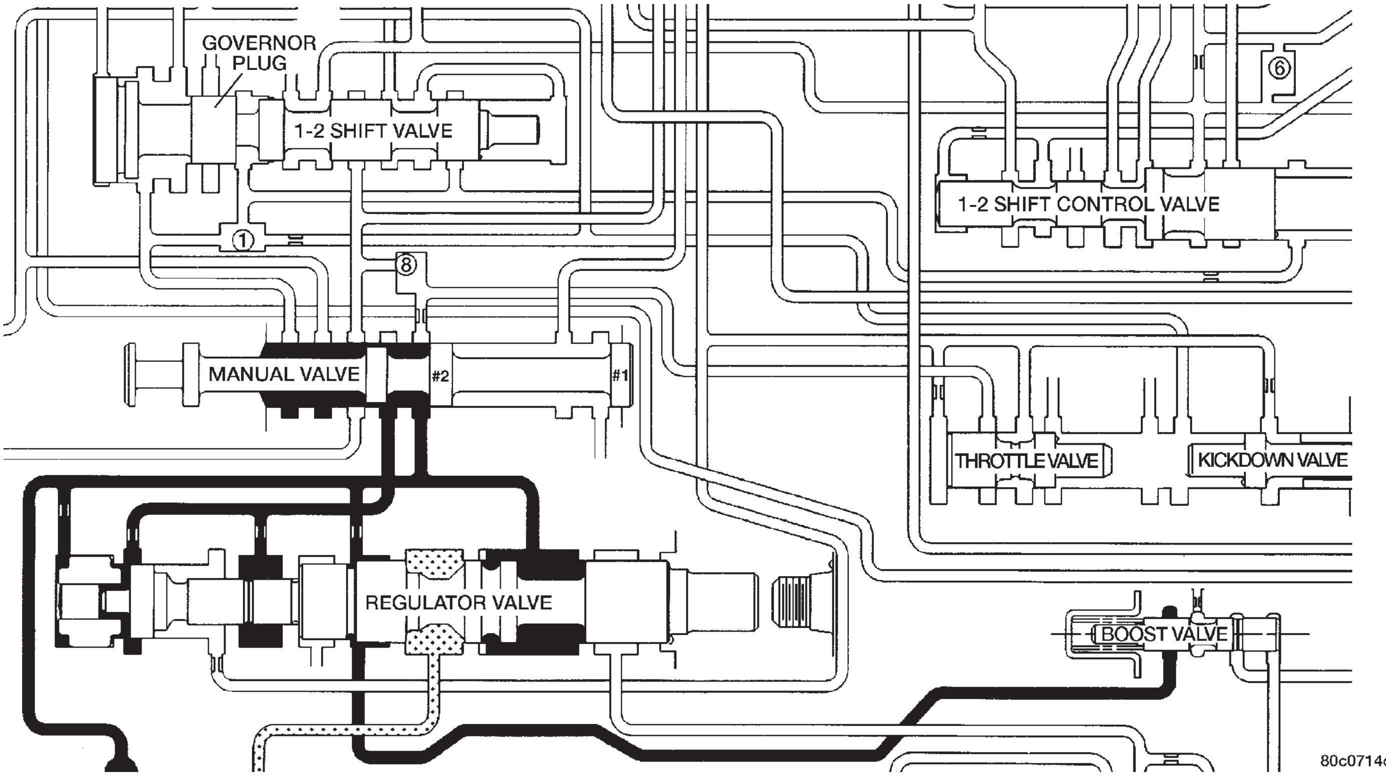


Fig. 43 Manual Valve

positions by a spring–loaded roller or ball that engages the "roostercomb" of the manual valve.

CONVERTER CLUTCH LOCK-UP VALVE

The torque converter clutch (TCC) lock-up valve controls the back (ON) side of the torque converter clutch. When the PCM energizes the TCC solenoid to engage the converter clutch piston, pressure is applied to the TCC lock-up valve which moves to the right and applies pressure to the torque converter clutch.

CONVERTER CLUTCH LOCK-UP TIMING VALVE

The torque converter clutch (TCC) lock-up timing valve is there to block any 4–3 downshift until the TCC is completely unlocked and the clutch is disengaged.

SHUTTLE VALVE

The assembly is contained in a bore in the valve body above the shift valves. When the manual valve is positioned in the Drive range, throttle pressure acts on the throttle plug of the shuttle valve (Fig. 31) to move it against a spring, increasing the spring force on the shuttle valve. During a part or full throttle 1–2 upshift, the throttle plug is bottomed by throttle pressure, holding the shuttle valve to the right against governor pressure, and opening a by–pass circuit. The shuttle valve controls the quality of the kickdown shift by restricting the rate of fluid discharge from the front clutch and servo release circuits. During a 3–2 kickdown, fluid discharges through the shuttle by–pass circuit. When the shuttle valve closes the by–pass circuit, fluid discharge is restricted and controlled for the application of the front band. During a 2–3 "lift foot" upshift, the shuttle valve by–passes the restriction to allow full fluid flow through the by-pass groove for a faster release of the band.

BOOST VALVE

The boost valve (Fig. 44) provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts (Fig. 45), and when accelerating in fourth gear.

ACCUMULATOR

DESCRIPTION

The accumulator (Fig. 46) is a hydraulic device that has the sole purpose of cushioning the application of a band or clutch. The accumulator consists of a dual–land piston and a spring located in a bore in the transmission case. The 3–4 accumulator is located in a housing attached to the side of the valve body (Fig. 47).

DESCRIPTION AND OPERATION (Continued)

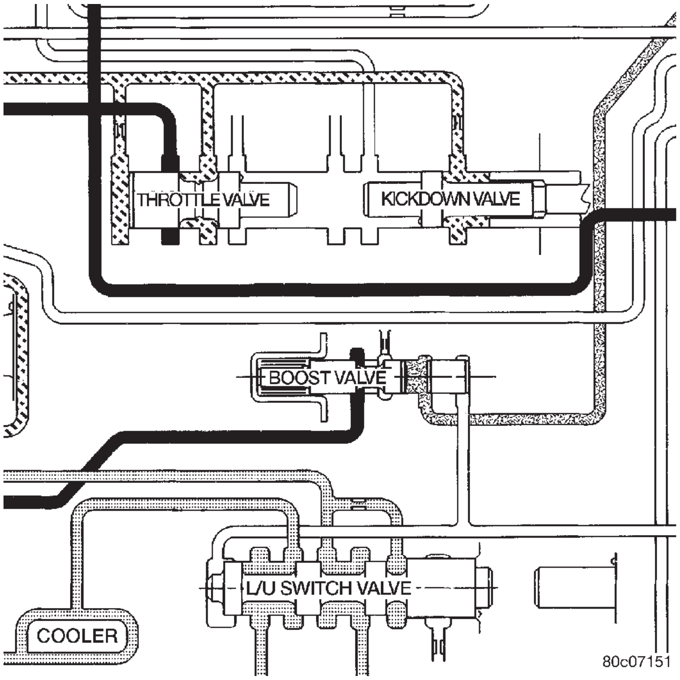


Fig. 44 Boost Valve Before Lock-up

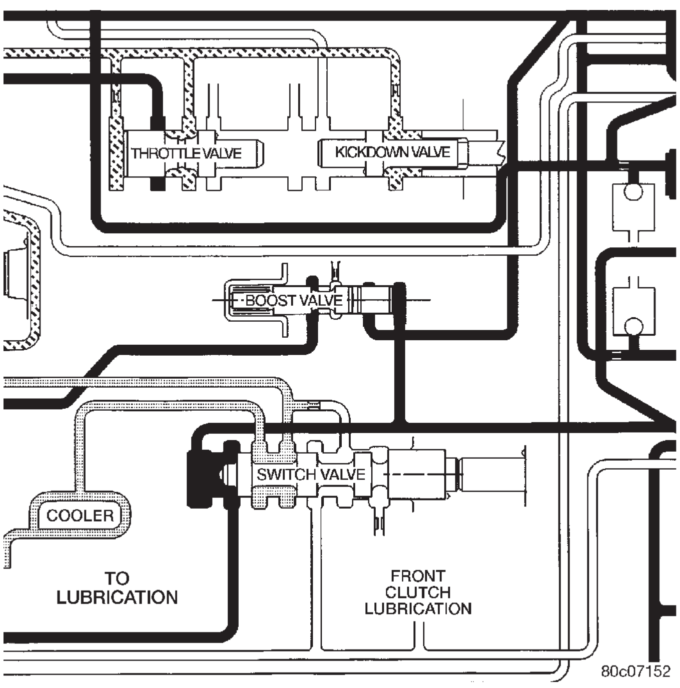


Fig. 45 Boost Valve After Lock-up

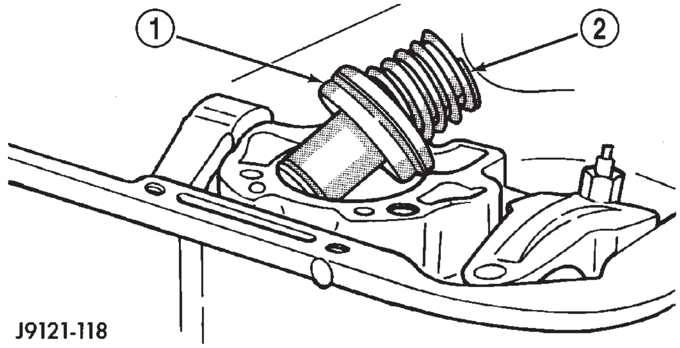


Fig. 46 Accumulator

1 – ACCUMULATOR PISTON
2 – PISTON SPRING

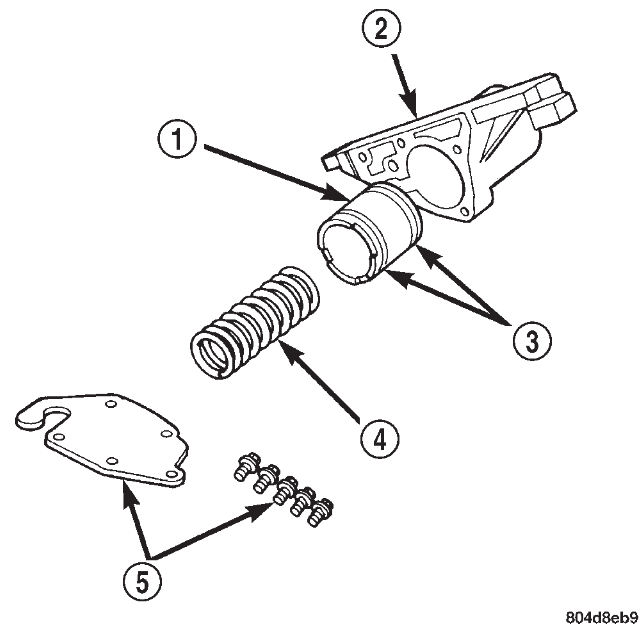


Fig. 47 3–4 Accumulator and Housing

1 – ACCUMULATOR PISTON
2 – 3–4 ACCUMULATOR HOUSING
3 – TEFLON SEALS
4 – PISTON SPRING
5 – COVER PLATE AND SCREWS

OPERATION

Both the accumulator and the 3–4 accumulator function the same. Line pressure is directed between the lands of the piston (Fig. 48), bottoming it against the accumulator plate. The accumulator stays in this position after the transmission is placed into a Drive position. When the 1–2 upshift occurs (Fig. 49), line pressure is directed to the large end of the piston and then to the kickdown servo. As the line pressure reaches the accumulator, the combination of spring pressure and line pressure forces the piston away from the accumulator plate. This causes a balanced pressure situation, which results in a cushioned band application. After the kickdown servo has become immovable, line pressure will finish pushing the accumulator up into its bore. When the large end of the accumulator piston is seated in its bore, the band or clutch is fully applied.

NOTE: The accumulator is shown in the inverted position for illustrative purposes.

DESCRIPTION AND OPERATION (Continued)

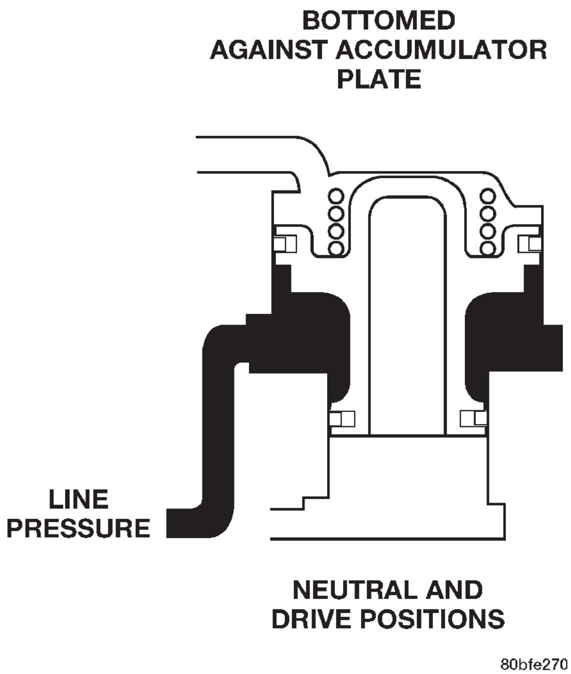


Fig. 48 Accumulator in Neutral and Drive Positions

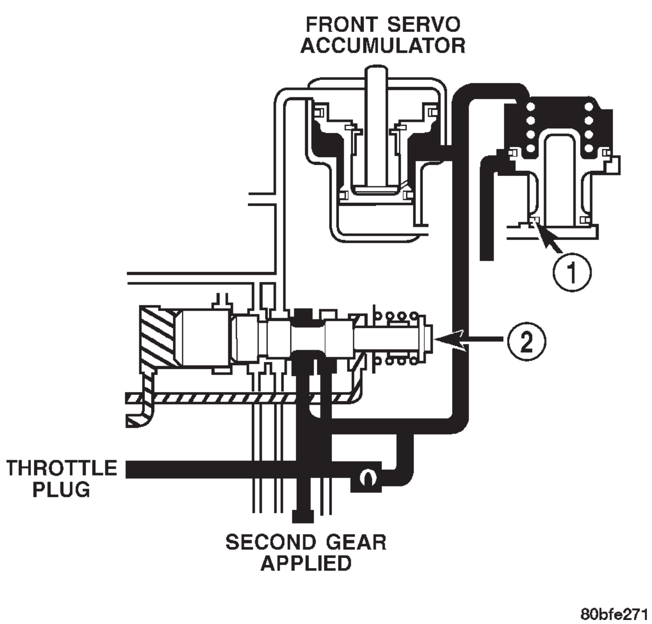


Fig. 49 Accumulator in Second Gear Position

1 – BOTTOM IN BORE
2 – SHUTTLE VALVE

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches, while others are used to apply bands. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PRESSURE

Pressure (Fig. 50) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in or 1 pound per square inch, or PSI as it is commonly referred to.

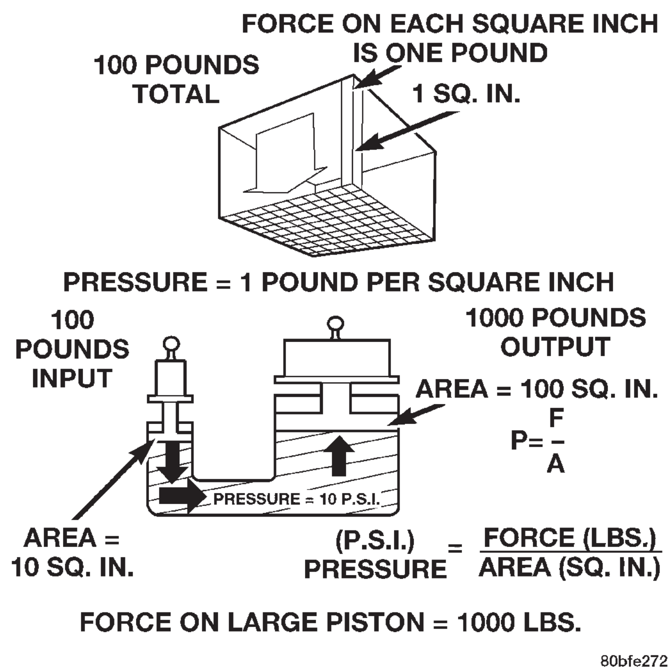


Fig. 50 Force and Pressure Relationship

PRESSURE ON A CONFINED FLUID

Pressure is exerted on a confined fluid (Fig. 51) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply "leak" past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O–rings, D–rings, lip seals, sealing rings, or extremely close tolerances

DESCRIPTION AND OPERATION (Continued)

between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal's Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the pressure in the fluid is the same everywhere within the container.

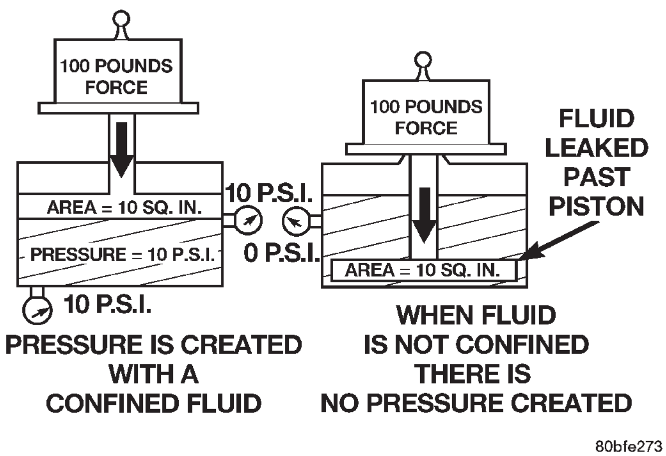


Fig. 51 Pressure on a Confined Fluid

FORCE MULTIPLICATION

Using the 10 PSI example used in the illustration (Fig. 52), a force of 1000 lbs. can be moved with a force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 52), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept "pressure is the same everywhere" means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

PISTON TRAVEL

The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it's a weight–to–distance output rather than a pressure–to–area output. Using the same forces and areas as in the previous example, the smaller piston

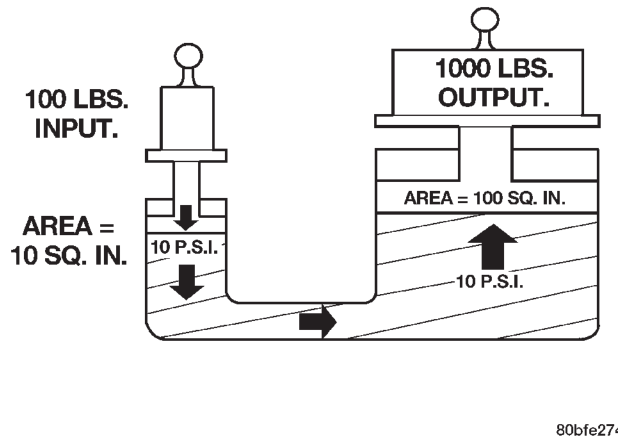


Fig. 52 Force Multiplication

(Fig. 53) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

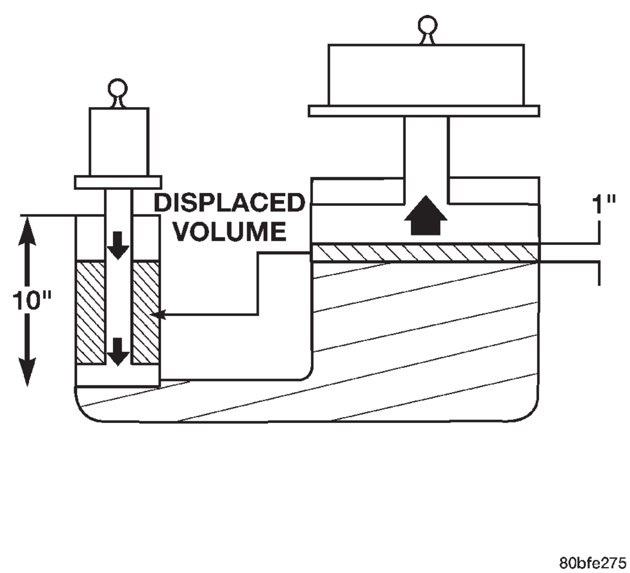


Fig. 53 Piston Travel

FRONT CLUTCH

DESCRIPTION

The front clutch assembly (Fig. 54) is composed of the front clutch retainer, pressure plate, four clutch plates, four driving discs, piston, piston return

DESCRIPTION AND OPERATION (Continued)

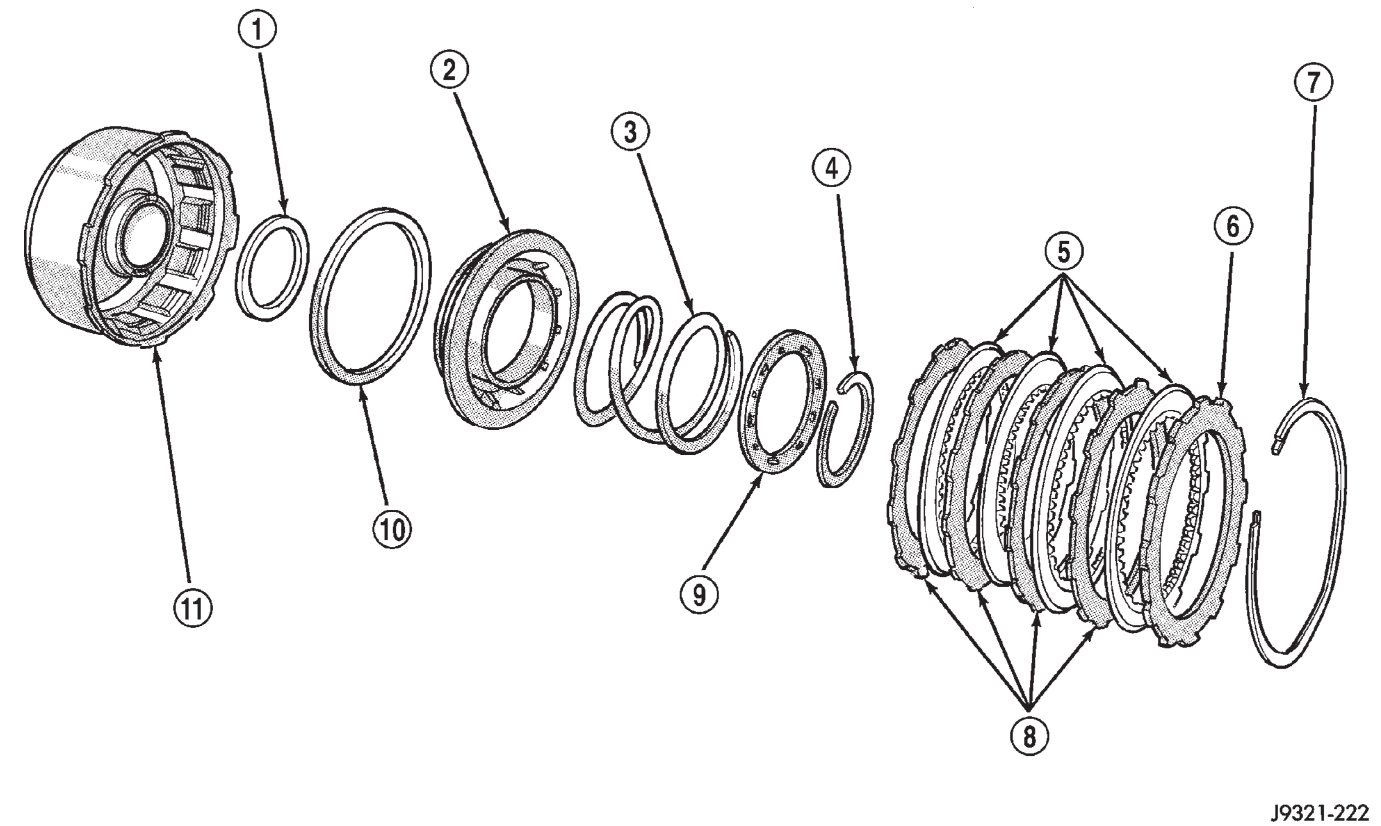


Fig. 54 Front Clutch

1 – RETAINER HUB SEAL
2 – CLUTCH PISTON
3 – PISTON SPRING
4 – SPRING RETAINER SNAP RING
5 – CLUTCH DISCS
6 – PRESSURE PLATE
7 – SNAP RING (WAVED)
8 – CLUTCH PLATES
9 – SPRING RETAINER
10 – PISTON SEAL
11 – FRONT CLUTCH RETAINER

spring, return spring retainer, and snap rings. The front clutch is the forwardmost component in the transmission geartrain and is directly behind the oil pump and is considered a driving component.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION

To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are lugged to the clutch retainer. The waved snap ring is used to cushion the application of the clutch pack. In some transmissions, the snap ring is selective and used to adjust clutch pack clearance.

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assembly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one–way ball–check–valve located in the clutch retainer. The check–valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

REAR CLUTCH

DESCRIPTION

The rear clutch assembly (Fig. 55) is composed of the rear clutch retainer, pressure plate, three clutch

DESCRIPTION AND OPERATION (Continued)

plates, four driving discs, piston, Belleville spring, and snap rings. The Belleville spring acts as a lever to multiply the force applied on to it by the apply piston. The increased apply force on the rear clutch pack, in comparison to the front clutch pack, is needed to hold against the greater torque load imposed onto the rear pack. The rear clutch is directly behind the front clutch and is considered a driving component.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION

To apply the clutch, pressure is applied between the clutch retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through the hub of the reaction shaft support. With pressure applied between the clutch retainer and piston, the piston moves away from the clutch retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the input shaft into the driving discs, and into the clutch plates and pressure plate that are lugged to the clutch retainer. The waved snap ring is used to cushion the application of the clutch pack. In some transmissions, the snap ring is selective and used to adjust clutch pack clearance.

When pressure is released from the piston, the spring returns the piston to its fully released position and disengages the clutch. The release spring also helps to cushion the application of the clutch assem-

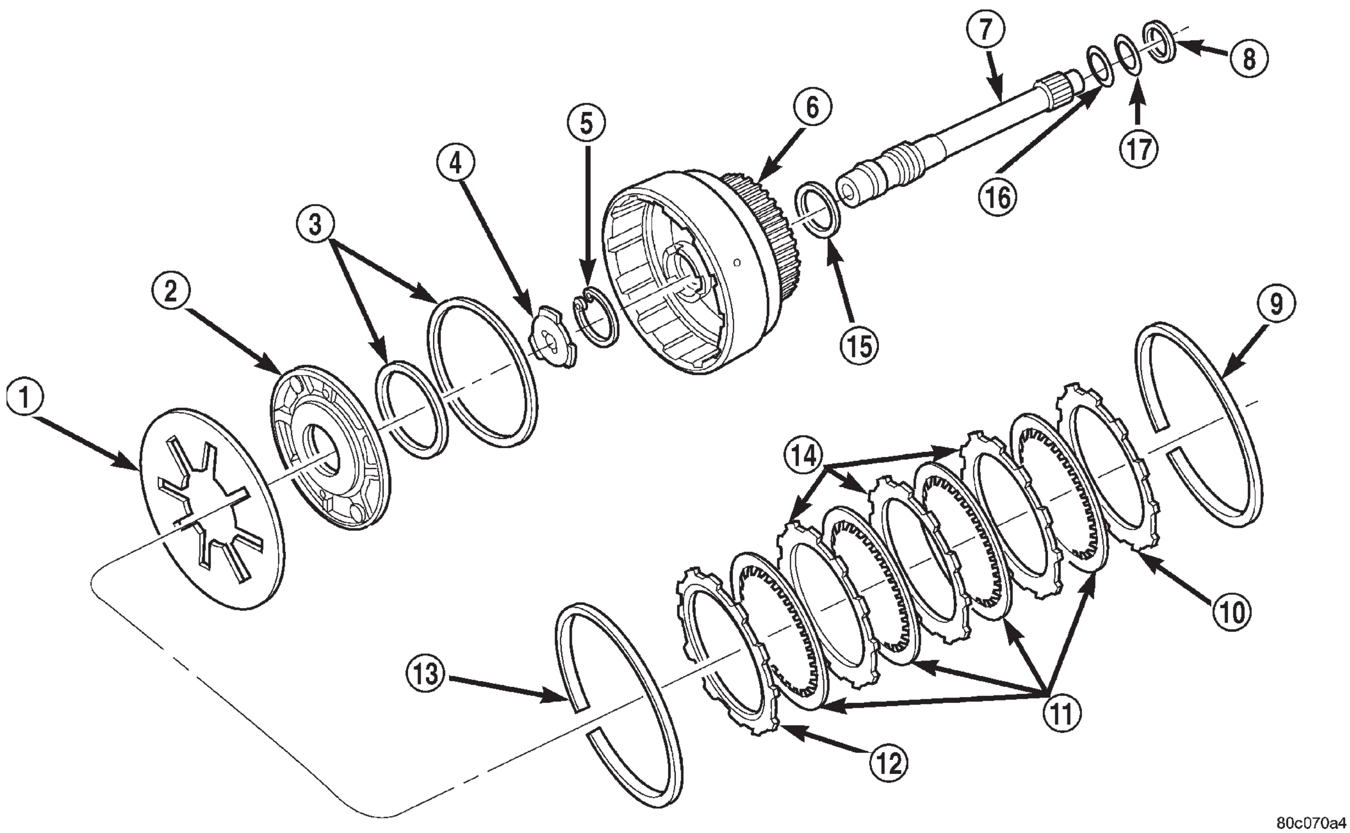


Fig. 55 Rear Clutch

1 – PISTON SPRING
2 – REAR CLUTCH PISTON
3 – CLUTCH PISTON SEALS
4 – OUTPUT SHAFT THRUST WASHER (METAL)
5 – INPUT SHAFT SNAP RING
6 – REAR CLUTCH RETAINER
7 – INPUT SHAFT
8 – REAR CLUTCH THRUST WASHER (FIBER)
9 – CLUTCH PACK SNAP RING (SELECTIVE)
10 – TOP PRESSURE PLATE
11 – CLUTCH DISCS (4)
12 – BOTTOM PRESSURE PLATE
13 – WAVE SPRING
14 – CLUTCH PLATES (3)
15 – RETAINER SEAL RING
16 – SHAFT REAR SEAL RING (PLASTIC)
17 – SHAFT FRONT SEAL RING (TEFLON)

DESCRIPTION AND OPERATION (Continued)

bly. When the clutch is in the process of being released by the release spring, fluid flows through a vent and one–way ball–check–valve located in the clutch retainer. The check–valve is needed to eliminate the possibility of plate drag caused by centrifugal force acting on the residual fluid trapped in the clutch piston retainer.

OVERDRIVE CLUTCH

DESCRIPTION

The overdrive clutch (Fig. 56) is composed of the pressure plate, two clutch plates, three holding discs, overdrive piston retainer, piston, piston spacer, and snap rings. The overdrive clutch is the forwardmost component in the transmission overdrive unit and is considered a holding component. The overdrive piston retainer, piston, and piston spacer are located on the rear of the main transmission case.

NOTE: The number of discs and plates may vary with each engine and vehicle combination.

OPERATION

To apply the clutch, pressure is applied between the piston retainer and piston. The fluid pressure is provided by the oil pump, transferred through the control valves and passageways, and enters the clutch through passages at the lower rear portion of the valve body area. With pressure applied between the piston retainer and piston, the piston moves away from the piston retainer and compresses the clutch pack. This action applies the clutch pack, allowing torque to flow through the intermediate shaft into the overdrive planetary gear set. The overdrive clutch discs are attached to the overdrive clutch hub while the overdrive clutch plates, reaction plate, and pressure plate are lugged to the overdrive housing. This allows the intermediate shaft to transfer the engine torque to the planetary gear and overrunning clutch. This drives the planetary gear inside the annulus, which is attached to the overdrive clutch drum and output shaft, creating the desired gear ratio. The waved snap ring is used to cushion the application of the clutch pack.

OVERRUNNING CLUTCH

DESCRIPTION

The overrunning clutch (Fig. 57) consists of an inner race, an outer race (or cam), rollers and springs, and the spring retainer. The number of rollers and springs depends on what transmission and which overrunning clutch is being dealt with.

OPERATION

As the inner race is rotated in a clockwise direction (as viewed from the front of the transmission), the race causes the rollers to roll toward the springs, causing them to compress against their retainer. The

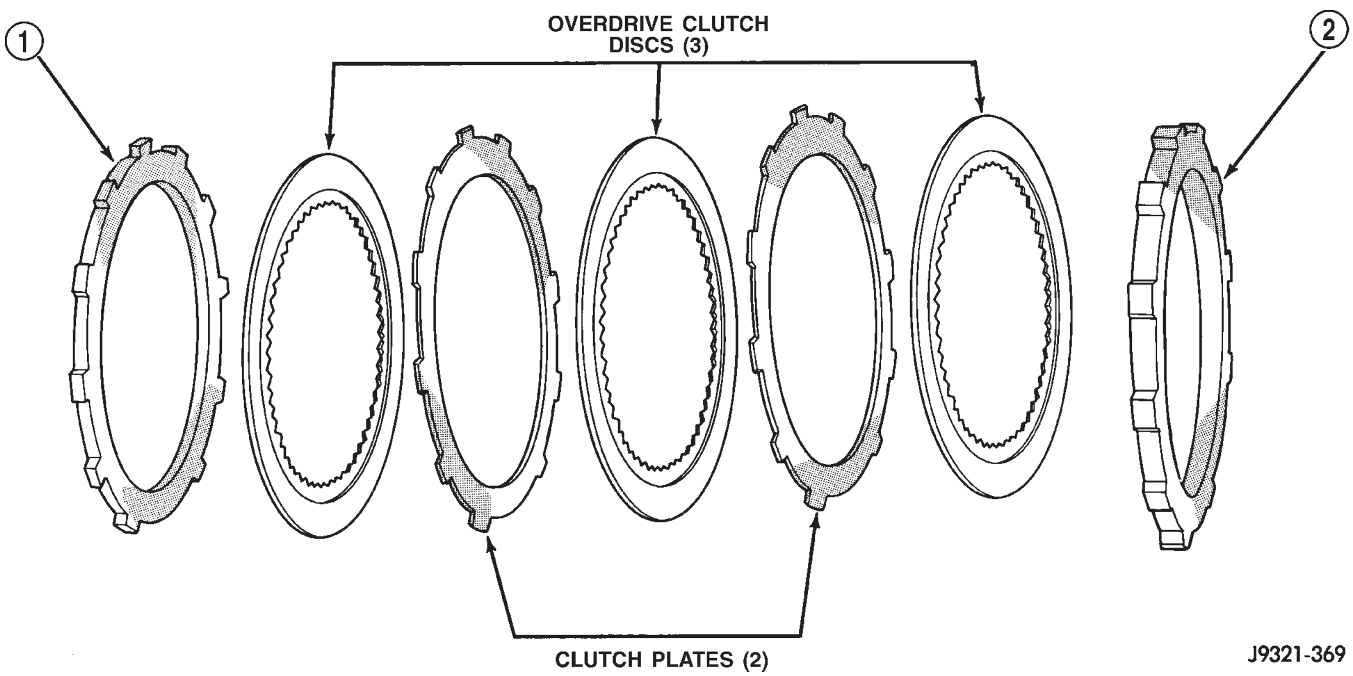


Fig. 56 Overdrive Clutch

1 – REACTION PLATE
2 – PRESSURE PLATE

DESCRIPTION AND OPERATION (Continued)

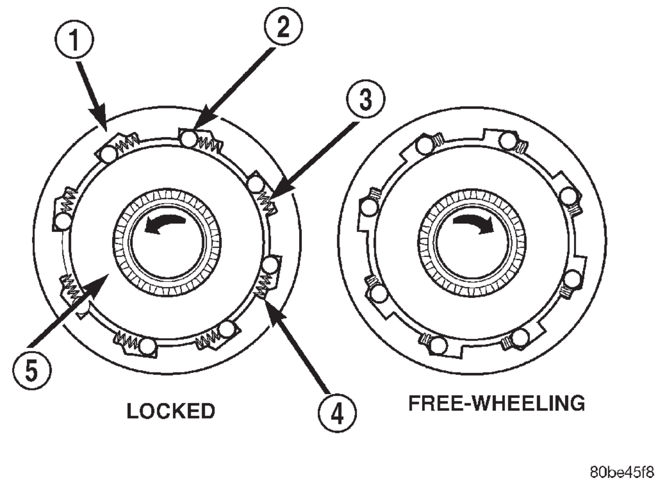


Fig. 57 Overrunning Clutch

1 – OUTER RACE (CAM)
2 – ROLLER
3 – SPRING
4 – SPRING RETAINER
5 – INNER RACE (HUB)

compression of the springs increases the clearance between the rollers and cam. This increased clearance between the rollers and cam results in a freewheeling condition. When the inner race attempts to rotate counterclockwise, the action causes the rollers to roll in the same direction as the race, aided by the pushing of the springs. As the rollers try to move in the same direction as the inner race, they are wedged between the inner and outer races due to the design of the cam. In this condition, the clutch is locked and acts as one unit.

PLANETARY GEARSET

DESCRIPTION

The planetary gearsets (Fig. 58) are designated as the front, rear, and overdrive planetary gear assemblies and located in such order. A simple planetary gearset consists of three main members:

- The sun gear which is at the center of the system.
- The planet carrier with planet pinion gears which are free to rotate on their own shafts and are in mesh with the sun gear.
- The annulus gear, which rotates around and is in mesh with the planet pinion gears.

NOTE: The number of pinion gears does not affect the gear ratio, only the duty rating.

OPERATION

With any given planetary gearset, several conditions must be met for power to be able to flow:

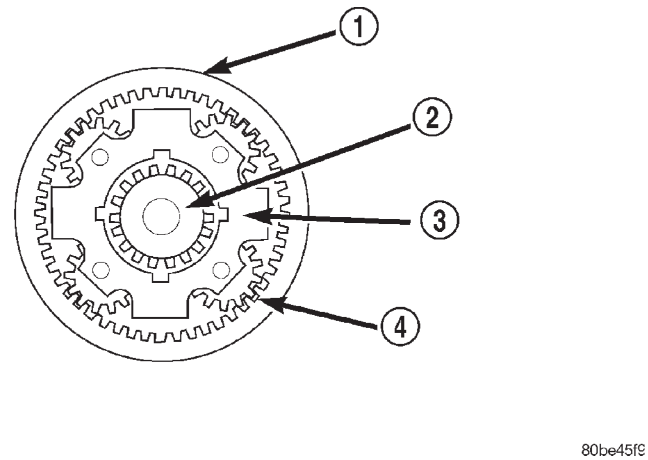


Fig. 58 Planetary Gearset

1 – ANNULUS GEAR
2 – SUN GEAR
3 – PLANET CARRIER
4 – PLANET PINIONS (4)

- One member must be held.
- Another member must be driven or used as an input.
- The third member may be used as an output for power flow.
- For direct drive to occur, two gear members in the front planetary gearset must be driven.

NOTE: Gear ratios are dependent on the number of teeth on the annulus and sun gears.

BANDS

DESCRIPTION

KICKDOWN (FRONT) BAND

The kickdown, or “front”, band (Fig. 59) holds the common sun gear of the planetary gear sets. The front (kickdown) band is made of steel, and faced on its inner circumference with a friction–type lining. One end of the band is anchored to the transmission case, and the other is acted on with a pushing force by a servo piston. The front band is a single–wrap design (the band does not completely encompass/ wrap the drum that it holds).

LOW/REVERSE (REAR) BAND

The low/reverse band, or “rear”, band (Fig. 60) is similar in appearance and operation to the front band.

DESCRIPTION AND OPERATION (Continued)

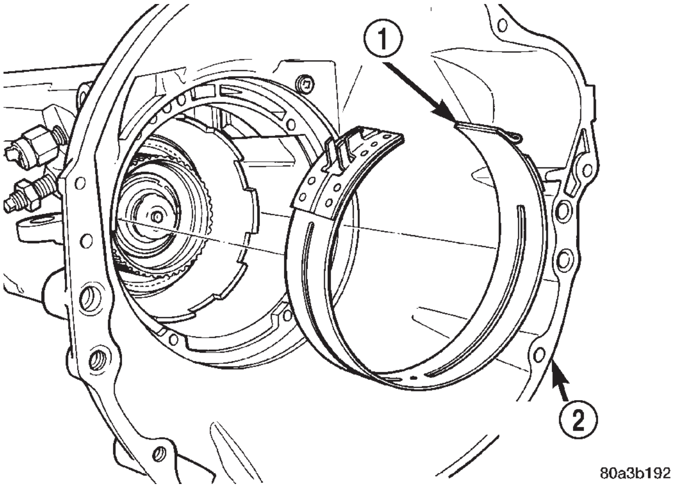


Fig. 59 Front Band

1 – FRONT BAND
2 – TRANSMISSION HOUSING

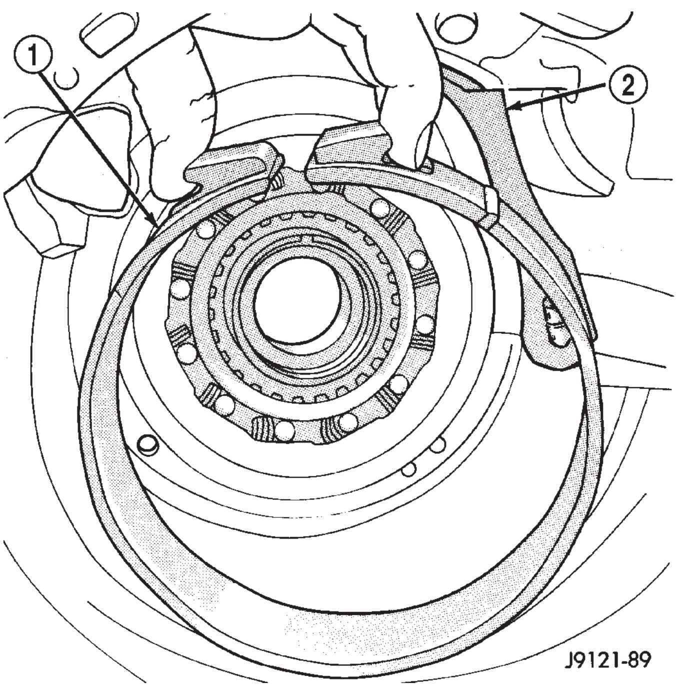


Fig. 60 Rear Band

1 – REAR BAND
2 – BAND LINK

OPERATION

KICKDOWN (FRONT) BAND

The kickdown band holds the common sun gear of the planetary gear sets by applying and holding the front clutch retainer, which is splined to the sun gear driving shell, and in turn splined directly to the sun gear. The application of the band by the servo is typically done by an apply lever and link bar.

LOW/REVERSE (REAR) BAND

The rear band holds the rear planet carrier stationary by being mounted around and applied to the low/reverse drum.

SERVOS

DESCRIPTION

KICKDOWN (FRONT) SERVO

The kickdown servo (Fig. 61) consists of a two–land piston with an inner piston, a piston rod and guide, and a return spring. The dual–land piston uses seal rings on its outer diameters and an O–ring for the inner piston.

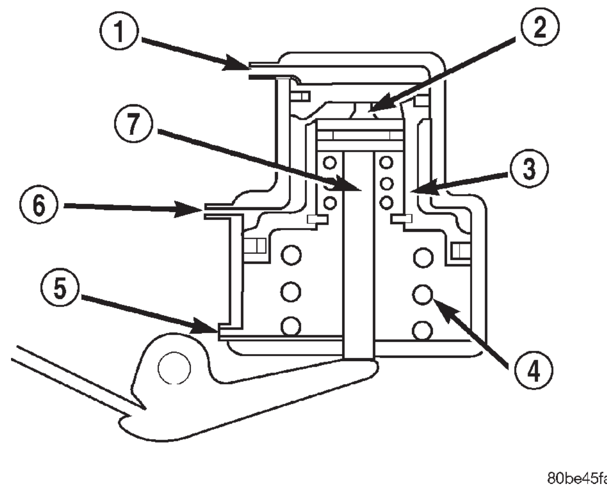


Fig. 61 Front Servo

1 – VENT
2 – INNER PISTON
3 – PISTON
4 – SPRING
5 – RELEASE PRESSURE
6 – APPLY PRESSURE
7 – PISTON ROD

LOW/REVERSE (REAR) SERVO

The rear (low/reverse) servo consists of a single stage or diameter piston and a spring loaded plug. The spring is used to cushion the application of the rear (low/reverse) band.

OPERATION

KICKDOWN (FRONT) SERVO

The application of the piston is accomplished by applying pressure between the two lands of the piston. The pressure acts against the larger lower land to push the piston downward, allowing the piston rod to extend though its guide against the apply lever. Release of the servo at the 2–3 upshift is accomplished by a combination of spring and line pressure,

DESCRIPTION AND OPERATION (Continued)

acting on the bottom of the larger land of the piston. The small piston is used to cushion the application of the band by bleeding oil through a small orifice in the larger piston. The release timing of the kickdown servo is very important to obtain a smooth but firm shift. The release has to be very quick, just as the front clutch application is taking place. Otherwise, engine runaway or a shift hesitation will occur. To accomplish this, the band retains its holding capacity until the front clutch is applied, giving a small amount of overlap between them.

LOW/REVERSE (REAR) SERVO

While in the de-energized state (no pressure applied), the piston is held up in its bore by the piston spring. The plug is held down in its bore, in the piston, by the plug spring. When pressure is applied to the top of the piston, the plug is forced down in its bore, taking up any clearance. As the piston moves, it causes the plug spring to compress, and the piston moves down over the plug. The piston continues to move down until it hits the shoulder of the plug and fully applies the band. The period of time from the initial application, until the piston is against the shoulder of the plug, represents a reduced shocking of the band that cushions the shift.

GEARSHIFT MECHANISM

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

OPERATION

Manual low (1) range provides first gear only. Overrun braking is also provided in this range. Manual second (2) range provides first and second gear only.

Drive range provides first, second third and overdrive fourth gear ranges. The shift into overdrive fourth gear range occurs only after the transmission has completed the shift into D third gear range. No further movement of the shift mechanism is required to complete the 3-4 shift.

The fourth gear upshift occurs automatically when the overdrive selector switch is in the ON position. No upshift to fourth gear will occur if any of the following are true:

- The transmission fluid temperature is below 10° C (50° F) or above 121° C (250° F).
- The shift to third is not yet complete.
- Vehicle speed is too low for the 3–4 shift to occur.
- Battery temperature is below –5° C (23° F).

CONVERTER DRAINBACK VALVE

DESCRIPTION

The drainback valve is located in the transmission cooler outlet (pressure) line.

OPERATION

The valve prevents fluid from draining from the converter into the cooler and lines when the vehicle is shut down for lengthy periods. Production valves have a hose nipple at one end, while the opposite end is threaded for a flare fitting. All valves have an arrow (or similar mark) to indicate direction of flow through the valve.

POWERTRAIN CONTROL MODULE (PCM)

DESCRIPTION

The Powertrain Control Module (PCM) is located in the engine compartment (Fig. 62). The PCM is referred to as JTEC.

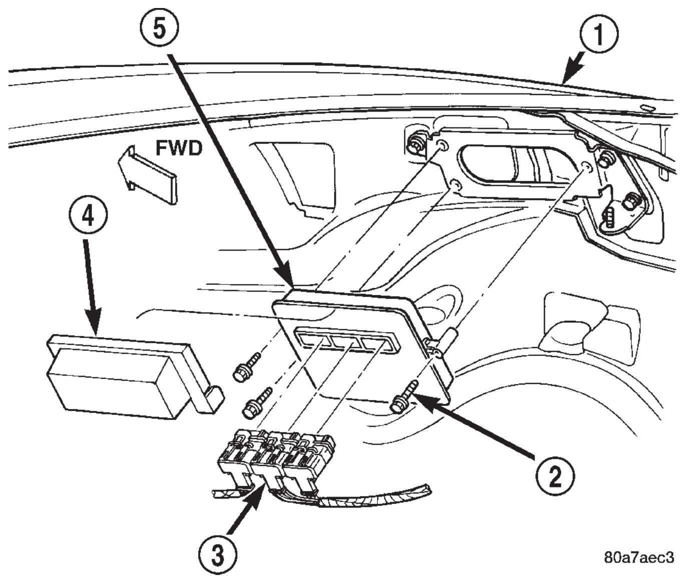


Fig. 62 PCM Location

1 – RIGHT FRONT FENDER
2 – PCM MOUNTING BOLTS (3)
3 – 32–WAY CONNECTORS (3)
4 – COVER
5 – POWERTRAIN CONTROL MODULE (PCM)

OPERATION

The PCM operates the fuel system. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio,

DESCRIPTION AND OPERATION (Continued)

emission control devices, charging system, certain transmission features, speed control, air conditioning compressor clutch engagement and idle speed. The PCM can adapt its programming to meet changing operating conditions.

The PCM receives input signals from various switches and sensors. Based on these inputs, the PCM regulates various engine and vehicle operations through different system components. These components are referred to as Powertrain Control Module (PCM) Outputs. The sensors and switches that provide inputs to the PCM are considered Powertrain Control Module (PCM) Inputs.

The PCM adjusts ignition timing based upon inputs it receives from sensors that react to: engine rpm, manifold absolute pressure, engine coolant temperature, throttle position, transmission gear selection (automatic transmission), vehicle speed and the brake switch.

The PCM adjusts idle speed based on inputs it receives from sensors that react to: throttle position, vehicle speed, transmission gear selection, engine coolant temperature and from inputs it receives from the air conditioning clutch switch and brake switch.

Based on inputs that it receives, the PCM adjusts ignition coil dwell. The PCM also adjusts the generator charge rate through control of the generator field and provides speed control operation.

NOTE: PCM Inputs:

- A/C request (if equipped with factory A/C)
- A/C select (if equipped with factory A/C)
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- CCD bus (+) circuits
- CCD bus (-) circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connection for DRB scan tool
- Engine coolant temperature sensor
- Fuel level
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure
- Output shaft speed sensor
- Overdrive/override switch
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transmission governor pressure sensor
- Transmission temperature sensor
- Vehicle speed inputs from ABS or RWAL system

NOTE: PCM Outputs:

- A/C clutch relay
- Auto shutdown (ASD) relay
- CCD bus (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Data link connection for DRB scan tool
- EGR valve control solenoid (if equipped)
- EVAP canister purge solenoid
- Five volt sensor supply (primary)
- Five volt sensor supply (secondary)
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Generator lamp (if equipped)
- Idle air control (IAC) motor
- Ignition coil
- Leak detection pump (if equipped)
- Malfunction indicator lamp (Check engine lamp). Driven through CCD circuits.
- Overdrive indicator lamp (if equipped)
- Radiator cooling fan (2.5L engine only)
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through CCD circuits.
- Transmission convertor clutch circuit
- Transmission 3–4 shift solenoid
- Transmission relay
- Transmission temperature lamp (if equipped)
- Transmission variable force solenoid

ELECTRONIC GOVERNOR

DESCRIPTION

Governor pressure is controlled electronically. Components used for governor pressure control include:

- Governor body
- Valve body transfer plate
- Governor pressure solenoid valve
- Governor pressure sensor
- Fluid temperature thermistor
- Throttle position sensor (TPS)
- Transmission speed sensor
- Powertrain control module (PCM)

DESCRIPTION AND OPERATION (Continued)

GOVERNOR PRESSURE SOLENOID VALVE

The solenoid valve is a duty-cycle solenoid which regulates the governor pressure needed for upshifts and downshifts. It is an electro-hydraulic device located in the governor body on the valve body transfer plate (Fig. 63).

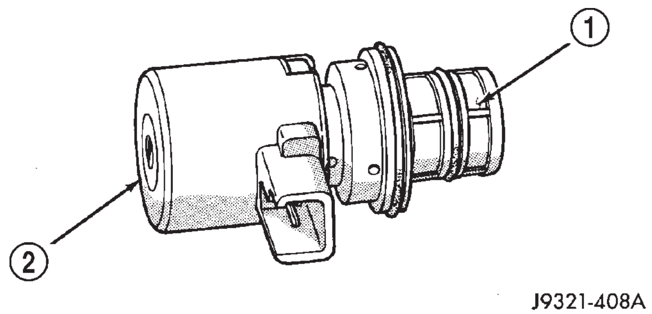


Fig. 63 Governor Pressure Solenoid Valve

1 – SOLENOID FILTER
2 – GOVERNOR PRESSURE SOLENOID

GOVERNOR PRESSURE SENSOR

The governor pressure sensor measures output pressure of the governor pressure solenoid valve (Fig. 64).

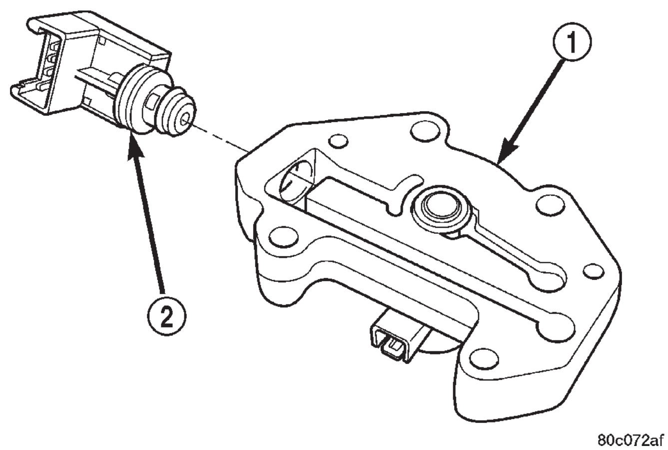


Fig. 64 Governor Pressure Sensor

1 – GOVERNOR BODY
2 – GOVERNOR PRESSURE SENSOR/TRANSMISSION FLUID TEMPERATURE THERMISTOR

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate is designed to supply transmission line pressure to the governor pressure solenoid valve and to return governor pressure.

The governor pressure solenoid valve is mounted in the governor body. The body is bolted to the lower side of the transfer plate (Fig. 64).

TRANSMISSION FLUID TEMPERATURE THERMISTOR

Transmission fluid temperature readings are supplied to the transmission control module by the thermistor. The temperature readings are used to control engagement of the fourth gear overdrive clutch, the converter clutch, and governor pressure. Normal resistance value for the thermistor at room temperature is approximately 1000 ohms.

The thermistor is part of the governor pressure sensor assembly and is immersed in transmission fluid at all times.

TRANSMISSION SPEED SENSOR

The speed sensor (Fig. 65) is located in the overdrive gear case. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed.

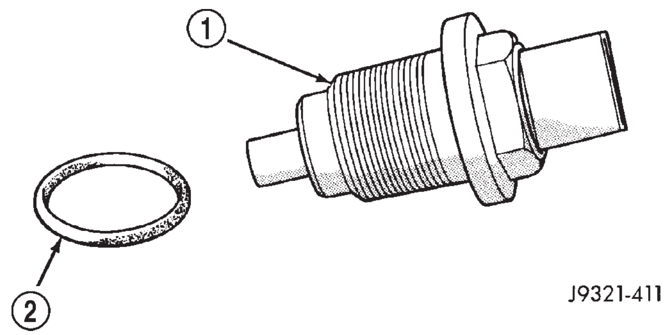


Fig. 65 Transmission Output Speed Sensor

1 – TRANSMISSION OUTPUT SHAFT SPEED SENSOR
2 – SEAL

OPERATION

Compensation is required for performance variations of two of the input devices. Though the slope of the transfer functions is tightly controlled, offset may vary due to various environmental factors or manufacturing tolerances.

The pressure transducer is affected by barometric pressure as well as temperature. Calibration of the zero pressure offset is required to compensate for shifting output due to these factors.

Normal calibration will be performed when sump temperature is above 50 degrees F, or in the absence of sump temperature data, after the first 10 minutes of vehicle operation. Calibration of the pressure transducer offset occurs each time the output shaft speed falls below 200 RPM. Calibration shall be repeated each 3 seconds the output shaft speed is below 200 RPM. A.5 second pulse of 95% duty cycle is applied to the governor pressure solenoid valve and the transducer output is read during this pulse. Averaging of the transducer signal is necessary to reject electrical noise.

Under cold conditions (below 50 degrees F sump), the governor pressure solenoid valve response may be too slow to guarantee 0 psi during the.5 second calibration pulse. Calibration pulses are continued during this period, however the transducer output

valves are discarded. Transducer offset must be read at key-on, under conditions which promote a stable reading. This value is retained and becomes the offset during the “cold” period of operation.

GOVERNOR PRESSURE SOLENOID VALVE

The inlet side of the solenoid valve is exposed to normal transmission line pressure. The outlet side of the valve leads to the valve body governor circuit.

The solenoid valve regulates line pressure to produce governor pressure. The average current supplied to the solenoid controls governor pressure. One amp current produces zero kPa/psi governor pressure. Zero amps sets the maximum governor pressure.

The powertrain control module (PCM) turns on the trans control relay which supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC). The PCM controls the ground side of the solenoid using the governor pressure solenoid control circuit.

GOVERNOR PRESSURE SENSOR

The sensor output signal provides the necessary feedback to the PCM. This feedback is needed to adequately control governor pressure.

GOVERNOR BODY AND TRANSFER PLATE

The transfer plate channels line pressure to the solenoid valve through the governor body. It also channels governor pressure from the solenoid valve to the governor circuit. It is the solenoid valve that develops the necessary governor pressure.

TRANSMISSION FLUID TEMPERATURE THERMISTOR

The PCM prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 10°C (50°F).

If fluid temperature exceeds 126°C (260°F), the PCM causes a 4-3 downshift and engage the converter clutch. Engagement is according to the third gear converter clutch engagement schedule.

The overdrive OFF lamp in the instrument panel illuminates when the shift back to third occurs. The transmission will not allow fourth gear operation until fluid temperature decreases to approximately 110°C (230°F).

TRANSMISSION SPEED SENSOR

Speed sensor signals are triggered by the park gear lugs as they rotate past the sensor pickup face. Input signals from the sensor are sent to the transmission control module for processing. The vehicle speed sensor also serves as a backup for the transmission speed sensor. Signals from this sensor are shared with the powertrain control module.

GOVERNOR PRESSURE CURVES

DESCRIPTION

There are four governor pressure curves programmed into the transmission control module. The different curves allow the control module to adjust governor pressure for varying conditions. One curve is used for operation when fluid temperature is at, or below, –1°C (30°F). A second curve is used when fluid temperature is at, or above, 10°C (50°F) during normal city or highway driving. A third curve is used during wide-open throttle operation. The fourth curve is used when driving with the transfer case in low range.

OPERATION

LOW TRANSMISSION FLUID TEMPERATURE

When the transmission fluid is cold the conventional governor can delay shifts, resulting in higher than normal shift speeds and harsh shifts. The electronically controlled low temperature governor pressure curve is higher than normal to make the transmission shift at normal speeds and sooner. The PCM uses a temperature sensor in the transmission oil sump to determine when low temperature governor pressure is needed.

NORMAL OPERATION

Normal operation is refined through the increased computing power of the PCM and through access to data on engine operating conditions provided by the PCM that were not available with the previous stand-alone electronic module. This facilitated the development of a load adaptive shift strategy - the ability to alter the shift schedule in response to vehicle load condition. One manifestation of this capability is grade “hunting” prevention - the ability of the transmission logic to delay an upshift on a grade if the engine does not have sufficient power to maintain speed in the higher gear. The 3-2 downshift and the potential for hunting between gears occurs with a heavily loaded vehicle or on steep grades. When hunting occurs, it is very objectionable because shifts are frequent and accompanied by large changes in noise and acceleration.

WIDE OPEN THROTTLE OPERATION

In wide-open throttle (WOT) mode, adaptive memory in the PCM assures that up-shifts occur at the preprogrammed optimum speed. WOT operation is determined from the throttle position sensor, which is also a part of the emission control system. The initial setting for the WOT upshift is below the optimum engine speed. As WOT shifts are repeated, the PCM learns the time required to complete the shifts

by comparing the engine speed when the shifts occur to the optimum speed. After each shift, the PCM adjusts the shift point until the optimum speed is reached. The PCM also considers vehicle loading, grade and engine performance changes due to high altitude in determining when to make WOT shifts. It does this by measuring vehicle and engine acceleration and then factoring in the shift time.

TRANSFER CASE LOW RANGE OPERATION

On four-wheel drive vehicles operating in low range, the engine can accelerate to its peak more rapidly than in Normal range, resulting in delayed shifts and undesirable engine "flare." The low range governor pressure curve is also higher than normal to initiate upshifts sooner. The PCM compares electronic vehicle speed signal used by the speedometer to the transmission output shaft speed signal to determine when the transfer case is in low range.

OVERDRIVE OFF SWITCH

DESCRIPTION

The overdrive OFF (control) switch is located in the shift lever arm.

OPERATION

The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function. At key-on, overdrive operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

DIAGNOSIS AND TESTING

AUTOMATIC TRANSMISSION DIAGNOSIS

Automatic transmission problems can be a result of poor engine performance, incorrect fluid level, incorrect linkage or cable adjustment, band or hydraulic control pressure adjustments, hydraulic system malfunctions or electrical/mechanical component malfunctions. Begin diagnosis by checking the easily accessible items such as: fluid level and condition, linkage adjustments and electrical connections. A road test will determine if further diagnosis is necessary.

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxidation and varnish buildup which interferes with valve, clutch and servo operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or improperly installed drainback valve, a damaged main cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(2) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to reverse flush cooler and lines after repair
- failure to replace contaminated converter after repair

The use of non recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

DIAGNOSIS AND TESTING (Continued)

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission for some time, an overhaul may also be necessary; especially if shift problems had developed.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in recontamination. Flushing applies to auxiliary coolers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVEABLE

(1) Check for transmission fault codes using DRB scan tool.

(2) Check fluid level and condition.

(3) Adjust throttle and gearshift linkage if complaint was based on delayed, erratic, or harsh shifts.

(4) Road test and note how transmission upshifts, downshifts, and engages.

(5) Perform stall test if complaint is based on sluggish acceleration. Or, if abnormal throttle opening is needed to maintain normal speeds with a properly tuned engine.

(6) Perform hydraulic pressure test if shift problems were noted during road test.

(7) Perform air-pressure test to check clutch-band operation.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken or disconnected gearshift or throttle linkage.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:

(a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.

(b) If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged drive plate, converter, oil pump, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

PARK/NEUTRAL POSITION SWITCH

The center terminal of the park/neutral position switch is the starter-circuit terminal. It provides the ground for the starter solenoid circuit through the selector lever in PARK and NEUTRAL positions only. The outer terminals on the switch are for the backup lamp circuit.

SWITCH TEST

To test the switch, remove the wiring connector. Test for continuity between the center terminal and the transmission case. Continuity should exist only when the transmission is in PARK or NEUTRAL.

Shift the transmission into REVERSE and test continuity at the switch outer terminals. Continuity should exist only when the transmission is in REVERSE. Continuity should not exist between the outer terminals and the case.

Check gearshift linkage adjustment before replacing a switch that tests faulty.

OVERDRIVE ELECTRICAL CONTROLS

The overdrive off switch, valve body solenoid, case connectors and related wiring can all be tested with a 12 volt test lamp or a volt/ohmmeter. Check continuity of each component when diagnosis indicates this is necessary. Refer to Group 8W, Wiring Diagrams, for component locations and circuit information.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

GEARSHIFT CABLE

(1) The shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With shift lever handle in:

DIAGNOSIS AND TESTING (Continued)

(a) PARK position—Apply forward force on center of lever and remove pressure. Engine starts must be possible.

(b) PARK position—Apply rearward force on center of lever and remove pressure. Engine starts must be possible.

(c) NEUTRAL position—Normal position. Engine starts must be possible.

(d) NEUTRAL position—Engine running and brakes applied, apply forward force on center of shift lever. Transmission shall not be able to shift from neutral to reverse.

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch, band or overrunning clutch problems. If the condition is advanced, an overhaul will be necessary to restore normal operation.

A slipping clutch or band can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch and Band Application chart provides a basis for analyzing road test results.

ANALYZING ROAD TEST

Refer to the Clutch and Band Application chart and note which elements are in use in the various gear ranges.

Note that the rear clutch is applied in all forward ranges (D, 2, 1). The transmission overrunning clutch is applied in first gear (D, 2 and 1 ranges) only. The rear band is applied in 1 and R range only.

Note that the overdrive clutch is applied only in fourth gear and the overdrive direct clutch and overrunning clutch are applied in all ranges except fourth gear.

For example: If slippage occurs in first gear in D and 2 range but not in 1 range, the transmission overrunning clutch is faulty. Similarly, if slippage occurs in any two forward gears, the rear clutch is slipping.

Applying the same method of analysis, note that the front and rear clutches are applied simultaneously only in D range third and fourth gear. If the transmission slips in third gear, either the front clutch or the rear clutch is slipping.

If the transmission slips in fourth gear but not in third gear, the overdrive clutch is slipping. By selecting another gear which does not use these clutches, the slipping unit can be determined. For example, if the transmission also slips in Reverse, the front clutch is slipping. If the transmission does not slip in Reverse, the rear clutch is slipping.

SHIFT LEVER POSITION	TRANSMISSION CLUTCHES AND BANDS					OVERDRIVE CLUTCHES		
	FRONT CLUTCH	FRONT BAND	REAR CLUTCH	REAR BAND	OVERRUN. CLUTCH	OVERDRIVE CLUTCH	DIRECT CLUTCH	OVERRUN. CLUTCH
Reverse	X			X			X	
Drive Range								
First			X		X		X	X
Second		X	X				X	X
Third	X		X				X	X
Fourth	X		X			X		
2-Range (Manual) Second)		X	X		X		X	X
1-Range (Manual Low)			X	X	X		X	X

J9421-218

Clutch And Band Application Chart

DIAGNOSIS AND TESTING (Continued)

If slippage occurs during the 3-4 shift or only in fourth gear, the overdrive clutch is slipping. Similarly, if the direct clutch were to fail, the transmission would lose both reverse gear and overrun braking in 2 position (manual second gear).

If the transmission will not shift to fourth gear, the control switch, overdrive solenoid or related wiring may also be the problem cause.

This process of elimination can be used to identify a slipping unit and check operation. Proper use of the Clutch and Band Application Chart is the key.

Although road test analysis will help determine the slipping unit, the actual cause of a malfunction usually cannot be determined until hydraulic and air pressure tests are performed. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

Unless a malfunction is obvious, such as no drive in D range first gear, do not disassemble the transmission. Perform the hydraulic and air pressure tests to help determine the probable cause.

HYDRAULIC PRESSURE TEST

Hydraulic test pressures range from a low of one psi (6.895 kPa) governor pressure, to 300 psi (2068 kPa) at the rear servo pressure port in reverse.

An accurate tachometer and pressure test gauges are required. Test Gauge C-3292 has a 100 psi range and is used at the accumulator, governor, and front servo ports. Test Gauge C-3293-SP has a 300 psi range and is used at the rear servo and overdrive ports where pressures exceed 100 psi.

Pressure Test Port Locations

Test ports are located at both sides of the transmission case (Fig. 66).

Line pressure is checked at the accumulator port on the right side of the case. The front servo pressure port is at the right side of the case just behind the filler tube opening.

The rear servo and governor pressure ports are at the right rear of the transmission case. The overdrive clutch pressure port is at the left rear of the case.

Test One - Transmission In Manual Low

NOTE: This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Both test gauges are required for this test.

(1) Connect tachometer to engine. Position tachometer so it can be observed from driver seat if helper will be operating engine. Raise vehicle on hoist that will allow rear wheels to rotate freely.

(2) Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port.

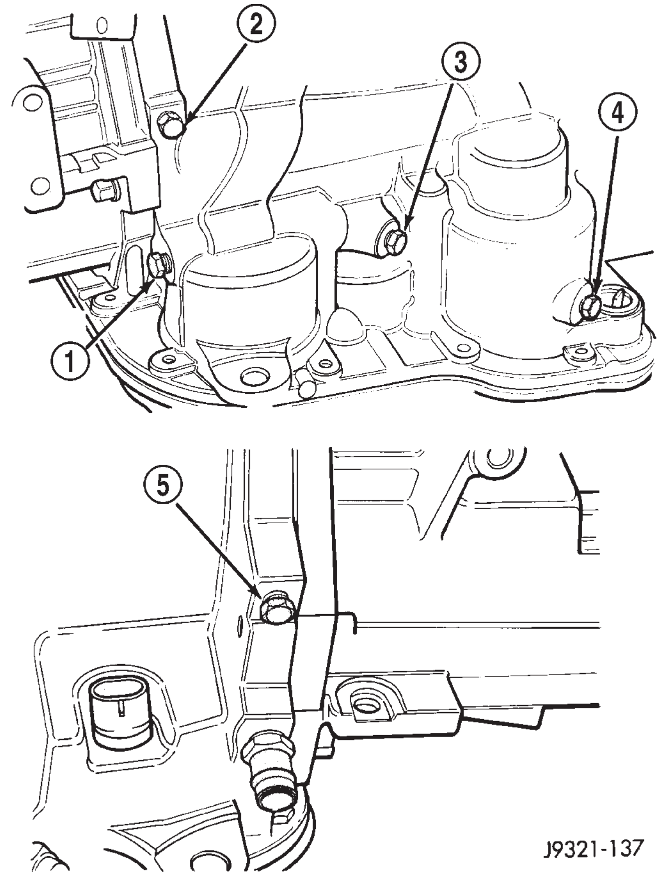


Fig. 66 Pressure Test Port Locations

1 – REAR SERVO TEST PORT
2 – GOVERNOR TEST PORT
3 – ACCUMULATOR TEST PORT
4 – FRONT SERVO TEST PORT
5 – OVERDRIVE CLUTCH TEST PORT

(3) Disconnect throttle and gearshift cables from levers on transmission valve body manual shaft.

(4) Have helper start and run engine at 1000 rpm.

(5) Move transmission shift lever fully forward into 1 range.

(6) Gradually move transmission throttle lever from full forward to full rearward position and note pressures on both gauges:

- Line pressure at accumulator port should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as throttle lever is moved rearward.
- Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two—Transmission In 2 Range

NOTE: This test checks pump output, line pressure and pressure regulation. Use 100 psi Test Gauge C-3292 for this test.

DIAGNOSIS AND TESTING (Continued)

(1) Leave vehicle in place on hoist and leave Test Gauge C-3292 connected to accumulator port.

(2) Have helper start and run engine at 1000 rpm.

(3) Move transmission shift lever one detent rearward from full forward position. This is 2 range.

(4) Move transmission throttle lever from full forward to full rearward position and read pressure on gauge.

(5) Line pressure should be 54-60 psi (372-414 kPa) with throttle lever forward and gradually increase to 90-96 psi (621-662 kPa) as lever is moved rearward.

Test Three—Transmission In D Range Third Gear

NOTE: This test checks pressure regulation and condition of the clutch circuits. Both test gauges are required for this test.

(1) Turn OD switch off.

(2) Leave vehicle on hoist and leave Gauge C-3292 in place at accumulator port.

(3) Move Gauge C-3293-SP over to front servo port for this test.

(4) Have helper start and run engine at 1600 rpm for this test.

(5) Move transmission shift lever two detents rearward from full forward position. This is D range.

(6) Read pressures on both gauges as transmission throttle lever is gradually moved from full forward to full rearward position:

- Line pressure at accumulator in D range third gear, should be 54-60 psi (372-414 kPa) with throttle lever forward and increase as lever is moved rearward.
- Front servo pressure in D range third gear, should be within 3 psi (21 kPa) of line pressure up to kickdown point.

Test Four—Transmission In Reverse

NOTE: This test checks pump output, pressure regulation and the front clutch and rear servo circuits. Use 300 psi Test Gauge C-3293-SP for this test.

(1) Leave vehicle on hoist and leave gauge C-3292 in place at accumulator port.

(2) Move 300 psi Gauge C-3293-SP back to rear servo port.

(3) Have helper start and run engine at 1600 rpm for test.

(4) Move transmission shift lever four detents rearward from full forward position. This is Reverse range.

(5) Move transmission throttle lever fully forward then fully rearward and note reading at Gauge C-3293-SP.

(6) Pressure should be 145 - 175 psi (1000-1207 kPa) with throttle lever forward and increase to 230 - 280 psi (1586-1931 kPa) as lever is gradually moved rearward.

Test Five—Governor Pressure

NOTE: This test checks governor operation by measuring governor pressure response to changes in vehicle speed. It is usually not necessary to check governor operation unless shift speeds are incorrect or if the transmission will not downshift. The test should be performed on the road or on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port.

(2) Move transmission shift lever two detents rearward from full forward position. This is D range.

(3) Have helper start and run engine at curb idle speed. Then firmly apply service brakes so wheels will not rotate.

(4) Note governor pressure:

- Governor pressure should be no more than 20.6 kPa (3 psi) at curb idle speed and wheels not rotating.
- If pressure exceeds 20.6 kPa (3 psi), a fault exists in governor pressure control system.

(5) Release brakes, slowly increase engine speed, and observe speedometer and pressure test gauge (do not exceed 30 mph on speedometer). Governor pressure should increase in proportion to vehicle speed. Or approximately 6.89 kPa (1 psi) for every 1 mph.

(6) Governor pressure rise should be smooth and drop back to no more than 20.6 kPa (3 psi), after engine returns to curb idle and brakes are applied to prevent wheels from rotating.

(7) Compare results of pressure test with analysis chart.

Test Six—Transmission In Overdrive Fourth Gear

NOTE: This test checks line pressure at the overdrive clutch in fourth gear range. Use 300 psi Test Gauge C-3293-SP for this test. The test should be performed on the road or on a chassis dyno.

(1) Remove tachometer; it is not needed for this test.

(2) Move 300 psi Gauge to overdrive clutch pressure test port. Then remove other gauge and reinstall test port plug.

(3) Lower vehicle.

(4) Turn OD switch on.

(5) Secure test gauge so it can be viewed from drivers seat.

(6) Start engine and shift into D range.

(7) Increase vehicle speed gradually until 3-4 shift occurs and note gauge pressure.

(8) Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-827 kPa (90-120 psi) at 1/2 to 3/4 throttle. Note that pressure can increase to around 896 kPa (130 psi) at full throttle.

(9) Return to shop or move vehicle off chassis dyno.

PRESSURE TEST ANALYSIS CHART

TEST CONDITION	INDICATION
Line pressure OK during any one test	Pump and regulator valve OK
Line pressure OK in R but low in D, 2, 1	Leakage in rear clutch area (seal rings, clutch seals)
Pressure low in D Fourth Gear Range	Overdrive clutch piston seal, or check ball problem
Pressure OK in 1, 2 but low in D3 and R	Leakage in front clutch area
Pressure OK in 2 but low in R and 1	Leakage in rear servo
Front servo pressure low in 2	Leakage in servo; broken servo ring or cracked servo piston
Pressure low in all positions	Clogged filter, stuck regulator valve, worn or faulty pump, low oil level
Governor pressure too high at idle speed	Governor pressure solenoid valve system fault. Refer to diagnostic book.
Governor pressure low at all mph figures	Faulty governor pressure solenoid, transmission control module, or governor pressure sensor
Lubrication pressure low at all throttle positions	Clogged fluid cooler or lines, seal rings leaking, worn pump bushings, pump, clutch retainer, or clogged filter.
Line pressure high	Output shaft plugged, sticky regulator valve
Line pressure low	Sticky regulator valve, clogged filter, worn pump

AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION

Air-pressure testing can be used to check transmission front/rear clutch and band operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check, after overhaul.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The servo and clutch apply passages are shown (Fig. 67).

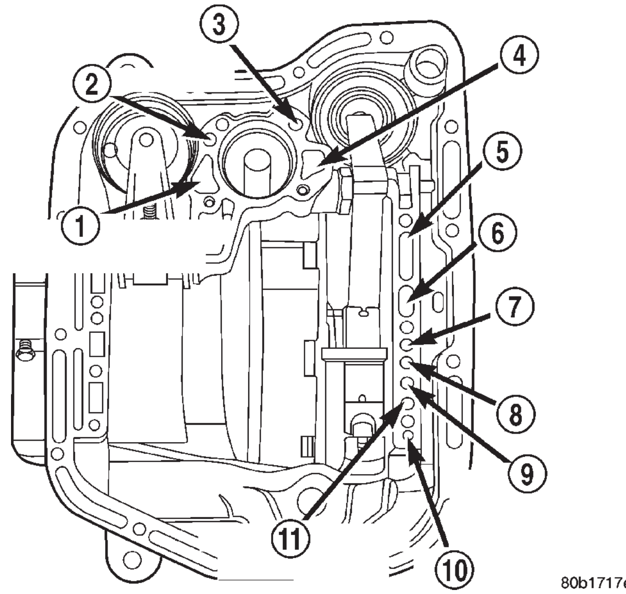


Fig. 67 Air Pressure Test Passages

1 – LINE PRESSURE TO ACCUMULATOR
2 – REAR SERVO APPLY
3 – FRONT SERVO APPLY
4 – FRONT SERVO RELEASE
5 – PUMP SUCTION
6 – PUMP PRESSURE
7 – FRONT CLUTCH APPLY
8 – REAR CLUTCH APPLY
9 – TO TORQUE CONVERTOR
10 – TO COOLER
11 – FROM TORQUE CONVERTER

Front Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

Rear Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through rear clutch apply passage. Piston movement can be felt and a soft thump heard as the clutch applies.

DIAGNOSIS AND TESTING (Continued)

Front Servo Air Test

Apply air pressure to the front servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

Rear Servo Air Test

Apply air pressure to the rear servo apply passage. The servo rod should extend and cause the band to tighten around the drum. Spring pressure should release the servo when air pressure is removed.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, two items must be established before repair.

(1) Verify that a leak condition actually exists.

(2) Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump O-ring or pump body leaks follow the same path as a seal leak (Fig. 68). Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 68). Pump seal or gasket leaks usually travel down the inside of the converter housing. Front band lever pin plug leaks are generally deposited on the housing and not on the converter.

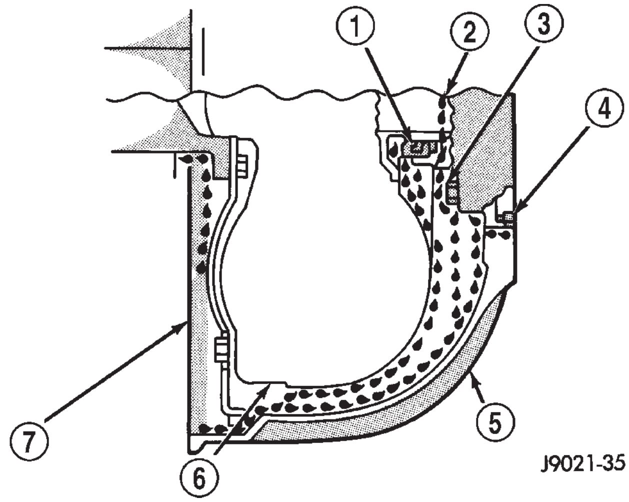


Fig. 68 Converter Housing Leak Paths

1 – PUMP SEAL
2 – PUMP VENT
3 – PUMP BOLT
4 – PUMP GASKET
5 – CONVERTER HOUSING
6 – CONVERTER
7 – REAR MAIN SEAL LEAK

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 69).

(2) Leaks at the converter hub weld (Fig. 69).

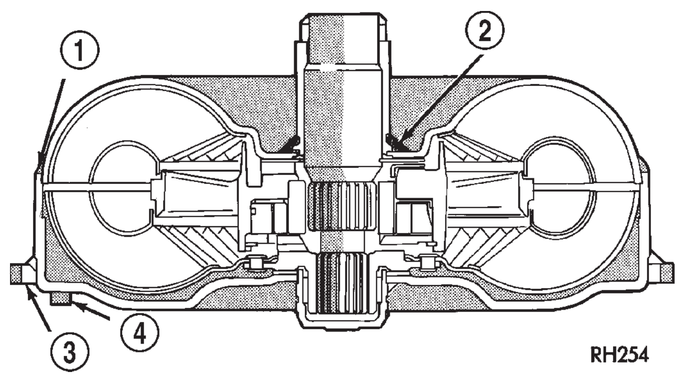


Fig. 69 Converter Leak Points—Typical

1 – OUTSIDE DIAMETER WELD
2 – TORQUE CONVERTER HUB WELD
3 – STARTER RING GEAR
4 – LUG

CONVERTER HOUSING AREA LEAK CORRECTION

(1) Remove converter.

(2) Tighten front band adjusting screw until band is tight around front clutch retainer. This prevents front/rear clutches from coming out when oil pump is removed.

(3) Remove oil pump and remove pump seal. Inspect pump housing drainback and vent holes for obstructions. Clear holes with solvent and wire.

(4) Inspect pump bushing and converter hub. If bushing is scored, replace it. If converter hub is scored, either polish it with crocus cloth or replace converter.

(5) Install new pump seal, O-ring, and gasket. Replace oil pump if cracked, porous or damaged in any way. Be sure to loosen the front band before installing the oil pump, damage to the oil pump seal may occur if the band is still tightened to the front clutch retainer.

(6) Loosen kickdown lever pin access plug three turns. Apply Loctite 592, or Permatex No. 2 to plug threads and tighten plug to 17 N·m (150 in. lbs.) torque.

(7) Adjust front band.

(8) Lubricate pump seal and converter hub with transmission fluid or petroleum jelly and install converter.

DIAGNOSIS AND TESTING (Continued)

(9) Install transmission and converter housing dust shield.

(10) Lower vehicle.

DIAGNOSIS TABLES AND CHARTS—RE TRANSMISSION

The diagnosis charts provide additional reference when diagnosing a transmission fault. The charts provide general information on a variety of transmission, overdrive unit and converter clutch fault conditions.

The hydraulic flow charts in the Schematics and Diagrams section of this group, outline fluid flow and hydraulic circuitry. Circuit operation is provided for neutral, third, fourth and reverse gear ranges. Normal working pressures are also supplied for each of the gear ranges.

DIAGNOSIS CHARTS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low	1. Add Fluid
	2. Throttle Linkage Misadjusted	2. Adjust linkage - setting may be too long.
	3. Mount and Driveline Bolts Loose	3. Check engine mount, transmission mount, propeller shaft, rear spring to body bolts, rear control arms, crossmember and axle bolt torque. Tighten loose bolts and replace missing bolts.
	4. U-Joint Worn/Broken	4. Remove propeller shaft and replace U-Joint.
	5. Axle Backlash Incorrect	5. Check per Service Manual. Correct as needed.
	6. Hydraulic Pressure Incorrect	6. Check pressure. Remove, overhaul or adjust valve body as needed.
	7. Band Misadjusted.	7. Adjust rear band.
	8. Valve Body Check Balls Missing.	8. Inspect valve body for proper check ball installation.
	9. Axle Pinion Flange Loose.	9. Replace nut and check pinion threads before installing new nut. Replace pinion gear if threads are damaged.
	10. Clutch, band or planetary component damaged.	10. Remove, disassemble and repair transmission as necessary.
	11. Converter Clutch Faulty.	11. Replace converter and flush cooler and line before installing new converter.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low.	1. Correct level and check for leaks.
	2. Filter Clogged.	2. Change filter.
	3. Gearshift Linkage Misadjusted.	3. Adjust linkage and repair linkage if worn or damaged.
	4. Torque Converter Drain Back (Oil drains from torque converter into transmission sump)	4. If vehicle moves normally after 5 seconds after shifting into gear, no repair is necessary. If longer, inspect pump bushing for wear. Replace pump house.
	5. Rear Band Misadjusted.	5. Adjust band.
	6. Valve Body Filter Plugged.	6. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.
	7. Oil Pump Gears Worn/Damaged.	7. Remove transmission and replace oil pump.
	8. Governor Circuit and Solenoid Valve Electrical Fault.	8. Test with DRB scan tool and repair as required.
	9. Hydraulic Pressure Incorrect.	9. Perform pressure test, remove transmission and repair as needed.
	10. Reaction Shaft Seal Rings Worn/Broken.	10. Remove transmission, remove oil pump and replace seal rings.
	11. Rear Clutch/Input Shaft, Rear Clutch Seal Rings Damaged.	11. Remove and disassemble transmission and repair as necessary.
	12. Regulator Valve Stuck.	12. Clean.
	13. Cooler Plugged.	13. Transfer case failure can plug cooler.
NO DRIVE RANGE (REVERSE OK)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Repair or replace linkage components.
	3. Rear Clutch Burnt.	3. Remove and disassemble transmission and rear clutch and seals. Repair/replace worn or damaged parts as needed.
	4. Valve Body Malfunction.	4. Remove and disassemble valve body. Replace assembly if any valves or bores are damaged.
	5. Transmission Overrunning Clutch Broken.	5. Remove and disassemble transmission. Replace overrunning clutch.
	6. Input Shaft Seal Rings Worn/ Damaged.	6. Remove and disassemble transmission. Replace seal rings and any other worn or damaged parts.
	7. Front Planetary Failed Broken.	7. Remove and repair.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE OR REVERSE (VEHICLE WILL NOT MOVE)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Inspect, adjust and reassemble linkage as needed. Replace worn/damaged parts.
	3. U-Joint/Axle/Transfer Case Broken.	3. Perform preliminary inspection procedure for vehicle that will not move. Refer to procedure in diagnosis section.
	4. Filter Plugged.	4. Remove and disassemble transmission. Repair or replace failed components as needed. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test. Flush oil. Replace cooler as necessary.
	5. Oil Pump Damaged.	5. Perform pressure test to confirm low pressure. Replace pump body assembly if necessary.
	6. Valve Body Malfunctioned.	6. Check and inspect valve body. Replace valve body (as assembly) if any valve or bore is damaged. Clean and reassemble correctly if all parts are in good condition.
	7. Transmission Internal Component Damaged.	7. Remove and disassemble transmission. Repair or replace failed components as needed.
	8. Park Sprag not Releasing - Check Stall Speed, Worn/Damaged/Stuck.	8. Remove, disassemble, repair.
	9. Torque Converter Damage.	9. Inspect and replace as required.
SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)	1. Fluid Level Low/High.	1. Correct fluid level and check for leaks if low.
	2. Fluid Filter Clogged.	2. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage as described in service section.
	4. Throttle Linkage Binding.	4. Check cable for binding. Check for return to closed throttle at transmission.
	5. Gearshift Linkage/Cable Misadjusted.	5. Adjust linkage/cable as described in service section.
	6. Clutch or Servo Failure.	6. Remove valve body and air test clutch, and band servo operation. Disassemble and repair transmission as needed.
	7. Governor Circuit Electrical Fault.	7. Test using DRB scan tool and repair as required.
	8. Front Band Misadjusted.	8. Adjust band.
	9. Pump Suction Passage Leak.	9. Check for excessive foam on dipstick after normal driving. Check for loose pump bolts, defective gasket. Replace pump assembly if needed.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO REVERSE (D RANGES OK)	1. Gearshift Linkage/Cable Misadjusted/Damaged.	1. Repair or replace linkage parts as needed.
	2. Park Sprag Sticking.	2. Replace overdrive annulus gear.
	3. Rear Band Misadjusted/Worn.	3. Adjust band; replace.
	4. Valve Body Malfunction.	4. Remove and service valve body. Replace valve body if any valves or valve bores are worn or damaged.
	5. Rear Servo Malfunction.	5. Remove and disassemble transmission. Replace worn/damaged servo parts as necessary.
	6. Direct Clutch in Overdrive Worn	6. Disassemble overdrive. Replace worn or damaged parts.
	7. Front Clutch Burnt.	7. Remove and disassemble transmission. Replace worn, damaged clutch parts as required.
HAS FIRST/REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)	1. Governor Circuit Electrical Fault.	1. Test using DRB scan tool and repair as required.
	2. Valve Body Malfunction.	2. Repair stuck 1-2 shift valve or governor plug.
	3. Front Servo/Kickdown Band Damaged/Burned.	3. Repair/replace.
MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW	1. Valve Body Malfunction.	1. Remove, clean and inspect. Look for stuck 1-2 valve or governor plug.
	2. Governor Valve Sticking.	2. Remove, clean and inspect. Replace faulty parts.
NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)	1. Governor Valve Sticking.	1. Remove governor, clean, inspect and repair as required.
	2. Governor Circuit Electrical Fault.	2. Test with DRB scan tool and repair as required.
	3. Valve Body Malfunction.	3. Remove, clean and inspect. Look for sticking 1-2 shift valve, 2-3 shift valve, governor plug or broken springs.
	4. Front Servo Piston Cocked in Bore.	4. Inspect servo and repair as required.
	5. Front Band Linkage Malfunction	5. Inspect linkage and look for bind in linkage.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Throttle Linkage Misadjusted.	1. Adjust linkage.
	2. Accelerator Pedal Travel Restricted.	2. Verify floor mat is not under pedal, repair worn accelerator cable or bent brackets.
	3. Valve Body Hydraulic Pressures Too High or Too Low Due to Valve Body Malfunction or Incorrect Hydraulic Control Pressure Adjustments.	3. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	4. Governor Circuit Electrical Fault.	4. Test with DRB scan tool and repair as required.
	5. Valve Body Malfunction.	5. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	6. TPS Malfunction.	6. Replace sensor, check with DRB scan tool.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if required.
	8. Valve Body Malfunction.	8. Repair sticking 1-2, 2-3 shift valves, governor plugs, 3-4 solenoid, 3-4 shift valve, 3-4 timing valve.
STUCK IN LOW GEAR (WILL NOT UPSHIFT)	1. Throttle Linkage Misadjusted/ Stuck.	1. Adjust linkage and repair linkage if worn or damaged. Check for binding cable or missing return spring.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage and repair linkage if worn or damaged.
	3. Governor Component Electrical Fault.	3. Check operating pressures and test with DRB scan tool, repair faulty component.
	4. Front Band Out of Adjustment.	4. Adjust Band.
	5. Clutch or Servo Malfunction.	5. Air pressure check operation of clutches and bands. Repair faulty component.
CREEPS IN NEUTRAL	1. Gearshift Linkage Misadjusted.	1. Adjust linkage.
	2. Rear Clutch Dragging/Warped.	2. Disassemble and repair.
	3. Valve Body Malfunction.	3. Perform hydraulic pressure test to determine cause and repair as required.
BUZZING NOISE	1. Fluid Level Low	1. Add fluid and check for leaks.
	2. Shift Cable Misassembled.	2. Route cable away from engine and bell housing.
	3. Valve Body Misassembled.	3. Remove, disassemble, inspect valve body. Reassemble correctly if necessary. Replace assembly if valves or springs are damaged. Check for loose bolts or screws.
	4. Pump Passages Leaking	4. Check pump for porous casting, scores on mating surfaces and excess rotor clearance. Repair as required. Loose pump bolts.
	5. Cooling System Cooler Plugged.	5. Flow check cooler circuit. Repair as needed.
	6. Overrunning Clutch Damaged.	6. Replace clutch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN REVERSE ONLY	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage.
	3. Rear Band Misadjusted.	3. Adjust band.
	4. Rear Band Worn.	4. Replace as required.
	5. Overdrive Direct Clutch Worn.	5. Disassemble overdrive. Repair as needed.
	6. Hydraulic Pressure Too Low.	6. Perform hydraulic pressure tests to determine cause.
	7. Rear Servo Leaking.	7. Air pressure check clutch-servo operation and repair as required.
	8. Band Linkage Binding.	8. Inspect and repair as required.
SLIPS IN FORWARD DRIVE RANGES	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Fluid Foaming.	2. Check for high oil level, bad pump gasket or seals, dirt between pump halves and loose pump bolts. Replace pump if necessary.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage.
	4. Gearshift Linkage Misadjusted.	4. Adjust linkage.
	5. Rear Clutch Worn.	5. Inspect and replace as needed.
	6. Low Hydraulic Pressure Due to Worn Pump, Incorrect Control Pressure Adjustments, Valve Body Warpage or Malfunction, Sticking, Leaking Seal Rings, Clutch Seals Leaking, Servo Leaks, Clogged Filter or Cooler Lines	6. Perform hydraulic and air pressure tests to determine cause.
	7. Rear Clutch Malfunction, Leaking Seals or Worn Plates.	7. Air pressure check clutch-servo operation and repair as required.
	8. Overrunning Clutch Worn, Not Holding (Slips in 1 Only).	8. Replace Clutch.
SLIPS IN LOW GEAR “D” ONLY, BUT NO IN 1 POSITION	Overrunning Clutch Faulty.	Replace overrunning clutch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GROWLING, GRATING OR SCRAPING NOISES	1. Drive Plate Broken.	1. Replace.
	2. Torque Converter Bolts Hitting Dust Shield.	2. Dust shield bent. Replace or repair.
	3. Planetary Gear Set Broken/ Seized.	3. Check for debris in oil pan and repair as required.
	4. Overrunning Clutch Worn/Broken.	4. Inspect and check for debris in oil pan. Repair as required.
	5. Oil Pump Components Scored/ Binding.	5. Remove, inspect and repair as required.
	6. Output Shaft Bearing or Bushing Damaged.	6. Remove, inspect and repair as required.
	7. Clutch Operation Faulty.	7. Perform air pressure check and repair as required.
	8. Front and Rear Bands Misadjusted.	8. Adjust bands.
DRAGS OR LOCKS UP	1. Fluid Level Low.	1. Check and adjust level.
	2. Clutch Dragging/Failed	2. Air pressure check clutch operation and repair as required.
	3. Front or Rear Band Misadjusted.	3. Adjust bands.
	4. Case Leaks Internally.	4. Check for leakage between passages in case.
	5. Servo Band or Linkage Malfunction.	5. Air pressure check servo operation and repair as required.
	6. Overrunning Clutch Worn.	6. Remove and inspect clutch. Repair as required.
	7. Planetary Gears Broken.	7. Remove, inspect and repair as required (look for debris in oil pan).
	8. Converter Clutch Dragging.	8. Check for plugged cooler. Perform flow check. Inspect pump for excessive side clearance. Replace pump as required.
NO 4-3 DOWNSHIFT	1. Circuit Wiring and/or Connectors Shorted.	1. Test wiring and connectors with test lamp and volt/ohmmeter. Repair wiring as necessary. Replace connectors and/or harnesses as required.
	2. PCM Malfunction.	2. Check PCM operation with DRB scan tool. Replace PCM only if faulty.
	3. TPS Malfunction	3. Check TPS with DRB scan tool at PCM.
	4. Lockup Solenoid Not Venting.	4. Remove valve body and replace solenoid assembly if plugged or shorted.
	5. Overdrive Solenoid Not Venting.	5. Remove valve body and replace solenoid if plugged or shorted.
	6. Valve Body Valve Sticking.	6. Repair stuck 3-4 shift valve or lockup timing valve.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF	1. Control Switch Open/Shorted.	1. Test and replace switch if faulty.
	2. Overdrive Solenoid Connector Shorted.	2. Test solenoids and replace if seized or shorted.
	3. PCM Malfunction.	3. Test with DRB scan tool. Replace PCM if faulty.
	4. Valve Body Stuck Valves.	4. Repair stuck 3-4, lockup or lockup timing valve.
CLUNK NOISE FROM DRIVELINE ON CLOSED THROTTLE 4-3 DOWNSHIFT	1. Transmission Fluid Low.	1. Add Fluid.
	2. Throttle Cable Misadjusted.	2. Adjust cable.
	3. Overdrive Clutch Select Spacer Wrong Spacer.	3. Replace overdrive piston thrust plate spacer.
3-4 UPSHIFT OCCURS IMMEDIATELY AFTER 2-3 SHIFT	1. Overdrive Solenoid Connector or Wiring Shorted.	1. Test connector and wiring for loose connections, shorts or ground and repair as needed.
	2. TPS Malfunction.	2. Test TPS and replace as necessary. Check with DRB scan tool.
	3. PCM Malfunction.	3. Test PCM with DRB scan tool and replace controller if faulty.
	4. Overdrive Solenoid Malfunction.	4. Replace solenoid.
	5. Valve Body Malfunction.	5. Remove, disassemble, clean and inspect valve body components. Make sure all valves and plugs slide freely in bores. Polish valves with crocus cloth if needed.
WHINE/NOISE RELATED TO ENGINE SPEED	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Shift Cable Incorrect Routing.	2. Check shift cable for correct routing. Should not touch engine or bell housing.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 3-4 UPSHIFT	1. Dash O/D Switch In OFF Position.	1. Turn control switch to ON position.
	2. Overdrive Circuit Fuse Blown.	2. Replace fuse. Determine why fuse failed and repair as necessary (i.e., shorts or grounds in circuit).
	3. O/D Switch Wire Shorted/Open Cut.	3. Check wires/connections with 12V test lamp and voltmeter. Repair damaged or loose wire/connection as necessary.
	4. Distance or Coolant Sensor Malfunction.	4. Check with DRB scan tool and repair or replace as necessary.
	5. TPS Malfunction.	5. Check with DRB scan tool and replace if necessary.
	6. Neutral Switch to PCM Wire Shorted/Cut.	6. Test switch as described in service section and replace if necessary. Engine no start.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if necessary.
	8. Overdrive Solenoid Shorted/Open.	8. Replace solenoid if shorted or open and repair loose or damaged wires (DRB scan tool).
	9. Solenoid Feed Orifice in Valve Body Blocked.	9. Remove, disassemble, and clean valve body thoroughly. Check feed orifice.
	10. Overdrive Clutch Failed.	10. Disassemble overdrive and repair as needed.
	11. Hydraulic Pressure Low.	11. Pressure test transmission to determine cause.
	12. Valve Body Valve Stuck.	12. Repair stuck 3-4 shift valve, 3-4 timing valve.
	13. O/D Piston Incorrect Spacer.	13. Remove unit, check end play and install correct spacer.
	14. Overdrive Piston Seal Failure.	14. Replace both seals.
	15. O/D Check Valve/Orifice Failed.	15. Check for free movement and secure assembly (in piston retainer). Check ball bleed orifice.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN OVERDRIVE FOURTH GEAR	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Overdrive Clutch Pack Worn.	2. Remove overdrive unit and rebuild clutch pack.
	3. Overdrive Piston Retainer Bleed Orifice Blown Out.	3. Disassemble transmission, remove retainer and replace orifice.
	4. Overdrive Piston or Seal Malfunction.	4. Remove overdrive unit. Replace seals if worn. Replace piston if damaged. If piston retainer is damaged, remove and disassemble the transmission.
	5. 3-4 Shift Valve, Timing Valve or Accumulator Malfunction.	5. Remove and overhaul valve body. Replace accumulator seals. Make sure all valves operate freely in bores and do not bind or stick. Make sure valve body screws are correctly tightened and separator plates are properly positioned.
	6. Overdrive Unit Thrust Bearing Failure.	6. Disassemble overdrive unit and replace thrust bearing (NO. 1 thrust bearing is between overdrive piston and clutch hub; NO. 2 thrust bearing is between the planetary gear and the direct clutch spring plate; NO. 3 thrust bearing is between overrunning clutch hub and output shaft).
	7. O/D Check Valve/Bleed Orifice Failure.	7. Check for function/secure orifice insert in O/D piston retainer.
DELAYED 3-4 UPSHIFT (SLOW TO ENGAGE)	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Throttle Valve Cable Misadjusted.	2. Adjust throttle valve cable.
	3. Overdrive Clutch Pack Worn/ Burnt.	3. Remove unit and rebuild clutch pack.
	4. TPS Faulty.	4. Test with DRB scan tool and replace as necessary
	5. Overdrive Clutch Bleed Orifice Plugged.	5. Disassemble transmission and replace orifice.
	6. Overdrive Solenoid or Wiring Shorted/Open.	6. Test solenoid and check wiring for loose/corroded connections or shorts/ grounds. Replace solenoid if faulty and repair wiring if necessary.
	7. Overdrive Excess Clearance	7. Remove unit. Measure end play and select proper spacer.
	8. O/D Check Valve Missing or Stuck.	8. Check for presence of check valve. Repair or replace as required.
TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR	Lockup Solenoid, Relay or Wiring Shorted/Open.	Test solenoid, relay and wiring for continuity, shorts or grounds. Replace solenoid and relay if faulty. Repair wiring and connectors as necessary.
HARSH 1-2, 2-3, 3-4 OR 3-2 SHIFTS	Lockup Solenoid Malfunction.	Remove valve body and replace solenoid assembly.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO START IN PARK OR NEUTRAL	1. Gearshift Linkage/Cable Misadjusted.	1. Adjust linkage/cable.
	2. Neutral Switch Wire Open/Cut.	2. Check continuity with test lamp. Repair as required.
	3. Neutral Switch Faulty.	3. Refer to service section for test and replacement procedure.
	4. Neutral Switch Connect Faulty.	4. Connectors spread open. Repair.
	5. Valve Body Manual Lever Assembly Bent/Worn/Broken.	5. Inspect lever assembly and replace if damaged.
NO REVERSE (OR SLIPS IN REVERSE)	1. Direct Clutch Pack (front clutch) Worn.	1. Disassemble unit and rebuild clutch pack.
	2. Rear Band Misadjusted.	2. Adjust band.
	3. Front Clutch Malfunctioned/ Burned.	3. Air-pressure test clutch operation. Remove and rebuild if necessary.
	4. Overdrive Thrust Bearing Failure.	4. Disassemble geartrain and replace bearings.
	5. Direct Clutch Spring Collapsed/ Broken.	5. Remove and disassemble unit. Check clutch position and replace spring.
OIL LEAKS.	1. Fluid Lines and Fittings Loose/ Leaks/Damaged.	1. Tighten fittings. If leaks persist, replace fittings and lines if necessary.
	2. Fill Tube (where tube enters case) Leaks/Damaged.	2. Replace tube seal. Inspect tube for cracks in fill tube.
	3. Pressure Port Plug Loose Loose/Damaged.	3. Tighten to correct torque. Replace plug or reseal if leak persists.
	4. Pan Gasket Leaks.	4. Tighten pan screws (150 in. lbs.). If leaks persist, replace gasket.
	5. Valve Body Manual Lever Shaft Seal Leaks/Worn.	5. Replace shaft seal.
	6. Rear Bearing Access Plate Leaks.	6. Replace gasket. Tighten screws.
	7. Gasket Damaged or Bolts are Loose.	7. Replace bolts or gasket or tighten both.
	8. Adapter/Extension Gasket Damaged Leaks/Damaged.	8. Replace gasket.
	9. Neutral Switch Leaks/Damaged.	9. Replace switch and gasket.
	10. Converter Housing Area Leaks.	10. Check for leaks at seal caused by worn seal or burr on converter hub (cutting seal), worn bushing, missing oil return, oil in front pump housing or hole plugged. Check for leaks past O-ring seal on pump or past pump-to-case bolts; pump housing porous, oil coming out vent due to overfill or leak past front band shaft access plug.
	11. Pump Seal Leaks/Worn/ Damaged.	11. Replace seal.
	12. Torque Converter Weld Leak/Cracked Hub.	12. Replace converter.
	13. Case Porosity Leaks.	13. Replace case.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY OPERATION IN FOURTH GEAR ONLY	1. Overdrive Clutch Discs, Plates or Snap Rings Damaged.	1. Remove unit and rebuild clutch pack.
	2. Overdrive Piston or Planetary Thrust Bearing Damaged.	2. Remove and disassemble unit. Replace either thrust bearing if damaged.
	3. Output Shaft Bearings Scored/ Damaged.	3. Remove and disassemble unit. Replace either bearing if damaged.
	4. Planetary Gears Worn/Chipped.	4. Remove and overhaul overdrive unit.
	5. Overdrive Unit Overrunning Clutch Rollers Worn/Scored.	5. Remove and overhaul overdrive unit.

SERVICE PROCEDURES

FLUID LEVEL CHECK

Transmission fluid level should be checked monthly under normal operation. If the vehicle is used for trailer towing or similar heavy load hauling, check fluid level and condition weekly. Fluid level is checked with the engine running at curb idle speed, the transmission in NEUTRAL and the transmission fluid at normal operating temperature.

FLUID LEVEL CHECK PROCEDURE

(1) Transmission fluid must be at normal operating temperature for accurate fluid level check. Drive vehicle if necessary to bring fluid temperature up to normal hot operating temperature of 82°C (180°F).

(2) Position vehicle on level surface.

(3) Start and run engine at curb idle speed.

(4) Apply parking brakes.

(5) Shift transmission momentarily into all gear ranges. Then shift transmission back to Neutral.

(6) Clean top of filler tube and dipstick to keep dirt from entering tube.

(7) Remove dipstick (Fig. 70) and check fluid level as follows:

(a) Correct acceptable level is in crosshatch area.

(b) Correct maximum level is to MAX arrow mark.

(c) Incorrect level is at or below MIN line.

(d) If fluid is low, add only enough Mopar® ATF Plus 3 to restore correct level. Do not overfill.

CAUTION: Do not overfill the transmission. Overfilling may cause leakage out the pump vent which can be mistaken for a pump seal leak. Overfilling will also cause fluid aeration and foaming as the excess fluid is picked up and churned by the gear train. This will significantly reduce fluid life.

FLUID AND FILTER REPLACEMENT

Refer to the Maintenance Schedules in Group 0, Lubrication and Maintenance, for proper service intervals. The service fluid fill after a filter change is approximately 3.8 liters (4.0 quarts).

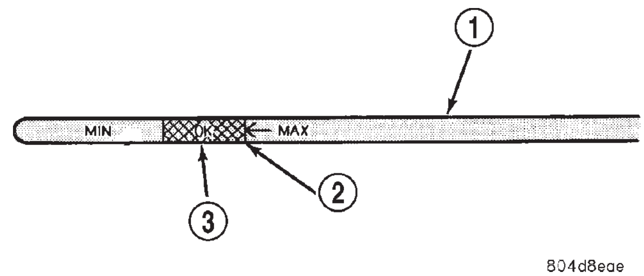


Fig. 70 Dipstick Fluid Level Marks—Typical

1 – DIPSTICK
2 – MAXIMUM CORRECT FLUID LEVEL
3 – ACCEPTABLE FLUID LEVEL

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Place a large diameter shallow drain pan beneath the transmission pan.

(3) Remove bolts holding front and sides of pan to transmission (Fig. 71).

(4) Loosen bolts holding rear of pan to transmission.

(5) Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.

(6) Hold up pan and remove remaining bolt holding pan to transmission.

(7) While holding pan level, lower pan away from transmission.

(8) Pour remaining fluid in pan into drain pan.

(9) Remove screws holding filter to valve body (Fig. 72).

(10) Separate filter from valve body and pour fluid in filter into drain pan.

(11) Dispose of used trans fluid and filter properly.

INSPECTION

Inspect bottom of pan and magnet for excessive amounts of metal or fiber contamination. A light coating of clutch or band material on the bottom of the pan does not indicate a problem unless accompanied by slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts or debris, refer to the diagnosis section of this group.

SERVICE PROCEDURES (Continued)

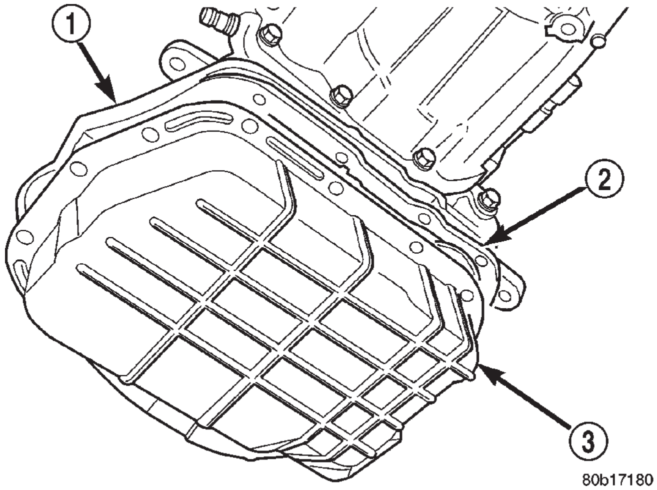


Fig. 71 Transmission Pan

1 – TRANSMISSION
2 – GASKET
3 – PAN

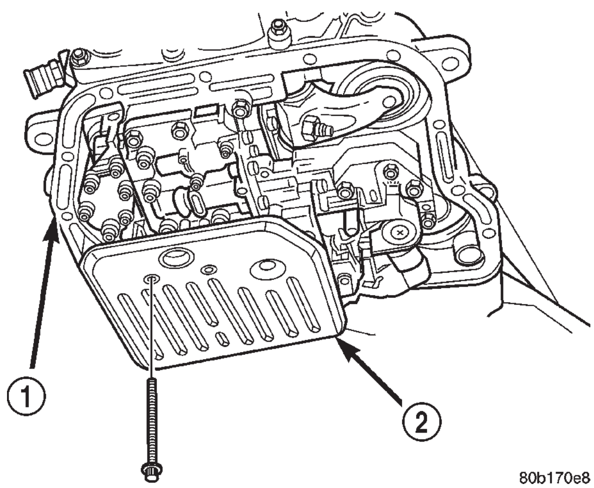


Fig. 72 Transmission Filter

1 – TRANSMISSION
2 – FILTER

Check the adjustment of the front and rear bands, adjust if necessary.

CLEANING

(1) Using a suitable solvent, clean pan and magnet.

(2) Using a suitable gasket scraper, clean gasket material from gasket surface of transmission case and the gasket flange around the pan.

INSTALLATION

(1) Place replacement filter in position on valve body.

(2) Install screws to hold filter to valve body (Fig. 72). Tighten screws to 4 N·m (35 in. lbs.) torque.

(3) Place new gasket in position on pan and install pan on transmission.

(4) Place pan in position on transmission.

(5) Install screws to hold pan to transmission (Fig. 71). Tighten bolts to 17 N·m (150 in. lbs.) torque.

(6) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

TRANSMISSION FILL PROCEDURE

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF Plus 3 to transmission:

(a) If only fluid and filter were changed, add **3 pints (1-1/2 quarts)** of ATF Plus 3 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **12 pints (6 quarts)** of ATF Plus 3 to transmission.

(3) Apply parking brakes.

(4) Start and run engine at normal curb idle speed.

(5) Apply service brakes, shift transmission through all gear ranges then back to NEUTRAL, set parking brake, and leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.

(7) Drive vehicle until transmission fluid is at normal operating temperature.

(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

CONVERTER DRAINBACK CHECK VALVE SERVICE

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator tank. The valve prevents fluid drainback when the vehicle is parked for lengthy periods. The valve check ball is spring loaded and has an opening pressure of approximately 2 psi.

SERVICE PROCEDURES (Continued)

The valve is serviced as an assembly; it is not repairable. Do not clean the valve if restricted, or contaminated by sludge, or debris. If the valve fails, or if a transmission malfunction occurs that generates significant amounts of sludge and/or clutch particles and metal shavings, the valve must be replaced.

The valve must be removed whenever the cooler and lines are reverse flushed. The valve can be flow tested when necessary. The procedure is exactly the same as for flow testing a cooler.

If the valve is restricted, installed backwards, or in the wrong line, it will cause an overheating condition and possible transmission failure.

CAUTION: The drainback valve is a one-way flow device. It must be properly oriented in terms of flow direction for the cooler to function properly. The valve must be installed in the pressure line. Otherwise flow will be blocked and would cause an overheating condition and eventual transmission failure.

OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF+3, type 7176, Automatic Transmission Fluid.

(1) Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If one quart of transmission fluid is collected in the container in 20 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 20 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.

(4) Re-connect the **To cooler** line to the transmission cooler inlet.

(5) Refill the transmission to proper level.

FLUSHING COOLERS AND TUBES

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906A Cooler Flusher.

CAUTION: The transmission oil cooler requires a two stage flushing procedure due to an internally mounted thermostat. Failure to follow the procedure can result in severe transmission damage.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906A

(1) Remove cover plate filler plug on Tool 6906A. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906A.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system. A suitable replacement hose can be found in the adapter kit supplied with the flushing tool.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

SERVICE PROCEDURES (Continued)

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Remove the transmission oil cooler from the vehicle. Refer to the Group 7, Cooling System, for the proper procedures.

(8) Remove the transmission oil cooler thermostat. Refer to the Group 7, Cooling System, for the proper procedures.

(9) Re-install the thermostat cover onto the oil cooler and install the snap ring.

(10) Re-connect the oil cooler to the transmission cooler lines.

(11) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the bypass circuit of the cooler only.

(12) Turn pump OFF.

(13) Remove the thermostat cover from the oil cooler.

(14) Install Special Tool Cooler Plug 8414 into the transmission oil cooler.

(15) Turn pump ON for two to three minutes to flush cooler(s) and lines.

NOTE: This flushes the main oil cooler core passages only.

(16) Turn pump OFF.

(17) Remove the thermostat cover from the oil cooler.

(18) Remove Special Tool Cooler Plug 8414 from the transmission oil cooler.

(19) Install a new thermostat spring, thermostat, cover, and snap-ring into the transmission oil cooler.

(20) Install the transmission oil cooler onto the vehicle.

(21) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(22) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(23) Place CLEAR suction line into a one quart container of Mopar® ATF Plus 3, type 7176 automatic transmission fluid.

(24) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(25) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL AND INSTALLATION

TRANSMISSION

The overdrive unit can be removed and serviced separately. It is not necessary to remove the entire transmission assembly to perform overdrive unit repairs.

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter drive plate, pump bushing, or oil seal can be damaged if the converter is left attached to the driveplate during removal.

REMOVAL

(1) Disconnect battery negative cable.

(2) Hoist and support vehicle.

(3) Remove skid plate, if equipped.

(4) Remove skid plate support crossmember, if equipped.

(5) Disconnect and lower or remove necessary exhaust components.

(6) Remove starter motor.

(7) Support engine with suitable support stand and wood block.

(8) Remove bolts attaching engine-to-transmission brackets to transmission.

(9) Remove bolt and nut attaching each engine-to-transmission bracket to the motor mounts.

(10) Remove bolts holding the engine-to-transmission brackets to the front axle, if equipped.

(11) Loosen bolts attaching engine-to-transmission brackets to each side of the engine block.

(12) Raise engine slightly.

(13) Remove torque converter access cover.

(14) Tighten bolts attaching engine-to-transmission brackets to each side of the engine block.

(15) Lower engine.

(16) Disconnect fluid cooler lines at transmission.

(17) If transmission is being removed for overhaul, remove transmission oil pan, drain fluid and reinstall pan.

(18) Remove fill tube bracket bolts and pull tube out of transmission. Retain fill tube seal. On 4 x 4

REMOVAL AND INSTALLATION (Continued)

models, it will also be necessary to remove bolt attaching transfer case vent tube to converter housing (Fig. 73).

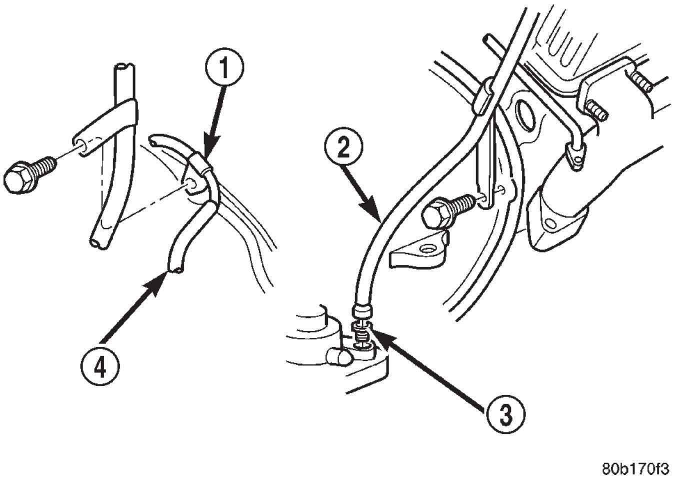


Fig. 73 Fill Tube Attachment

1 – TRANSFER CASE VENT TUBE
2 – FILL TUBE (V8)
3 – TUBE SEAL
4 – FILL TUBE (V6)

(19) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(20) Mark propeller shaft and axle yokes for assembly alignment. Then disconnect and remove propeller shaft.

(21) Disconnect wires from park/neutral position switch and transmission solenoid.

(22) Disconnect throttle valve cable from transmission bracket and throttle valve lever.

(23) On 4 x 4 models, disconnect shift rod from transfer case shift lever. Or remove shift lever from transfer case and tie rod and lever to chassis component with wire.

(24) Raise transmission slightly with service jack to relieve load on crossmember and supports.

(25) Remove bolts securing rear support and cushion to transmission and crossmember. Raise transmission slightly, slide exhaust hanger arm from bracket (Fig. 74) and remove rear support.

(26) Remove bolts attaching crossmember to frame and remove crossmember.

(27) On 4 x 4 models, disconnect vent hose from transfer case. Then remove transfer case with transmission jack or aid of helper.

(28) Remove all converter housing bolts.

(29) Carefully work transmission and torque converter assembly rearward off engine block dowels.

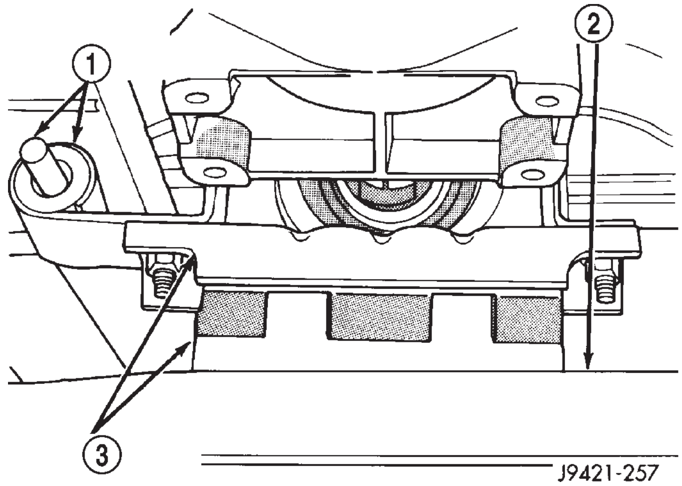


Fig. 74 Rear Support Cushion

1 – EXHAUST PIPE ARM AND BRACKET
2 – CROSSMEMBER
3 – REAR SUPPORT AND CUSHION

(30) Lower transmission and remove assembly from under the vehicle.

INSTALLATION

(1) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

(2) Lubricate oil pump seal lip with transmission fluid.

(3) Lubricate converter pilot hub pocket in the rear of the crankshaft with a light coating of Mopar® High Temp Grease.

(4) Align and install converter in oil pump.

(5) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(6) Check converter seating with steel scale and straightedge (Fig. 75). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) Temporarily secure converter with wedge tool or C-clamp.

(8) Position transmission on jack and secure it with chains.

(9) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to held transmission in alignment.**

(10) Raise transmission and align converter with drive plate and converter housing with engine block.

REMOVAL AND INSTALLATION (Continued)

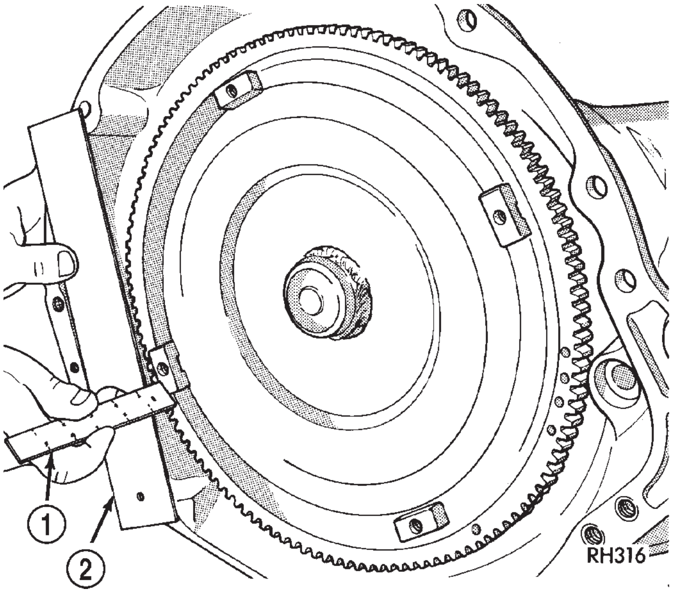


Fig. 75 Typical Method Of Checking Converter Seating

1 – SCALE
2 – STRAIGHTEDGE

(11) Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

(12) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

(13) Install bolts attaching converter housing to engine.

(14) Install rear support. Then lower transmission onto crossmember and install bolts attaching transmission mount to crossmember.

(15) Install new plastic retainer grommet on any shift linkage rod or lever that was disconnected. Grommets should not be reused.

(16) Connect gearshift and throttle cable to transmission.

(17) Connect wires to park/neutral position switch, transmission solenoid(s) and oxygen sensor. Be sure transmission harnesses are properly routed.

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

(18) Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in. lbs.).

(19) Raise engine slightly.

(20) Loosen bolts attaching engine-to-transmission brackets to each side of the engine block.

(21) Install converter housing access cover.

(22) Install bolts attaching engine-to-transmission brackets to transmission.

(23) Tighten bolts attaching engine-to-transmission brackets to each side of the engine block.

(24) Lower engine.

(25) Install bolt and nut attaching each engine-to-transmission bracket to the motor mounts.

(26) Remove engine support.

(27) Install bolts to hold engine-to-transmission brackets to the front axle, if equipped.

(28) Install starter motor and cooler line bracket.

(29) Connect cooler lines to transmission.

(30) Install transmission fill tube. Install new seal on tube before installation.

(31) Install exhaust components.

(32) Install transfer case, if necessary.

(33) Align and connect propeller shaft(s).

(34) Install rear skid plate, if equipped.

(35) Adjust gearshift linkage and throttle valve cable if necessary.

(36) Install front skid plate, if equipped.

(37) Lower vehicle.

(38) Fill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

TORQUE CONVERTER

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition.

The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

(1) Lubricate converter hub and oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 76). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

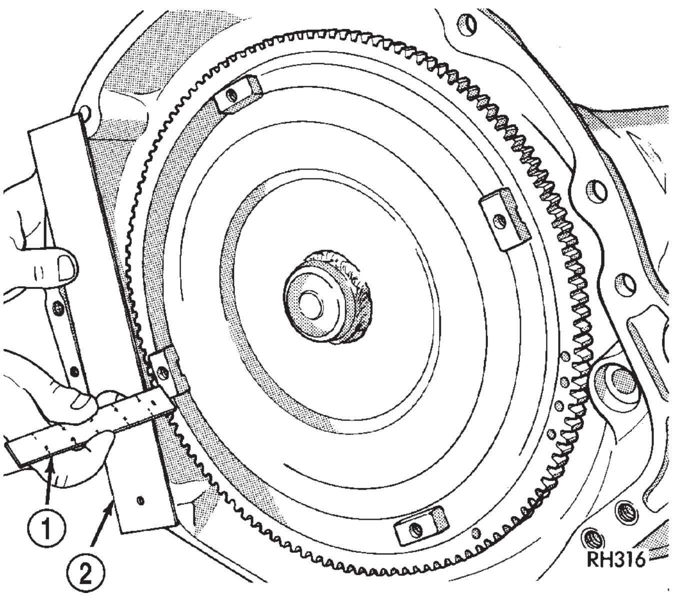


Fig. 76 Checking Torque Converter Seating

1 – SCALE
2 – STRAIGHTEDGE

YOKE SEAL REPLACEMENT

REMOVAL

(1) Raise vehicle.

(2) Mark propeller shaft and axle companion flange for alignment reference.

(3) Disconnect and remove propeller shaft.

(4) Remove old seal with Seal Remover C-3985-B (Fig. 77) from overdrive housing.

INSTALLATION

(1) Place seal in position on overdrive housing.

(2) Drive seal into overdrive housing with Seal Installer C-3995-A (Fig. 78).

(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle companion flange.

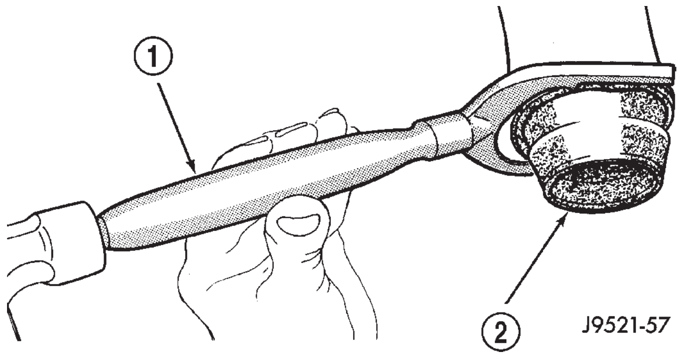


Fig. 77 Removing Overdrive Housing Yoke Seal

1 – SPECIAL TOOL C-3985–B
2 – SEAL

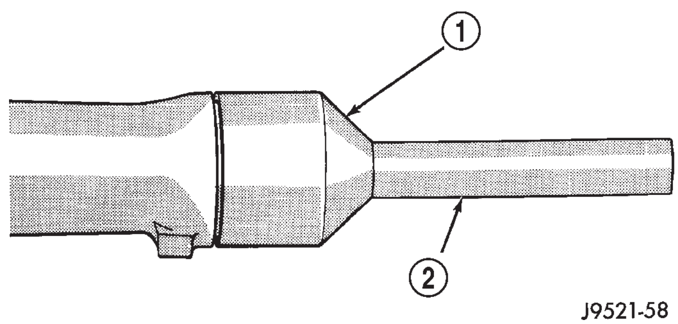


Fig. 78 Installing Overdrive Housing Yoke Seal

1 – SPECIAL TOOL C-3995–A OR C-3972–A
2 – SPECIAL TOOL C-4471

PARK/NEUTRAL POSITION SWITCH

REMOVAL

(1) Raise vehicle and position drain pan under switch.

(2) Disconnect switch wires.

(3) Remove switch from case.

INSTALLATION

(1) Move shift lever to Park and Neutral positions. Verify that switch operating lever fingers are centered in switch opening in case (Fig. 79).

(2) Install new seal on switch and install switch in case. Tighten switch to 34 N·m (25 ft. lbs.) torque.

(3) Test continuity of new switch with 12V test lamp.

(4) Connect switch wires and lower vehicle.

(5) Top off transmission fluid level.

REMOVAL AND INSTALLATION (Continued)

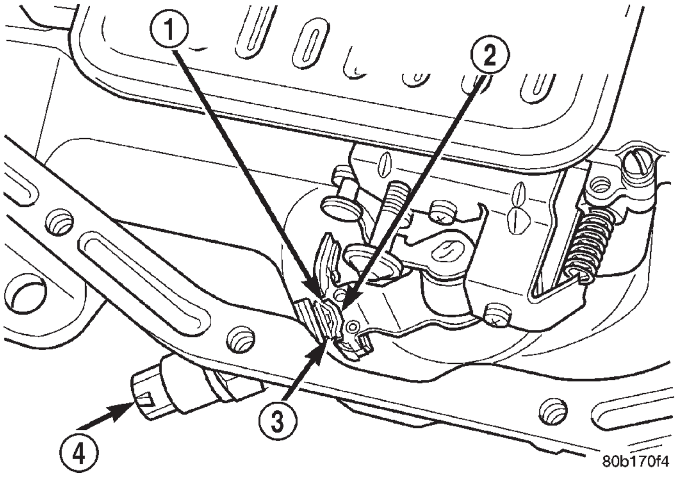


Fig. 79 Park/Neutral Position Switch

1 – NEUTRAL CONTACT
2 – MANUAL LEVER AND SWITCH PLUNGER IN REVERSE POSITION
3 – PARK CONTACT
4 – SWITCH

GEARSHIFT CABLE

REMOVAL

(1) Shift transmission into Park.

(2) Remove nuts retaining the shift cable housing to the dash panel (Fig. 80).

(3) Disconnect cable at lower column lever and feed cable through dash panel opening to underside of vehicle (Fig. 81).

(4) Raise vehicle.

(5) Disengage cable eyelet at transmission shift lever and pull cable adjuster out of mounting bracket (Fig. 82). Remove old cable from vehicle.

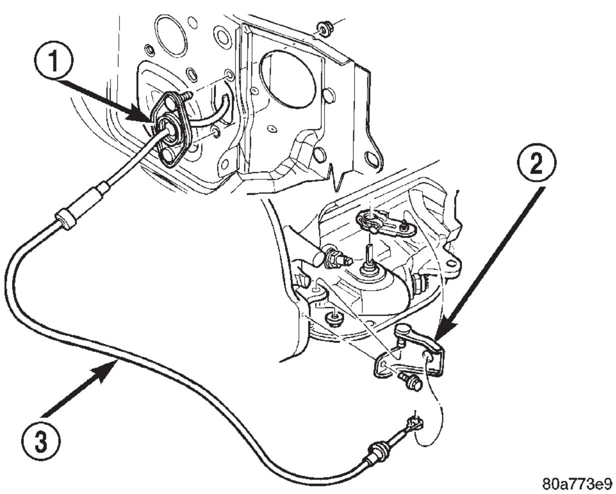


Fig. 80 Cable Mounting

1 – CABLE MOUNTING
2 – CABLE BRACKET AT TRANS.
3 – GEARSHIFT CABLE

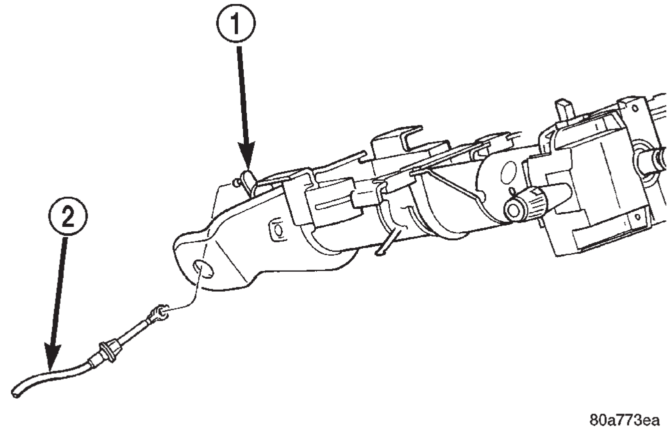


Fig. 81 Cable at Gearshift Lever

1 – GEARSHIFT LEVER
2 – GEARSHIFT CABLE

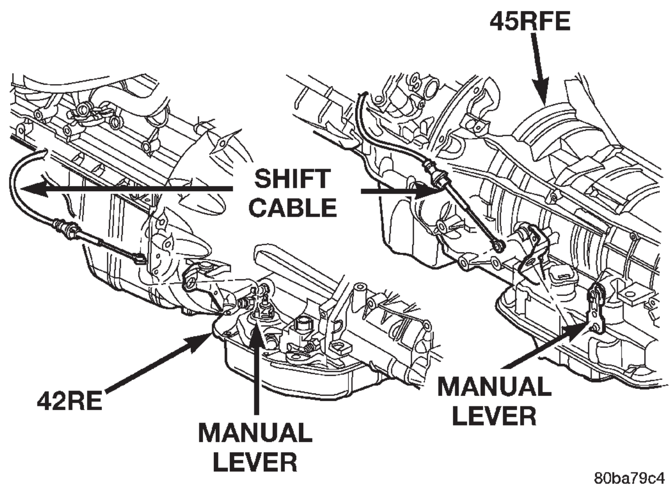


Fig. 82 Shift Cable at the Transmission

INSTALLATION

(1) Snap the cable into the transmission bracket so the retaining ears are engaged and connect cable end fitting onto the manual control lever ball stud.

(2) Lower vehicle.

(3) Route cable through hole in dash panel. Seat cable bracket to dash panel. Install retaining nuts to cable housing bracket studs inside the vehicle at the dash panel.

(4) Place the auto transmission manual shift control lever in “Park” detent (rearmost) position and rotate prop shaft to ensure transmission is in park.

(5) Connect shift cable to shifter lever by snapping cable retaining ears into shifter bracket and press cable end fitting into lever.

(6) Check for proper operation of Park/Neutral switch.

(7) If the gearshift cable is out of adjustment, refer to Adjustments section.

REMOVAL AND INSTALLATION (Continued)

GOVERNOR SOLENOID AND PRESSURE SENSOR

REMOVAL

(1) Hoist and support vehicle on safety stands.
(2) Remove transmission fluid pan and filter.
(3) Disengage wire connectors from pressure sensor and solenoid (Fig. 83).
(4) Remove screws holding pressure solenoid retainer to governor body.
(5) Separate solenoid retainer from governor (Fig. 84).
(6) Pull solenoid from governor body (Fig. 85).
(7) Pull pressure sensor from governor body.
(8) Remove bolts holding governor body to valve body.
(9) Separate governor body from valve body (Fig. 86).
(10) Remove governor body gasket.

INSTALLATION

Before installing the pressure sensor and solenoid in the governor body, replace O-ring seals, clean the gasket surfaces and replace gasket.

(1) Place gasket in position on back of governor body (Fig. 86).
(2) Place governor body in position on valve body.
(3) Install bolts to hold governor body to valve body.
(4) Lubricate O-ring on pressure sensor with transmission fluid.
(5) Align pressure sensor to bore in governor body.
(6) Push pressure sensor into governor body.
(7) Lubricate O-ring, on pressure solenoid, with transmission fluid.
(8) Align pressure solenoid to bore in governor body (Fig. 85).
(9) Push solenoid into governor body.
(10) Place solenoid retainer in position on governor (Fig. 84).
(11) Install screws to hold pressure solenoid retainer to governor body.
(12) Engage wire connectors into pressure sensor and solenoid (Fig. 83).
(13) Install transmission fluid pan and (new) filter.
(14) Lower vehicle and road test to verify repair.

VALVE BODY

The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to Disassembly and Assembly section for proper procedures.

The only replaceable valve body components are:

- Manual lever.

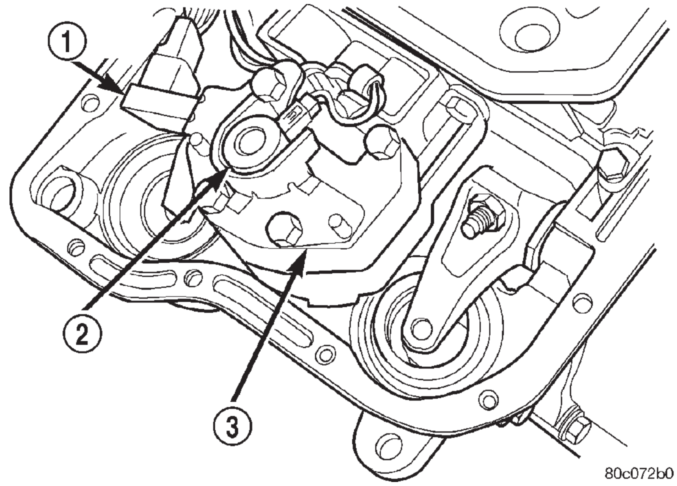


Fig. 83 Governor Solenoid And Pressure Sensor

1 – PRESSURE SENSOR
2 – PRESSURE SOLENOID
3 – GOVERNOR

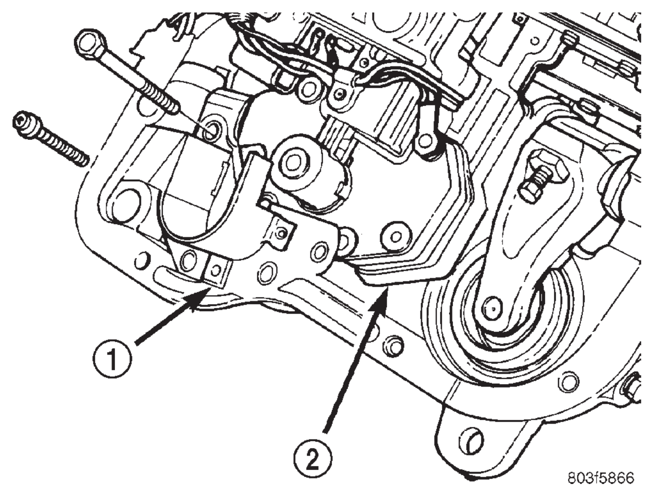


Fig. 84 Pressure Solenoid Retainer

1 – PRESSURE SOLENOID RETAINER
2 – GOVERNOR

- Manual lever washer, seal, E-clip, and shaft seal.
- Manual lever detent ball.
- Throttle lever.
- Fluid filter.
- Pressure adjusting screw bracket.
- Governor pressure solenoid.
- Governor pressure sensor (includes transmission temperature thermistor).
- Converter clutch/overdrive solenoid assembly and harness.
- Governor housing gasket.
- Solenoid case connector O-rings.

The remaining valve body components are serviced only as part of a complete valve body assembly.

REMOVAL AND INSTALLATION (Continued)

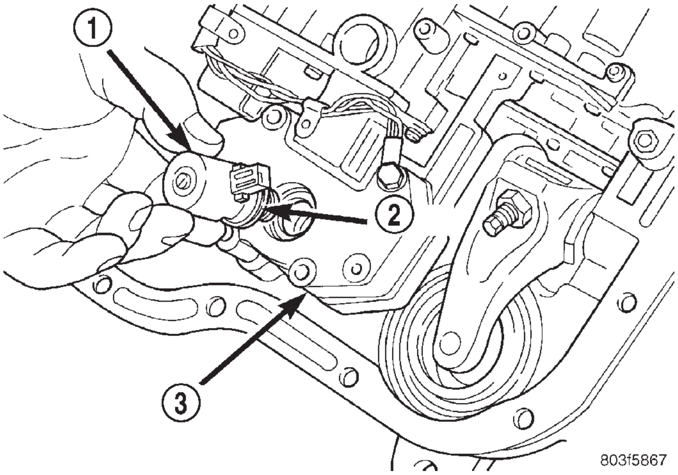


Fig. 85 Pressure Solenoid and O-ring

1 – PRESSURE SOLENOID
2 – O-RING
3 – GOVERNOR

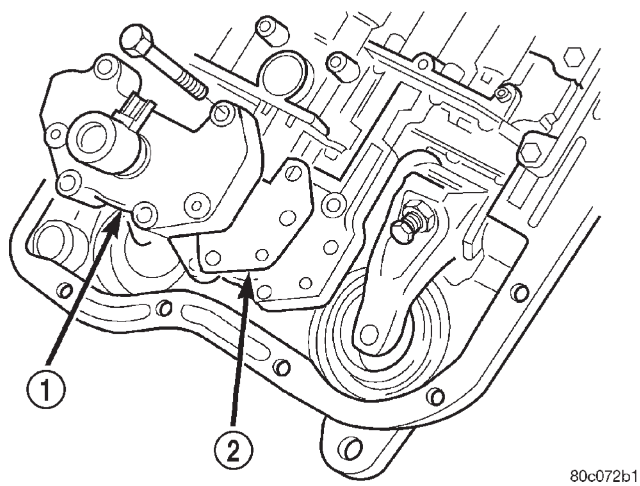


Fig. 86 Governor Body and Gasket

1 – GOVERNOR BODY
2 – GASKET

REMOVAL

(1) Shift transmission into NEUTRAL.

(2) Raise vehicle.

(3) Remove gearshift and throttle levers from shaft of valve body manual lever.

(4) Disconnect wires at solenoid case connector (Fig. 87).

(5) Position drain pan under transmission oil pan.

(6) Remove transmission oil pan and gasket.

(7) Remove fluid filter from valve body.

(8) Remove bolts attaching valve body to transmission case.

(9) Lower valve body enough to remove accumulator piston and springs.

(10) Work manual lever shaft and electrical connector out of transmission case.

(11) Lower valve body, rotate valve body away from case, pull park rod out of sprag, and remove valve body (Fig. 88).

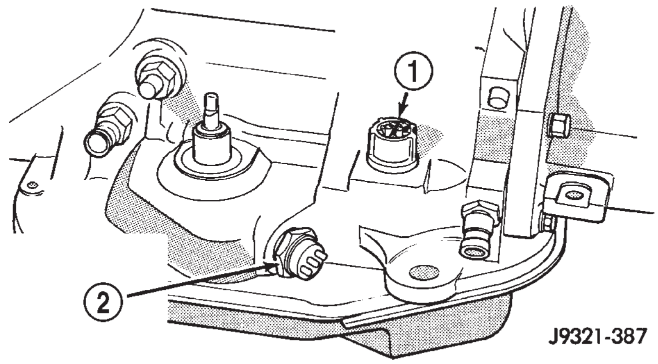


Fig. 87 Transmission Case Connector

1 – SOLENOID CASE CONNECTOR
2 – PARK/NEUTRAL POSITION SWITCH CONNECTOR TERMINAL

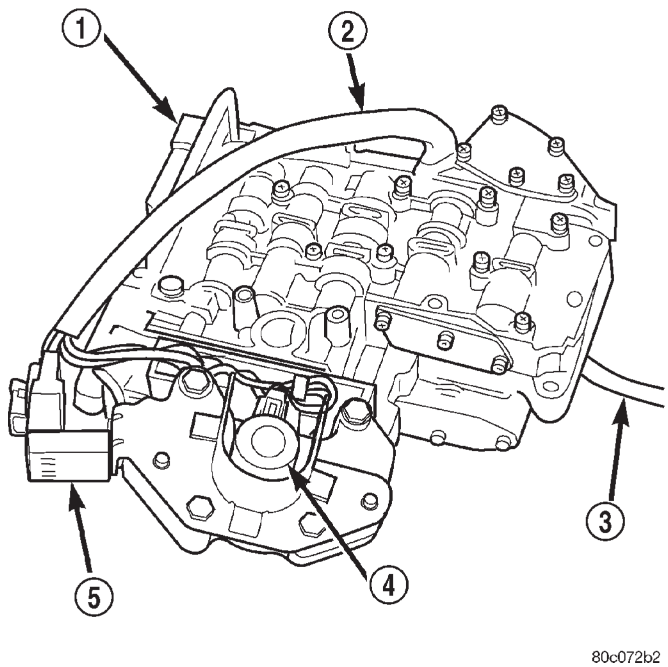


Fig. 88 Valve Body

1 – VALVE BODY
2 – WIRE HARNESS
3 – PARK ROD
4 – GOVERNOR PRESSURE SOLENOID
5 – GOVERNOR PRESSURE SENSOR

INSTALLATION

(1) Check condition of O-ring seals on valve body harness connector (Fig. 89). Replace seals on connector body if cut or worn.

REMOVAL AND INSTALLATION (Continued)

(2) Check condition of manual lever shaft seal in transmission case. Replace seal if lip is cut or worn. Install new seal with 15/16 deep well socket (Fig. 90).

(3) Check condition of seals on accumulator piston (Fig. 91). Install new piston seals, if necessary.

(4) Place valve body manual lever in low (1 position) so ball on park lock rod will be easier to install in sprag.

(5) Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal in case.

(6) Lubricate seal rings on valve body harness connector with petroleum jelly.

(7) Position valve body in case and work end of park lock rod into and through pawl sprag. Turn propeller shaft to align sprag and park lock teeth if necessary. The rod will click as it enters pawl. Move rod to check engagement.

CAUTION: It is possible for the park rod to displace into a cavity just above the pawl sprag during installation. Make sure the rod is actually engaged in the pawl and has not displaced into this cavity.

(8) Install accumulator springs and piston into case. Then swing valve body over piston and outer spring to hold it in place.

(9) Align accumulator piston and outer spring, manual lever shaft and electrical connector in case.

(10) Then seat valve body in case and install one or two bolts to hold valve body in place.

(11) Tighten valve body bolts alternately and evenly to 11 N·m (100 in. lbs.) torque.

(12) Install new fluid filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.) torque.

(13) Install throttle and gearshift levers on valve body manual lever shaft.

(14) Check and adjust front and rear bands if necessary.

(15) Connect solenoid case connector wires.

(16) Install oil pan and new gasket. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(17) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

(18) Check and adjust gearshift and throttle valve cables, if necessary.

OVERDRIVE UNIT

REMOVAL

(1) Shift transmission into Park.

(2) Raise vehicle.

(3) Remove transfer case, if equipped.

(4) Mark propeller shaft universal joint(s) and axle pinion yoke, or the companion flange and flange yoke, for alignment reference at installation, if neccesary.

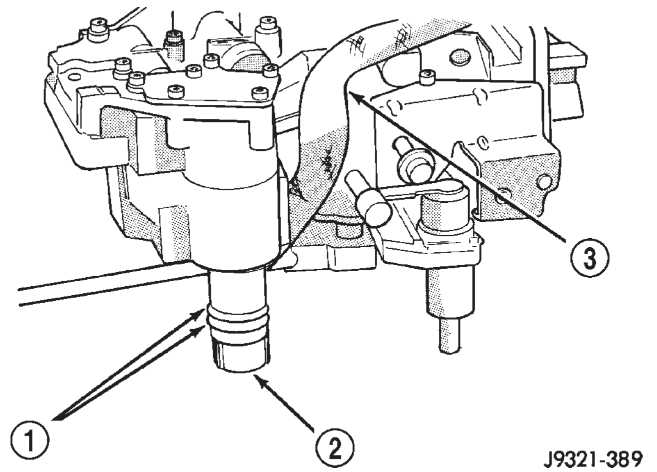


Fig. 89 Valve Body Harness Connector O-Ring Seal

1 – CONNECTOR O-RINGS
2 – VALVE BODY HARNESS CONNECTOR
3 – HARNESS

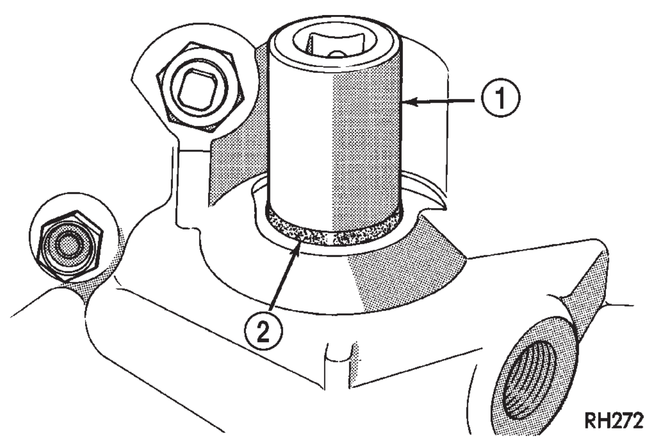


Fig. 90 Manual Lever Shaft Seal

1 – 15/16'' SOCKET
2 – SEAL

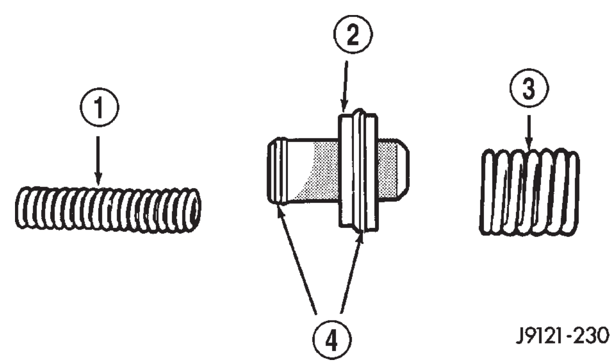


Fig. 91 Accumulator Piston Components

1 – INNER SPRING
2 – ACCUMULATOR PISTON
3 – OUTER SPRING
4 – SEAL RINGS

REMOVAL AND INSTALLATION (Continued)

(5) Disconnect and remove the rear propeller shaft, if necessary.

(6) Remove transmission oil pan, remove gasket, drain oil and reinstall pan.

(7) If overdrive unit had malfunctioned, or if fluid is contaminated, remove entire transmission. If diagnosis indicated overdrive problems only, remove just the overdrive unit.

(8) Support transmission with transmission jack.

(9) Remove vehicle speed sensor.

(10) Remove bolts attaching overdrive unit to transmission (Fig. 92).

CAUTION: Support the overdrive unit with a jack before moving it rearward. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

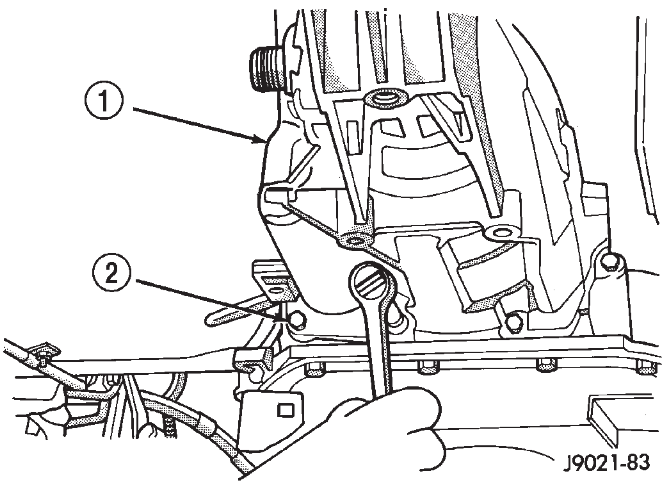


Fig. 92 Overdrive Unit Bolts

1 – OVERDRIVE UNIT
2 – ATTACHING BOLTS (7)

(11) Carefully work overdrive unit off intermediate shaft. Do not tilt unit during removal. Keep it as level as possible.

(12) If overdrive unit does not require service, immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch to prevent splines from rotating out of alignment. If misalignment occurs, overdrive unit will have to be disassembled in order to realign splines.

(13) Remove and retain overdrive piston thrust bearing. Bearing may remain on piston or in clutch hub during removal.

(14) Position drain pan on workbench.

(15) Place overdrive unit over drain pan. Tilt unit to drain residual fluid from case.

(16) Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

(17) If overdrive unit does not require any service, leave alignment tool in position. Tool will prevent accidental misalignment of planetary gear and overrunning clutch splines.

INSTALLATION

(1) Be sure overdrive unit Alignment Tool 6227-2 is fully seated before moving unit. If tool is not seated and gear splines rotate out of alignment, overdrive unit will have to be disassembled in order to realign splines.

(2) If overdrive piston retainer was not removed during service and original case gasket is no longer reusable, prepare new gasket by trimming it.

(3) Cut out old case gasket around piston retainer with razor knife (Fig. 93).

(4) Use old gasket as template and trim new gasket to fit.

(5) Position new gasket over piston retainer and on transmission case. Use petroleum jelly to hold gasket in place if necessary. Do not use any type of sealer to secure gasket. Use petroleum jelly only.

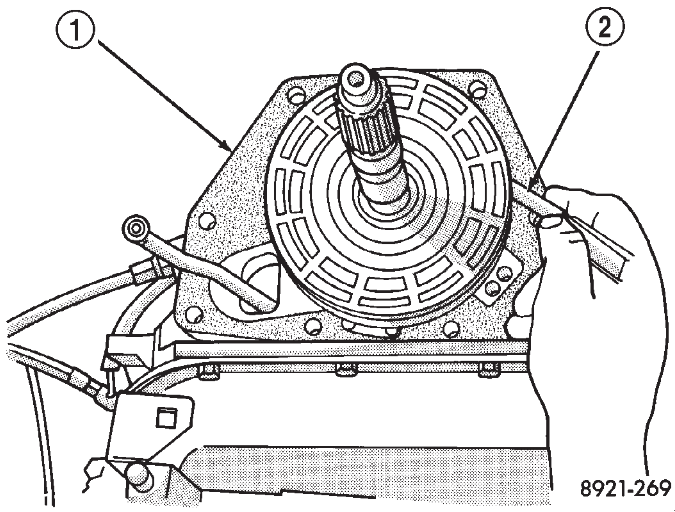


Fig. 93 Trimming Overdrive Case Gasket

1 – GASKET
2 – SHARP KNIFE

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 94).

(7) Install thrust bearing in overdrive unit sliding hub. Use petroleum jelly to hold bearing in position.

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(8) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Alignment Tool 6227-2. Overdrive unit cannot be installed if splines are not aligned. If splines have rotated out

REMOVAL AND INSTALLATION (Continued)

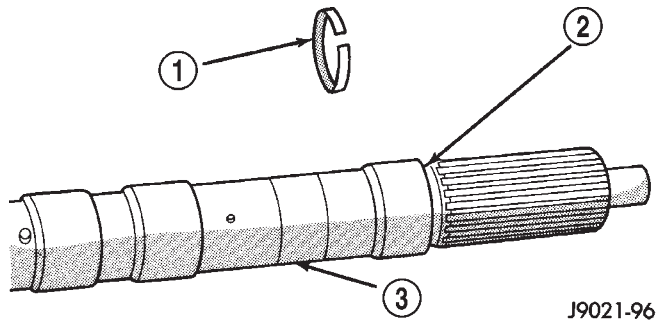


Fig. 94 Intermediate Shaft Selective Spacer Location

1 – SELECTIVE SPACER
2 – SPACER GROOVE
3 – INTERMEDIATE SHAFT

of alignment, unit will have to be disassembled to realign splines.

(9) Carefully slide Alignment Tool 6227-2 out of overdrive planetary gear and overrunning clutch splines.

(10) Raise overdrive unit and carefully slide it straight onto intermediate shaft. Insert park rod into park lock reaction plug at same time. Avoid tilting overdrive during installation as this could cause planetary gear and overrunning clutch splines to rotate out of alignment. If this occurs, it will be necessary to remove and disassemble overdrive unit to realign splines.

(11) Work overdrive unit forward on intermediate shaft until seated against transmission case.

(12) Install bolts attaching overdrive unit to transmission unit. Tighten bolts in diagonal pattern to 34 N·m (25 ft-lbs).

(13) Install speed sensor.

(14) Connect speed sensor and overdrive wires.

(15) Install the transfer case, if equipped.

(16) Align and install rear propeller shaft, if necessary.

OVERDRIVE HOUSING BUSHING

REMOVAL

(1) Remove overdrive housing yoke seal.

(2) Insert Remover 6957 into overdrive housing. Tighten tool to bushing and remove bushing (Fig. 95).

INSTALLATION

(1) Align bushing oil hole with oil slot in overdrive housing.

(2) Tap bushing into place with Installer 6951 and Handle C-4171.

(3) Install new oil seal in housing using Seal Installer C-3995–A (Fig. 96).

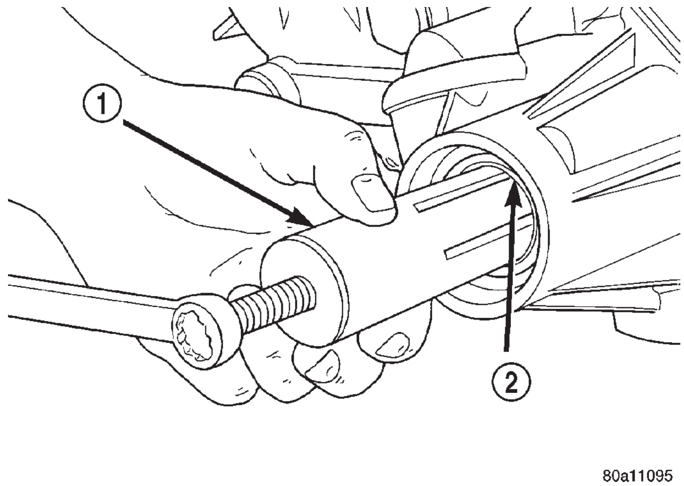


Fig. 95 Bushing Removal—Typical

1 – REMOVER 6957
2 – EXTENSION HOUSING BUSHING

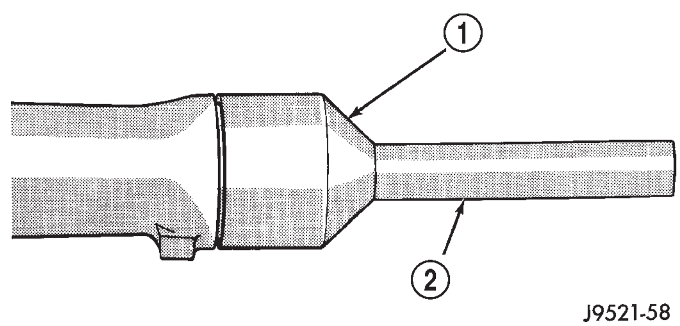


Fig. 96 Overdrive Housing Seal Installation

1 – SPECIAL TOOL C-3995–A OR C-3972–A
2 – SPECIAL TOOL C-4471

OUTPUT SHAFT REAR BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

(3) Remove snap ring holding output shaft rear bearing into overdrive housing (Fig. 97).

(4) Using a suitable driver inserted through the rear end of housing, drive bearing from housing.

INSTALLATION

(1) Place replacement bearing in position in housing.

(2) Using a suitable driver, drive bearing into housing until the snap ring groove is visible.

(3) Install snap ring to hold bearing into housing (Fig. 97).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

REMOVAL AND INSTALLATION (Continued)

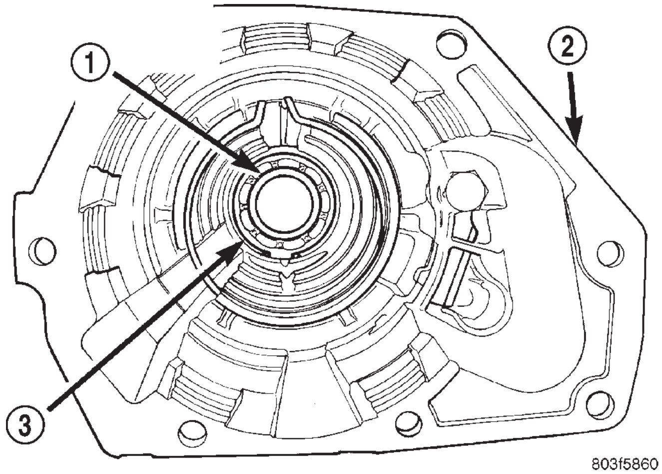


Fig. 97 Output Shaft Rear Bearing

1 – OUTPUT SHAFT REAR BEARING
2 – OVERDRIVE HOUSING
3 – SNAP RING

OUTPUT SHAFT FRONT BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.
(2) Remove overdrive geartrain from housing.
(3) Remove snap ring holding output shaft front bearing to overdrive geartrain. (Fig. 98).
(4) Pull bearing from output shaft.

INSTALLATION

(1) Place replacement bearing in position on geartrain with locating retainer groove toward the rear.
(2) Push bearing onto shaft until the snap ring groove is visible.
(3) Install snap ring to hold bearing onto output shaft (Fig. 98).
(4) Install overdrive geartrain into housing.
(5) Install overdrive unit in vehicle.

DISASSEMBLY AND ASSEMBLY

VALVE BODY

Remove the valve body from the transmission, refer to Removal and Installation procedures section in this group.

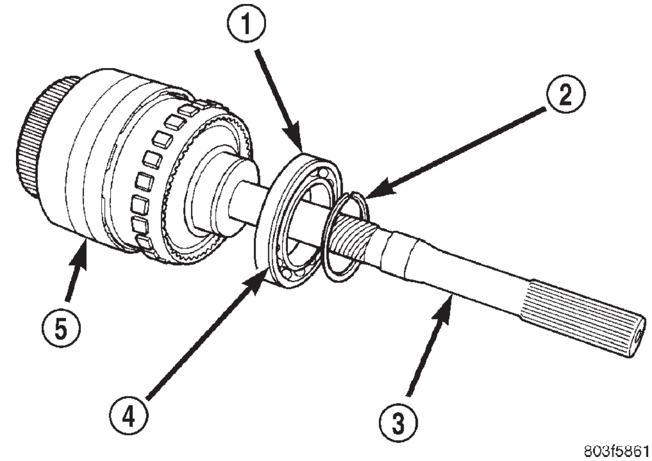


Fig. 98 Output Shaft Front Bearing

1 – OUTPUT SHAFT FRONT BEARING
2 – SNAP RING
3 – OUTPUT SHAFT
4 – GROOVE TO REAR
5 – OVERDRIVE GEARTRAIN

DISASSEMBLY

CAUTION: Do not clamp any valve body component in a vise. This practice can damage the component resulting in unsatisfactory operation after assembly and installation. Do not use pliers to remove any of the valves, plugs or springs and do not force any of the components out or into place. The valves and valve body housings will be damaged if force is used. Tag or mark the valve body springs for reference as they are removed. Do not allow them to become intermixed.

(1) Remove fluid filter.
(2) Disconnect wires from governor pressure sensor and solenoid.
(3) Remove screws attaching governor body and retainer plate to transfer plate.
(4) Remove retainer plate, governor body and gasket from transfer plate.
(5) Remove governor pressure sensor from governor body
(6) Remove governor pressure solenoid by pulling it straight out of bore in governor body. Remove and discard solenoid O-rings if worn, cut, or torn.

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Remove small shoulder bolt that secures solenoid harness case connector to 3-4 accumulator housing (Fig. 99). **Retain shoulder bolt. Either tape it to harness or thread it back into accumulator housing after connector removal.**

(8) Unhook overdrive/converter solenoid harness from 3-4 accumulator cover plate (Fig. 100).

(9) Turn valve body over and remove screws that attach overdrive/converter solenoid assembly to valve body (Fig. 101).

(10) Remove solenoid and harness assembly from valve body (Fig. 102).

(11) Remove boost valve cover (Fig. 103).

(12) Remove boost valve retainer, valve spring and boost valve (Fig. 104).

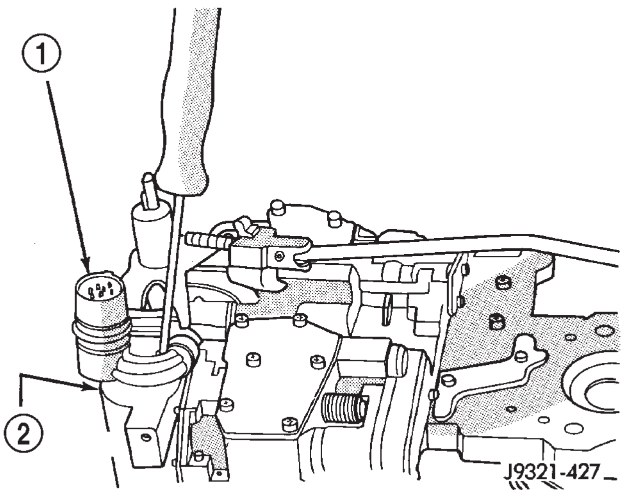


Fig. 99 Solenoid Harness Case Connector Shoulder Bolt

1 – SOLENOID HARNESS CASE CONNECTOR
2 – 3–4 ACCUMULATOR HOUSING

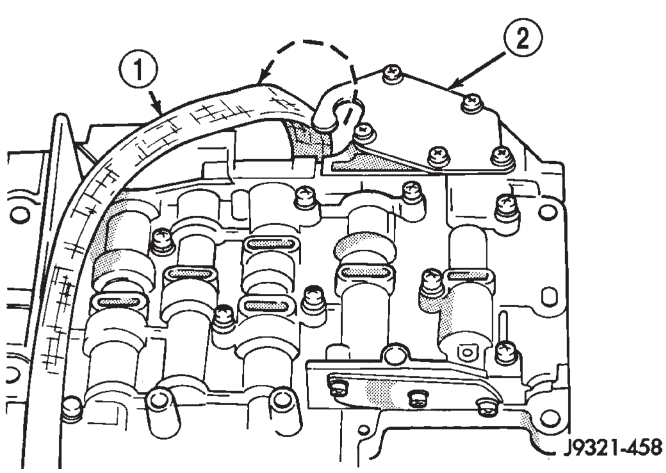


Fig. 100 Unhooking Solenoid Harness From Accumulator Cover Plate

1 – OVERDRIVE/CONVERTER SOLENOID WIRE HARNESS
2 – 3–4 ACCUMULATOR COVER PLATE

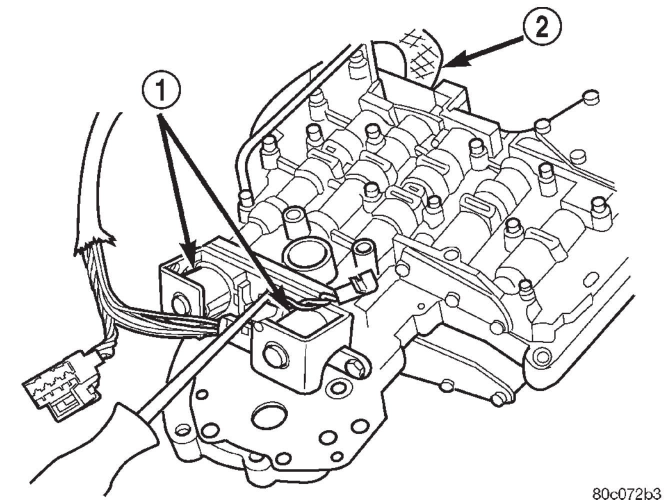


Fig. 101 Solenoid Assembly Screws

1 – OVERDRIVE/CONVERTER CLUTCH SOLENOID ASSEMBLY
2 – HARNESS

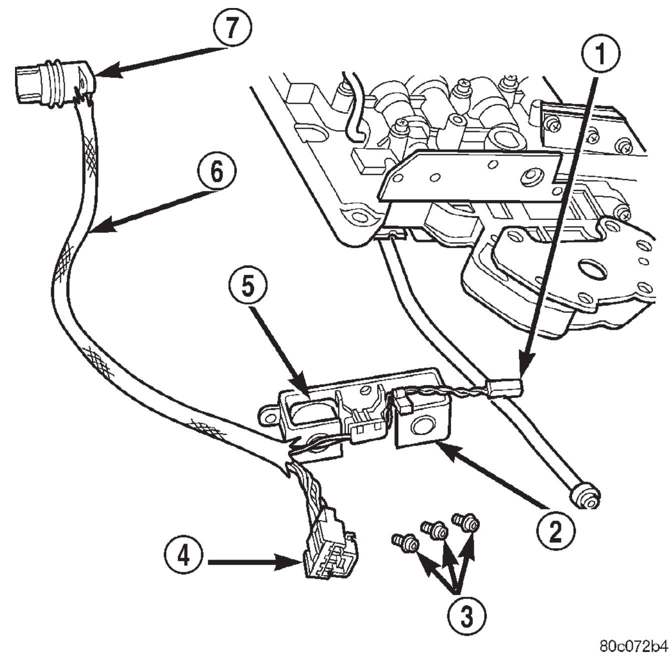


Fig. 102 Solenoid Assembly

1 – GOVERNOR SOLENOID WIRES
2 – CONVERTER CLUTCH SOLENOID
3 – SOLENOID SCREWS
4 – GOVERNOR SENSOR WIRES
5 – OVERDRIVE SOLENOID
6 – HARNESS
7 – CASE CONNECTOR

(13) Secure detent ball and spring with Retainer Tool 6583 (Fig. 105).

(14) Remove park rod E-clip and separate rod from manual lever (Fig. 106).

(15) Remove E-clip and washer that retains throttle lever shaft in manual lever (Fig. 107).

DISASSEMBLY AND ASSEMBLY (Continued)

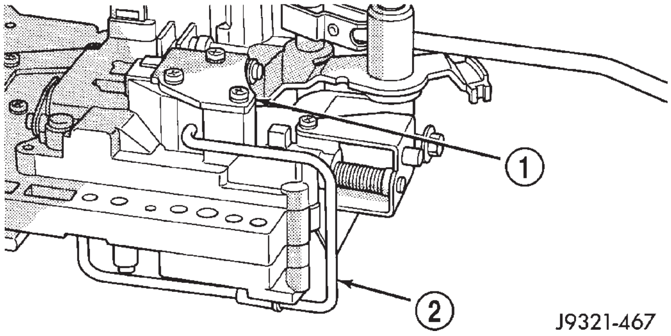


Fig. 103 Boost Valve Cover Location

1 – BOOST VALVE HOUSING AND COVER
2 – BOOST VALVE TUBE

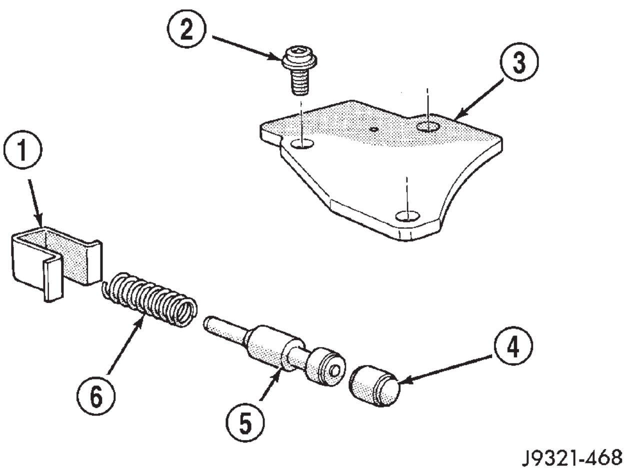


Fig. 104 Boost Valve Components

1 – SPRING AND VALVE RETAINER
2 – COVER SCREWS
3 – BOOST VALVE COVER
4 – BOOST VALVE PLUG
5 – BOOST VALVE
6 – BOOST VALVE SPRING

(16) Remove manual lever and throttle lever (Fig. 108). Rotate and lift manual lever off valve body and throttle lever shaft. Then slide throttle lever out of valve body.

(17) Position pencil magnet next to detent housing to catch detent ball and spring. Then carefully remove Retainer Tool 6583 and remove detent ball and spring (Fig. 109).

(18) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate (Fig. 110). Hold bracket firmly against spring tension while removing last screw.

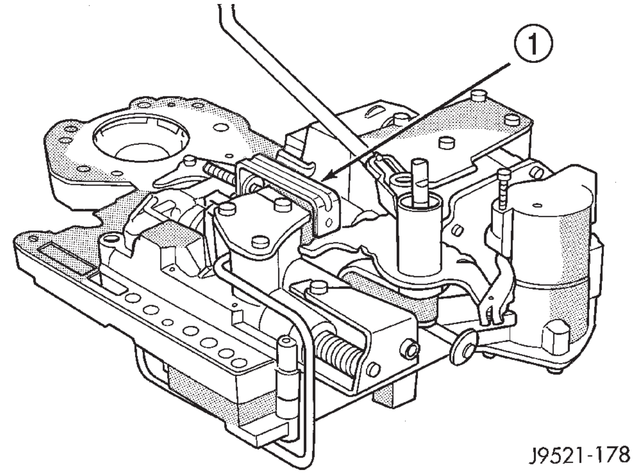


Fig. 105 Detent Ball And Spring

1 – SPECIAL TOOL 6583 POSITIONED ON DETENT HOUSING

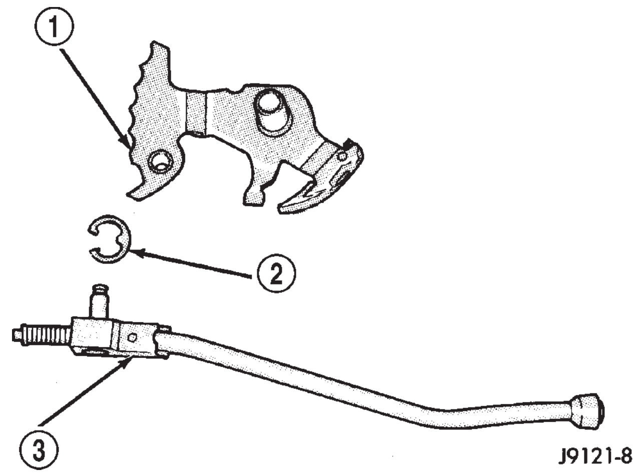


Fig. 106 Park Rod

1 – MANUAL LEVER
2 – E-CLIP
3 – PARK ROD

(19) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator valve spring and switch valve spring (Fig. 111). **Do not remove throttle pressure adjusting screw from bracket and do not disturb setting of either adjusting screw during removal.**

(20) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 112).

(21) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 112).

DISASSEMBLY AND ASSEMBLY (Continued)

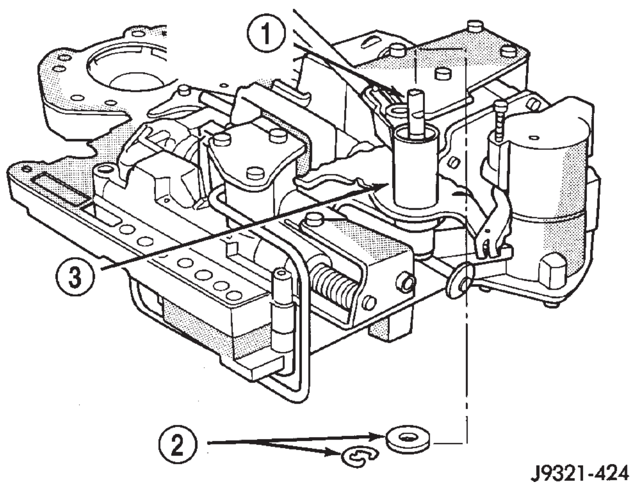


Fig. 107 Throttle Lever E-Clip And Washer

1 – THROTTLE LEVER SHAFT
2 – E-CLIP AND WASHER
3 – MANUAL SHAFT

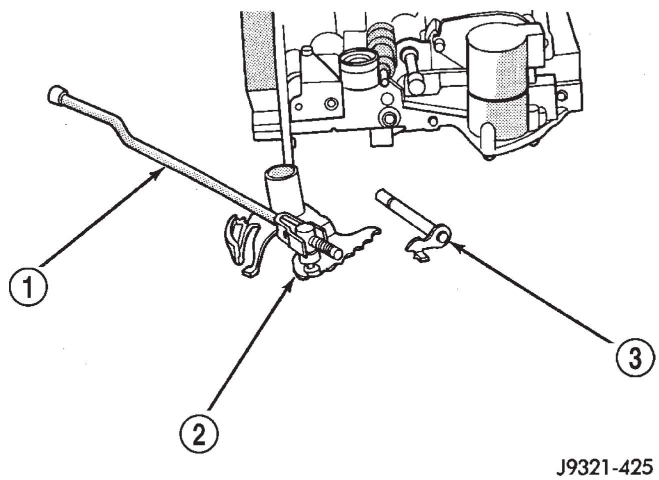


Fig. 108 Manual And Throttle Lever

1 – PARK ROD
2 – MANUAL LEVER ASSEMBLY
3 – THROTTLE LEVER

(22) Loosen left-side 3-4 accumulator housing attaching screw about 2-3 threads. Then remove center and right-side housing attaching screws (Fig. 113).

(23) Carefully rotate 3-4 accumulator housing upward and remove 3-4 shift valve spring and converter clutch valve plug and spring (Fig. 114).

(24) Remove left-side screw and remove 3-4 accumulator housing from valve body (Fig. 115).

(25) Bend back tabs on boost valve tube brace (Fig. 116).

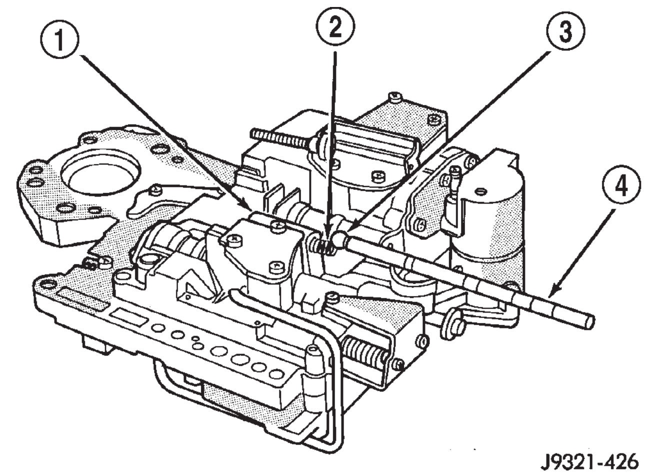


Fig. 109 Detent Ball And Spring

1 – DETENT HOUSING
2 – DETENT SPRING
3 – DETENT BALL
4 – PENCIL MAGNET

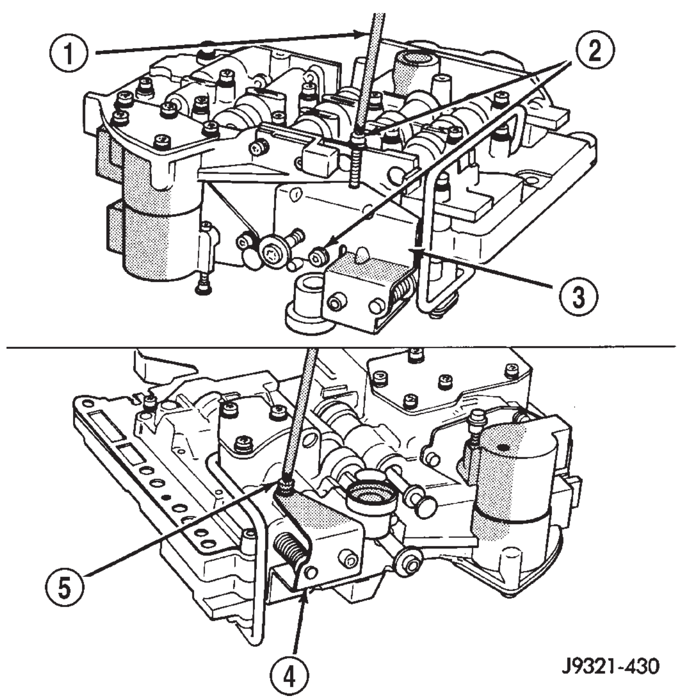


Fig. 110 Adjusting Screw Bracket Fastener

1 – T25 TORX BIT
2 – REMOVE THESE SCREWS FIRST
3 – BRACKET
4 – BRACKET
5 – REMOVE THIS SCREW LAST

DISASSEMBLY AND ASSEMBLY (Continued)

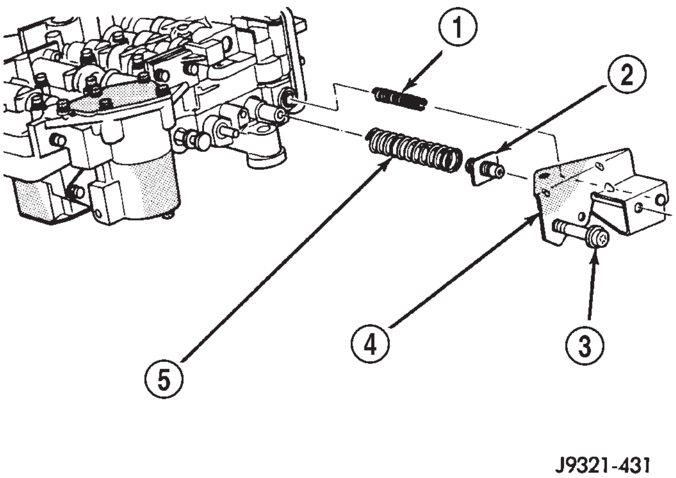


Fig. 111 Adjusting Screw Bracket And Spring

1 – SWITCH VALVE SPRING
2 – LINE PRESSURE SCREW
3 – THROTTLE PRESSURE ADJUSTING SCREW
4 – ADJUSTING SCREW BRACKET
5 – PRESSURE REGULATOR VALVE SPRING

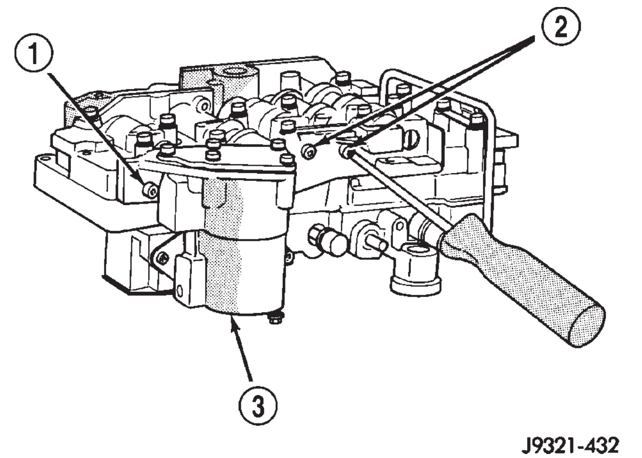


Fig. 113 Accumulator Housing Screw Locations

1 – LOOSEN THIS SCREW
2 – REMOVE THESE SCREWS
3 – 3–4 ACCUMULATOR HOUSING

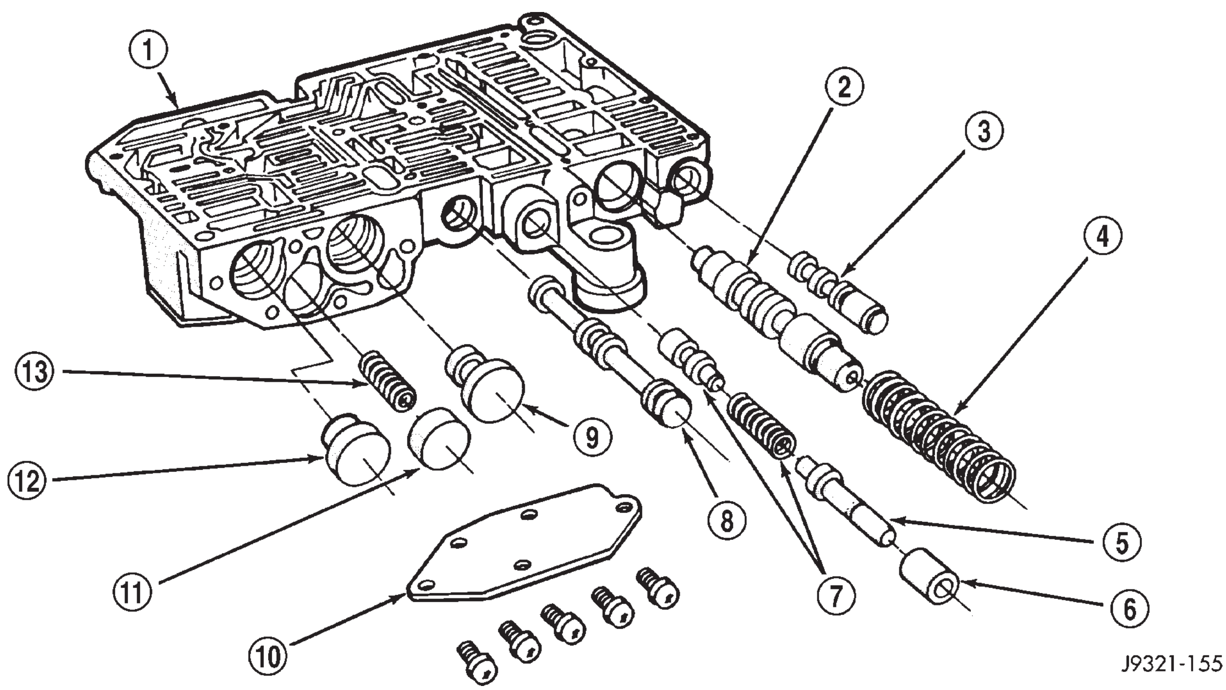


Fig. 112 Upper Housing Control Valve Locations

1 – UPPER HOUSING
2 – REGULATOR VALVE
3 – SWITCH VALVE
4 – REGULATOR VALVE SPRING
5 – KICKDOWN VALVE
6 – KICKDOWN DETENT
7 – THROTTLE VALVE AND SPRING
8 – MANUAL VALVE
9 – 1–2 GOVERNOR PLUG
10 – GOVERNOR PLUG COVER
11 – THROTTLE PLUG
12 – 2–3 GOVERNOR PLUG
13 – SHUTTLE VALVE PRIMARY SPRING

DISASSEMBLY AND ASSEMBLY (Continued)

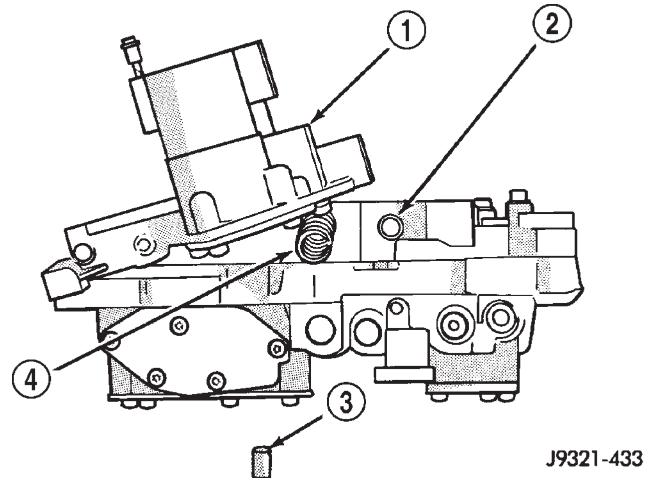


Fig. 114 3-4 Shift And Converter Clutch Valve Springs And Plug

1 – ACCUMULATOR HOUSING
2 – CONVERTER CLUTCH VALVE SPRING
3 – CLUTCH VALVE PLUG
4 – 3–4 SHIFT VALVE SPRING

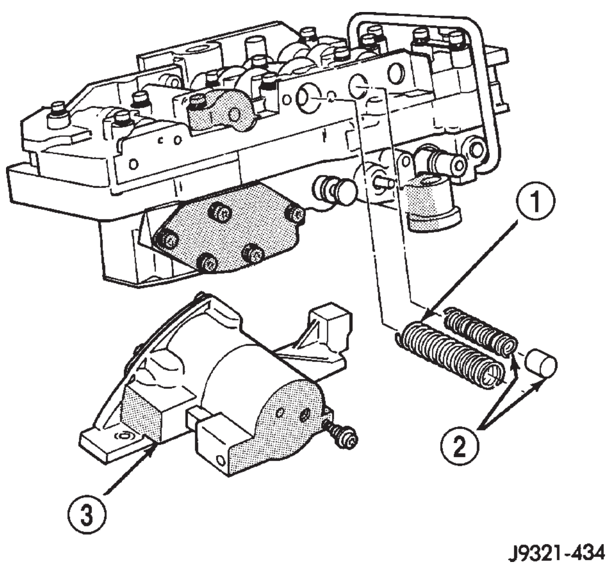


Fig. 115 Accumulator Housing, Valve Springs And Plug

1 – 3–4 SHIFT VALVE SPRING
2 – CONVERTER CLUTCH VALVE SPRING AND PLUG
3 – 3–4 ACCUMULATOR HOUSING

(26) Remove boost valve connecting tube (Fig. 117). Disengage tube from upper housing port first. Then rock opposite end of tube back and forth to work it out of lower housing.

CAUTION: Do not use tools to loosen or pry the connecting tube out of the valve body housings. Loosen and remove the tube by hand only.

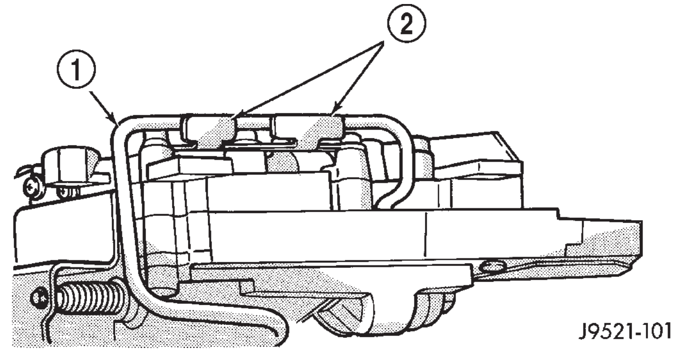


Fig. 116 Boost Valve Tube Brace

1 – BOOST VALVE TUBE
2 – TUBE BRACE (DOUBLE TAB)

(27) Turn valve body over so lower housing is facing upward (Fig. 118). In this position, the two check balls in upper housing will remain in place and not fall out when lower housing and separator plate are removed.

(28) Remove screws attaching valve body lower housing to upper housing and transfer plate (Fig. 118). **Note position of boost valve tube brace for assembly reference.**

(29) Remove lower housing and overdrive separator plate from transfer plate (Fig. 118).

(30) Remove the ECE check ball from the transfer plate (Fig. 119). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(31) Remove transfer plate from upper housing (Fig. 120).

(32) Turn transfer plate over so upper housing separator plate is facing upward.

(33) Remove upper housing separator plate from transfer plate (Fig. 121). Note position of filter in separator plate for assembly reference.

(34) Remove rear clutch and rear servo check balls from transfer plate. Note check ball location for assembly reference (Fig. 122).

VALVE BODY UPPER HOUSING

(1) Note location of check balls in valve body upper housing (Fig. 123). Then remove the one large diameter and the six smaller diameter check balls.

(2) Remove governor plug and shuttle valve covers (Fig. 125).

(3) Remove E-clip that secures shuttle valve secondary spring on valve stem (Fig. 124).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 125).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 112).

DISASSEMBLY AND ASSEMBLY (Continued)

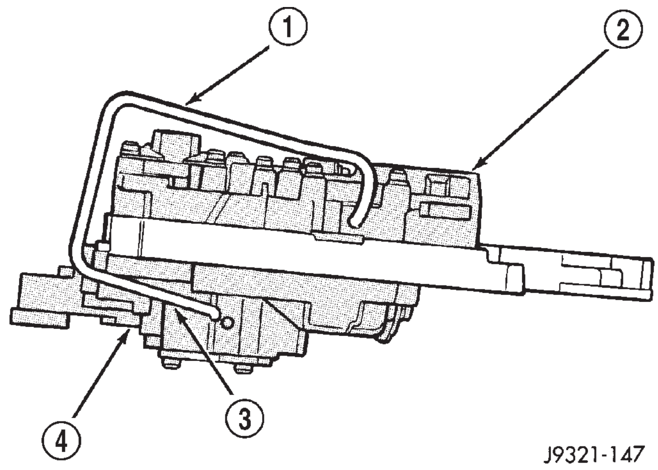


Fig. 117 Boost Valve Tube

1 – BOOST VALVE TUBE
2 – LOWER HOUSING
3 – DISENGAGE THIS END OF TUBE FIRST
4 – UPPER HOUSING

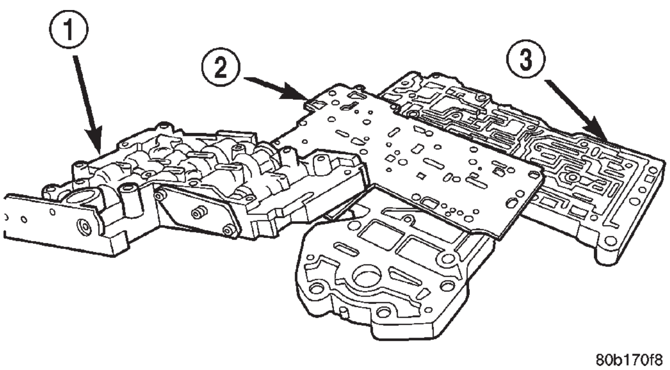


Fig. 118 Lower Housing

1 – LOWER HOUSING
2 – OVERDRIVE SEPARATOR PLATE
3 – TRANSFER PLATE AND UPPER HOUSING

(7) Turn upper housing around and remove limit valve and shift valve covers (Fig. 126).

(8) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 126).

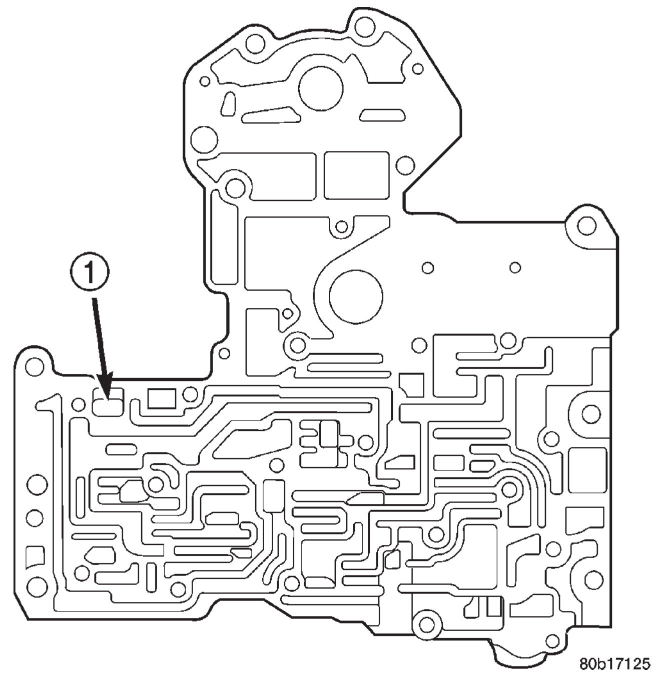


Fig. 119 ECE Check Ball

1 – ECE CHECK BALL (3/16”)

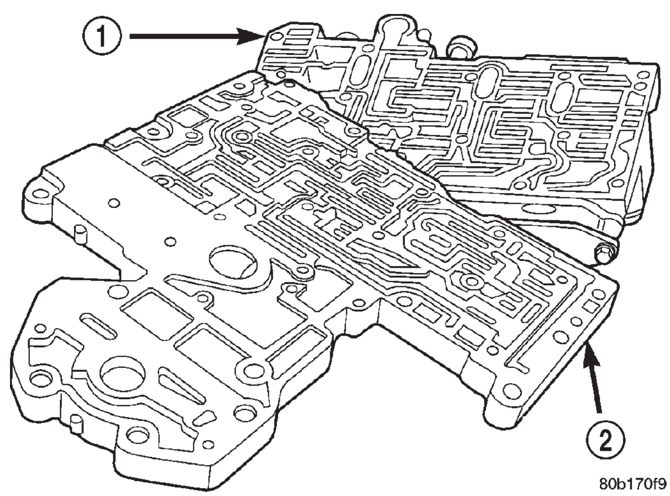


Fig. 120 Transfer Plate

1 – UPPER HOUSING
2 – TRANSFER PLATE

DISASSEMBLY AND ASSEMBLY (Continued)

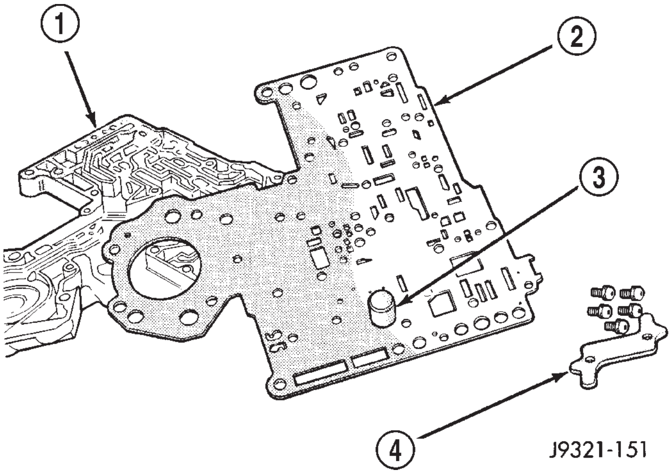


Fig. 121 Upper Housing Separator Plate

1 – TRANSFER PLATE
2 – UPPER HOUSING SEPARATOR PLATE
3 – FILTER SCREEN
4 – BRACE

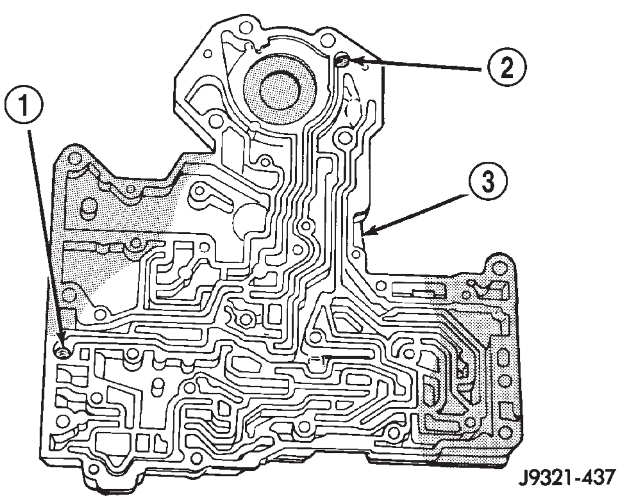


Fig. 122 Rear Clutch And Rear Servo Check Ball Locations

1 – REAR CLUTCH CHECK BALL
2 – REAR SERVO CHECK BALL
3 – TRANSFER PLATE

(9) Remove 1-2 shift control valve and spring (Fig. 126).

(10) Remove 1-2 shift valve and spring (Fig. 126).

(11) Remove 2-3 shift valve and spring from valve body (Fig. 126).

(12) Remove pressure plug cover (Fig. 126).

(13) Remove line pressure plug, sleeve, throttle pressure plug and spring (Fig. 126).

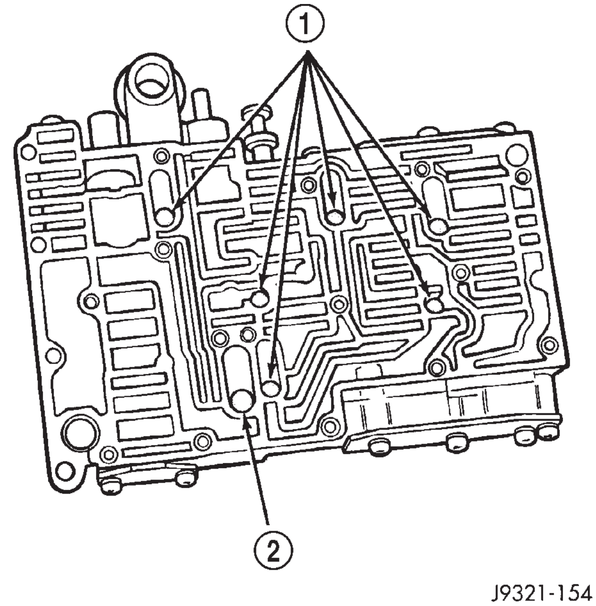


Fig. 123 Check Ball Locations In Upper Housing

1 – SMALL DIAMETER CHECK BALLS (6)
2 – LARGE DIAMETER CHECK BALL (1)

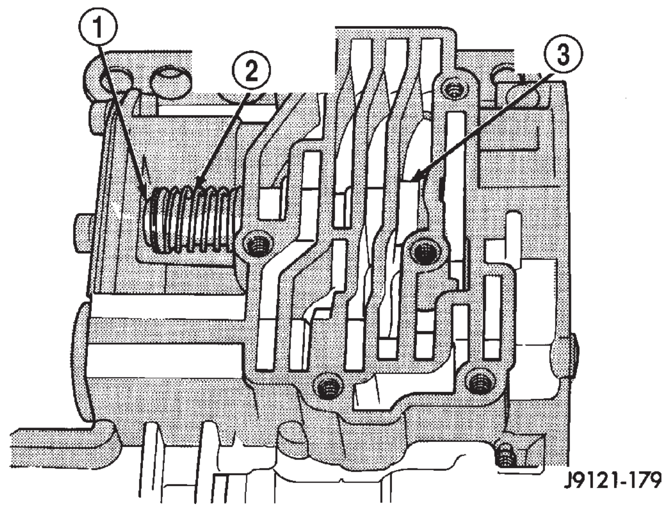


Fig. 124 Shuttle Valve E-Clip And Secondary Spring Location

1 – E-CLIP
2 – SECONDARY SPRING AND GUIDES
3 – SHUTTLE VALVE

VALVE BODY LOWER HOUSING

(1) Remove timing valve cover.

(2) Remove 3-4 timing valve and spring.

(3) Remove 3-4 quick fill valve, spring and plug.

(4) Remove 3-4 shift valve and spring.

(5) Remove converter clutch valve, spring and plug (Fig. 127).

DISASSEMBLY AND ASSEMBLY (Continued)

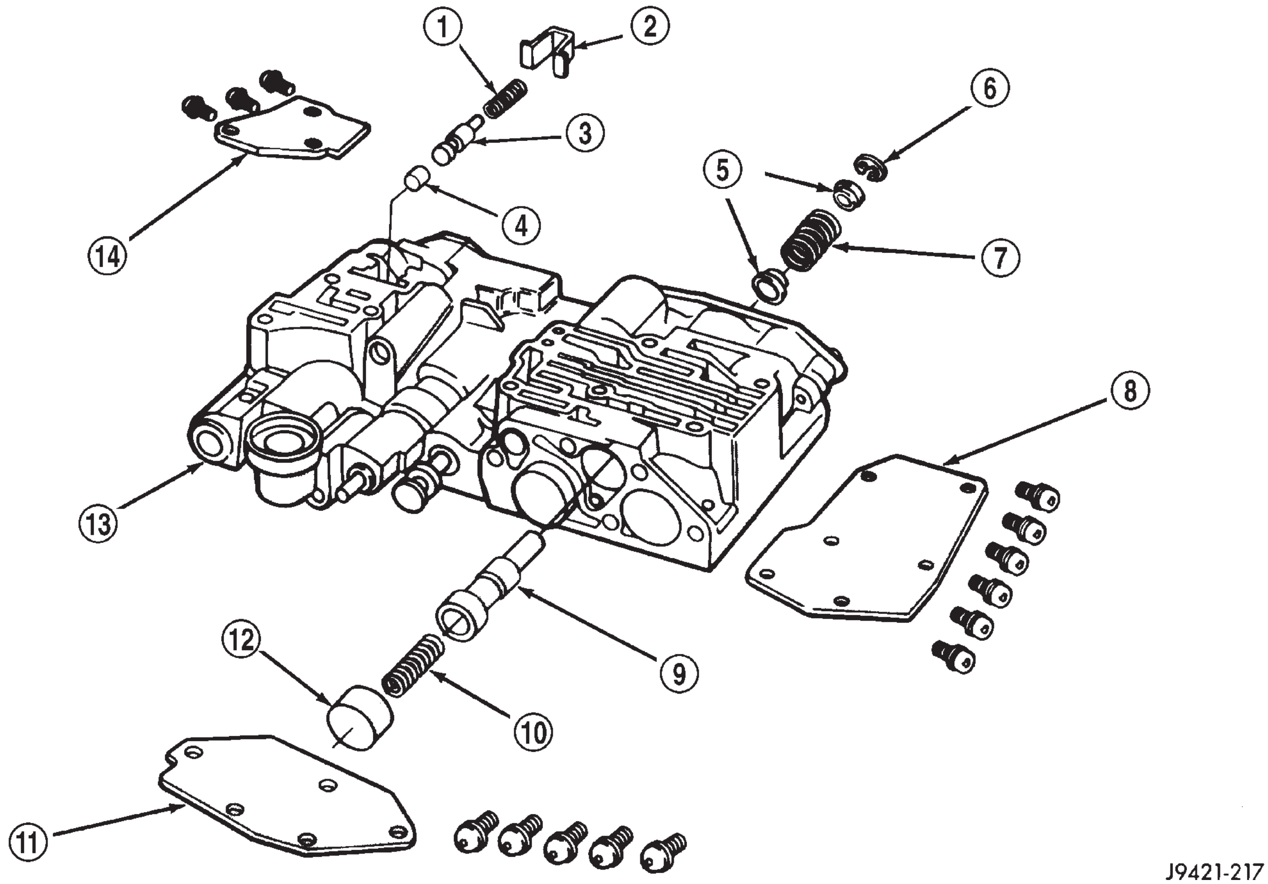


Fig. 125 Shuttle And Boost Valve Components

1 – SPRING
2 – RETAINER
3 – BOOST VALVE
4 – BOOST VALVE PLUG
5 – SPRING GUIDES
6 – E-CLIP
7 – SHUTTLE VALVE SECONDARY SPRING
8 – SHUTTLE VALVE COVER
9 – SHUTTLE VALVE
10 – SHUTTLE VALVE PRIMARY SPRING
11 – GOVERNOR PLUG COVER
12 – THROTTLE PLUG
13 – UPPER HOUSING
14 – BOOST VALVE COVER

DISASSEMBLY AND ASSEMBLY (Continued)

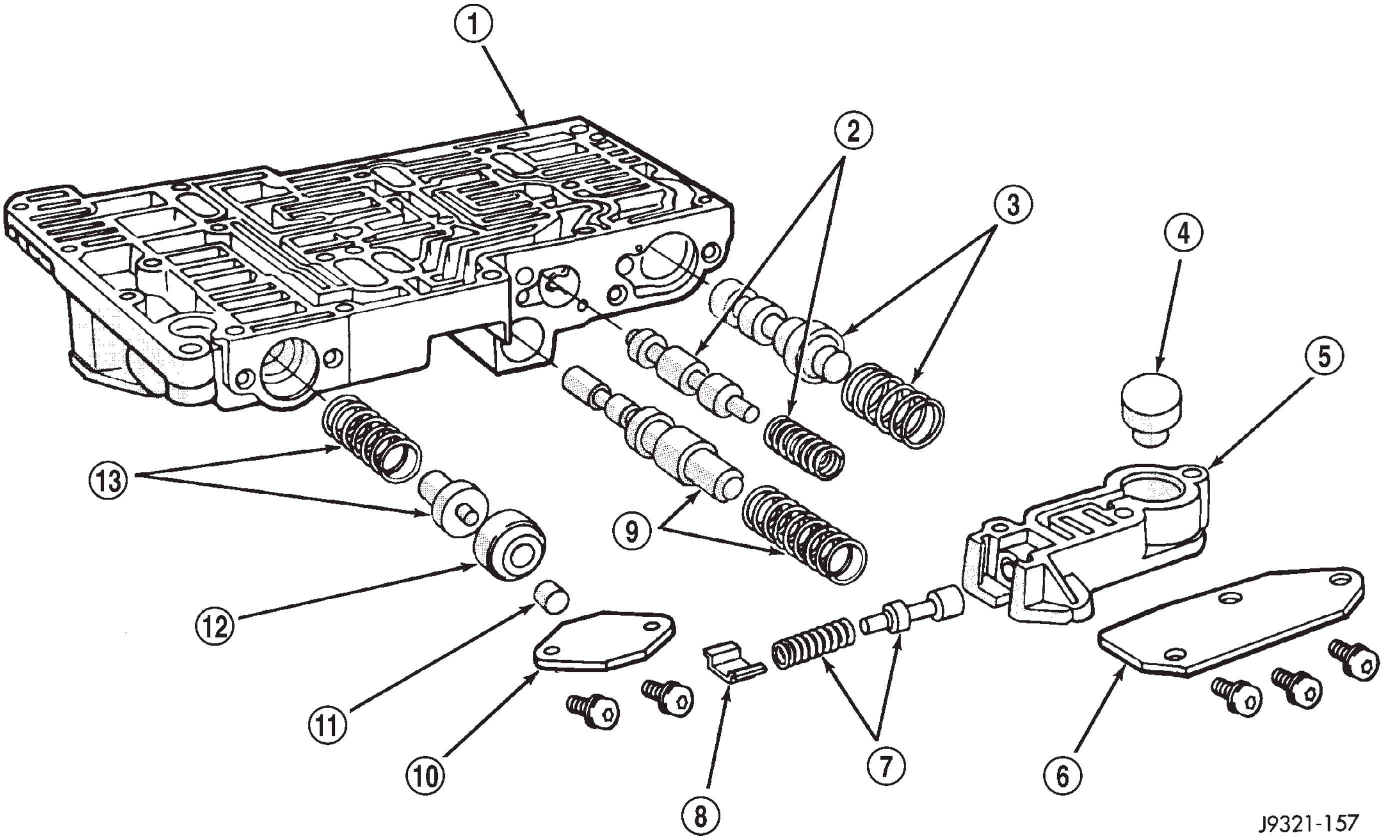


Fig. 126 Upper Housing Shift Valve And Pressure Plug Locations

1 – UPPER HOUSING
2 – 1–2 SHIFT VALVE AND SPRING
3 – 2–3 SHIFT VALVE AND SPRING
4 – 2–3 THROTTLE PLUG
5 – LIMIT VALVE HOUSING
6 – LIMIT VALVE COVER
7 – LIMIT VALVE AND SPRING
8 – RETAINER
9 – 1–2 SHIFT CONTROL VALVE AND SPRING
10 – PRESSURE PLUG COVER
11 – LINE PRESSURE PLUG
12 – PLUG SLEEVE
13 – THROTTLE PRESSURE SPRING AND PLUG

DISASSEMBLY AND ASSEMBLY (Continued)

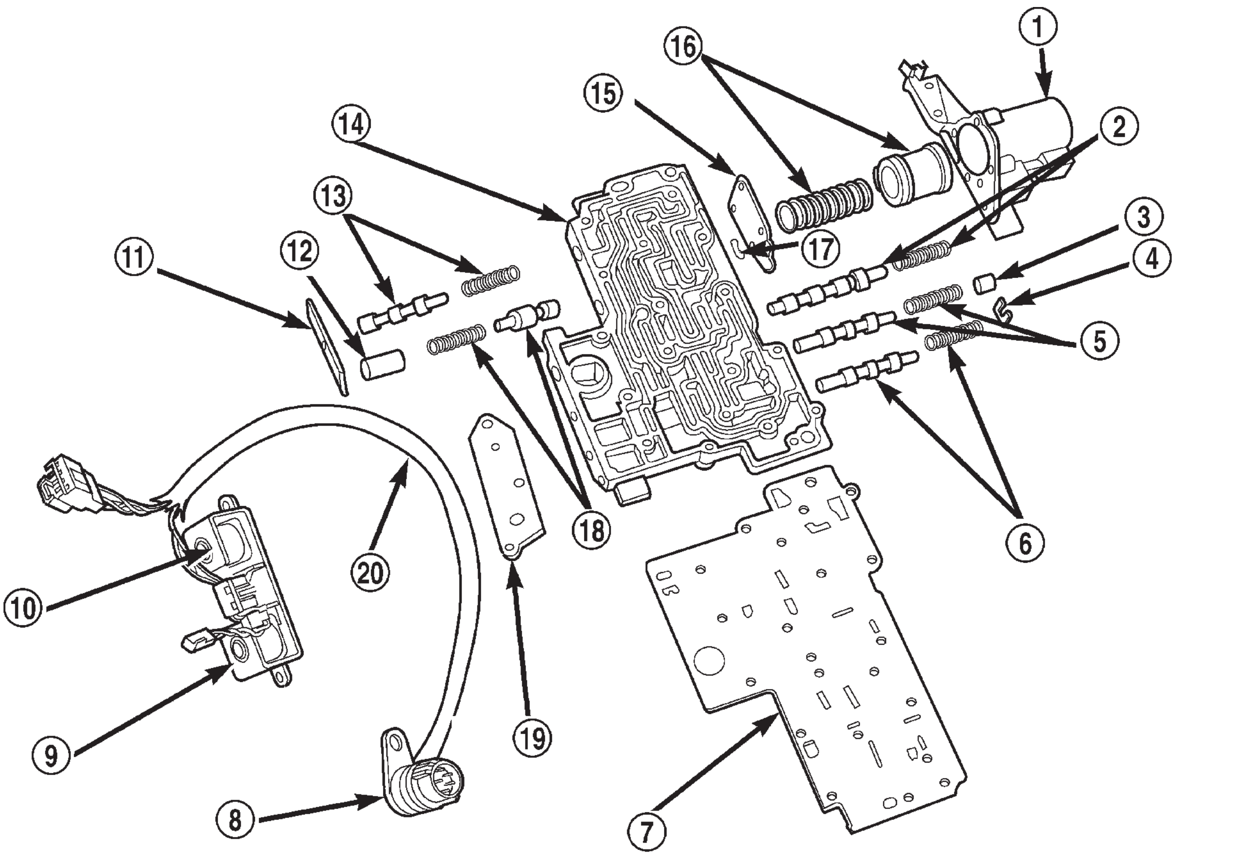


Fig. 127 Lower Housing Shift Valves And Springs

1 – 3-4 ACCUMULATOR HOUSING
2 – 3-4 SHIFT VALVE AND SPRING
3 – PLUG
4 – SPRING RETAINER
5 – CONVERTER CLUTCH VALVE AND SPRING
6 – CONVERTER CLUTCH TIMING VALVE AND SPRING
7 – OVERDRIVE SEPARATOR PLATE
8 – CASE CONNECTOR
9 – CONVERTER CLUTCH SOLENOID
10 – OVERDRIVE SOLENOID
11 – TIMING VALVE COVER
12 – PLUG
13 – 3-4 TIMING VALVE AND SPRING
14 – LOWER HOUSING
15 – ACCUMULATOR END PLATE
16 – 3-4 ACCUMULATOR PISTON AND SPRING
17 – E-CLIP
18 – 3-4 QUICK FILL SPRING AND VALVE
19 – SOLENOID GASKET
20 – HARNESS

(6) Remove converter clutch timing valve, retainer and valve spring.

3-4 ACCUMULATOR HOUSING

(1) Remove end plate from housing.

(2) Remove piston spring.

(3) Remove piston. Remove and discard piston seals (Fig. 128).

DISASSEMBLY AND ASSEMBLY (Continued)

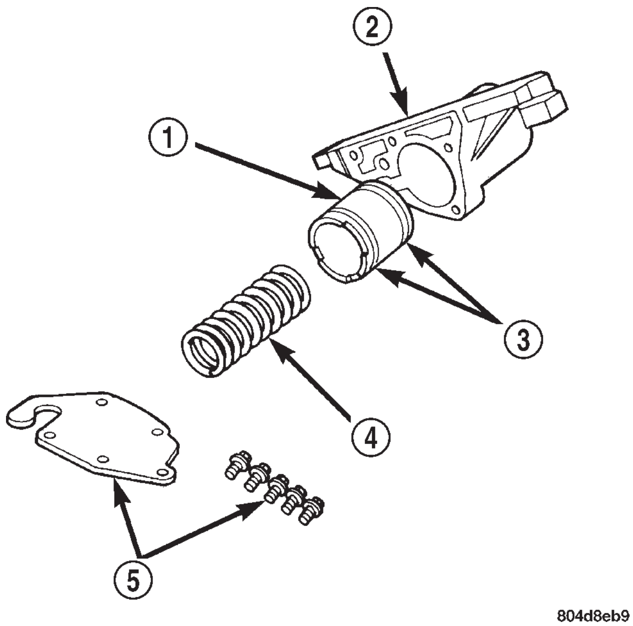


Fig. 128 Accumulator Housing Components

1 – ACCUMULATOR PISTON
2 – 3–4 ACCUMULATOR HOUSING
3 – TEFLON SEALS
4 – PISTON SPRING
5 – COVER PLATE AND SCREWS

ASSEMBLY

CAUTION: Do not force valves or plugs into place during reassembly. If the valve body bores, valves and plugs are free of distortion or burrs, the valve body components should all slide into place easily. In addition, do not overtighten the transfer plate and valve body screws during reassembly. Over-tightening can distort the housings resulting in valve sticking, cross leakage and unsatisfactory operation. Tighten valve body screws to recommended torque only.

LOWER HOUSING

(1) Lubricate valves, springs, and the housing valve and plug bores with clean transmission fluid (Fig. 127).

(2) Install 3-4 timing valve spring and valve in lower housing.

(3) Install 3-4 quick fill valve in lower housing.

(4) Install 3-4 quick fill valve spring and plug in housing.

(5) Install timing valve end plate. Tighten end plate screws to 4 N·m (35 in. lbs.) torque.

3-4 ACCUMULATOR

(1) Lubricate accumulator piston, seals and housing piston bore with clean transmission fluid (Fig. 128).

(2) Install new seal rings on accumulator piston.

(3) Install piston and spring in housing.

(4) Install end plate on housing.

TRANSFER PLATE

(1) Install rear clutch and rear servo check balls in transfer plate (Fig. 129).

(2) Install filter screen in upper housing separator plate (Fig. 130).

(3) Align and position upper housing separator plate on transfer plate (Fig. 131).

(4) Install brace plate (Fig. 131). Tighten brace attaching screws to 4 N·m (35 in. lbs.) torque.

(5) Install remaining separator plate attaching screws. Tighten screws to 4 N·m (35 in. lbs.) torque.

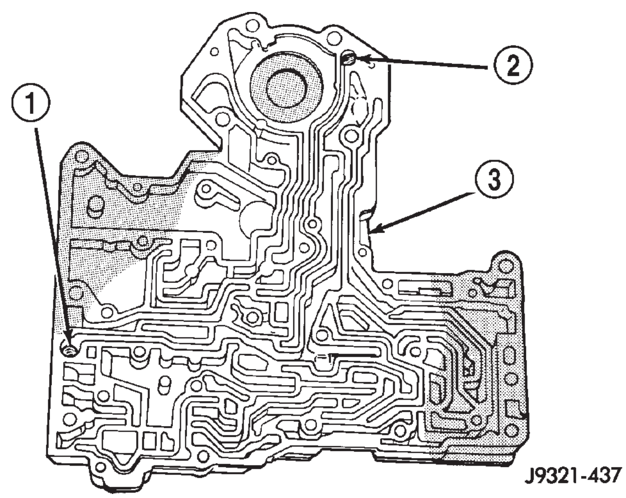


Fig. 129 Rear Clutch And Rear Servo Check Ball Locations

1 – REAR CLUTCH CHECK BALL
2 – REAR SERVO CHECK BALL
3 – TRANSFER PLATE

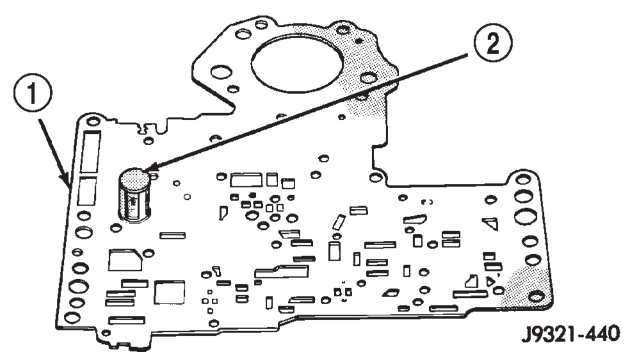


Fig. 130 Separator Plate Filter Screen Installation

1 – UPPER HOUSING SEPARATOR PLATE
2 – FILTER SCREEN

UPPER AND LOWER HOUSING

(1) Position upper housing so internal passages and check ball seats are facing upward. Then install

DISASSEMBLY AND ASSEMBLY (Continued)

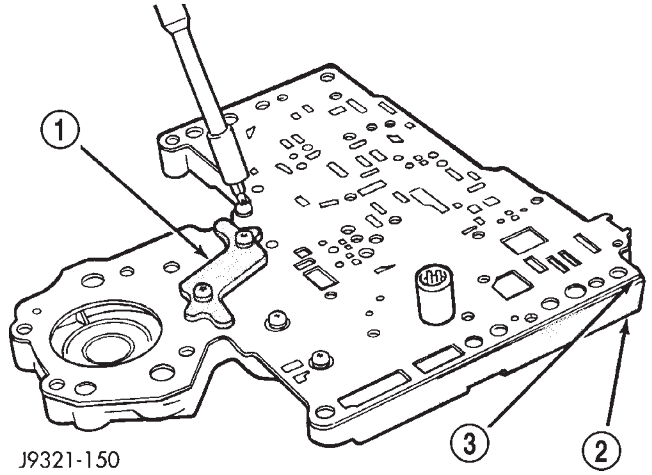


Fig. 131 Brace Plate

1 – BRACE
2 – TRANSFER PLATE
3 – SEPARATOR PLATE

check balls in housing (Fig. 132). Eight check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The single small check ball is approximately 4.8 mm (3/16 in.) in diameter. The remaining 6 check balls are approximately 6.3 mm (1/4 in.) in diameter.

(2) Position assembled transfer plate and upper housing separator plate on upper housing (Fig. 133). Be sure filter screen is seated in proper housing recess.

(3) Install the ECE check ball into the transfer plate (Fig. 119). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(4) Position lower housing separator plate on transfer plate (Fig. 134).

(5) Install lower housing on assembled transfer plate and upper housing (Fig. 135).

(6) Install and start all valve body screws by hand except for the screws to hold the boost valve tube brace. Save those screws for later installation. Then tighten screws evenly to 4 N·m (35 in. lbs.) torque. Start at center and work out to sides when tightening screws (Fig. 135).

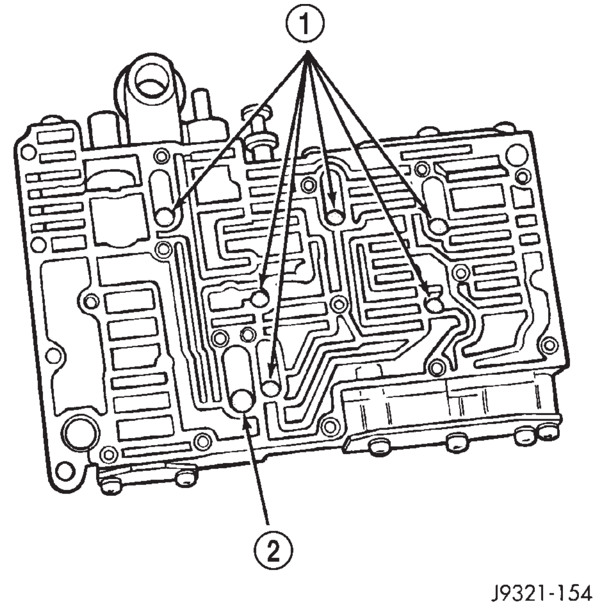


Fig. 132 Check Ball Locations In Upper Housing

1 – SMALL DIAMETER CHECK BALLS (6)
2 – LARGE DIAMETER CHECK BALL (1)

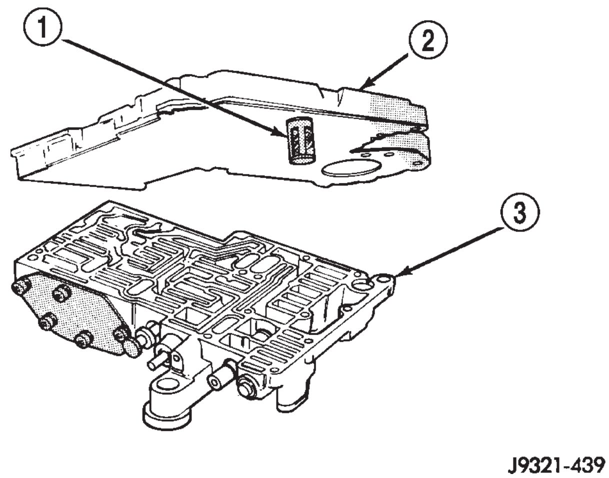


Fig. 133 Installing Transfer Plate On Upper Housing

1 – FILTER SCREEN
2 – TRANSFER PLATE/SEPARATOR PLATE ASSEMBLY
3 – UPPER HOUSING

DISASSEMBLY AND ASSEMBLY (Continued)

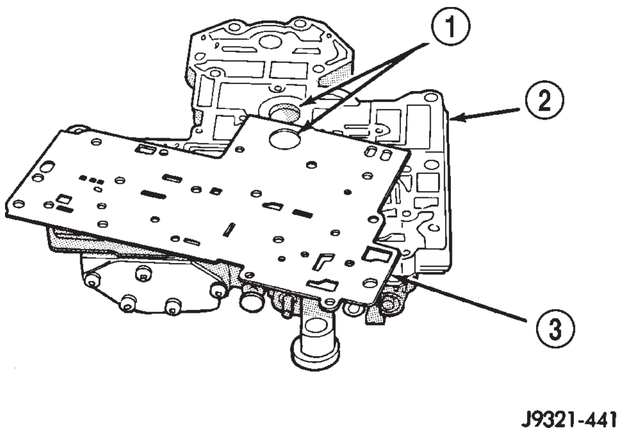


Fig. 134 Lower Housing Separator Plate

1 – BE SURE TO ALIGN BORES
2 – TRANSFER PLATE
3 – LOWER HOUSING (OVERDRIVE) SEPARATOR PLATE

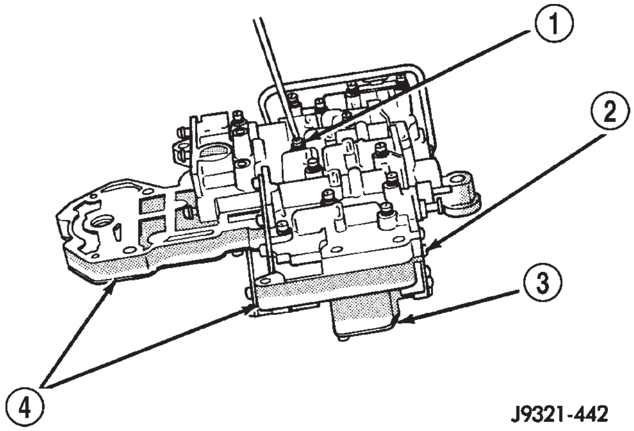


Fig. 135 Installing Lower Housing On Transfer Plate And Upper Housing

1 – VALVE BODY SCREWS (13)
2 – LOWER HOUSING
3 – UPPER HOUSING
4 – TRANSFER PLATE

UPPER HOUSING VALVE AND PLUG

Refer to (Fig. 136), (Fig. 137) and (Fig. 138) to perform the following steps.

(1) Lubricate valves, plugs, springs with clean transmission fluid.

(2) Assemble regulator valve line pressure plug, sleeve, throttle plug and spring. Insert assembly in upper housing and install cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(3) Install 1-2 and 2-3 shift valves and springs.

(4) Install 1-2 shift control valve and spring.

(5) Install retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing.

(6) Install limit valve housing and cover plate. Tighten screws to 4 N·m (35 in. lbs.).

(7) Install shuttle valve as follows:

(a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.

(b) Install shuttle valve into housing.

(c) Hold shuttle valve in place.

(d) Compress secondary spring and install E-clip in groove at end of shuttle valve.

(e) Verify that spring and E-clip are properly seated before proceeding.

(8) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(9) Install 1-2 and 2-3 valve governor plugs in valve body.

(10) Install shuttle valve primary spring and throttle plug.

(11) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

BOOST VALVE TUBE AND BRACE

(1) Position valve body assembly so lower housing is facing upward (Fig. 139).

(2) Lubricate tube ends and housing ports with transmission fluid or petroleum jelly.

(3) Start tube in lower housing port first. Then swing tube downward and work opposite end of tube into upper housing port (Fig. 139).

DISASSEMBLY AND ASSEMBLY (Continued)

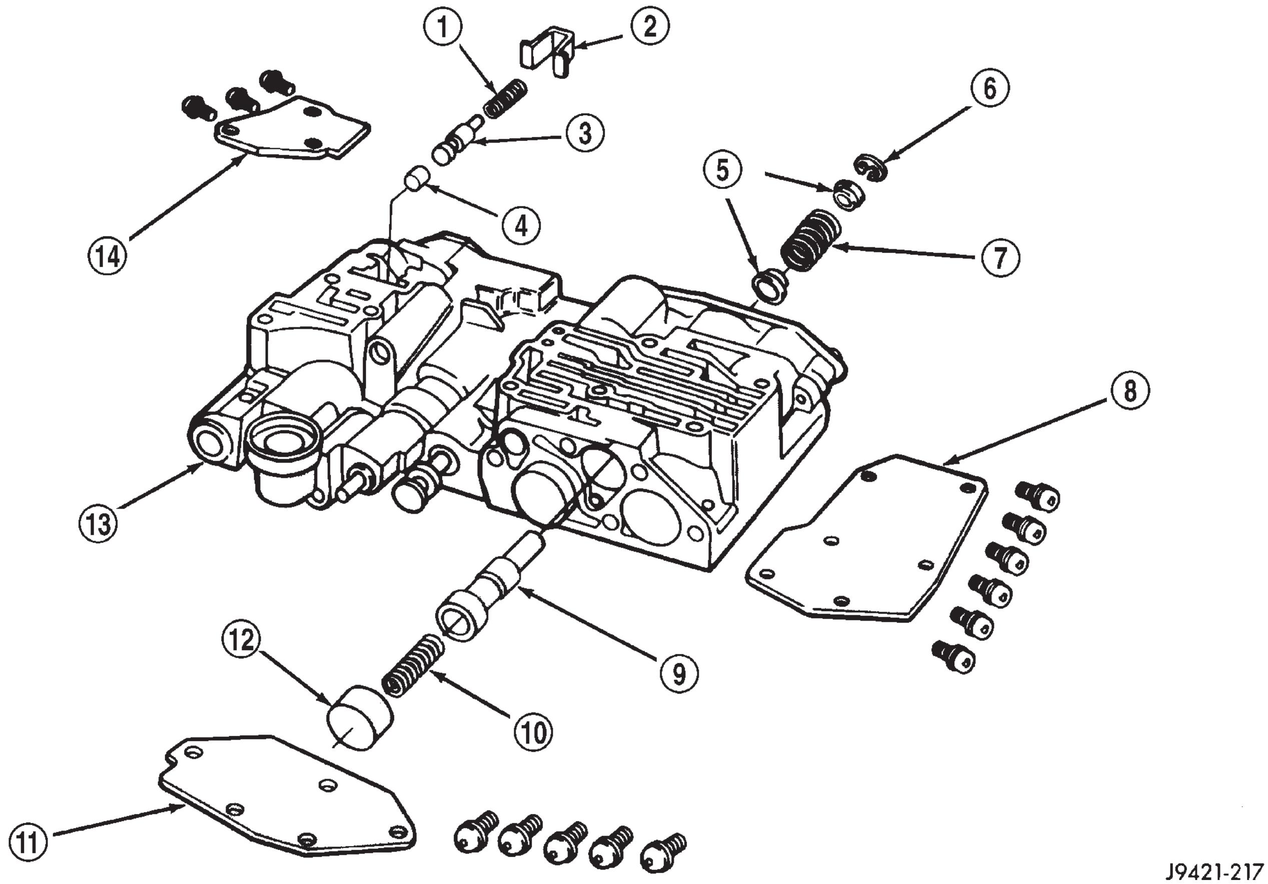


Fig. 136 Shuttle And Boost Valve Components

1 – SPRING
2 – RETAINER
3 – BOOST VALVE
4 – BOOST VALVE PLUG
5 – SPRING GUIDES
6 – E-CLIP
7 – SHUTTLE VALVE SECONDARY SPRING
8 – SHUTTLE VALVE COVER
9 – SHUTTLE VALVE
10 – SHUTTLE VALVE PRIMARY SPRING
11 – GOVERNOR PLUG COVER
12 – THROTTLE PLUG
13 – UPPER HOUSING
14 – BOOST VALVE COVER

DISASSEMBLY AND ASSEMBLY (Continued)

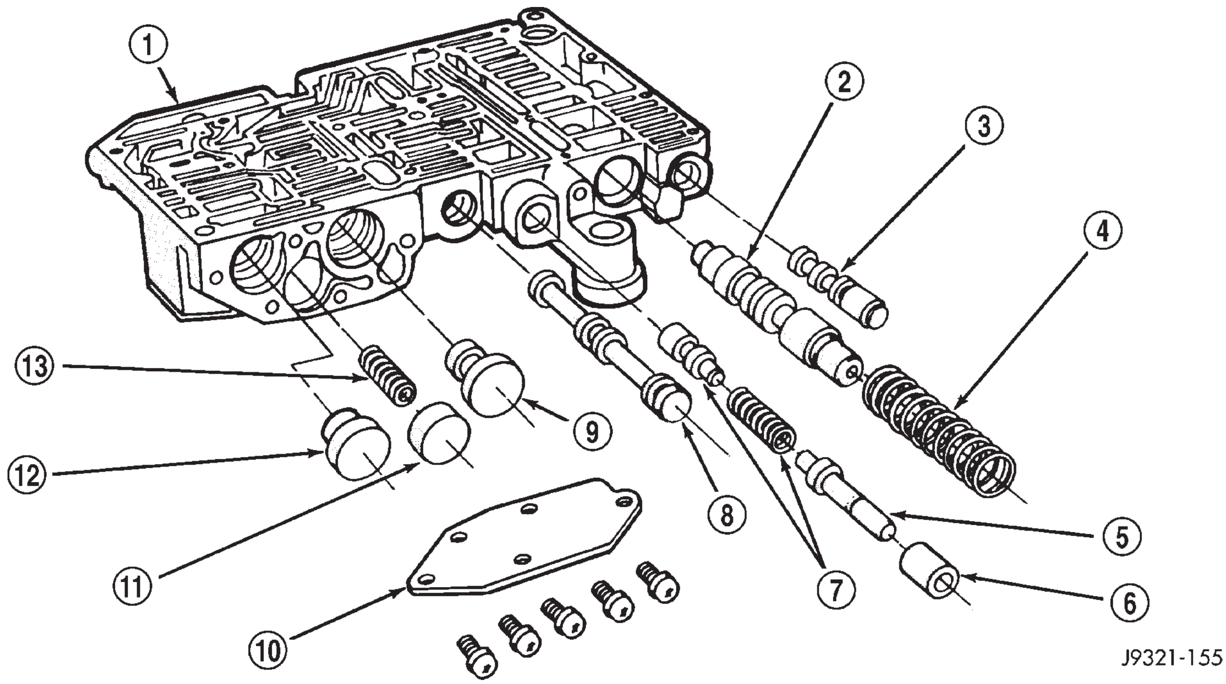


Fig. 137 Upper Housing Control Valve Locations

1 – UPPER HOUSING
2 – REGULATOR VALVE
3 – SWITCH VALVE
4 – REGULATOR VALVE SPRING
5 – KICKDOWN VALVE
6 – KICKDOWN DETENT
7 – THROTTLE VALVE AND SPRING
8 – MANUAL VALVE
9 – 1–2 GOVERNOR PLUG
10 – GOVERNOR PLUG COVER
11 – THROTTLE PLUG
12 – 2–3 GOVERNOR PLUG
13 – SHUTTLE VALVE PRIMARY SPRING

DISASSEMBLY AND ASSEMBLY (Continued)

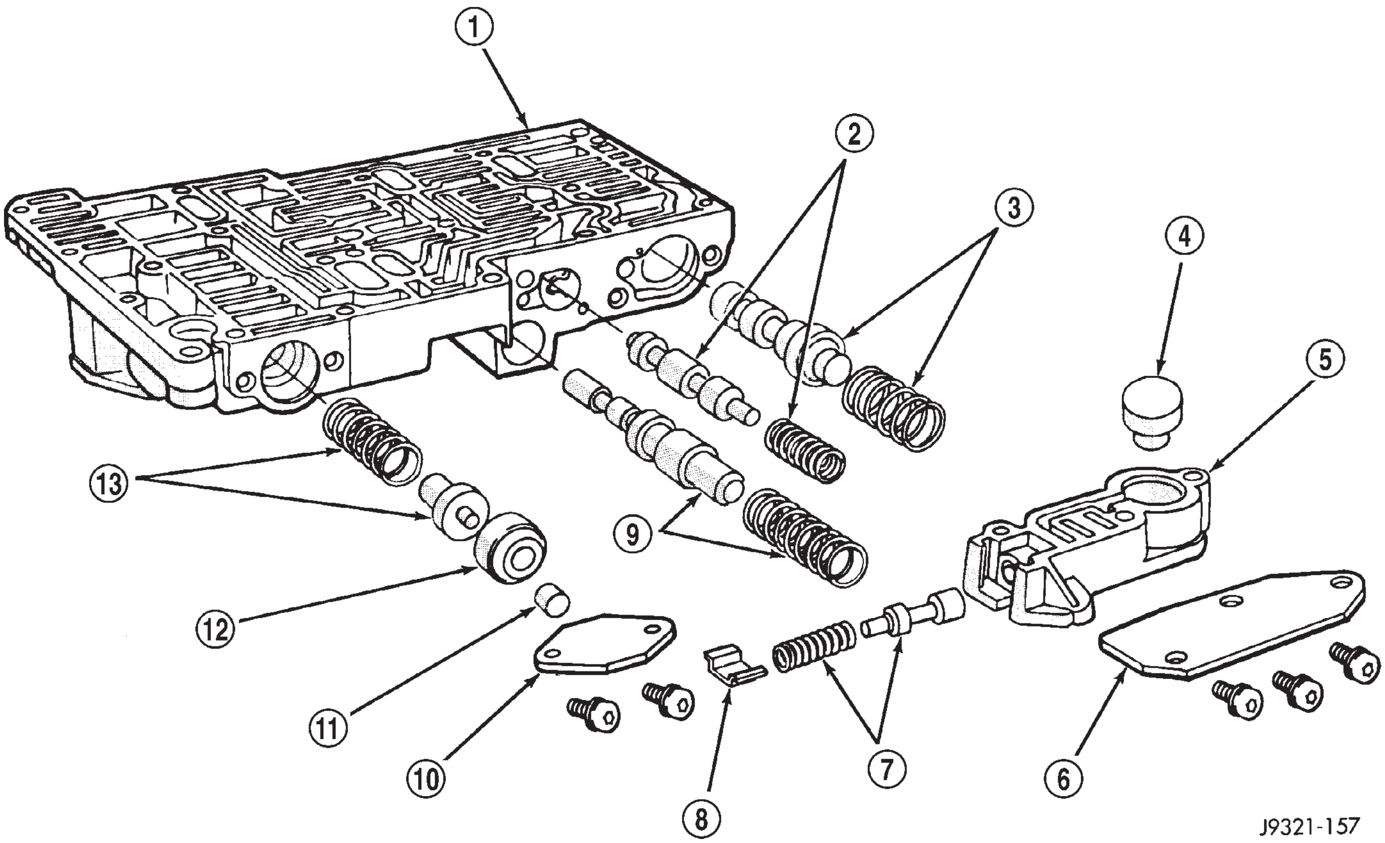


Fig. 138 Upper Housing Shift Valve And Pressure Plug Locations

1 – UPPER HOUSING
2 – 1–2 SHIFT VALVE AND SPRING
3 – 2–3 SHIFT VALVE AND SPRING
4 – 2–3 THROTTLE PLUG
5 – LIMIT VALVE HOUSING
6 – LIMIT VALVE COVER
7 – LIMIT VALVE AND SPRING
8 – RETAINER
9 – 1–2 SHIFT CONTROL VALVE AND SPRING
10 – PRESSURE PLUG COVER
11 – LINE PRESSURE PLUG
12 – PLUG SLEEVE
13 – THROTTLE PRESSURE SPRING AND PLUG

(4) Insert and seat each end of tube in housings.

(5) Slide tube brace under tube and into alignment with valve body screw holes (Fig. 140).

(6) Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 140).

(7) Bend tube brace tabs up and against tube to hold it in position (Fig. 141).

(8) Tighten all valve body housing screws to 4 N·m (35 in. lbs.) torque after tube and brace are installed. Tighten screws in diagonal pattern starting at center and working outward.

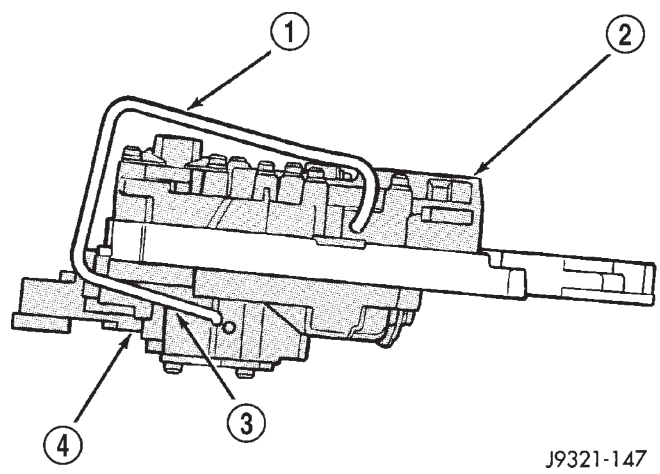


Fig. 139 Boost Valve Tube

1 – BOOST VALVE TUBE
2 – LOWER HOUSING
3 – DISENGAGE THIS END OF TUBE FIRST
4 – UPPER HOUSING

DISASSEMBLY AND ASSEMBLY (Continued)

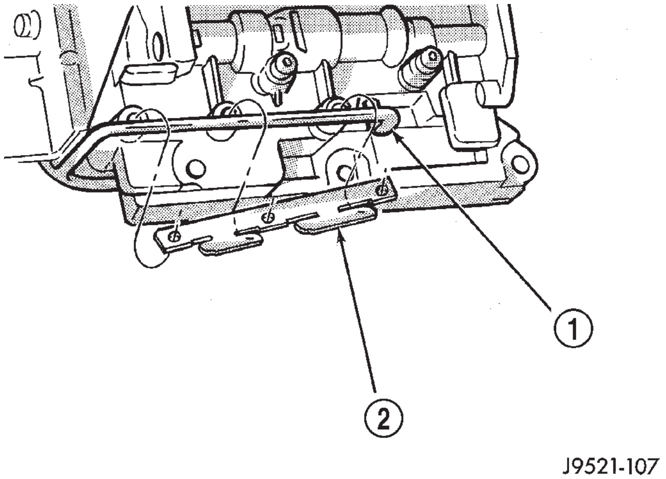


Fig. 140 Boost Valve Tube And Brace

1 – BOOST VALVE TUBE
2 – TUBE BRACE

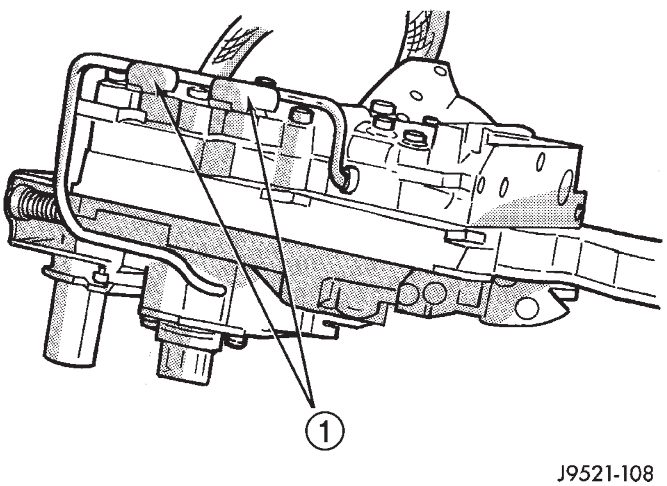


Fig. 141 Securing Boost Valve Tube With Brace Tabs

1 – BEND TABS UP AGAINST TUBE AS SHOWN

3-4 ACCUMULATOR

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 142).

(2) Loosely attach accumulator housing with right-side screw (Fig. 142). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

(3) Install 3-4 shift valve and spring.

(4) Install converter clutch timing valve and spring.

(5) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(6) Swing accumulator housing upward over valve springs and plug.

(7) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 143). Tighten screws to 4 N·m (35 in. lbs.).

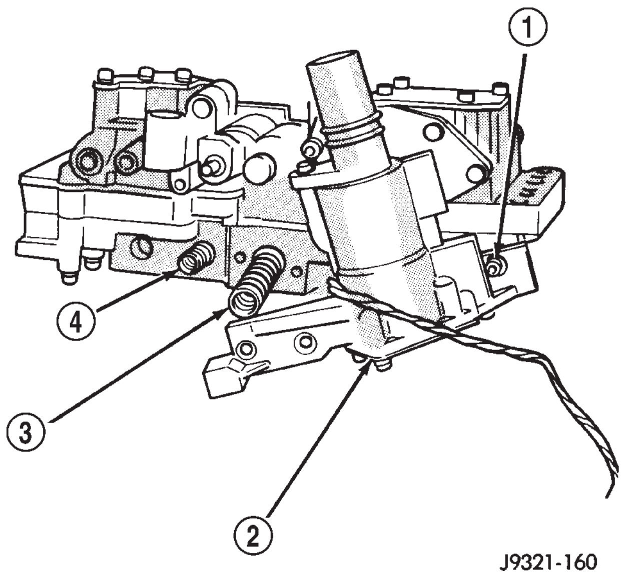


Fig. 142 Converter Clutch And 3-4 Shift Valve Springs

1 – RIGHT-SIDE SCREW
2 – 3–4 ACCUMULATOR
3 – 3–4 SHIFT VALVE SPRING
4 – CONVERTER CLUTCH VALVE SPRING

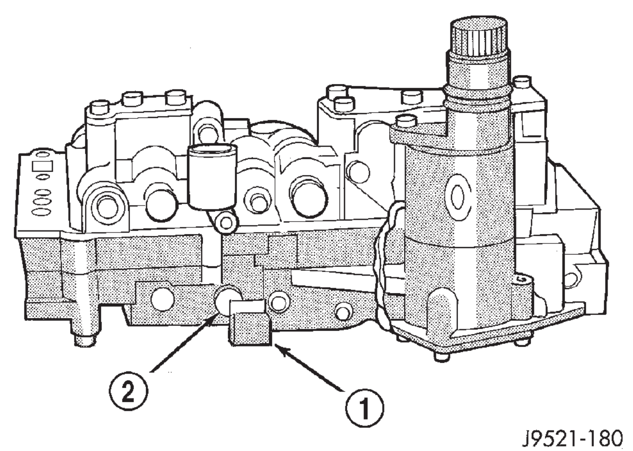


Fig. 143 Seating 3-4 Accumulator On Lower Housing

1 – ACCUMULATOR BOX
2 – CONVERTER CLUTCH VALVE PLUG

VALVE BODY FINAL

(1) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(2) Insert manual lever detent spring in upper housing.

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 144).

(4) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.

(5) Align manual lever with detent ball and manual valve. Hold throttle lever upward. Then press down on manual lever until fully seated. Remove detent ball retainer tool after lever is seated.

(6) Then install manual lever seal, washer and E-clip.

(7) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 145).

(8) Position line pressure adjusting screw in adjusting screw bracket.

(9) Install spring on end of line pressure regulator valve.

(10) Install switch valve spring on tang at end of adjusting screw bracket.

(11) Install manual valve.

(12) Install throttle valve and spring.

(13) Install kickdown valve and detent.

(14) Install pressure regulator valve.

(15) Install switch valve.

(16) Position adjusting screw bracket on valve body. Align valve springs and press bracket into place. Install short, upper bracket screws first and long bottom screw last. Verify that valve springs and bracket are properly aligned. Then tighten all three bracket screws to 4 N·m (35 in. lbs.) torque.

(17) Perform Line Pressure and Throttle Pressure adjustments. Refer to adjustment section of this group for proper procedures.

(18) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

(19) Attach solenoid case connector to 3-4 accumulator with shoulder-type screw. Connector has small locating tang that fits in dimple at top of accumulator housing (Fig. 146). Seat tang in dimple before tightening connector screw.

(20) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(21) Verify that solenoid wire harness is properly routed (Fig. 147). **Solenoid harness must be clear of manual lever and park rod and not be pinched between accumulator housing and cover.**

GOVERNOR BODY, SENSOR AND SOLENOID

(1) Turn valve body assembly over so accumulator side of transfer plate is facing down.

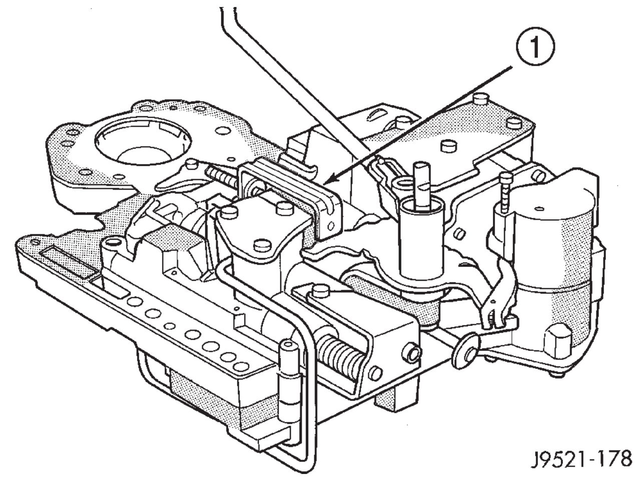


Fig. 144 Detent Ball Spring

1 – SPECIAL TOOL 6583 POSITIONED ON DETENT HOUSING

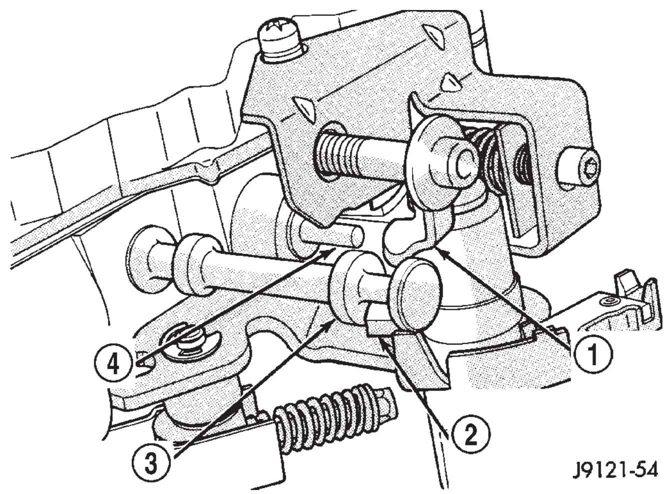


Fig. 145 Manual And Throttle Lever Alignment

1 – THROTTLE LEVER
2 – MANUAL LEVER VALVE ARM
3 – MANUAL VALVE
4 – KICKDOWN VALVE

(2) Install new O-rings on governor pressure solenoid and sensor.

(3) Lubricate solenoid and sensor O-rings with clean transmission fluid.

(4) Install governor pressure sensor in governor body.

(5) Install governor pressure solenoid in governor body. Push solenoid in until it snaps into place in body.

(6) Position governor body gasket on transfer plate.

(7) Install retainer plate on governor body and around solenoid. Be sure solenoid connector is positioned in retainer cutout.

DISASSEMBLY AND ASSEMBLY (Continued)

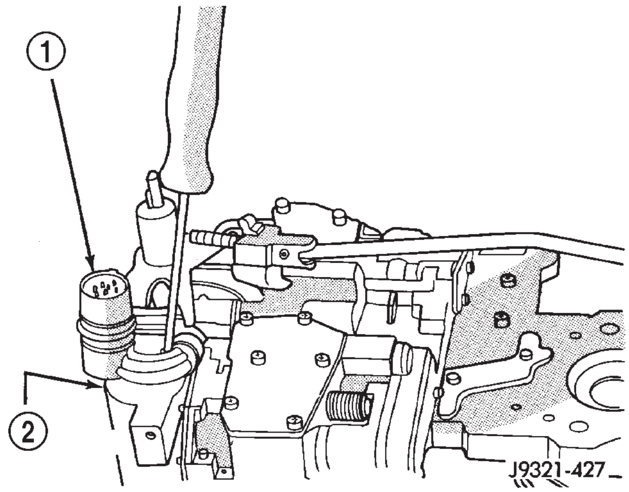


Fig. 146 Solenoid Harness Case Connector Shoulder Bolt

1 – SOLENOID HARNESS CASE CONNECTOR
2 – 3–4 ACCUMULATOR HOUSING

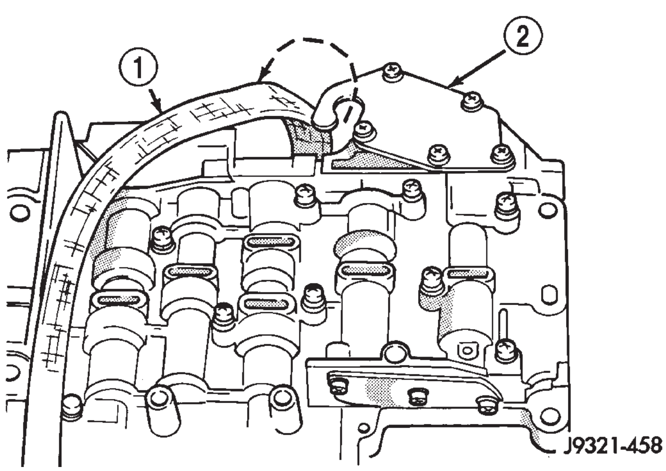


Fig. 147 Solenoid Harness Routing

1 – OVERDRIVE/CONVERTER SOLENOID WIRE HARNESS
2 – 3–4 ACCUMULATOR COVER PLATE

(8) Align screw holes in governor body and transfer plate. Then install and tighten governor body screws to 4 N·m (35 in. lbs.) torque.

(9) Connect harness wires to governor pressure solenoid and governor pressure sensor.

(10) Install fluid filter and pan.

(11) Lower vehicle.

(12) Fill transmission with recommended fluid and road test vehicle to verify repair.

TRANSMISSION

DISASSEMBLY

(1) Clean exterior of transmission with suitable solvent or pressure washer.

(2) Place transmission in vertical position.

(3) Measure and record the input shaft end-play measurement.

(4) Remove throttle and shift levers from valve body manual shaft and throttle lever shaft.

(5) Remove transmission oil pan and gasket.

(6) Remove filter from valve body (Fig. 148). Keep filter screws separate from other valve body screws. Filter screws are longer and should be kept with filter.

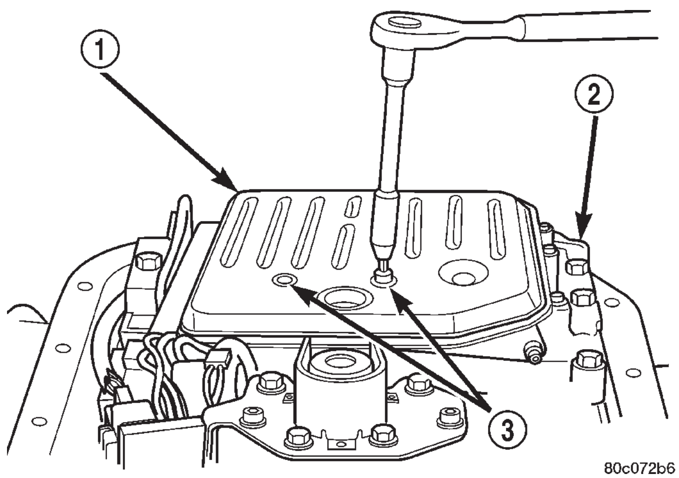


Fig. 148 Oil Filter Removal

1 – OIL FILTER
2 – VALVE BODY
3 – FILTER SCREWS (2)

(7) Remove park/neutral position switch and seal.

(8) Remove hex head bolts attaching valve body to transmission case (Fig. 149). A total of 10 bolts are used. Note different bolt lengths for assembly reference.

(9) Remove valve body assembly. Push valve body harness connector out of case. Then work park rod and valve body out of case (Fig. 150).

(10) Remove accumulator outer spring, piston and inner spring (Fig. 151). Note position of piston and springs for assembly reference. Remove and discard piston seals if worn or cut.

(11) Remove pump oil seal with suitable pry tool or slide-hammer mounted screw.

DISASSEMBLY AND ASSEMBLY (Continued)

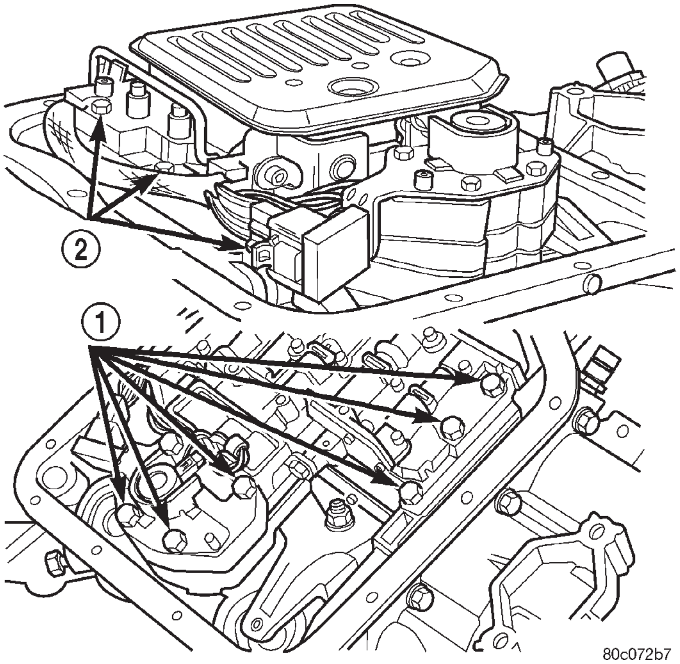


Fig. 149 Valve Body Bolt Locations

1 – VALVE BODY BOLTS
2 – VALVE BODY BOLTS

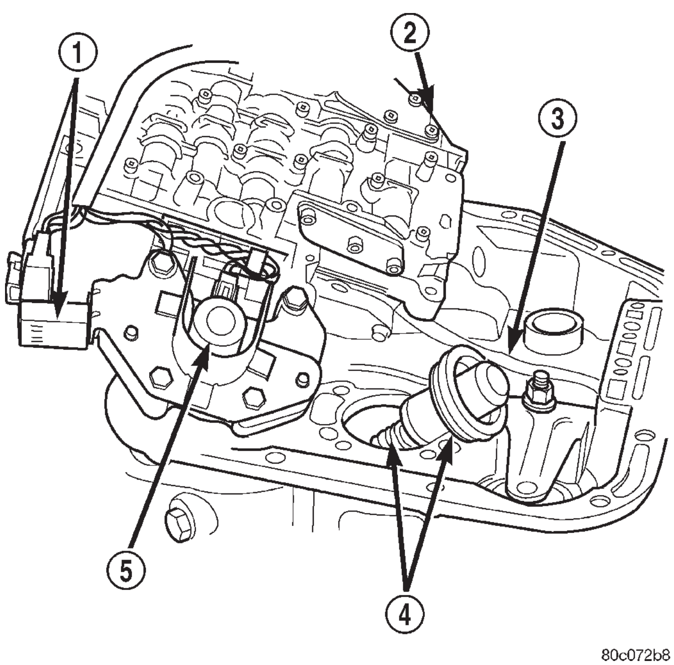


Fig. 150 Valve Body Removal

1 – GOVERNOR PRESSURE SENSOR
2 – VALVE BODY
3 – PARK ROD
4 – ACCUMULATOR PISTON
5 – GOVERNOR PRESSURE SOLENOID

(12) Remove front band lever pin access plug (Fig. 152). Use square end of 1/4 in. drive extension to remove plug as shown.

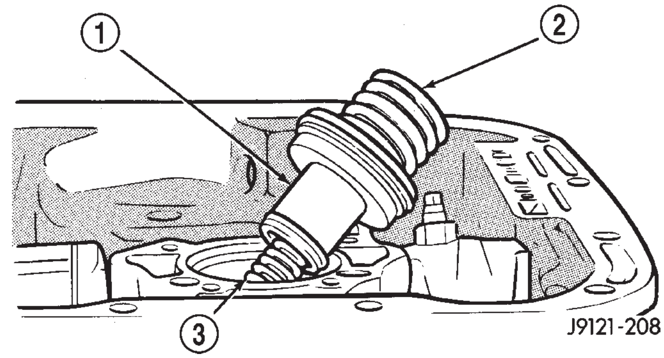


Fig. 151 Accumulator Component Removal

1 – ACCUMULATOR PISTON
2 – OUTER SPRING
3 – INNER SPRING

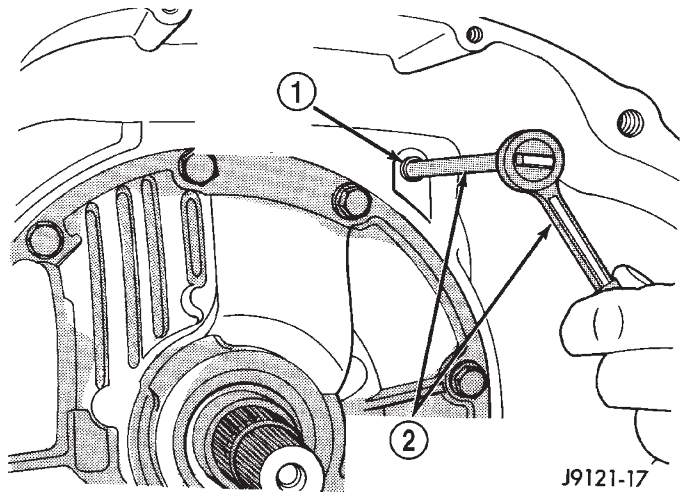


Fig. 152 Front Band Lever Pin Access Plug

1 – FRONT BAND REACTION PIN ACCESS PLUG
2 – 1/4 DRIVE EXTENSION AND RATCHET

(13) Remove oil pump and reaction shaft support assembly as follows:

(a) Tighten front band adjusting screw until band is tight around front clutch retainer (Fig. 153). This will prevent retainer from coming out with pump and possibly damaging clutch or pump components.

(b) Remove oil pump bolts.

(c) Thread Slide Hammer Tools C-3752 into threaded holes in flange of oil pump housing (Fig. 154).

(d) Remove oil pump and reaction shaft support by bumping slide hammers outward alternately to pull pump from case (Fig. 155).

DISASSEMBLY AND ASSEMBLY (Continued)

(14) Remove oil pump gasket (Fig. 156). Note gasket position in case for assembly reference.

(15) Loosen front band adjusting screw until band is completely loose.

(16) Remove front band strut and anchor (Fig. 157).

(17) Squeeze front band together slightly and slide band over front clutch retainer and out of case (Fig. 158).

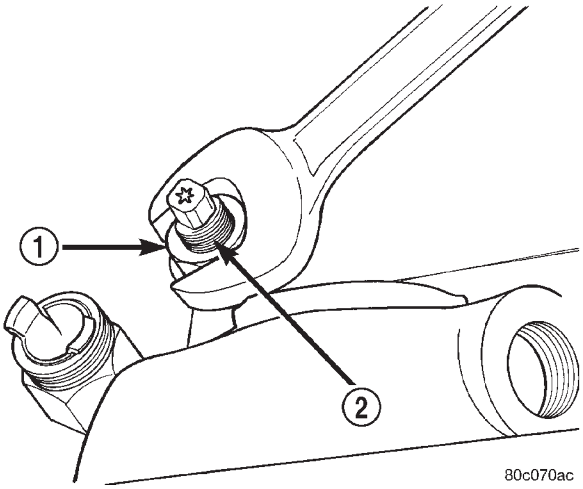


Fig. 153 Tightening Front Band To Hold Front Clutch In Place

1 – LOCK-NUT
2 – FRONT BAND ADJUSTER

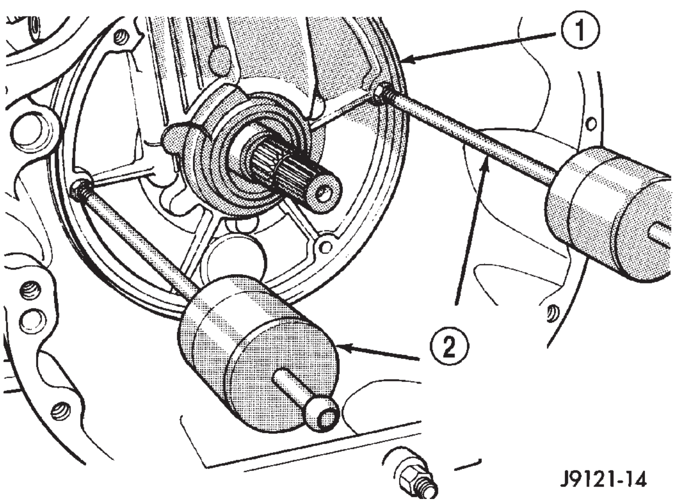


Fig. 154 Oil Pump Removal Tools

1 – PUMP HOUSING
2 – SLIDE HAMMER TOOLS (THREAD INTO PUMP HOUSING)

(18) Remove front and rear clutch assemblies as a unit (Fig. 159).

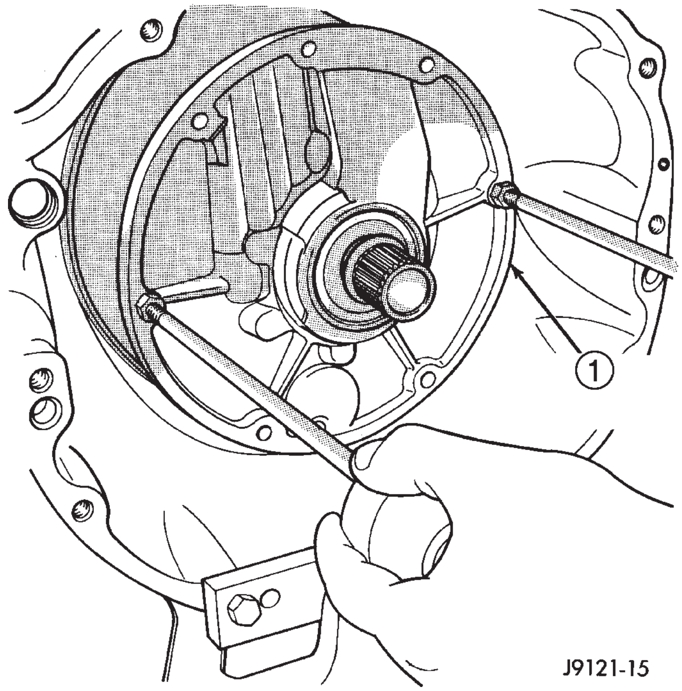


Fig. 155 Oil Pump Removal

1 – OIL PUMP AND REACTION SHAFT SUPPORT

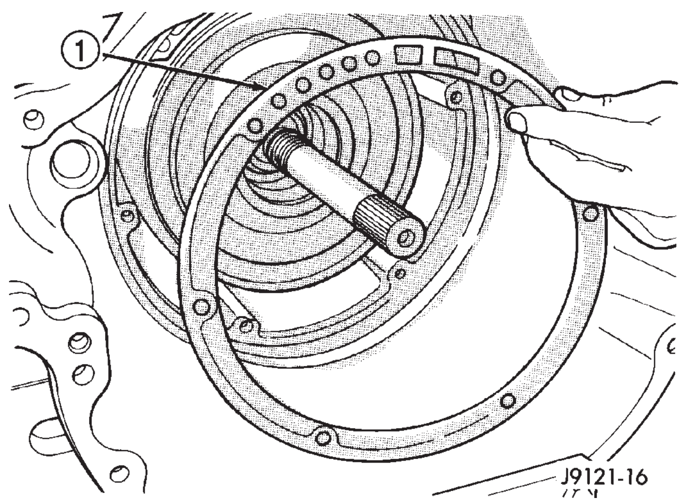


Fig. 156 Oil Pump Gasket

1 – OIL PUMP GASKET

(19) Remove front band reaction pin and lever. Start pin through lever and out of case bore with drift or punch. Then use pencil magnet to withdraw pin completely (Fig. 160).

(20) Remove intermediate shaft thrust washer. Triangular shaped washer will either be on shaft pilot hub or in rear clutch retainer (Fig. 161).

DISASSEMBLY AND ASSEMBLY (Continued)

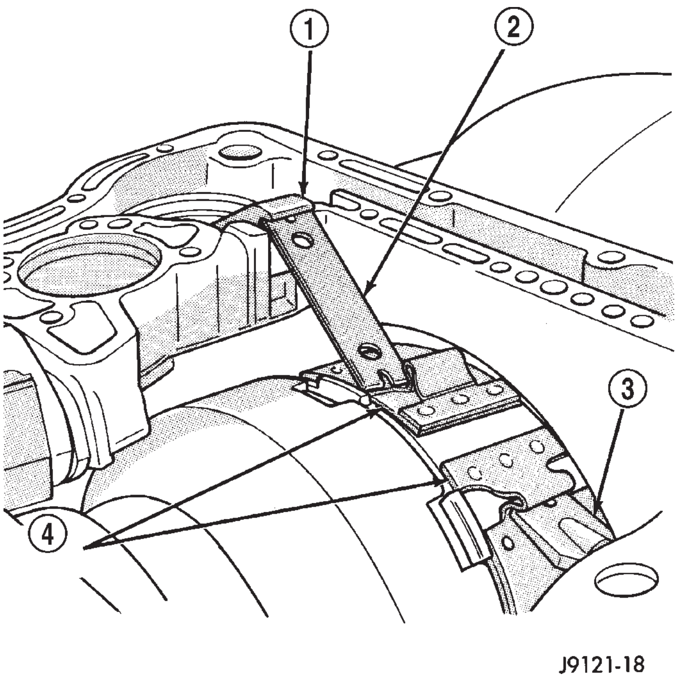


Fig. 157 Front Band Linkage

1 – LEVER
2 – STRUT
3 – ANCHOR
4 – FRONT BAND

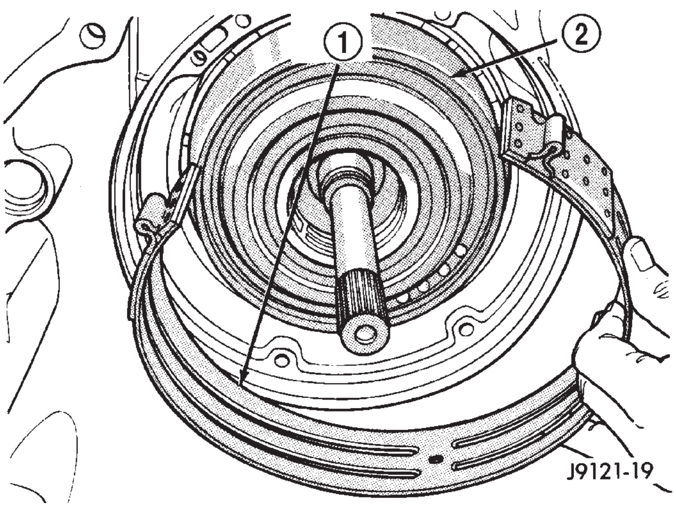


Fig. 158 Front Band

1 – FRONT BAND
2 – FRONT CLUTCH RETAINER

(21) Remove thrust plate from intermediate shaft hub (Fig. 162).

(22) Remove intermediate shaft-planetary geartrain assembly (Fig. 163).

(23) If overdrive unit is not to be serviced, install Alignment Shaft 6227-2 into the overdrive unit to prevent misalignment of the overdrive clutches during service of main transmission components.

(24) Loosen rear band locknut and loosen adjusting screw 3-4 turns.

(25) Remove snap ring that retains low-reverse drum on overdrive piston retainer hub (Fig. 164).

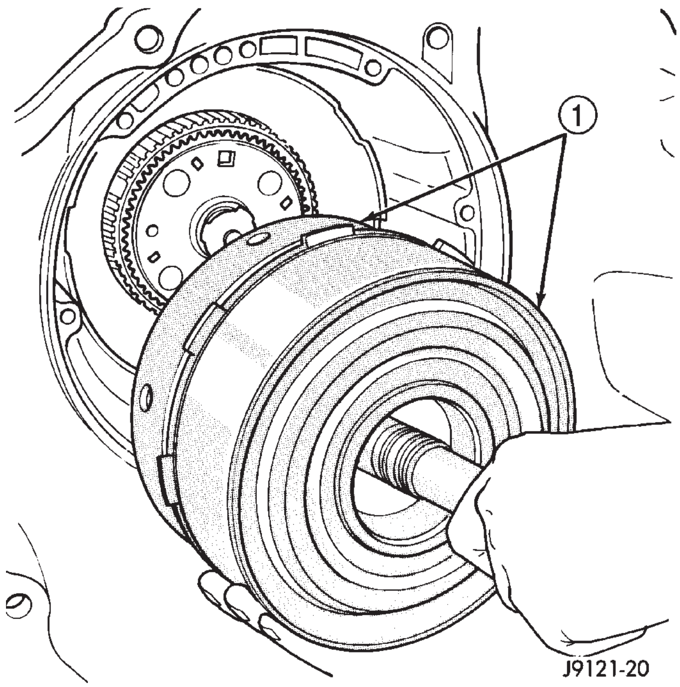


Fig. 159 Removing Front/Rear Clutch Assemblies

1 – FRONT AND REAR CLUTCH ASSEMBLIES

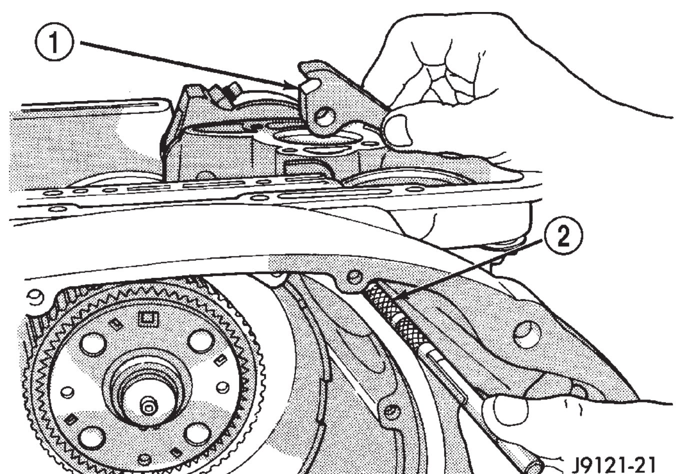


Fig. 160 Front Band Lever And Pin

1 – BAND LEVER
2 – USE PENCIL MAGNET TO REMOVE REACTION PIN

(26) Slide low-reverse drum and thrust washer off piston retainer hub and out of rear band (Fig. 165).

(27) Note that overrunning clutch race will remain on splines of low-reverse drum after removal (Fig. 166). **The race is a permanent press fit on the hub splines. Do not attempt to remove the race.**

DISASSEMBLY AND ASSEMBLY (Continued)

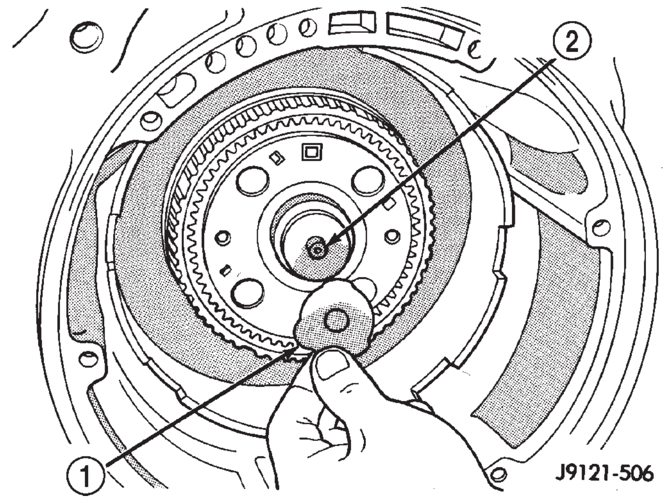


Fig. 161 Intermediate Shaft Thrust Washer

1 – THRUST WASHER
2 – INTERMEDIATE SHAFT PILOT HUB

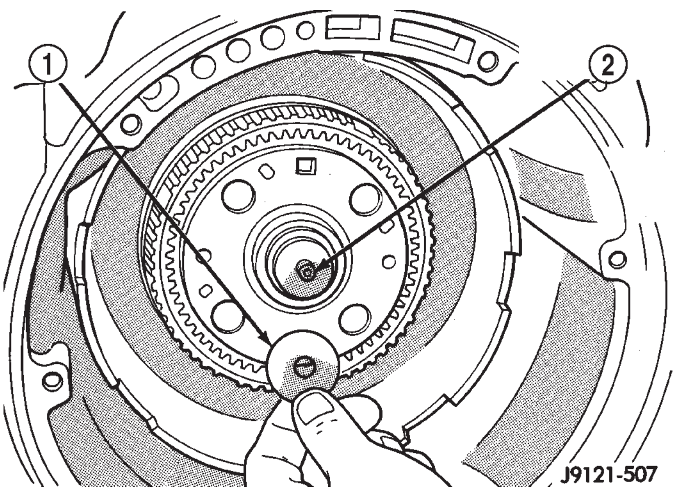


Fig. 162 Intermediate Shaft Thrust Plate

1 – SHAFT THRUST PLATE
2 – INTERMEDIATE SHAFT PILOT HUB

(28) Remove overrunning clutch assembly (Fig. 167). Assembly can be removed without displacing rollers and springs if care is exercised. Note position of rollers and springs for assembly reference.

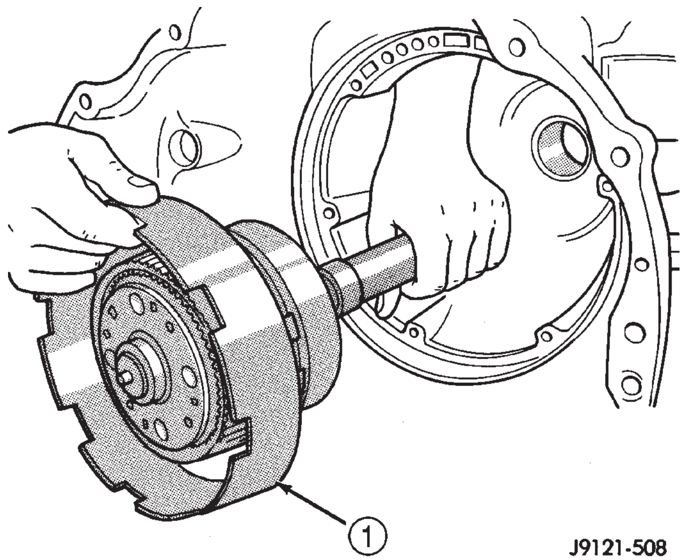


Fig. 163 Intermediate Shaft And Planetary Geartrain

1 – INTERMEDIATE SHAFT AND PLANETARY GEAR TRAIN ASSEMBLY

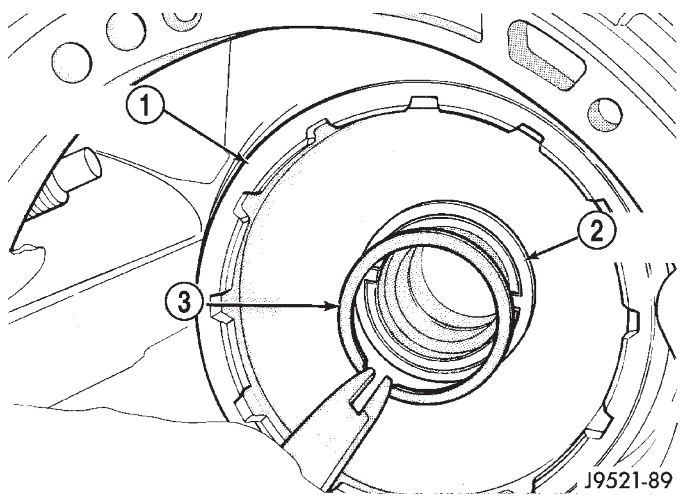


Fig. 164 Low-Reverse Drum Snap Ring

1 – LOW-REVERSE DRUM
2 – TABBED WASHER
3 – SNAP RING

DISASSEMBLY AND ASSEMBLY (Continued)

(29) Remove rear band adjusting lever, reaction lever and pin (Fig. 168).

(30) Remove strut from rear band. Keep strut with levers and pin for cleaning, inspection and assembly reference.

(31) Remove rear band and link (Fig. 169).

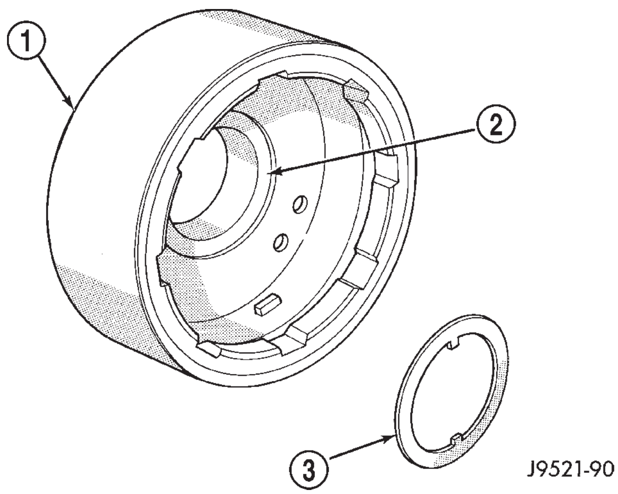


Fig. 165 Low-Reverse Drum And Thrust Washer

1 – LOW-REVERSE DRUM
2 – SPOTFACE FOR WASHER
3 – THRUST WASHER

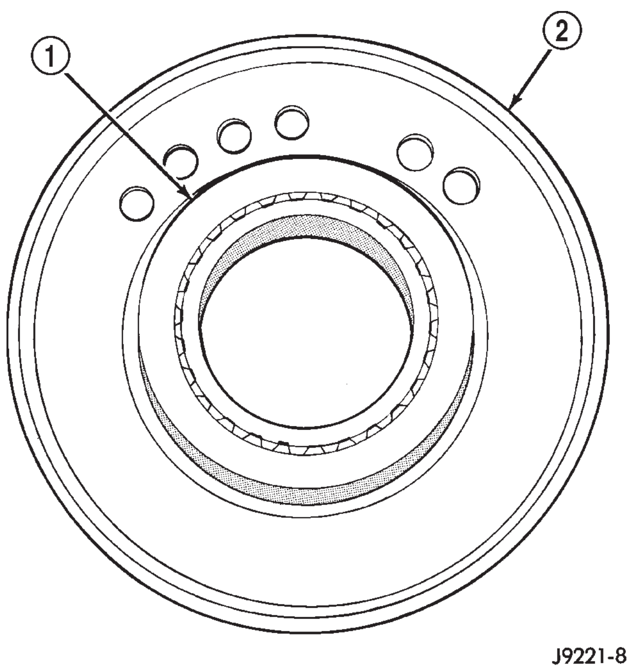


Fig. 166 Overrunning Clutch Race Position On Low-Reverse Drum

1 – OVERRUNNING CLUTCH RACE
2 – LOW-REVERSE DRUM

(32) Compress front servo rod guide with large C-clamp and Tool C-4470, or Compressor Tool

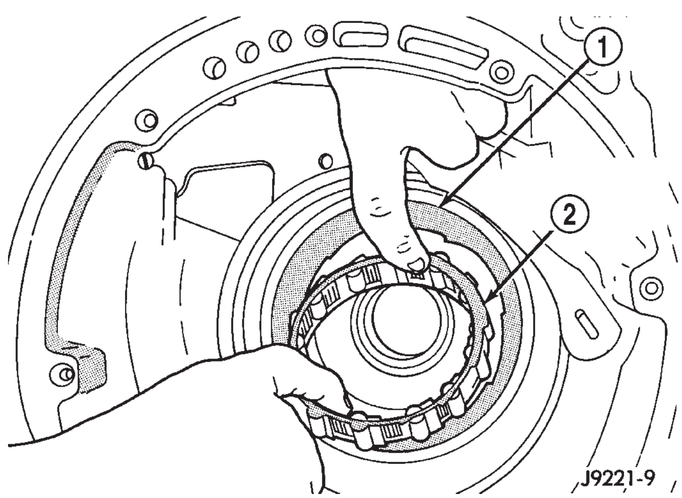


Fig. 167 Overrunning Clutch

1 – CLUTCH CAM
2 – OVERRUNNING CLUTCH ASSEMBLY

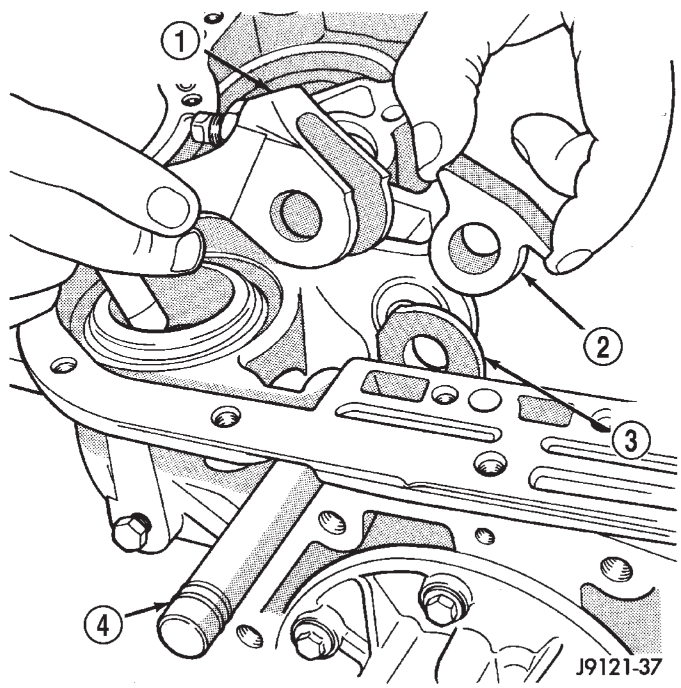


Fig. 168 Rear Band Levers And Pins

1 – REAR BAND ADJUSTING LEVER
2 – REACTION LEVER
3 – BAND LINK
4 – REAR BAND REACTION PIN

C-3422-B (Fig. 170). Compress guide only enough to permit snap ring removal (about 1/8 in.).

(33) Remove servo piston snap ring (Fig. 170). Unseat one end of ring. Then carefully work removal tool around back of ring until free of ring groove. **Exercise caution when removing snap ring. Servo bore can be scratched or nicked if care is not exercised.**

DISASSEMBLY AND ASSEMBLY (Continued)

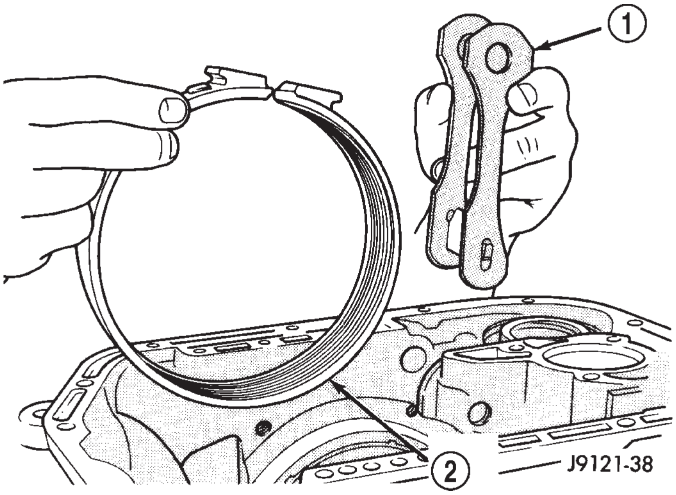


Fig. 169 Rear Band And Link

1 – BAND LINK
2 – REAR BAND

(34) Remove tools and remove servo piston and spring.

(35) Compress rear servo piston with C-clamp and Tool C-4470, or Valve Spring Compressor C-3422-B (Fig. 171). Compress servo spring retainer only enough to permit snap ring removal.

(36) Remove servo piston snap ring (Fig. 171). Start one end of ring out of bore. Then carefully work removal tool around back of snap ring until free of ring groove. **Exercise caution when removing snap ring. Servo bore can be scratched or nicked if care is not exercised.**

(37) Remove tools and remove rear servo retainer, spring and piston assembly.

ASSEMBLY

Do not allow dirt, grease, or foreign material to enter the case or transmission components during assembly. Keep the transmission case and components clean. Also make sure the tools and workbench area used for reassembly operations are equally clean.

Shop towels used for wiping off tools and your hands must be made from **lint free** materials. Lint will stick to transmission parts and could interfere with valve operation or even restrict fluid passages.

Lubricate transmission clutch and gear components with Mopar® ATF Plus 3, type 7176, during reassembly. Soak clutch discs in transmission fluid before installation.

Use Mopar® Door Ease, or Ru-Glyde on piston seals and O-rings to ease installation. Petroleum jelly can also be used to lubricate and hold thrust washers and plates in position during assembly.

Do not use chassis grease, bearing grease, white grease, or similar lubricants on any part.

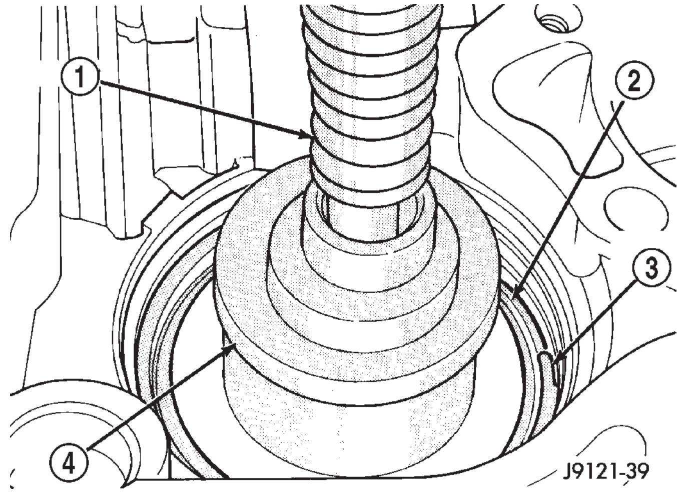


Fig. 170 Front Servo Retaining Snap Ring

1 – C-CLAMP
2 – FRONT SERVO ROD GUIDE
3 – SNAP RING
4 – TOOL C-4470

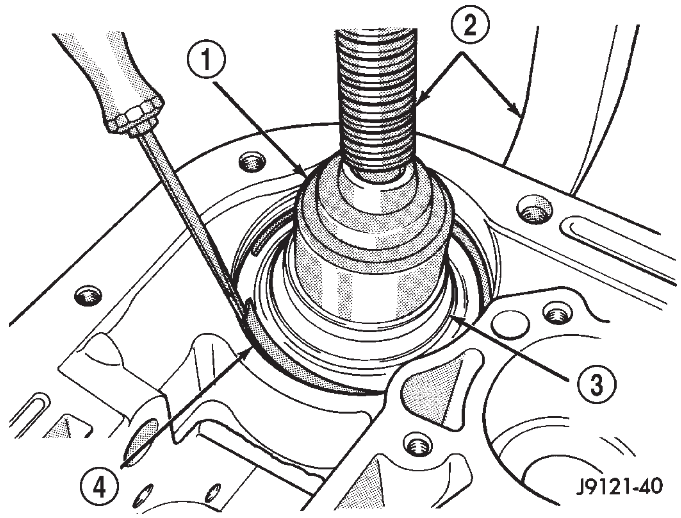


Fig. 171 Rear Servo Retaining Snap Ring

1 – TOOL C-4470
2 – C-CLAMP
3 – REAR SERVO SPRING RETAINER
4 – RETAINER SNAP RING

These types of lubricants can eventually block or restrict fluid passages and valve operation. Use petroleum jelly only.

Do not force parts into place. The transmission components and sub-assemblies are easily installed by hand when properly aligned. If a part seems difficult to install, it is either misaligned or incorrectly assembled. Verify that thrust washers, thrust plates and seal rings are correctly positioned.

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install

DISASSEMBLY AND ASSEMBLY (Continued)

when the transmission case is upright. Either tilt the case upward with wood blocks, or cut a hole in the bench large enough for the intermediate shaft and rear support. Then lower the shaft and support into the hole and support the rear of the case directly on the bench.

FRONT/REAR SERVO

(1) Lubricate rear servo piston seal with Mopar® Door Ease or ATF Plus 3. Lubricate servo bore in case with ATF Plus 3.

(2) Install rear servo piston in case. Position piston at slight angle to bore and insert piston with twisting motion (Fig. 172).

(3) Install rear servo spring and retainer in case bore (Fig. 173). Be sure spring is seated on piston.

(4) Compress rear servo piston with C-clamp or Valve Spring Compressor C-3422-B and install servo piston snap ring (Fig. 174).

(5) Lubricate front servo piston components and servo bore in case with transmission fluid.

(6) Install front servo piston in bore. Carefully "run" small, suitable tool around piston ring to press it back into groove and ease installation (Fig. 175). Rotate piston into bore at same time. Rock piston slightly to ease piston ring past snap ring groove and into bore.

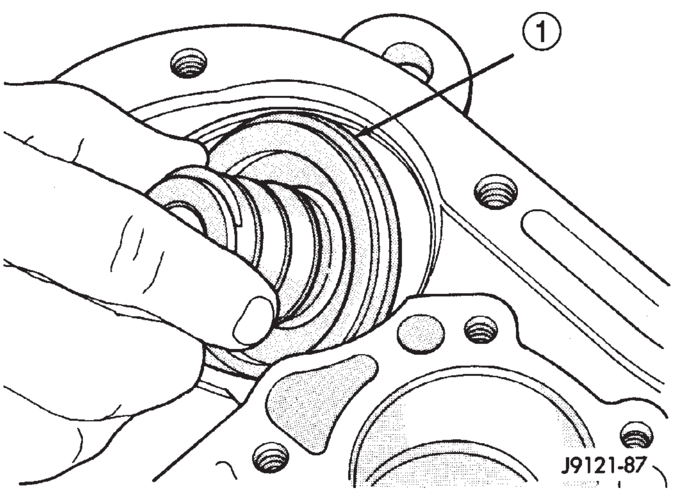


Fig. 172 Rear Servo Piston

1 – REAR SERVO PISTON

(7) Bottom front servo piston in bore and install servo spring.

(8) Install front servo piston rod guide as follows:

(a) Place Tool SP-5560 (or similar size tool) on guide and position C-clamp on tool and case (Fig. 176).

(b) Slowly compress rod guide while simultaneously easing seal ring into bore with suitable tool.

(9) Install rod guide snap ring (Fig. 176).

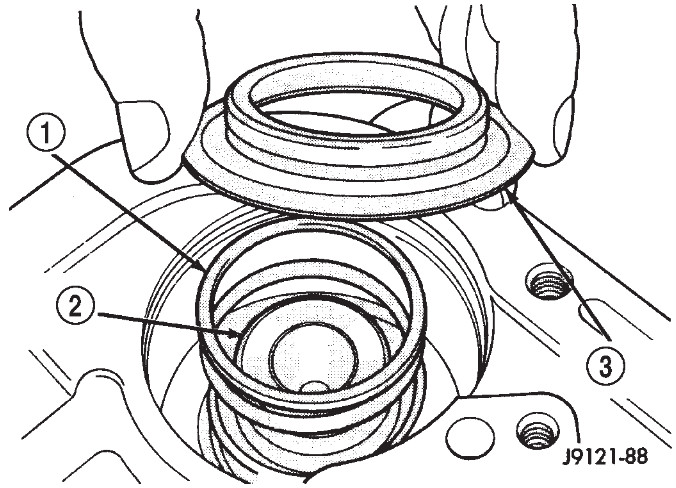


Fig. 173 Rear Servo Piston Spring And Retainer

1 – PISTON SPRING
2 – REAR SERVO PISTON
3 – SPRING RETAINER

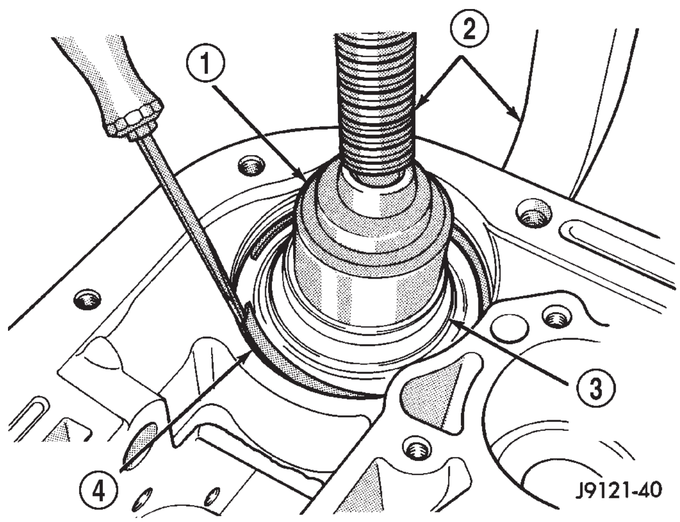


Fig. 174 Rear Servo Snap Ring

1 – TOOL C-4470
2 – C-CLAMP
3 – REAR SERVO SPRING RETAINER
4 – RETAINER SNAP RING

OVERRUNNING CLUTCH, REAR BAND, AND LOW-REVERSE DRUM

(1) Install overrunning clutch components if not yet installed.

(2) Position rear band and link in case (Fig. 177).

(3) Install low-reverse drum (Fig. 178). Slide drum through rear band, onto piston retainer hub and into engagement with overrunning clutch and race.

(4) Install thrust washer in low-reverse drum spotface (Fig. 179). Use petroleum jelly to hold washer in place.

DISASSEMBLY AND ASSEMBLY (Continued)

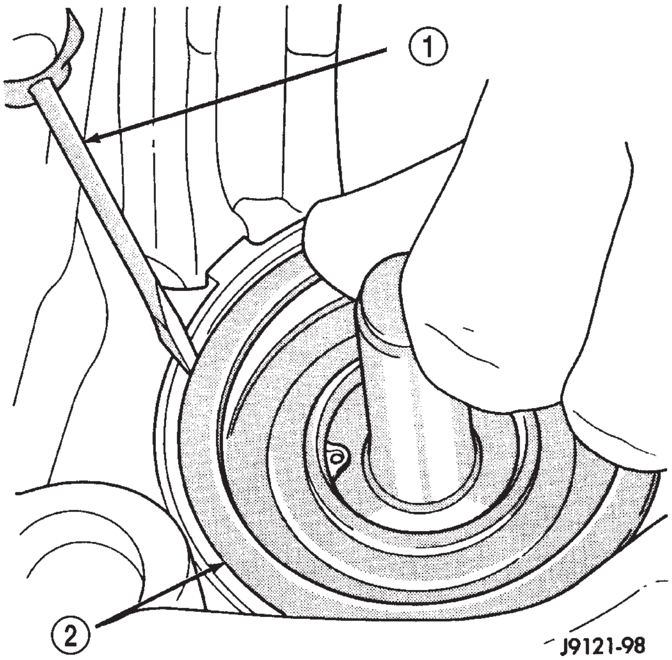


Fig. 175 Front Servo Piston

1 – USE SUITABLE TOOL TO HELP SEAT PISTON RING
2 – FRONT SERVO PISTON

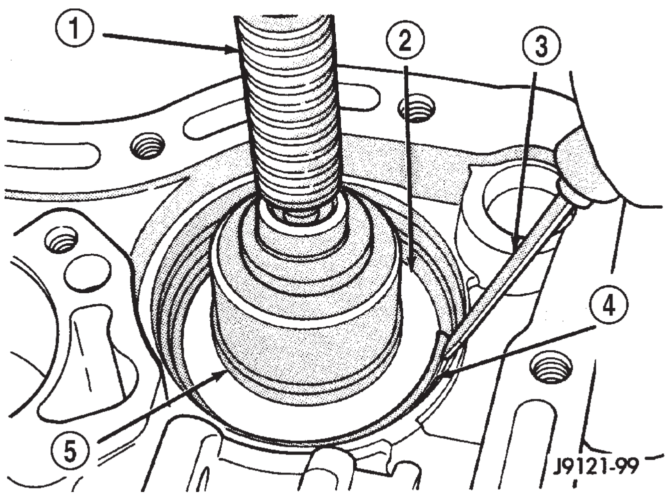


Fig. 176 Front Servo Rod Guide And Snap Ring

1 – C-CLAMP
2 – ROD GUIDE
3 – SMALL SCREWDRIVER
4 – ROD GUIDE SNAP RING
5 – TOOL SP-5560

(5) Install snap ring that secures low-reverse drum to piston retainer hub (Fig. 179).

(6) Insert band reaction pin part way into case and band link (Fig. 180).

(7) Install rear band adjusting lever, reaction lever, and strut (Fig. 181). Be sure levers and strut are aligned and engaged before seating band reaction pin in case.

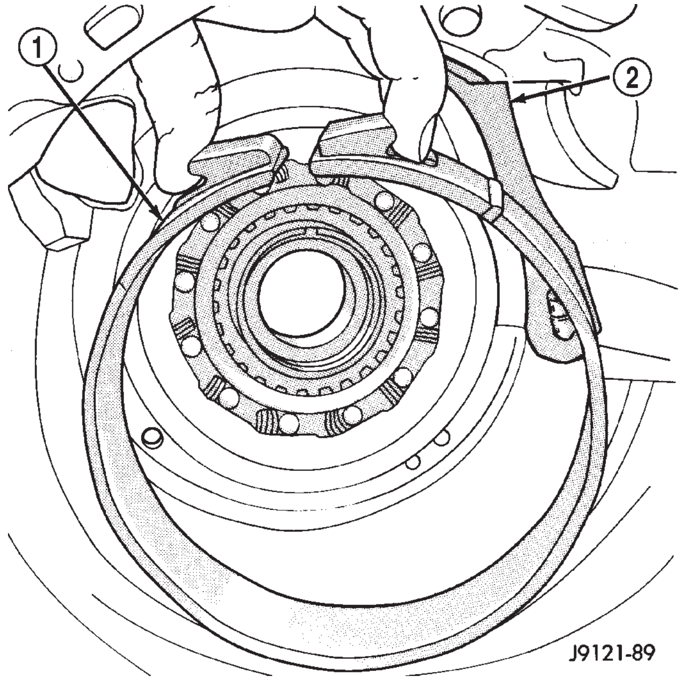


Fig. 177 Rear Band And Link

1 – REAR BAND
2 – BAND LINK

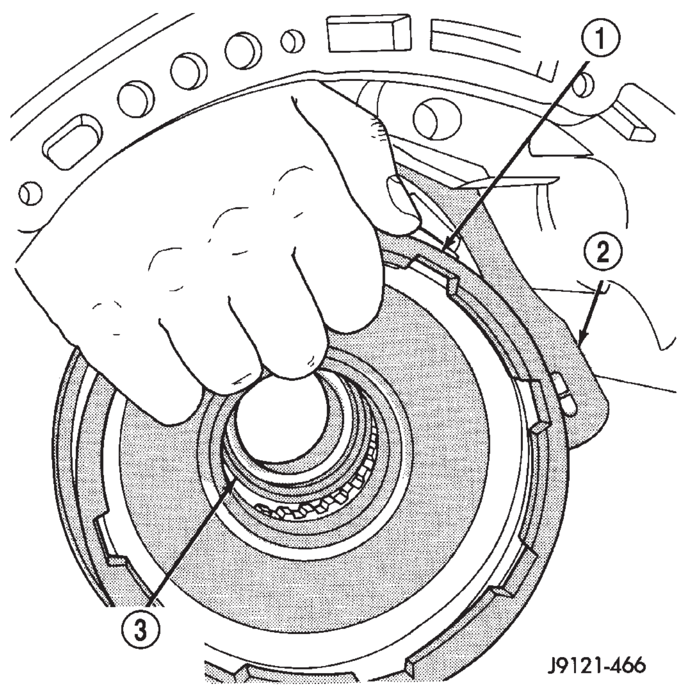


Fig. 178 Low-Reverse Drum

1 – LOW-REVERSE DRUM
2 – REAR BAND LINK
3 – HUB OF OVERDRIVE PISTON RETAINER

DISASSEMBLY AND ASSEMBLY (Continued)

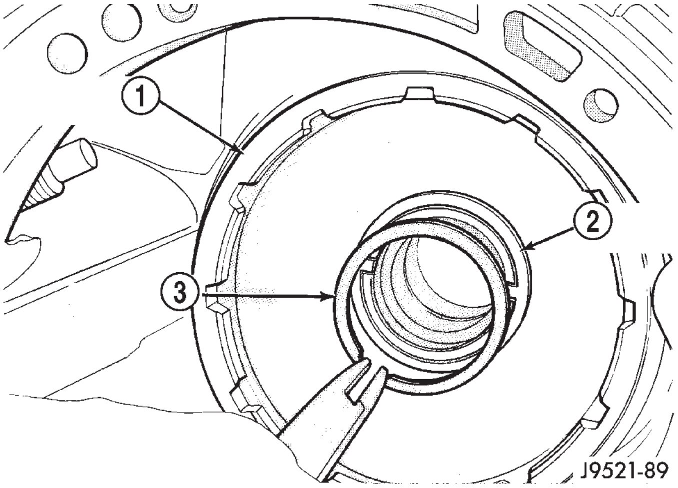


Fig. 179 Low-Reverse Drum Snap Ring

1 – LOW-REVERSE DRUM
2 – TABBED WASHER
3 – SNAP RING

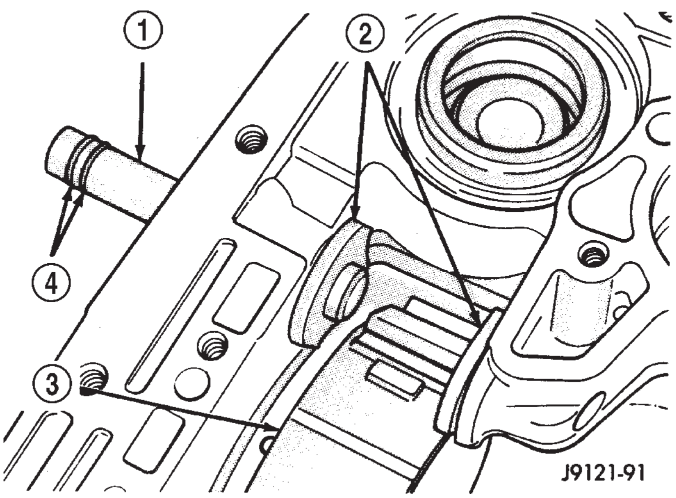


Fig. 180 Rear Band Reaction Pin

1 – REACTION PIN
2 – BAND LINK
3 – REAR BAND
4 – O-RINGS

PLANETARY GEARTRAIN, FRONT/REAR CLUTCH, AND FRONT BAND

(1) Remove Alignment Shaft 6227-2, if installed previously.

(2) Install assembled intermediate shaft and planetary geartrain (Fig. 182). **Support shaft carefully during installation. Do not allow shaft bearing/ bushing surfaces to become nicked or scratched.**

(3) Lubricate intermediate shaft thrust plate with petroleum jelly and install plate on shaft pilot hub (Fig. 183).

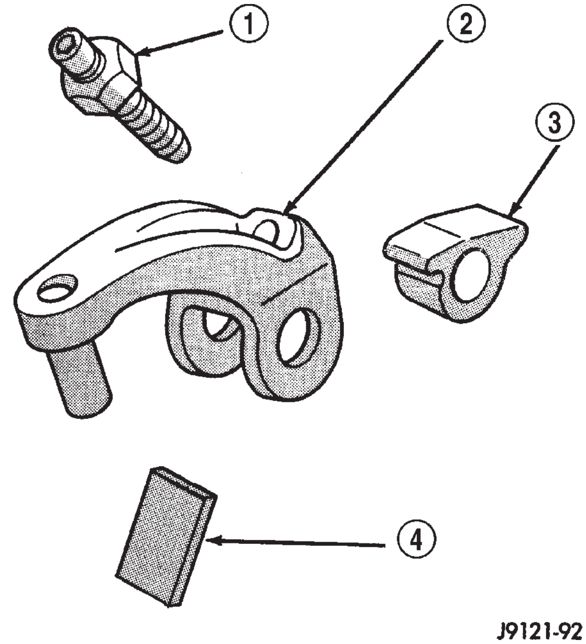


Fig. 181 Rear Band Levers And Strut

1 – ADJUSTING SCREW AND NUT
2 – ADJUSTING LEVER
3 – REACTION LEVER
4 – STRUT

(4) Check input shaft front seal rings, fiber thrust washer and rear seal ring (Fig. 184). Be ends of rear seal ring are hooked together and diagonal cut ends of front seal rings are firmly seated against each other as shown. Lubricate seal rings with petroleum jelly after checking them.

(5) Assemble front and rear clutches (Fig. 185). Align lugs on front clutch discs. Mount front clutch on rear clutch. Turn front clutch retainer back and forth until front clutch discs are fully seated on rear clutch splined hub.

(6) Install intermediate shaft thrust washer in hub of rear clutch retainer (Fig. 186). Use petroleum jelly to hold washer in place. Position washer so grooves are facing outward. **Washer only fits one way in clutch retainer hub.**

(7) Place transmission case in upright position, or place blocks under front end of transmission repair stand to tilt case rearward. This makes it easier to install front/rear clutch assembly.

(8) Align discs in rear clutch. Then install and engage assembly in front planetary and driving shell (Fig. 187). Turn clutch retainers back and forth until both clutches are seated.

(9) Position front band lever in case and over servo rod guide. Then install front band lever pin in case and slide it through lever.

DISASSEMBLY AND ASSEMBLY (Continued)

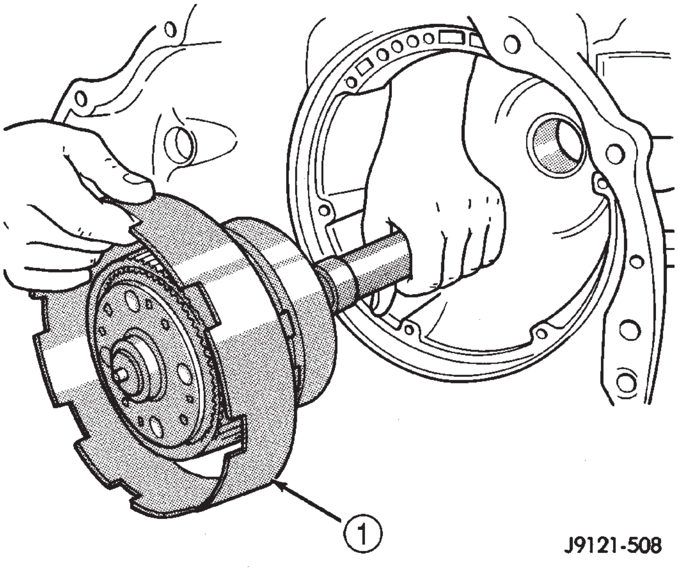


Fig. 182 Intermediate Shaft And Planetary Geartrain

1 – INTERMEDIATE SHAFT AND PLANETARY GEAR TRAIN ASSEMBLY

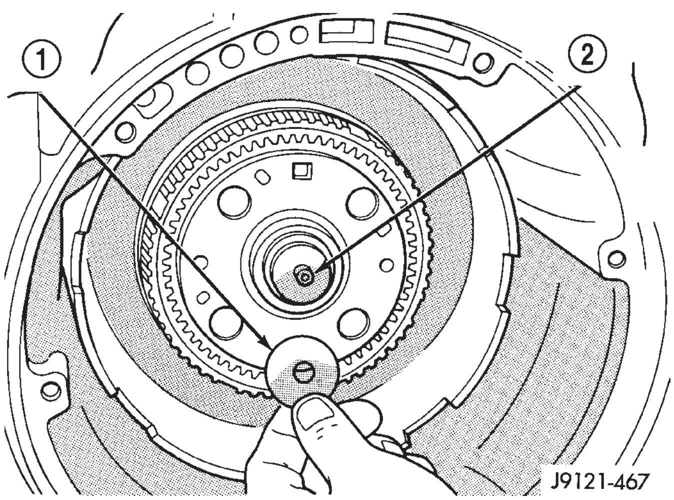


Fig. 183 Intermediate Shaft Thrust Plate

1 – SHAFT THRUST PLATE
2 – INTERMEDIATE SHAFT PILOT HUB

(10) Coat threads of front band pin access plug with sealer and install it in case. Tighten plug to 17 N·m (13 ft. lbs.) torque.

(11) Slide front band over front clutch retainer and install front band strut and anchor (Fig. 188).

(12) Tighten front band adjusting screw until band is tight on clutch retainer. This will hold clutches in place while oil pump is being installed. **Verify that front/rear clutch assembly is still properly seated before tightening band.**

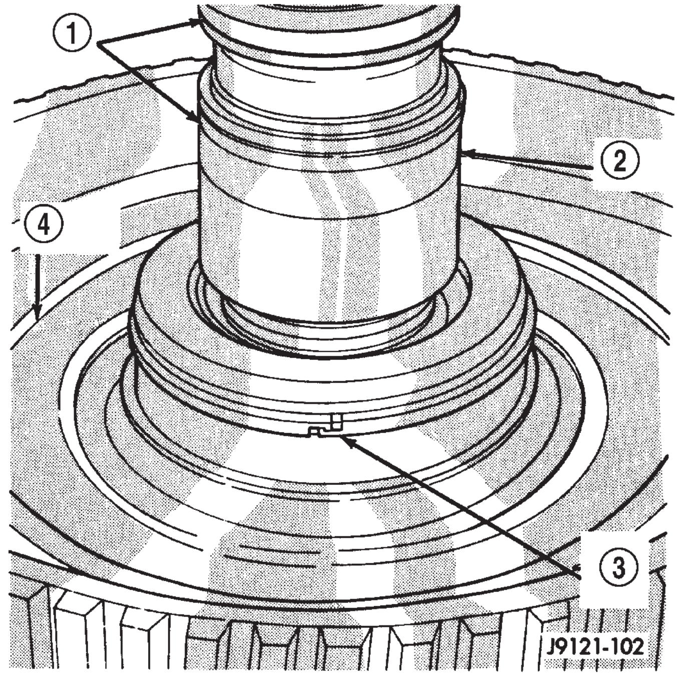


Fig. 184 Input Shaft Seal Ring And Thrust Washer

1 – FRONT SEAL RINGS
2 – INPUT SHAFT
3 – REAR SEAL RING
4 – THRUST WASHER

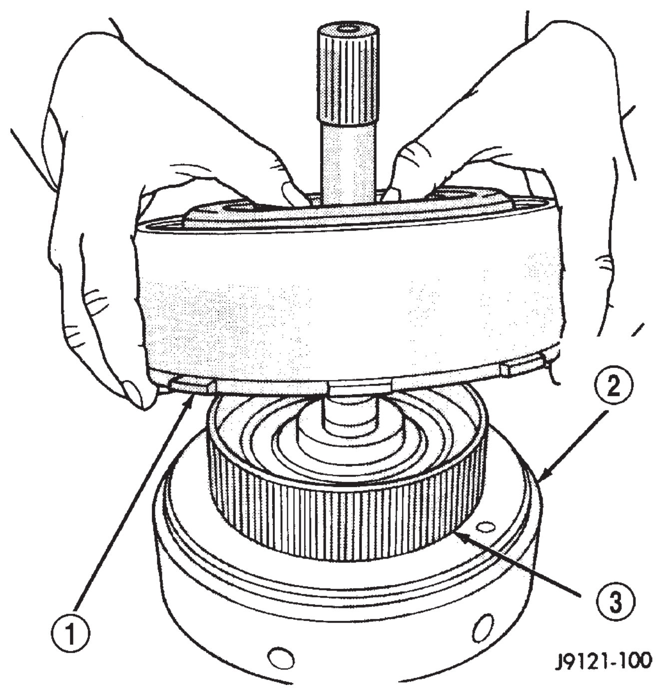


Fig. 185 Assembling Front And Rear Clutches

1 – FRONT CLUTCH ASSEMBLY
2 – REAR CLUTCH ASSEMBLY
3 – REAR CLUTCH SPLINED HUB

DISASSEMBLY AND ASSEMBLY (Continued)

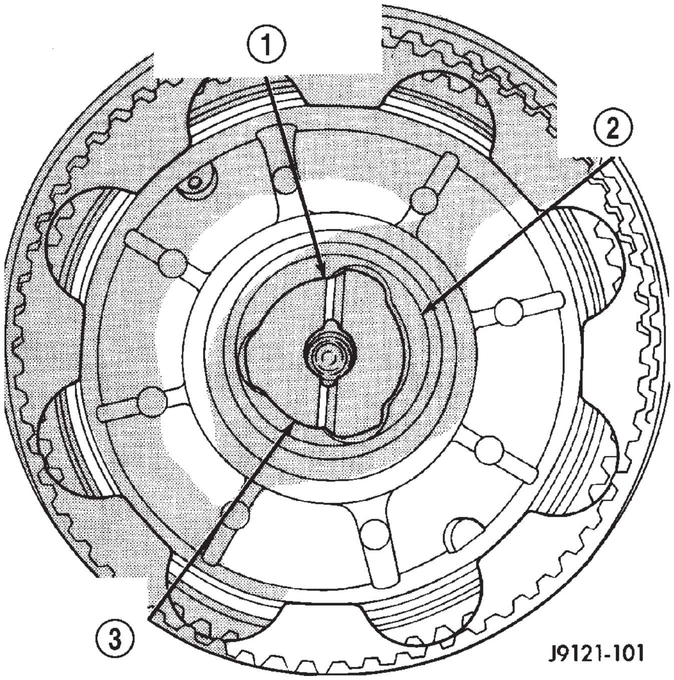


Fig. 186 Intermediate Shaft Thrust Washer

1 – BE SURE WASHER GROOVES FACE OUT AS SHOWN
2 – REAR CLUTCH RETAINER HUB
3 – OUTPUT SHAFT THRUST WASHER

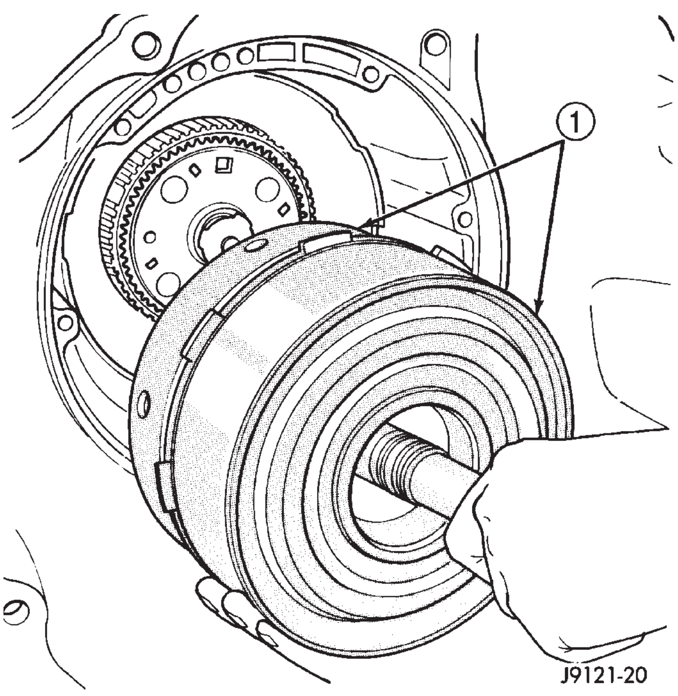


Fig. 187 Front/Rear Clutch Assemblies

1 – FRONT AND REAR CLUTCH ASSEMBLIES

OIL PUMP

(1) Install oil pump Pilot Studs C-3288-B in case (Fig. 189).

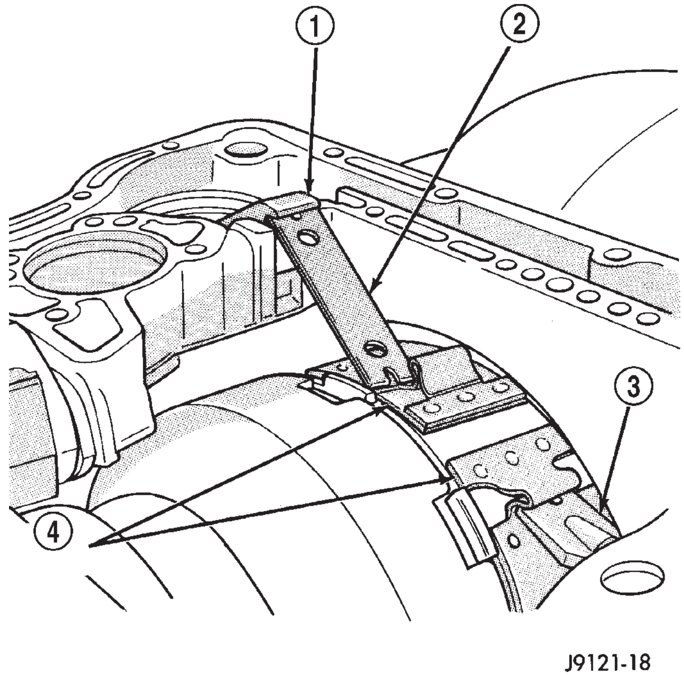


Fig. 188 Front Band And Linkage

1 – LEVER
2 – STRUT
3 – ANCHOR
4 – FRONT BAND

(2) Install new oil pump gasket on pilot studs and seat it in case. Be sure gasket is properly aligned with fluid passages in case (Fig. 189).

(3) Coat front clutch thrust washer with petroleum jelly to hold it in place. Then install washer over reaction shaft hub and seat it on pump (Fig. 190).

CAUTION: The thrust washer bore (I.D.), is chamfered on one side. Make sure the chamfered side is installed so it faces the pump.

(4) Check seal rings on reaction shaft support. Be sure rings are hooked together correctly. Also be sure fiber thrust washer is in position (Fig. 191). Use extra petroleum jelly to hold washer in place if necessary.

(5) Lubricate oil pump seals with petroleum Mopar® ATF Plus 3, type 7176.

(6) Mount oil pump on pilot studs and slide pump into case opening (Fig. 192). **Work pump into case by hand. Do not use a mallet or similar tools to seat pump.**

(7) Remove pilot studs and install oil pump bolts. Tighten pump bolts alternately and evenly to fully seat pump in case. Then final-tighten pump bolts to 20 N·m (15 ft. lbs.) torque.

(8) Verify correct installation. Rotate input and intermediate shafts and check for bind. If bind exists, components are either mis-assembled, or not seated.

DISASSEMBLY AND ASSEMBLY (Continued)

Disassemble and correct as necessary before proceeding.

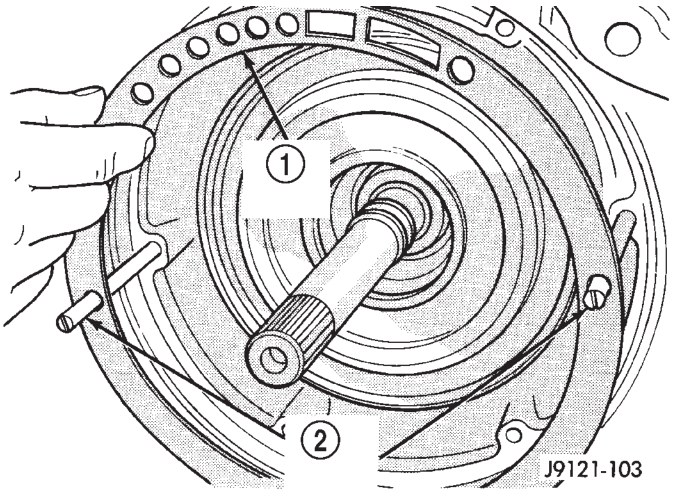


Fig. 189 Oil Pump Gasket And Pilot Studs

1 – OIL PUMP GASKET
2 – PILOT STUDS C-3288–B

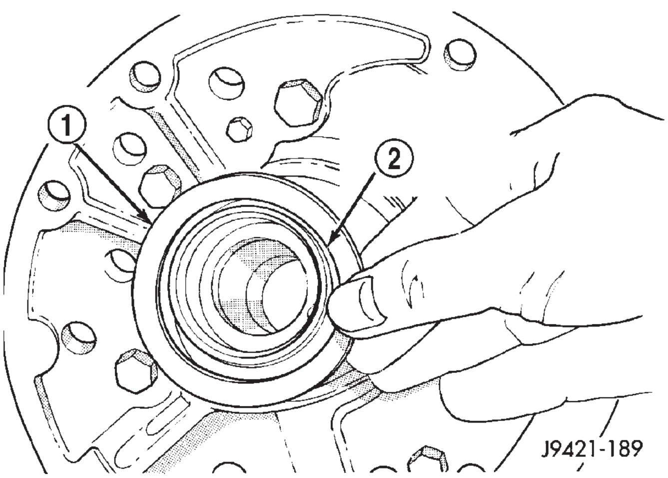


Fig. 190 Front Clutch Thrust Washer

1 – THRUST WASHER
2 – CHAMFERED SIDE OF WASHER BORE GOES TOWARD PUMP

INPUT SHAFT END PLAY CHECK

NOTE: Overdrive unit must be installed in order to correctly measure the input shaft end-play.

(1) Measure input shaft end play (Fig. 193).

NOTE: If end play is incorrect, transmission is incorrectly assembled, or reaction shaft thrust washer is incorrect. The reaction shaft thrust washer is selective.

(a) Attach Adapter 8266–5 to Handle 8266–8.

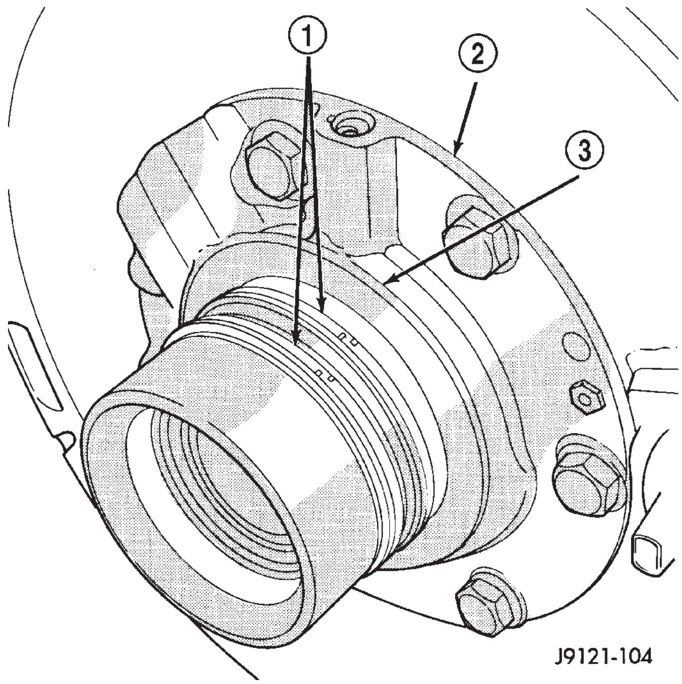


Fig. 191 Reaction Shaft Seal Ring And Thrust Washer

1 – SEAL RINGS
2 – REACTION SHAFT SUPPORT
3 – THRUST WASHER (FIBER)

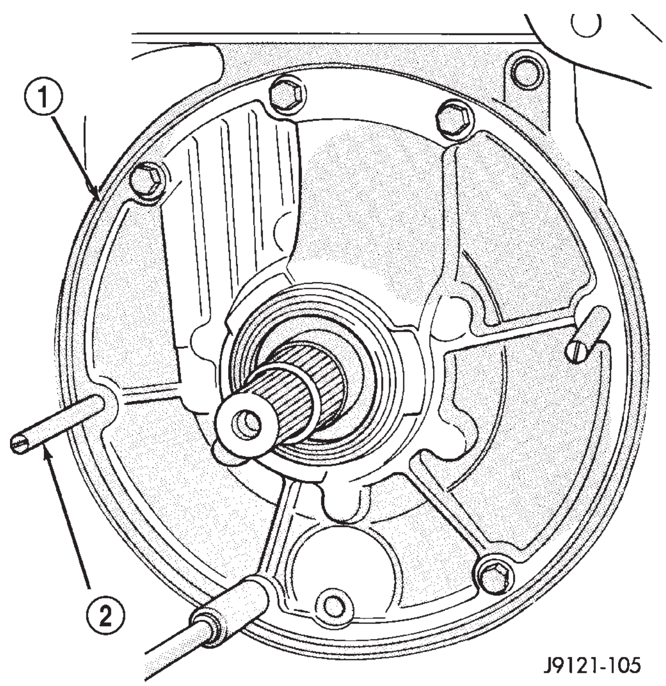


Fig. 192 Oil Pump

1 – SEAT OIL PUMP IN CASE BY HAND
2 – REMOVE PILOT STUDS WHEN PUMP IS SEATED

(b) Attach dial indicator C-3339 to Handle 8266–8.

DISASSEMBLY AND ASSEMBLY (Continued)

(c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266–5 to secure it to the input shaft.

(d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.

(e) Move input shaft in and out and record reading. End play should be 0.86 - 2.13 mm (0.034 - 0.084 in.). Adjust as necessary.

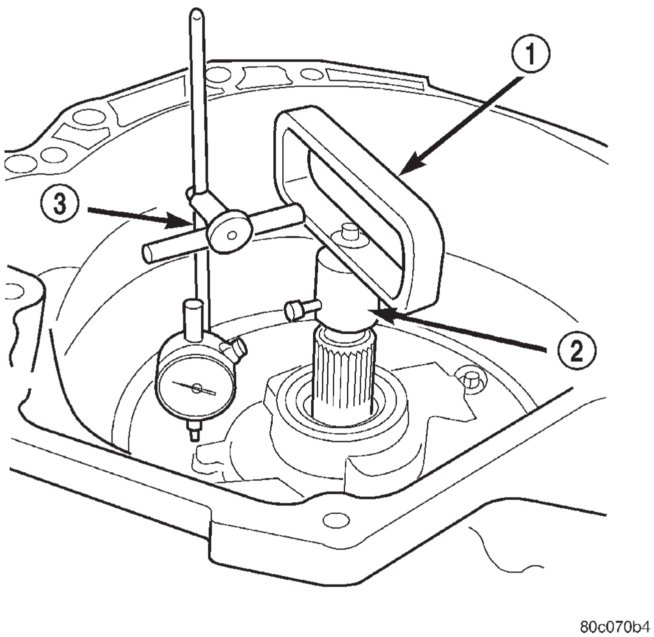


Fig. 193 Checking Input Shaft End Play

1 – TOOL 8266-8
2 – TOOL 8266-5
3 – TOOL C-3339

ACCUMULATOR, VALVE BODY, OIL PAN, AND TORQUE CONVERTER

(1) Install accumulator inner spring, piston and outer spring (Fig. 194).

(2) Verify that park/neutral position switch has **not** been installed in case. Valve body can not be installed if switch is in position.

(3) Install new valve body manual shaft seal in case (Fig. 195). Lubricate seal lip and manual shaft with petroleum jelly. Start seal over shaft and into case. Seat seal with 15/16 inch, deep well socket.

(4) Install valve body as follows:

(a) Start park rod into park pawl. If rod will not slide past park pawl, pawl is engaged in park gear. Rotate overdrive output shaft with suitable size 12 point socket; this will free pawl and allow rod to engage.

(b) Align and seat valve body on case. Be sure manual lever shaft and overdrive connector are fully seated in case.

(c) Install and start all valve body attaching bolts by hand. Then tighten bolts evenly, in a diagonal pattern to 12 N·m (105 in. lbs.) torque. **Do not overtighten valve body bolts. This could result in distortion and cross leakage after installation.**.

(5) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(6) Install seal on park/neutral position switch. Then install and tighten switch to 34 N·m (25 ft. lbs.).

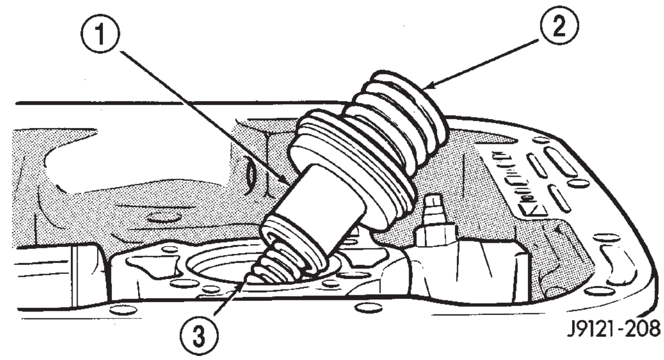


Fig. 194 Accumulator Piston And Springs

1 – ACCUMULATOR PISTON
2 – OUTER SPRING
3 – INNER SPRING

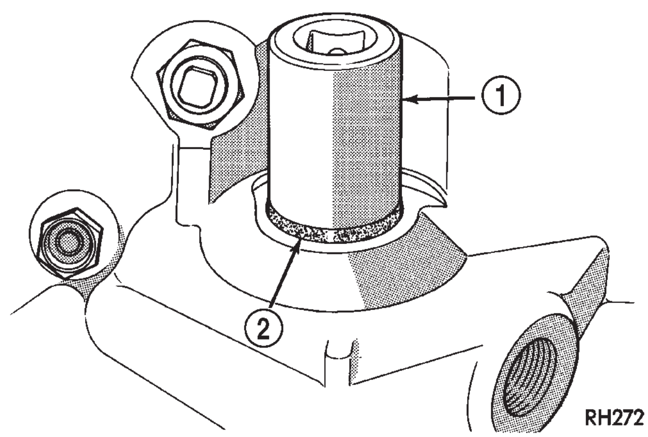


Fig. 195 Manual Lever Shaft Seal

1 – 15/16'' SOCKET
2 – SEAL

CAUTION: If the condition of the transmission before the overhaul procedure caused excessive metallic or fiber contamination in the fluid, replace the torque converter and reverse flush the cooler(s) and cooler lines. Fluid contamination and transmission failure can result if not done.

(7) Install torque converter. Use C-clamp or metal strap to hold converter in place for installation.

DISASSEMBLY AND ASSEMBLY (Continued)

BAND ADJUSTMENT AND FINAL

(1) Adjust front and rear bands as follows:

(a) Loosen locknut on each band adjusting screw 4-5 turns.

(b) Tighten both adjusting screws to 8 N·m (72 in. lbs.).

(c) Back off front band adjusting screw 2-7/8 turns.

(d) Back off rear band adjusting screw 2 turns.

(e) Hold each adjusting screw in position and tighten locknut to 34 N·m (25 ft. lbs.) torque.

(2) Install magnet in oil pan. Magnet seats on small protrusion at corner of pan.

(3) Position new oil pan gasket on case and install oil pan. Tighten pan bolts to 17 N·m (13 ft. lbs.).

(4) Install throttle valve and shift selector levers on valve body manual lever shaft.

(5) Apply small quantity of dielectric grease to terminal pins of solenoid case connector and neutral switch.

(6) Fill transmission with recommended fluid. Refer to Service Procedures section of this group.

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER

NOTE: TO SERVICE THE OVERRUNNING CLUTCH CAM AND THE OVERDRIVE PISTON RETAINER, THE TRANSMISSION GEARTRAIN AND OVERDRIVE UNIT MUST BE REMOVED FROM THE TRANSMISSION.

DISASSEMBLY

(1) Remove the overdrive piston (Fig. 196).

(2) Remove the overdrive piston retainer bolts.

(3) Remove overdrive piston retainer.

(4) Remove case gasket.

(5) Tap old cam out of case with pin punch. Insert punch through bolt holes at rear of case (Fig. 197). Alternate position of punch to avoid cocking cam during removal.

(6) Clean clutch cam bore and case. Be sure to remove all chips/shavings generated during cam removal.

ASSEMBLY

(1) Temporarily install overdrive piston retainer in case. Use 3-4 bolts to secure retainer.

(2) Align and start new clutch cam and spring retainer in case. Be sure serrations on cam and in case are aligned (Fig. 198). Then tap cam into case just enough to hold it in place.

(3) **Verify that cam is correctly positioned before proceeding any further. Narrow ends of cam ramps should be to left when cam is viewed from front end of case** (Fig. 198).

(4) Insert Adapter Tool SP-5124 into piston retainer (Fig. 199).

(5) Assemble Puller Bolt SP-3701 and Press Plate SP-3583-A (Fig. 200).

(6) Install assembled puller plate and bolt (Fig. 201). Insert bolt through cam, case and adapter tool. Be sure plate is seated squarely on cam.

(7) Hold puller plate and bolt in place and install puller nut SP-3701 on puller bolt (Fig. 202).

(8) Tighten puller nut to press clutch cam into case (Fig. 202). **Be sure cam is pressed into case evenly and does not become cocked.**

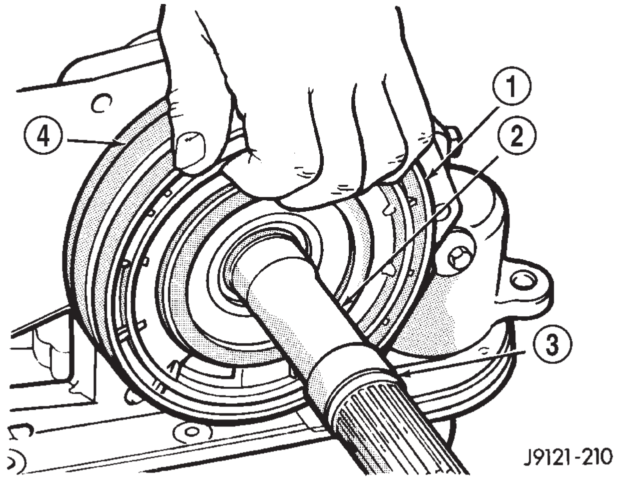


Fig. 196 Overdrive Piston Removal

1 – OVERDRIVE CLUTCH PISTON
2 – INTERMEDIATE SHAFT
3 – SELECTIVE SPACER
4 – PISTON RETAINER

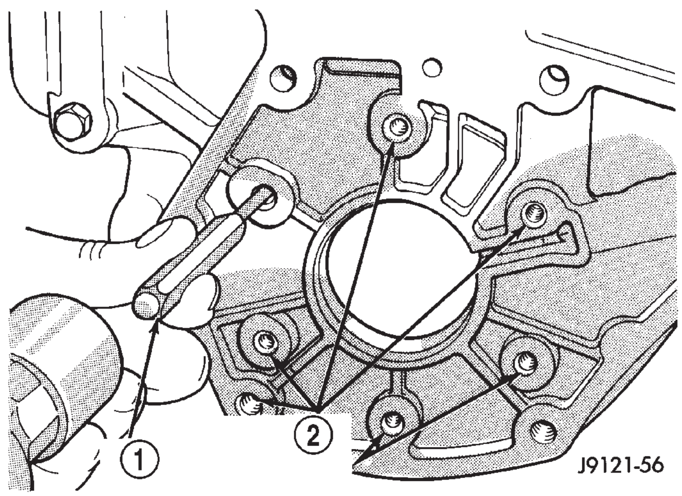


Fig. 197 Overrunning Clutch Cam

1 – PIN PUNCH
2 – REAR SUPPORT BOLT HOLES

DISASSEMBLY AND ASSEMBLY (Continued)

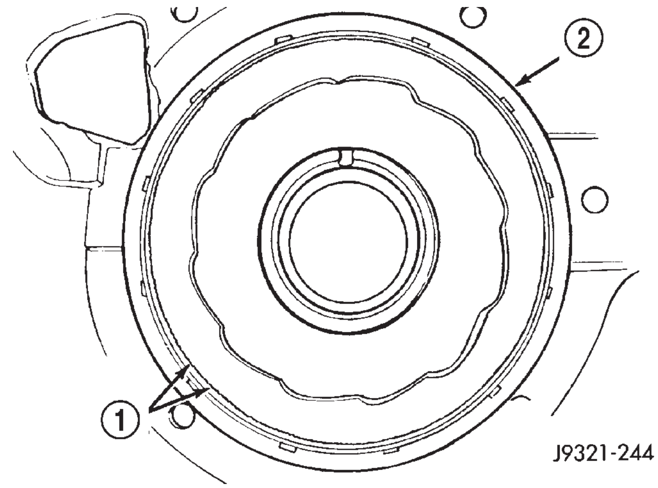


Fig. 198 Positioning Replacement Clutch Cam In Case

1 – ALIGN SERRATIONS ON CAM AND IN CASE
2 – CLUTCH CAM

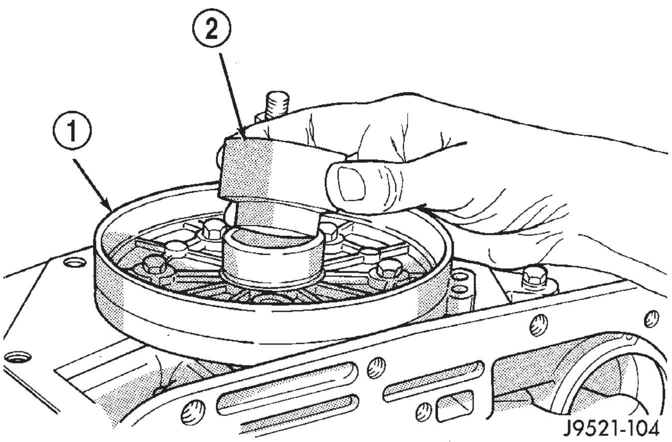


Fig. 199 Positioning Adapter Tool In Overdrive Piston Retainer

1 – PISTON RETAINER
2 – SPECIAL TOOL SP5124

(9) Remove clutch cam installer tools.

(10) **Stake case in 12 places around clutch cam to help secure cam in case. Use blunt punch or chisel to stake case.**

(11) Remove piston retainer from case. Cover retainer with plastic sheeting, or paper to keep it dust free.

(12) Clean case and cam thoroughly. Be sure any chips/shavings generated during cam installation are removed from case.

(13) Install new gasket at rear of transmission case. Use petroleum jelly to hold gasket in place. Be sure to align governor feed holes in gasket with feed passages in case (Fig. 203). Also install gasket before

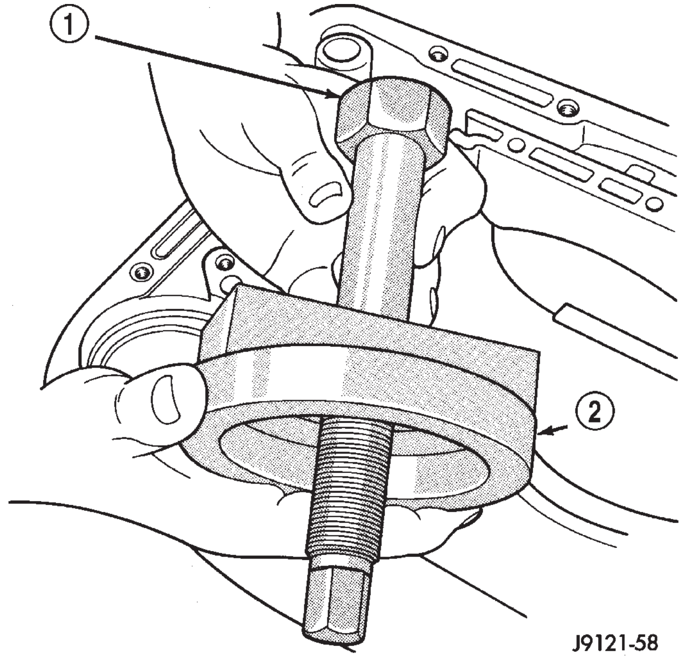


Fig. 200 Assembling Clutch Cam Puller Bolt And Press Plate

1 – PULLER BOLT SP-3701
2 – PRESS PLATE SP-3583–A

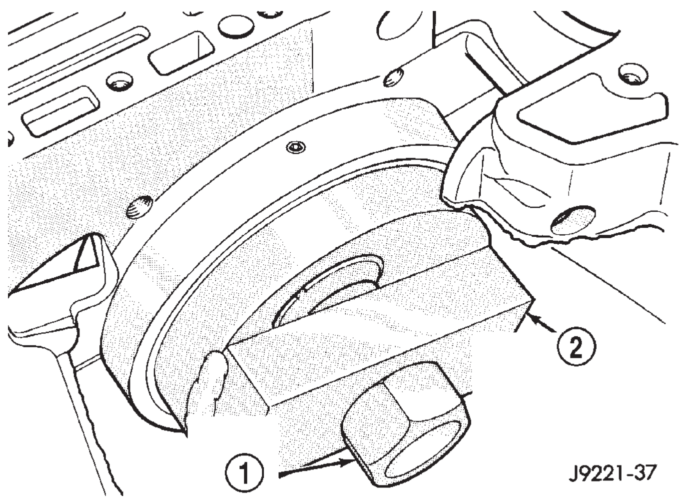


Fig. 201 Positioning Puller Plate On Clutch Cam

1 – SPECIAL TOOL SP-3701
2 – BE SURE PLATE SP-3583–A IS SEATED SQUARELY ON CAM

overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer.

(14) Position overdrive piston retainer on transmission case and align bolt holes in retainer, gasket and case (Fig. 204). Then install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

(15) Install new seals on overdrive piston.

(16) Stand transmission case upright on bellhousing.

DISASSEMBLY AND ASSEMBLY (Continued)

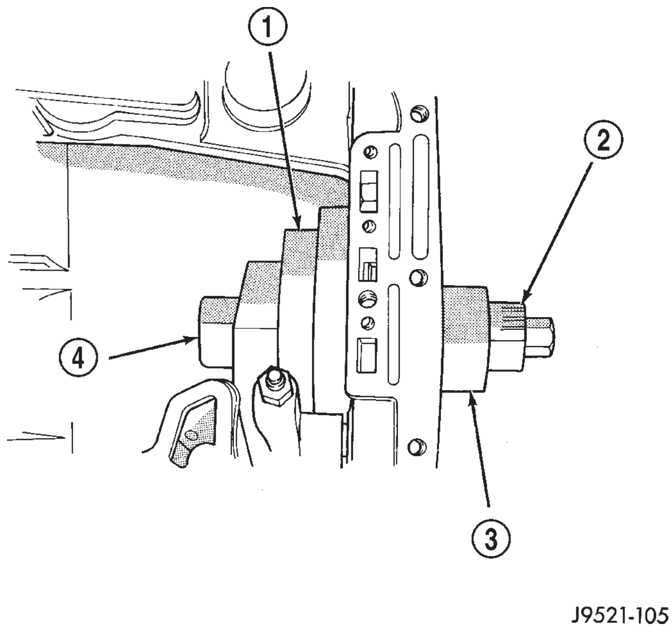


Fig. 202 Pressing Overrunning Clutch Cam Into Case

1 – SPECIAL TOOL SP3583–A
2 – TIGHTEN NUT TO DRAW CAM INTO CASE (NUT IS PART OF BOLT SP3701)
3 – SPECIAL TOOL SP5124
4 – SPECIAL TOOL SP3701

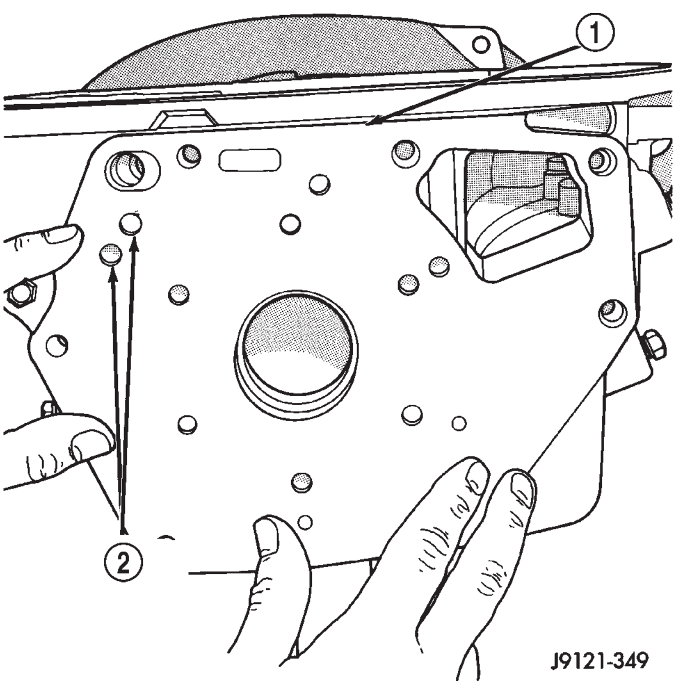


Fig. 203 Installing/Aligning Case Gasket

1 – CASE GASKET
2 – BE SURE GOVERNOR TUBE FEED HOLES IN CASE AND GASKET ARE ALIGNED

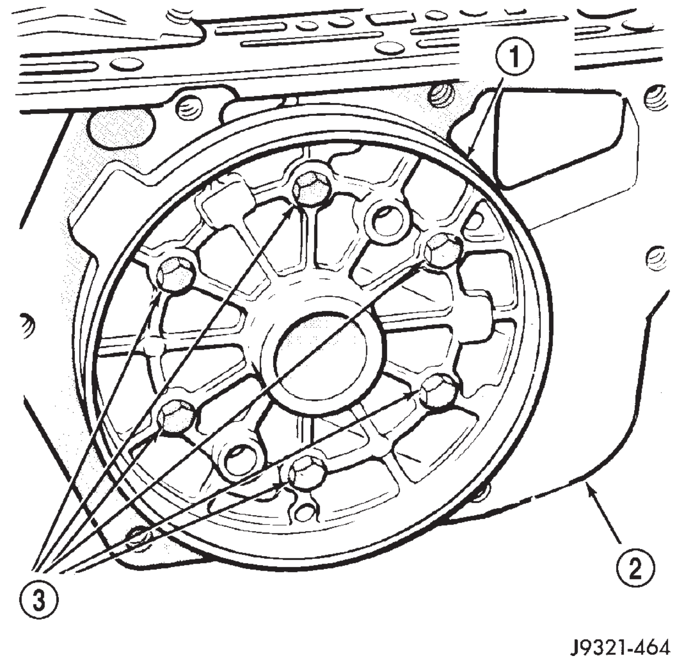


Fig. 204 Aligning Overdrive Piston Retainer

1 – PISTON RETAINER
2 – GASKET
3 – RETAINER BOLTS

(17) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(18) Position Seal Guide 8114-3 on inner edge of overdrive piston retainer.

(19) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114–3 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

FRONT SERVO PISTON

DISASSEMBLY

(1) Remove seal ring from rod guide (Fig. 205).

(2) Remove small snap ring from servo piston rod. Then remove piston rod, spring and washer from piston.

(3) Remove and discard servo component O-ring and seal rings.

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

Clean and inspect front servo components.

(1) Lubricate new O-ring and seal rings with petroleum jelly and install them on piston, guide and rod.

(2) Install rod in piston. Install spring and washer on rod. Compress spring and install snap ring (Fig. 205).

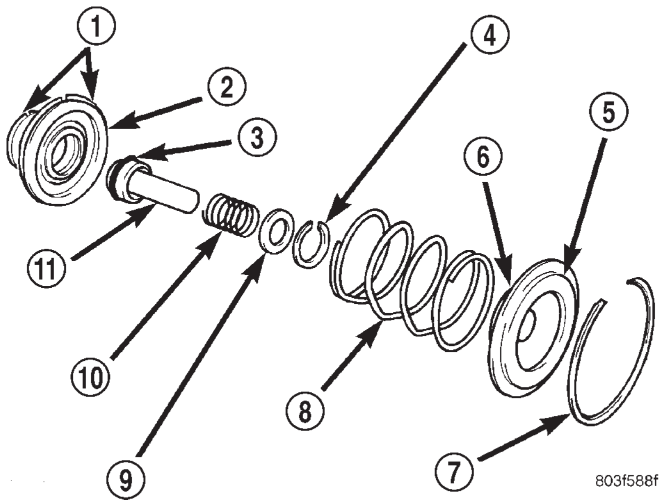


Fig. 205 Front Servo

1 – PISTON RINGS
2 – SERVO PISTON
3 – O-RING
4 – SNAP RING
5 – PISTON ROD GUIDE
6 – SEAL RING
7 – SNAP RING
8 – SERVO SPRING
9 – WASHER
10 – SPRING
11 – PISTON ROD

REAR SERVO PISTON

DISASSEMBLY

(1) Remove small snap ring and remove plug and spring from servo piston (Fig. 206).

(2) Remove and discard servo piston seal ring.

ASSEMBLY

(1) Lubricate piston and guide seals with petroleum jelly. Lubricate other servo parts with Mopar® ATF Plus 3, Type 7176, transmission fluid.

(2) Install new seal ring on servo piston.

(3) Assemble piston, plug, spring and new snap ring.

(4) Lubricate piston seal lip with petroleum jelly.

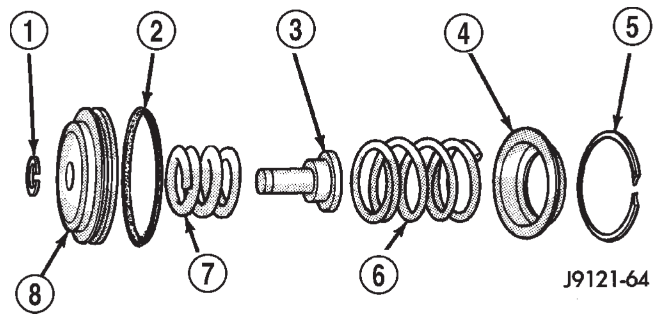


Fig. 206 Rear Servo Components

1 – SNAP RING
2 – PISTON SEAL
3 – PISTON PLUG
4 – SPRING RETAINER
5 – SNAP RING
6 – PISTON SPRING
7 – CUSHION SPRING
8 – PISTON

OIL PUMP AND REACTION SHAFT SUPPORT

DISASSEMBLY

(1) Mark position of support in oil pump body for assembly alignment reference. Use scriber or paint to make alignment marks.

(2) Place pump body on two wood blocks.

(3) Remove reaction shaft support bolts and separate support from pump body (Fig. 207).

(4) Remove pump inner and outer gears (Fig. 208).

(5) Remove O-ring seal from pump body (Fig. 209). Discard seal after removal.

(6) Remove oil pump seal with Remover Tool C-3981. Discard seal after removal.

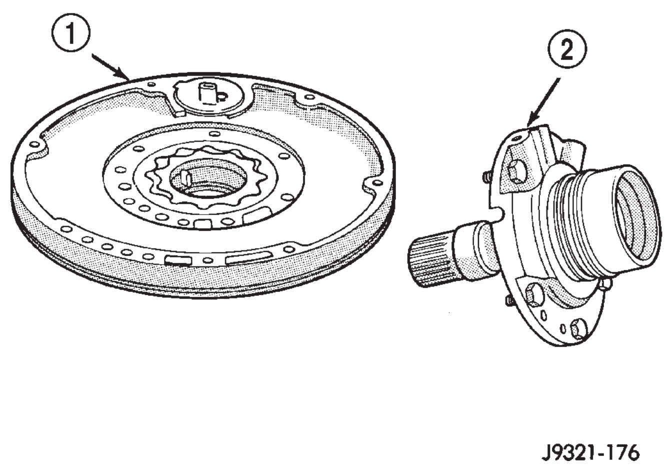


Fig. 207 Reaction Shaft Support

1 – OIL PUMP
2 – REACTION SHAFT SUPPORT

DISASSEMBLY AND ASSEMBLY (Continued)

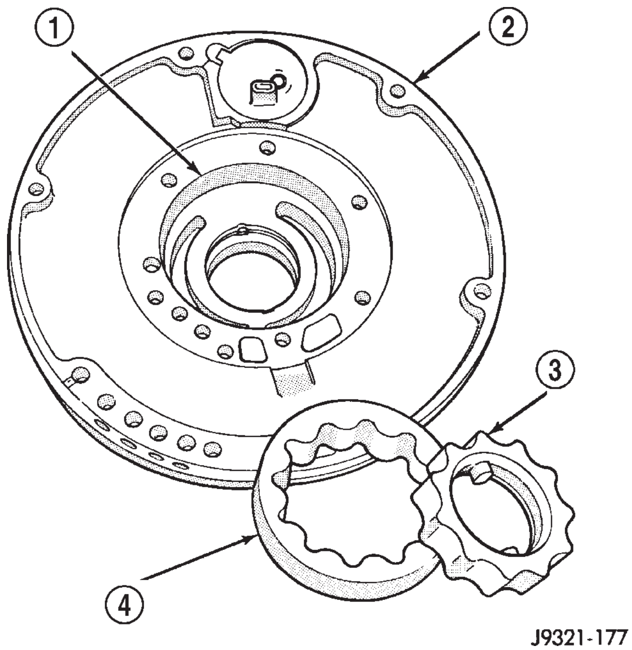


Fig. 208 Pump Gear

1 – GEAR BORE
2 – PUMP BODY
3 – INNER GEAR
4 – OUTER GEAR

OIL PUMP BUSHING REMOVAL

(1) Position pump housing on clean, smooth surface with gear cavity facing down.

(2) Remove bushing with Tool Handle C-4171 and Bushing Remover SP-3550 (Fig. 210).

REACTION SHAFT SUPPORT BUSHING REMOVAL

(1) Assemble Cup Tool SP-3633, Nut SP-1191 and Bushing Remover SP-5301 (Fig. 212).

(2) Hold cup tool firmly against reaction shaft. Thread remover tool into bushing as far as possible by hand.

(3) Using wrench, thread remover tool an additional 3-4 turns into bushing to firmly engage tool.

(4) Tighten tool hex nut against cup tool to pull bushing from shaft. Clean all chips from shaft and support after bushing removal.

ASSEMBLY

OIL PUMP BUSHING INSTALLATION

(1) Assemble Tool Handle C-4171 and Bushing Installer SP-5118.

(2) Place bushing on installer tool and start bushing into shaft.

(3) Tap bushing into place until Installer Tool SP-5118 bottoms in pump cavity. Keep tool and bushing square with bore. Do not allow bushing to become cocked during installation.

DISASSEMBLY AND ASSEMBLY (Continued)

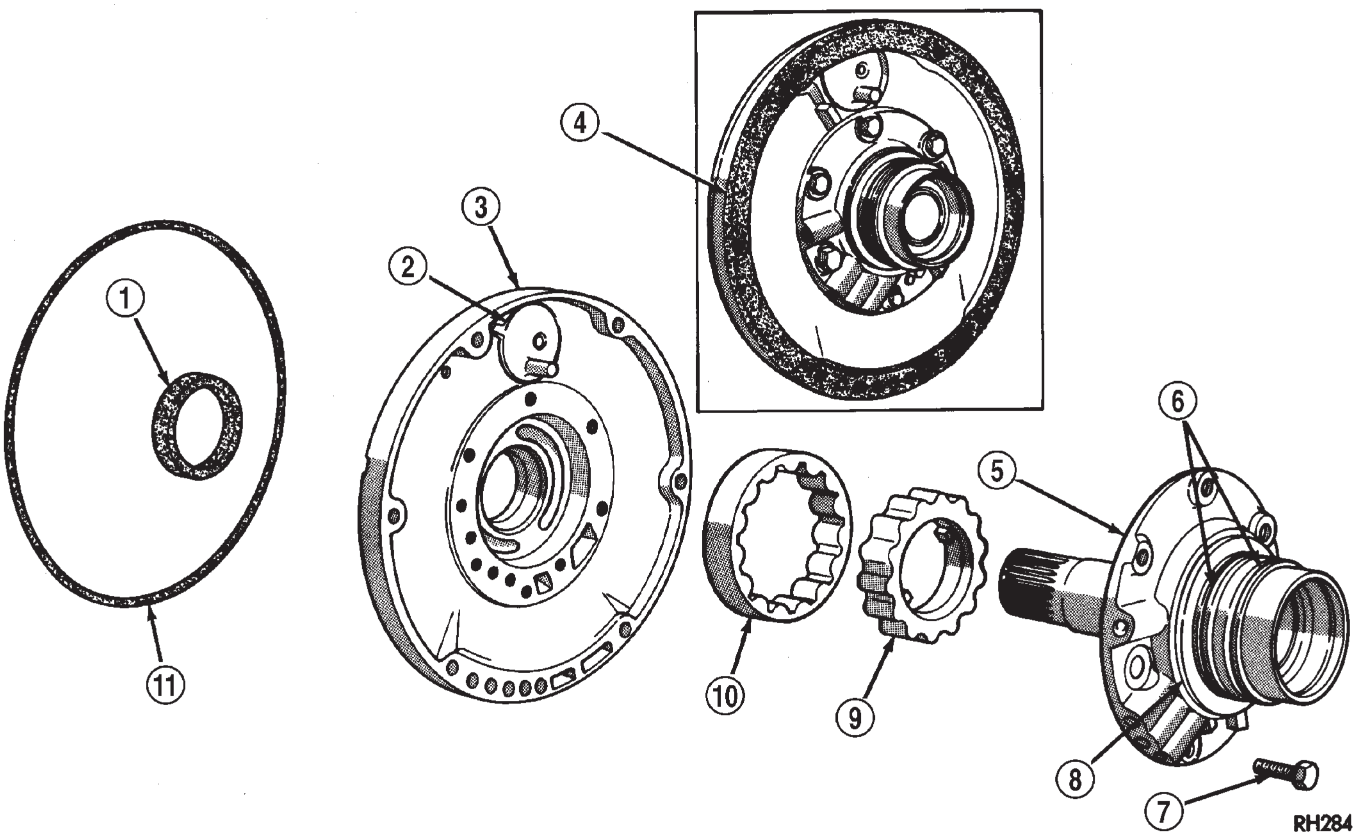


Fig. 209 Oil Pump And Reaction Shaft Components

1 – OIL SEAL
2 – VENT BAFFLE
3 – OIL PUMP BODY
4 – GASKET
5 – REACTION SHAFT SUPPORT
6 – SEAL RINGS
7 – BOLTS (6)
8 – #1 THRUST WASHER (SELECTIVE)
9 – INNER GEAR
10 – OUTER GEAR
11 – “O” RING

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Stake pump bushing in two places with blunt punch. Remove burrs from stake points with knife blade (Fig. 211).

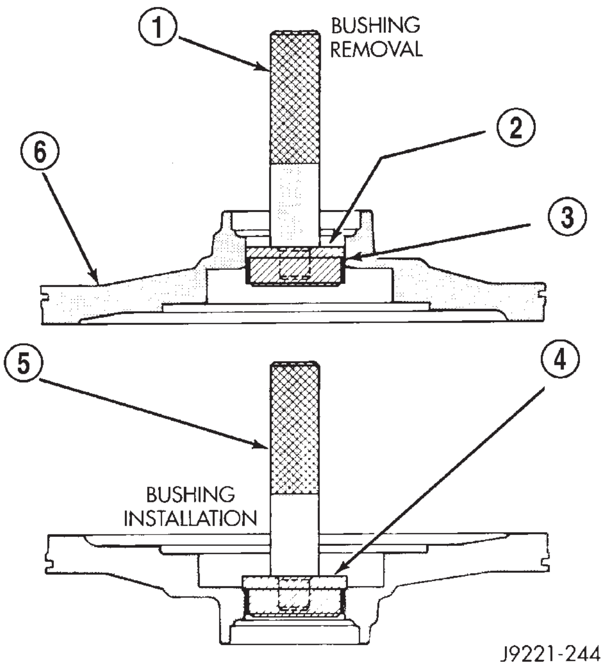


Fig. 210 Oil Pump Bushing

1 – BUSHING REMOVAL
2 – SPECIAL TOOL SP-3550
3 – BUSHING
4 – SPECIAL TOOL SP-5118
5 – SPECIAL TOOL C-4171
6 – PUMP HOUSING

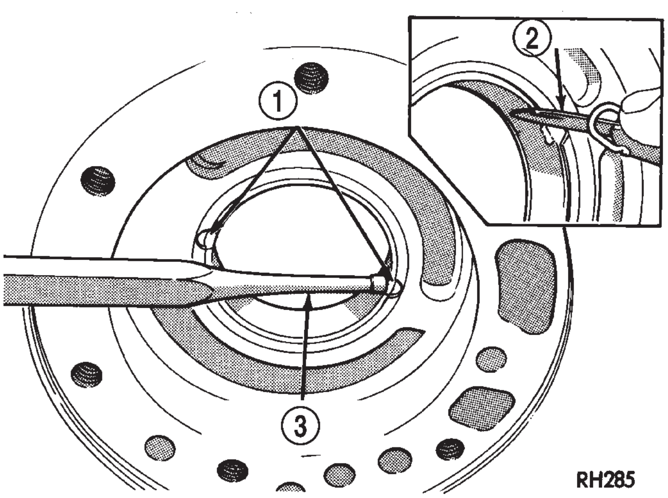


Fig. 211 Staking-Deburring Oil Pump Bushing

1 – TWO STAKES
2 – NARROW BLADE
3 – BLUNT PUNCH

REACTION SHAFT SUPPORT BUSHING INSTALLATION

(1) Place reaction shaft support upright on a clean, smooth surface.

(2) Assemble Bushing Installer Tools C-4171 and SP-5302. Then slide new bushing onto installer tool (Fig. 212).

(3) Start bushing in shaft. Tap bushing into shaft until installer tool bottoms against support flange.

(4) Clean reaction shaft support thoroughly after bushing replacement (to remove any chips).

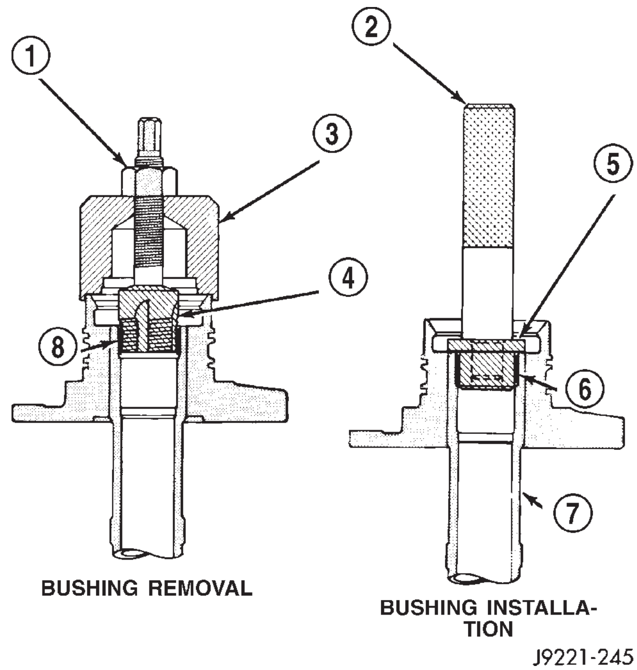


Fig. 212 Reaction Shaft Bushing

1 – SPECIAL TOOL SP-1191
2 – SPECIAL TOOL C-4171
3 – SPECIAL TOOL SP-3633
4 – SPECIAL TOOL SP-5301
5 – SPECIAL TOOL SP-5302
6 – BUSHING
7 – REACTION SHAFT
8 – BUSHING

(1) Lubricate pump gears with transmission fluid and install them in pump body.

(2) Install thrust washer on reaction shaft support hub. Lubricate washer with petroleum jelly or transmission fluid before installation.

(3) If reaction shaft seal rings are being replaced, install new seal rings on support hub. Lubricate seal rings with transmission fluid or petroleum jelly after installation. Squeeze each ring until ring ends are securely hooked together.

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: The reaction shaft support seal rings will break if overspread, or twisted. If new rings are being installed, spread them only enough for installation. Also be very sure the ring ends are securely hooked together after installation. Otherwise, the rings will either prevent pump installation, or break during installation.

(4) Align and install reaction shaft support on pump body.

(5) Install bolts attaching reaction shaft support to pump. Tighten bolts to 20 N·m (175 in. lbs.) torque.

(6) Install new pump seal with Installer Tool C-3860-A (Fig. 213). Use hammer or mallet to tap seal into place.

(7) Install new O-ring on pump body. Lubricate oil seal and O-ring with petroleum jelly.

(8) Cover pump assembly to prevent dust entry and set aside for assembly installation.

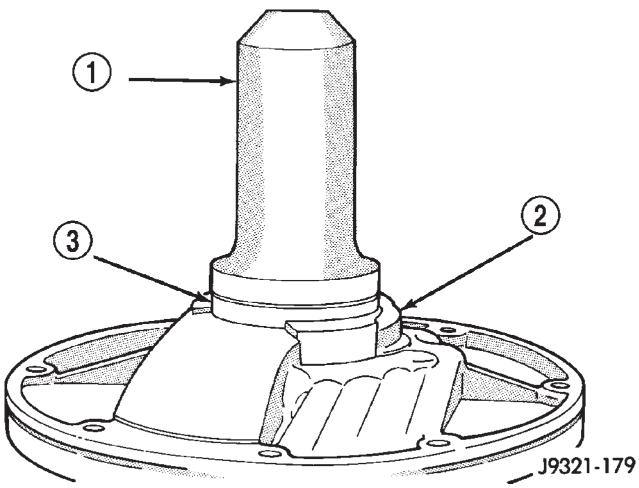


Fig. 213 Oil Pump Seal

1 – SPECIAL TOOL C-3860–A
2 – PUMP BODY
3 – PUMP SEAL

FRONT CLUTCH

DISASSEMBLY

(1) Remove waved snap ring and remove reaction plate, clutch plates and clutch discs.

(2) Compress clutch piston retainer and piston springs with Compressor Tool C-3863-A (Fig. 214).

(3) Remove retainer snap ring and remove compressor tool.

(4) Remove clutch piston springs (Fig. 215). **Note position of piston springs for assembly reference.**

(5) Remove clutch piston from retainer with a twisting motion.

(6) Remove and discard clutch piston inner and outer seals.

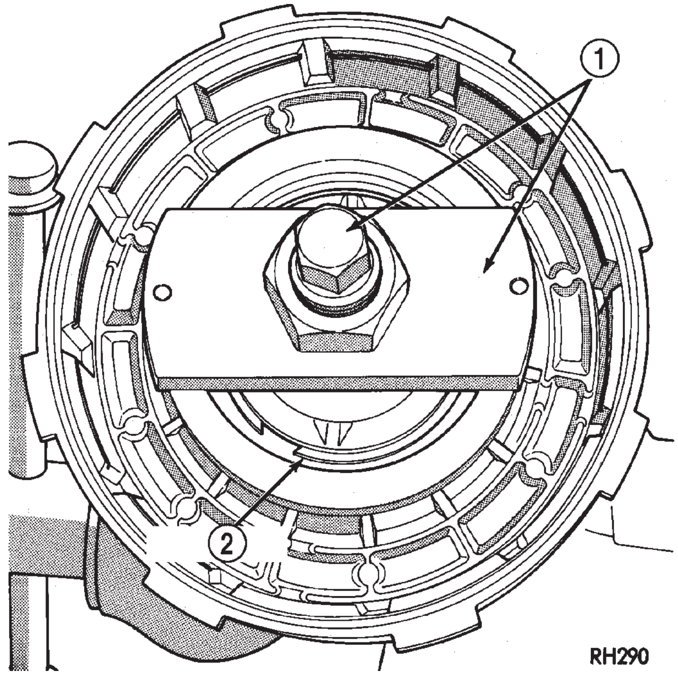


Fig. 214 Removing Front Clutch Spring Retainer Snap Ring

1 – SPECIAL TOOL C-3863–A
2 – SNAP RING

(7) Assemble Tool Handle C-4171 and Bushing Remover SP-3629 (Fig. 216).

(8) Insert remover tool in bushing and drive bushing straight out of clutch retainer.

ASSEMBLY

(1) Mount Bushing Installer SP-5511 on tool handle (Fig. 216).

(2) Slide new bushing onto installer tool and start bushing into retainer.

(3) Tap new bushing into place until installer tool bottoms against clutch retainer.

(4) Remove installer tools and clean retainer thoroughly.

(5) Soak clutch discs in transmission fluid.

(6) Install new inner and outer seals on clutch piston. Be sure seal lips face interior of retainer.

(7) Lubricate new inner and outer piston seals with Ru-Glyde, or Mopar® Door Ease.

(8) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.015 - 0.020 in. thick), can be used to guide seals into place if necessary.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

DISASSEMBLY AND ASSEMBLY (Continued)

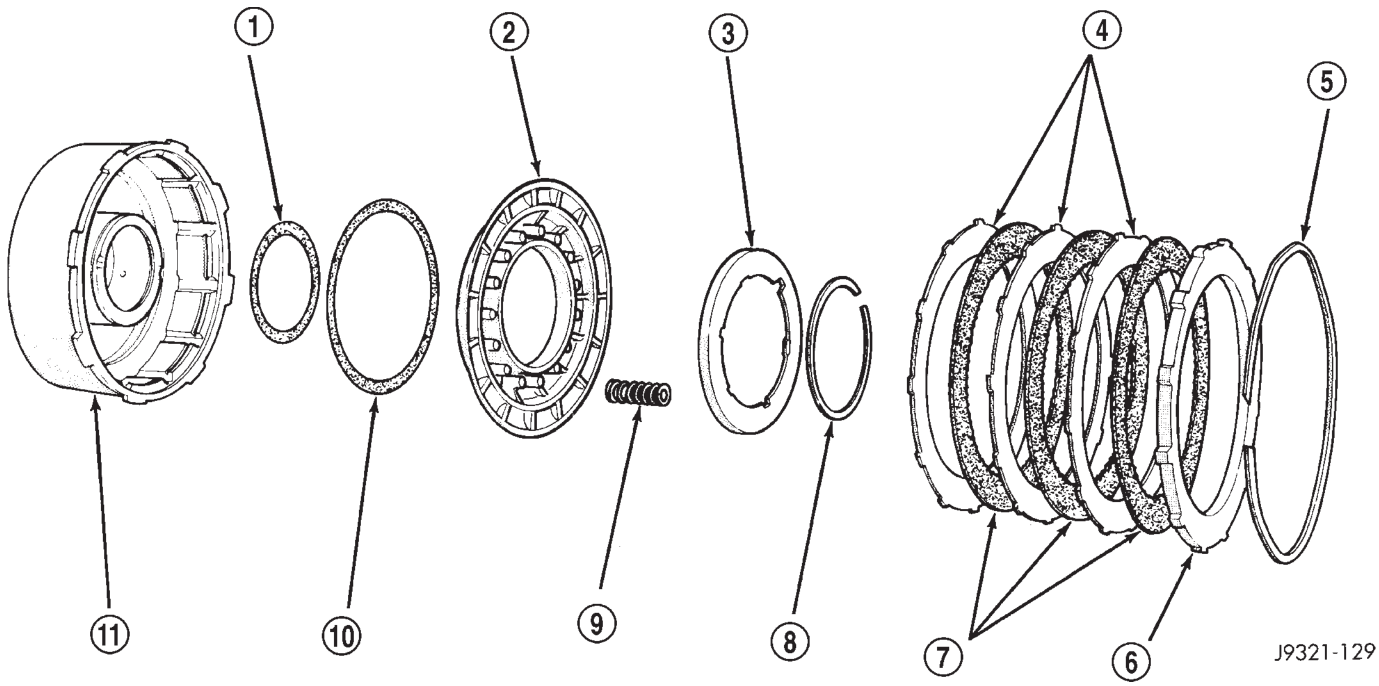


Fig. 215 Front Clutch Components

1 – INNER PISTON SEAL
2 – CLUTCH PISTON
3 – CLUTCH PISTON SPRING RETAINER
4 – CLUTCH PLATES
5 – CLUTCH PACK SNAP RING (WAVED)
6 – REACTION PLATE
7 – CLUTCH DISCS
8 – RETAINER SNAP RING
9 – CLUTCH PISTON SPRINGS (9)
10 – OUTER PISTON SEAL
11 – FRONT CLUTCH RETAINER

DISASSEMBLY AND ASSEMBLY (Continued)

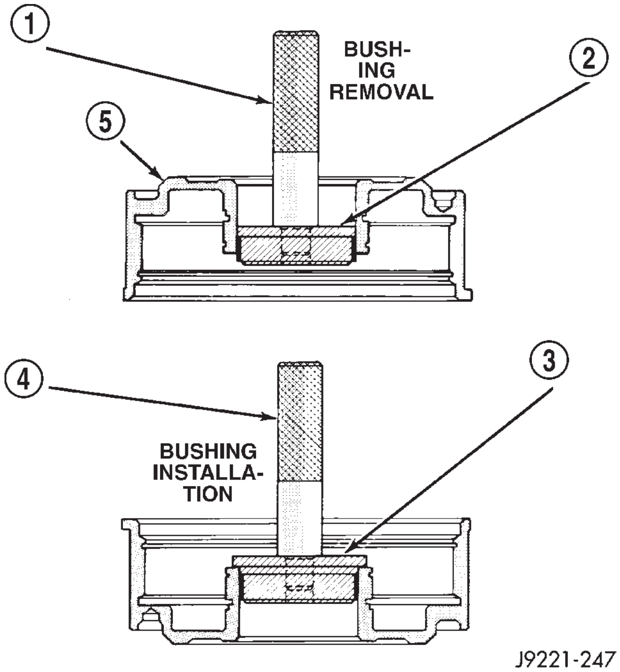


Fig. 216 Front Clutch Retainer Bushing Replacement Tools

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL SP-3629
3 – SPECIAL TOOL SP-5511
4 – SPECIAL TOOL C-4171
5 – FRONT CLUTCH RETAINER

(9) Install and position nine clutch piston springs (Fig. 217).

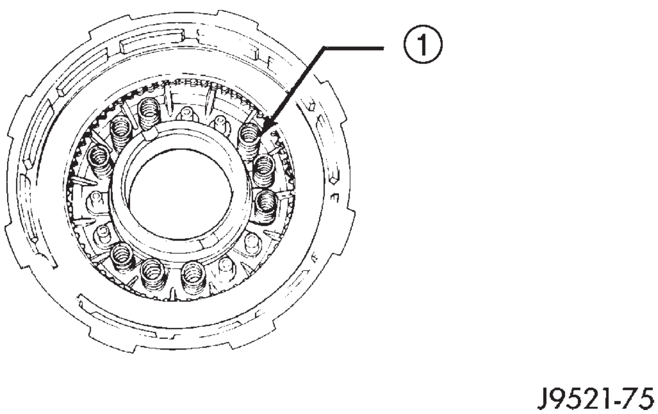


Fig. 217 Front Clutch Spring Position

1 – 9 SPRING CLUTCH

(10) Install spring retainer on top of piston springs.

(11) Compress spring retainer and piston springs with Tool C-3863-A.

(12) Install spring retainer snap ring and remove compressor tool.

(13) Install clutch plates and discs (Fig. 215). Three clutch discs, three steel plates and one reaction plate are required.

(14) Install reaction plate followed by waved snap ring.

(15) Check clutch pack clearance with feeler gauge (Fig. 218). Clearance between waved spring and pressure plate should 1.78 - 3.28 mm (0.070 - 0.129 in.). If clearance is incorrect, clutch plates, clutch discs, snap ring, or pressure plate may have to be changed.

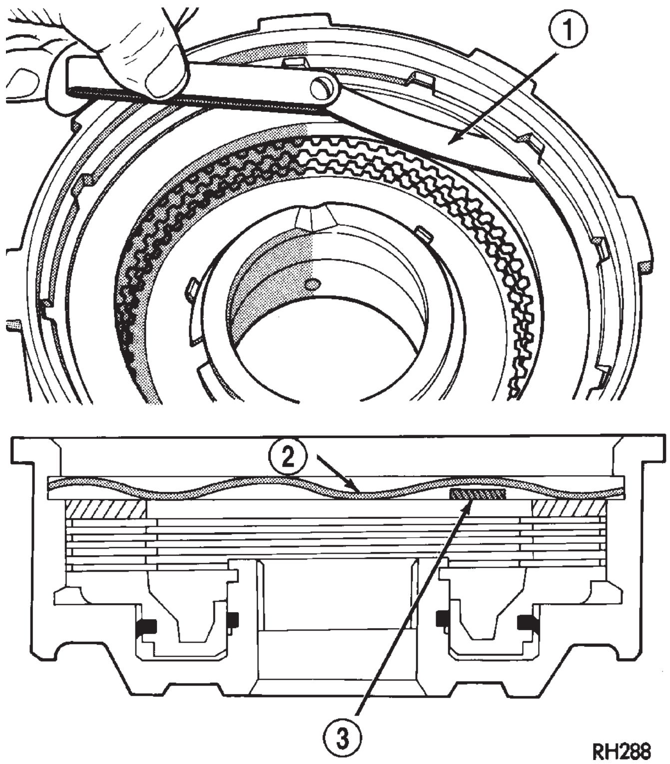


Fig. 218 Typical Method Of Measuring Front Clutch Pack Clearance

1 – FEELER GAUGE
2 – WAVED SNAP RING
3 – FEELER GAUGE

REAR CLUTCH

DISASSEMBLY

(1) Remove fiber thrust washer from forward side of clutch retainer.

(2) Remove input shaft front/rear seal rings.

(3) Remove selective clutch pack snap ring (Fig. 219).

(4) Remove top pressure plate, clutch discs, steel plates, bottom pressure plate and wave snap ring and wave spring (Fig. 219).

(5) Remove clutch piston with rotating motion.

(6) Remove and discard piston seals.

DISASSEMBLY AND ASSEMBLY (Continued)

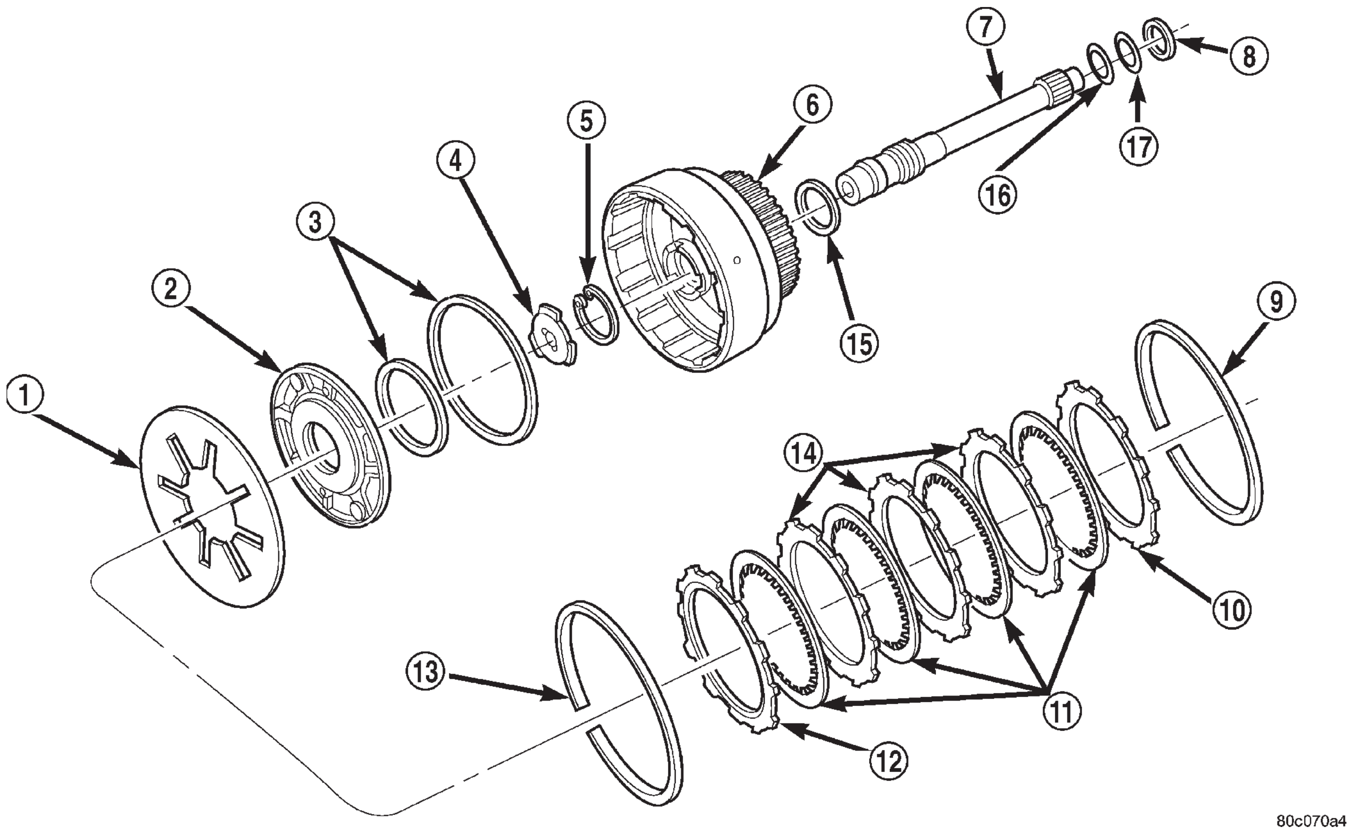


Fig. 219 Rear Clutch Components

1 – PISTON SPRING
2 – REAR CLUTCH PISTON
3 – CLUTCH PISTON SEALS
4 – OUTPUT SHAFT THRUST WASHER (METAL)
5 – INPUT SHAFT SNAP RING
6 – REAR CLUTCH RETAINER
7 – INPUT SHAFT
8 – REAR CLUTCH THRUST WASHER (FIBER)
9 – CLUTCH PACK SNAP RING (SELECTIVE)
10 – TOP PRESSURE PLATE
11 – CLUTCH DISCS (4)
12 – BOTTOM PRESSURE PLATE
13 – WAVE SPRING
14 – CLUTCH PLATES (3)
15 – RETAINER SEAL RING
16 – SHAFT REAR SEAL RING (PLASTIC)
17 – SHAFT FRONT SEAL RING (TEFLON)

(7) Remove input shaft snap-ring (Fig. 220). It may be necessary to press the input shaft in slightly to relieve tension on the snap-ring

(8) Press input shaft out of retainer with shop press and suitable size press tool. Use a suitably sized press tool to support the retainer as close to the input shaft as possible.

ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seal rings on clutch retainer hub and input shaft if necessary (Fig. 221).

(a) Be sure clutch hub seal ring is fully seated in groove and is not twisted.

(3) Lubricate splined end of input shaft and clutch retainer with transmission fluid. Then press input shaft into retainer (Fig. 223). Use a suitably sized press tool to support retainer as close to input shaft as possible.

(4) Install input shaft snap-ring (Fig. 220).

(5) Invert retainer and press input shaft in opposite direction until snap-ring is seated.

(6) Install new seals on clutch piston. Be sure lip of each seal faces interior of clutch retainer.

(7) Lubricate lip of piston seals with generous quantity of Mopar® Door Ease. Then lubricate retainer hub and bore with light coat of transmission fluid.

(8) Install clutch piston in retainer. Use twisting motion to seat piston in bottom of retainer. A thin strip of plastic (about 0.020” thick), can be used to guide seals into place if necessary.

DISASSEMBLY AND ASSEMBLY (Continued)

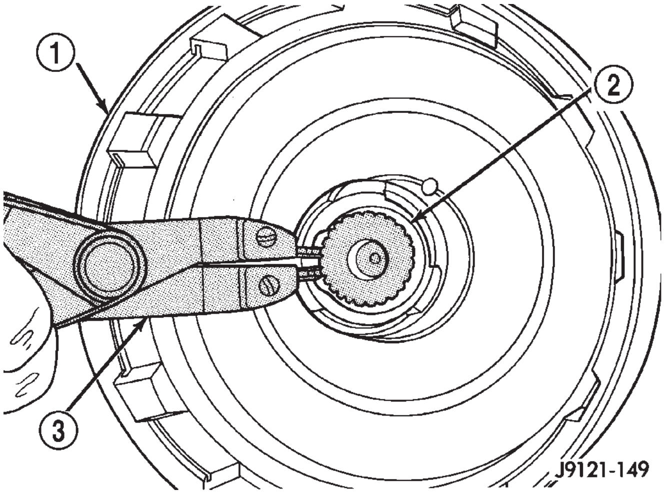


Fig. 220 Removing/Installing Input Shaft Snap-Ring

1 – REAR CLUTCH RETAINER
2 – INPUT SHAFT SNAP RING
3 – SNAP RING PLIERS

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip. In addition, never use any type of metal tool to help ease the piston seals into place. Metal tools will cut, shave, or score the seals.

(9) Install piston spring in retainer and on top of piston (Fig. 224). Concave side of spring faces downward (toward piston).

(10) Install wave spring in retainer (Fig. 224). Be sure spring is completely seated in retainer groove.

(11) Install bottom pressure plate (Fig. 219). Ridged side of plate faces downward (toward piston) and flat side toward clutch pack.

(12) Install first clutch disc in retainer on top of bottom pressure plate. Then install a clutch plate followed by a clutch disc until entire clutch pack is installed (4 discs and 3 plates are required) (Fig. 219).

(13) Install top pressure plate.

(14) Install selective snap ring. Be sure snap ring is fully seated in retainer groove.

(15) Using a suitable gauge bar and dial indicator, measure clutch pack clearance (Fig. 225).

(a) Position gauge bar across the clutch drum with the dial indicator pointer on the pressure plate (Fig. 225).

(b) Using two small screw drivers, lift the pressure plate and release it.

(c) Zero the dial indicator.

(d) Lift the pressure plate until it contacts the snap-ring and record the dial indicator reading.

Clearance should be 0.635 - 0.914 mm (0.025 - 0.036 in.). If clearance is incorrect, steel plates, discs, selective snap ring and pressure plates may have to be changed.

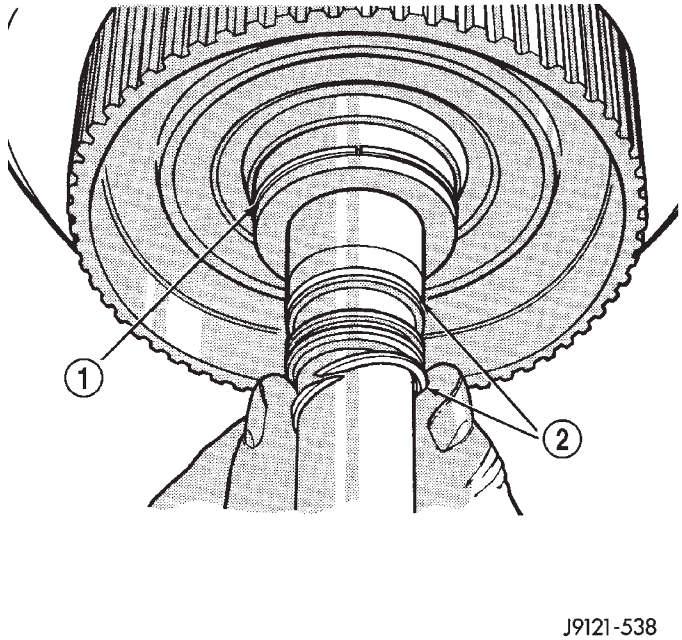


Fig. 221 Rear Clutch Retainer And Input Shaft Seal Ring Installation

1 – REAR CLUTCH RETAINER HUB SEAL RING
2 – INPUT SHAFT SEAL RINGS

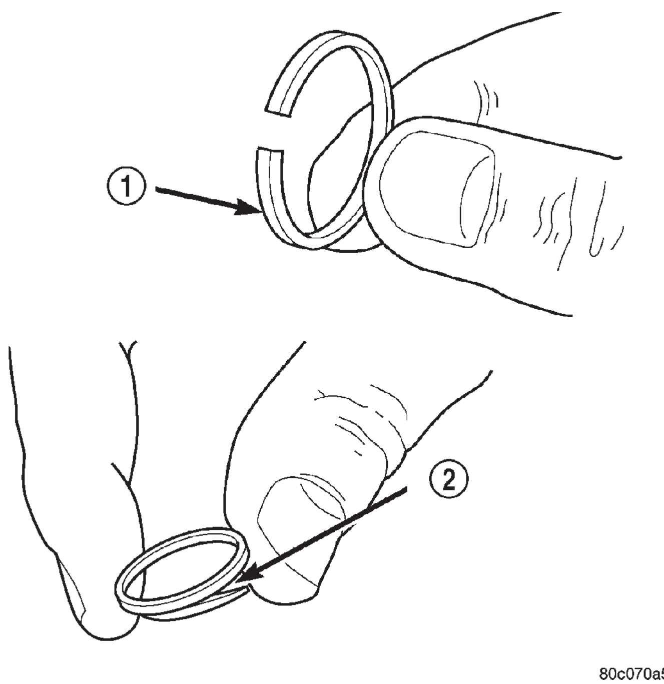


Fig. 222 Input Shaft Seal Ring Identification

1 – PLASTIC REAR SEAL RING
2 – TEFLON FRONT SEAL RING (SQUEEZE RING TOGETHER SLIGHTLY BEFORE INSTALLATION FOR BETTER FIT)

DISASSEMBLY AND ASSEMBLY (Continued)

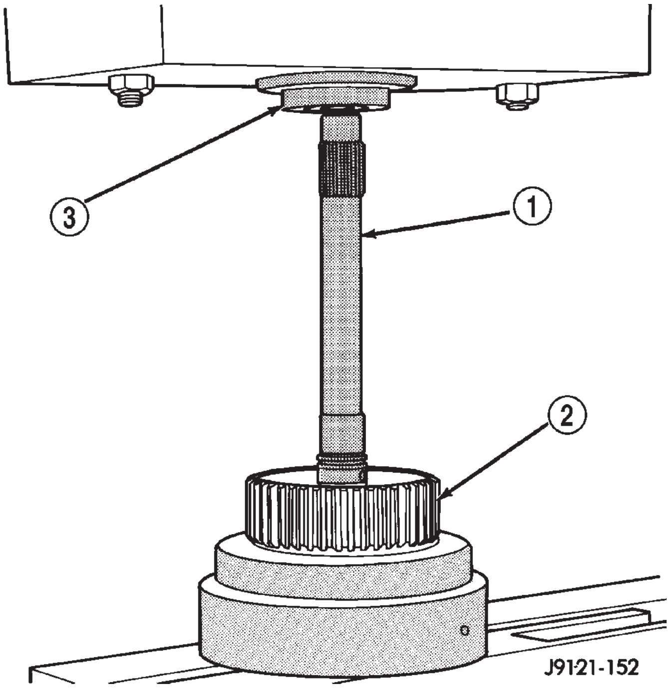


Fig. 223 Pressing Input Shaft Into Rear Clutch Retainer

1 – INPUT SHAFT
2 – REAR CLUTCH RETAINER
3 – PRESS RAM

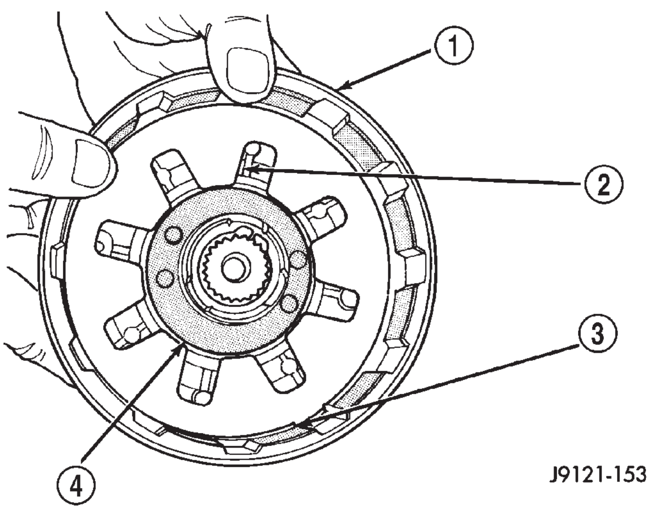


Fig. 224 Piston Spring/Wave Spring Position

1 – REAR CLUTCH RETAINER
2 – PISTON SPRING
3 – WAVE SPRING
4 – CLUTCH PISTON

The selective snap ring thicknesses are:

- .107–.109 in.
- .098–.100 in.
- .095–.097 in.
- .083–.085 in.
- .076–.078 in.
- .071–.073 in.
- .060–.062 in.

(16) Coat rear clutch thrust washer with petroleum jelly and install washer over input shaft and into clutch retainer (Fig. 226). Use enough petroleum jelly to hold washer in place.

(17) Set rear clutch aside for installation during final assembly.

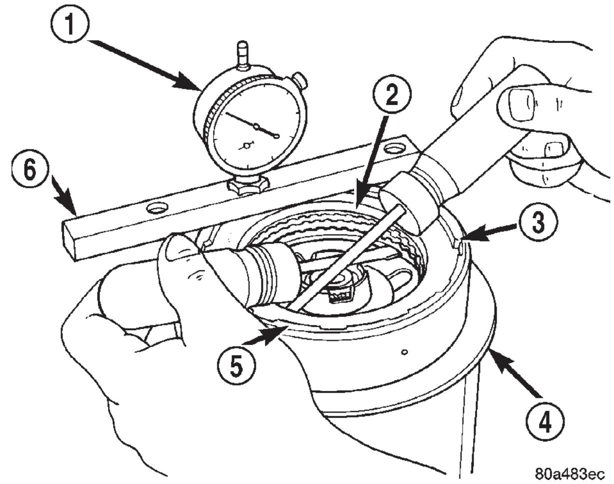


Fig. 225 Checking Rear Clutch Pack Clearance

1 – DIAL INDICATOR
2 – PRESSURE PLATE
3 – SNAP RING
4 – STAND
5 – REAR CLUTCH
6 – GAUGE BAR

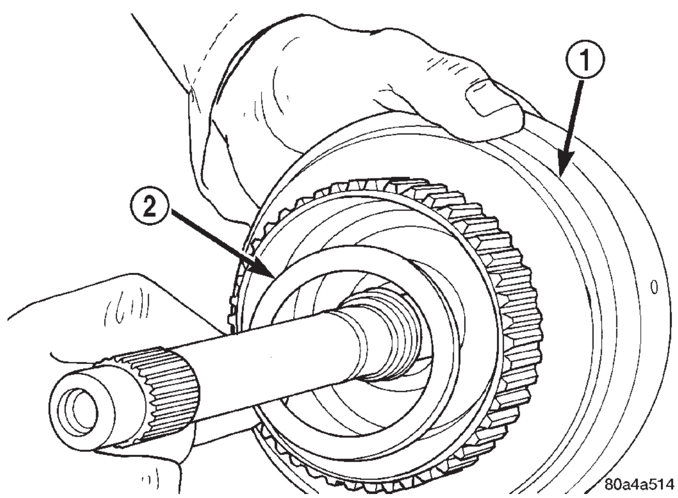


Fig. 226 Installing Rear Clutch Thrust Washer

1 – REAR CLUTCH RETAINER
2 – REAR CLUTCH THRUST WASHER

PLANETARY GEARTRAIN/OUTPUT SHAFT

DISASSEMBLY

(1) Remove planetary snap ring from intermediate shaft (Fig. 227). Discard snap ring as it is not reusable.

(2) Remove front planetary gear and front annulus gear as assembly (Fig. 228).

(3) Remove front planetary gear and thrust washer from front annulus gear (Fig. 229). Note thrust washer position for assembly reference.

(4) Remove tabbed thrust washer from driving shell (Fig. 230). Note washer position for assembly reference.

(5) Remove sun gear and driving shell as assembly (Fig. 231).

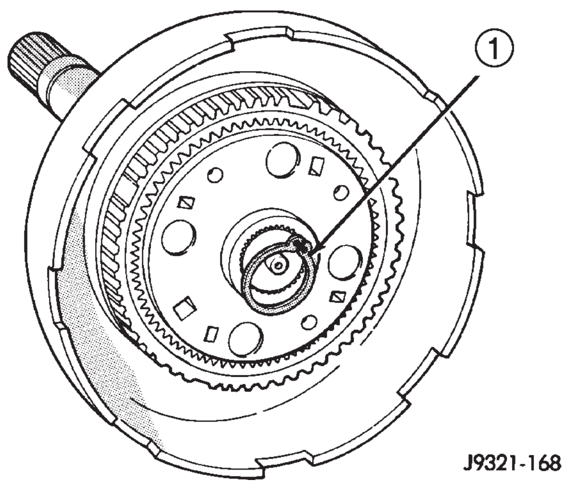


Fig. 227 Removing Planetary Snap Ring

1 – PLANETARY SNAP RING

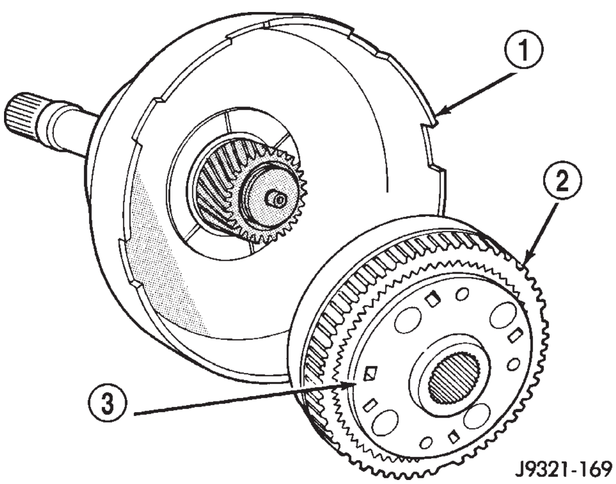


Fig. 228 Removing Front Planetary And Annulus Gears

1 – DRIVING SHELL
2 – FRONT ANNULUS GEAR
3 – FRONT PLANETARY GEAR

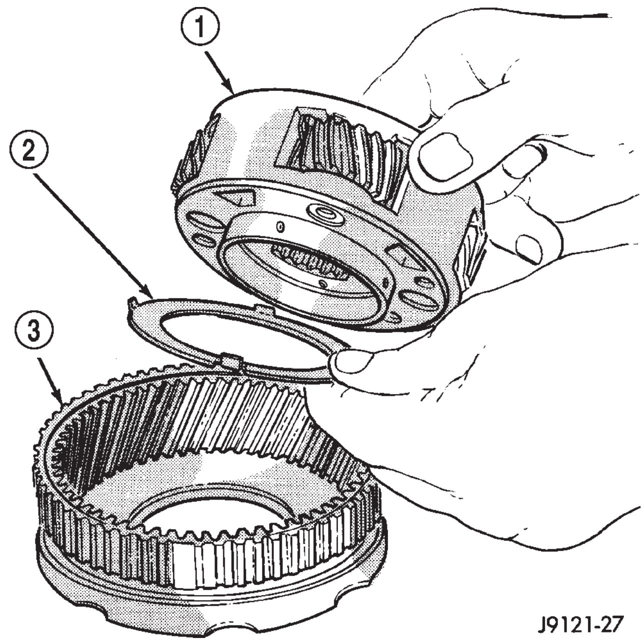


Fig. 229 Disassembling Front Planetary And Annulus Gears

1 – FRONT PLANETARY GEAR
2 – TABBED THRUST WASHER
3 – FRONT ANNULUS GEAR

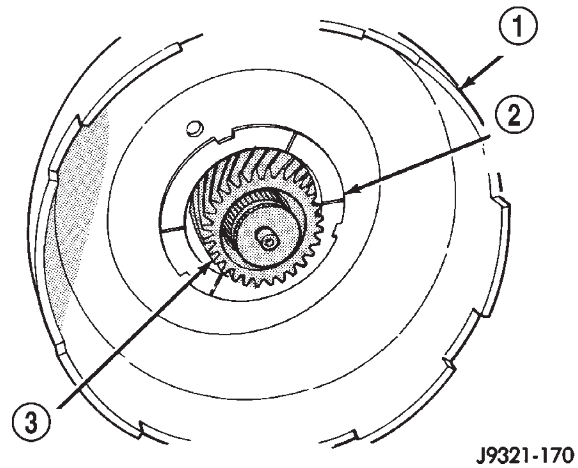


Fig. 230 Driving Shell Thrust Washer Removal

1 – DRIVING SHELL
2 – TABBED THRUST WASHER
3 – SUN GEAR

(6) Remove tabbed thrust washer from rear planetary gear (Fig. 232). Note washer position on gear for assembly reference.

(7) Remove rear planetary gear and rear annulus gear from intermediate shaft (Fig. 233).

(8) Remove thrust plate from rear annulus gear (Fig. 234).

DISASSEMBLY AND ASSEMBLY (Continued)

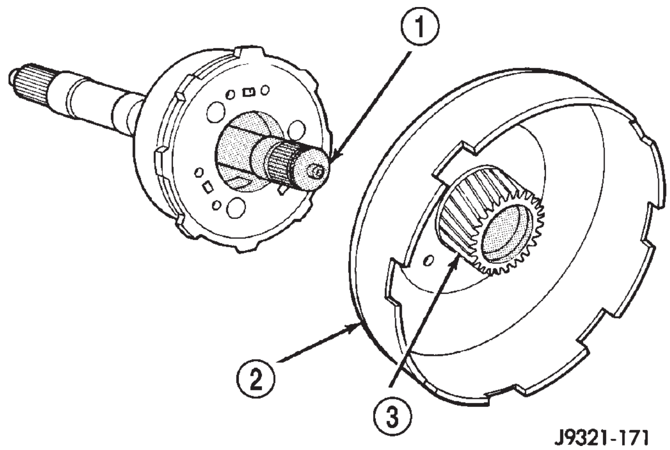


Fig. 231 Sun Gear And Driving Shell Removal

1 – INTERMEDIATE SHAFT
2 – DRIVING SHELL
3 – SUN GEAR

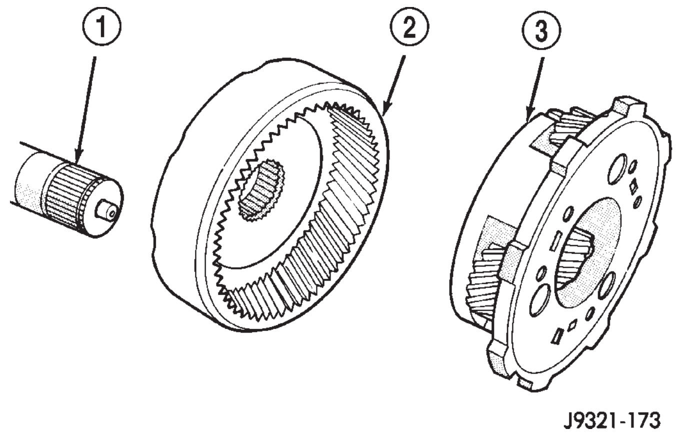


Fig. 233 Rear Planetary And Annulus Gear Removal

1 – INTERMEDIATE SHAFT
2 – REAR ANNULUS GEAR
3 – REAR PLANETARY GEAR

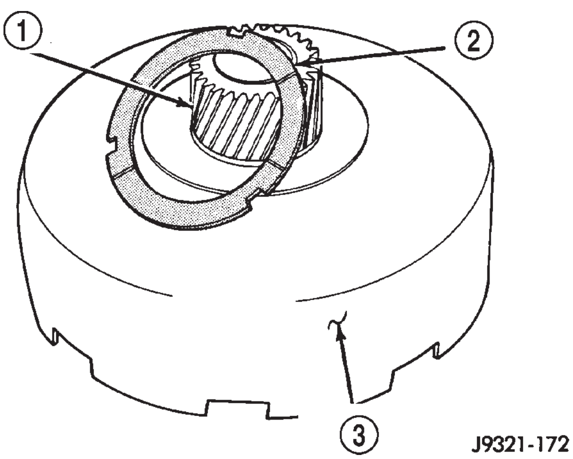


Fig. 232 Rear Planetary Thrust Washer Removal

1 – SUN GEAR
2 – REAR PLANETARY THRUST WASHER
3 – DRIVING SHELL

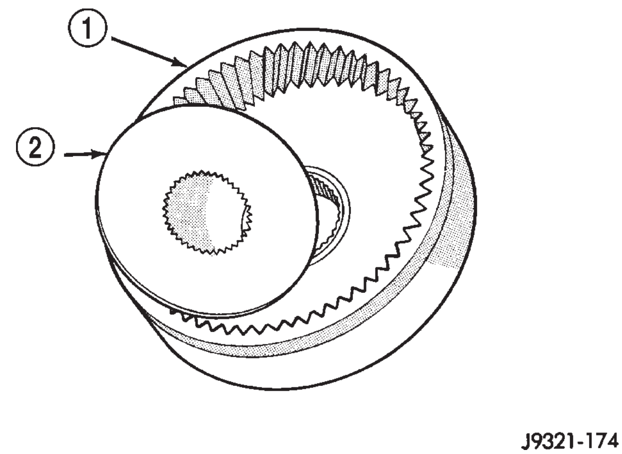


Fig. 234 Rear Annulus Thrust Plate Removal

1 – REAR ANNULUS GEAR
2 – THRUST PLATE

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

(1) Lubricate sun gear and planetary gears with transmission fluid during assembly. Use petroleum jelly to lubricate intermediate shaft bushing surfaces, thrust washers and thrust plates and to hold these parts in place during assembly.

(2) Install front snap ring on sun gear and install gear in driving shell. Then install thrust plate over sun gear and against rear side of driving shell (Fig. 235). Install rear snap ring to secure sun gear and thrust plate in driving shell.

(3) Install rear annulus gear on intermediate shaft (Fig. 236).

(4) Install thrust plate in annulus gear (Fig. 237). Be sure plate is seated on shaft splines and against gear.

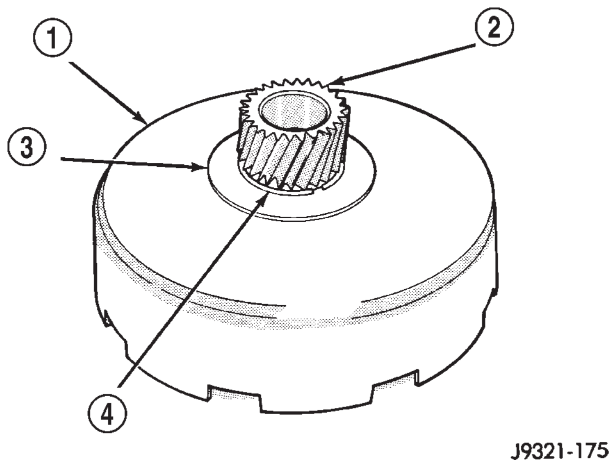


Fig. 235 Sun Gear Installation

1 – DRIVING SHELL
2 – SUN GEAR
3 – THRUST PLATE
4 – SUN GEAR REAR RETAINING RING

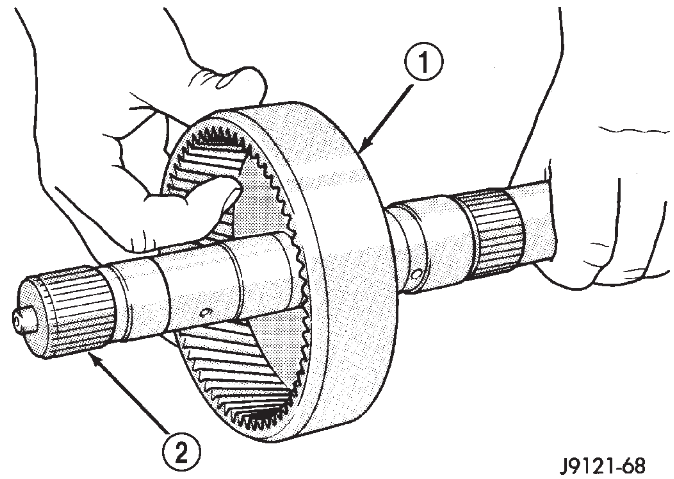


Fig. 236 Installing Rear Annulus Gear On Intermediate Shaft

1 – REAR ANNULUS GEAR
2 – OUTPUT SHAFT

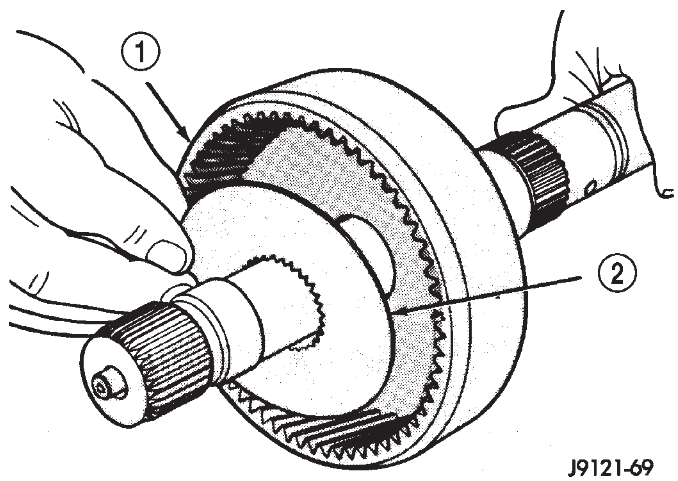


Fig. 237 Installing Rear Annulus Thrust Plate

1 – REAR ANNULUS GEAR
2 – THRUST PLATE

(5) Install rear planetary gear in rear annulus gear (Fig. 238). Be sure planetary carrier is seated against annulus gear.

(6) Install tabbed thrust washer on front face of rear planetary gear (Fig. 239). Seat washer tabs in matching slots in face of gear carrier. Use extra petroleum jelly to hold washer in place if desired.

(7) Lubricate sun gear bushings with petroleum jelly or transmission fluid.

(8) Install sun gear and driving shell on intermediate shaft (Fig. 240). Seat shell against rear planetary gear. Verify that thrust washer on planetary gear was not displaced during installation.

(9) Install tabbed thrust washer in driving shell (Fig. 241), be sure washer tabs are seated in tab slots of driving shell. Use extra petroleum jelly to hold washer in place if desired.

(10) Install tabbed thrust washer on front planetary gear (Fig. 242). Seat washer tabs in matching slots in face of gear carrier. Use extra petroleum jelly to hold washer in place if desired.

(11) Install front annulus gear over and onto front planetary gear (Fig. 243). Be sure gears are fully meshed and seated.

DISASSEMBLY AND ASSEMBLY (Continued)

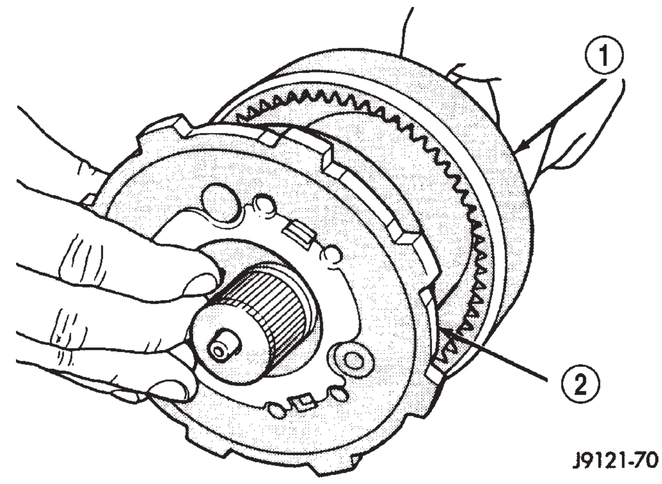


Fig. 238 Installing Rear Planetary Gear

1 – REAR ANNULUS GEAR
2 – REAR PLANETARY GEAR

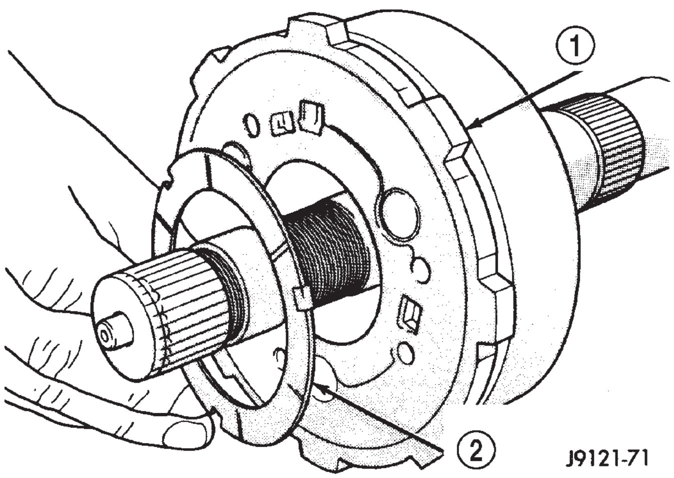


Fig. 239 Installing Rear Planetary Thrust Washer

1 – REAR PLANETARY GEAR
2 – TABBED THRUST WASHER

(12) Install front planetary and annulus gear assembly (Fig. 244). Hold gears together and slide them onto shaft. Be sure planetary pinions are seated on sun gear and that planetary carrier is seated on intermediate shaft.

(13) Place geartrain in upright position. Rotate gears to be sure all components are seated and properly assembled. Snap ring groove at forward end of intermediate shaft will be completely exposed when components are assembled correctly.

(14) Install new planetary snap ring in groove at end of intermediate shaft (Fig. 245).

(15) Turn planetary geartrain over. Position wood block under front end of intermediate shaft and support geartrain on shaft. Be sure all geartrain parts

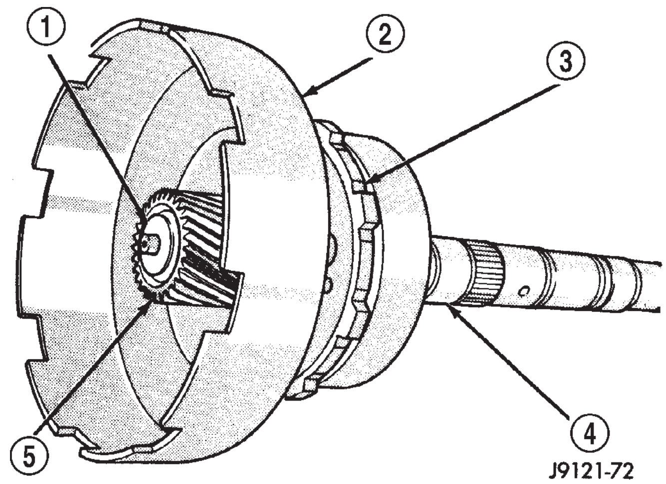


Fig. 240 Installing Sun Gear And Driving Shell

1 – OUTPUT SHAFT
2 – DRIVING SHELL
3 – REAR PLANETARY GEAR
4 – OUTPUT SHAFT
5 – SUN GEAR

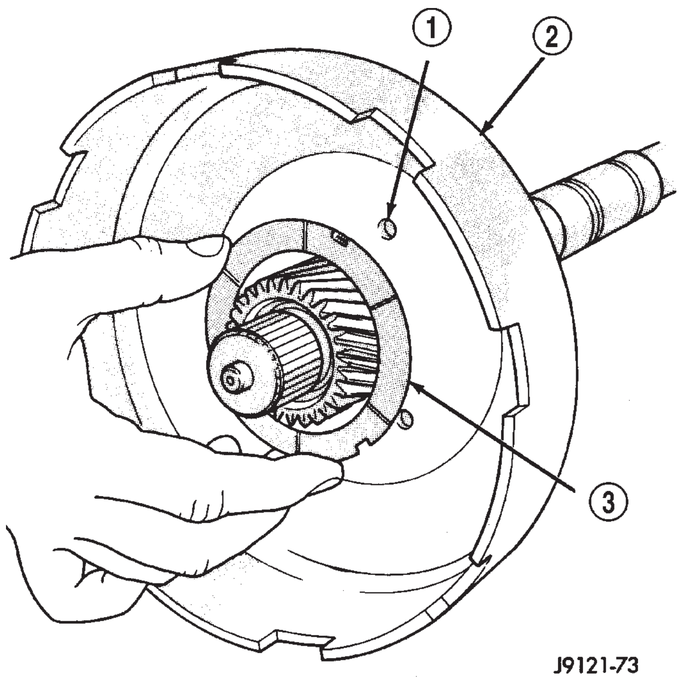


Fig. 241 Installing Driving Shell Thrust Washer

1 – TAB SLOTS (3)
2 – DRIVING SHELL
3 – TABBED THRUST WASHER

have moved forward against planetary snap ring. This is important for accurate end play check.

(16) Check planetary geartrain end play with feeler gauge (Fig. 246). Insert gauge between rear annulus gear and shoulder on intermediate shaft as

DISASSEMBLY AND ASSEMBLY (Continued)

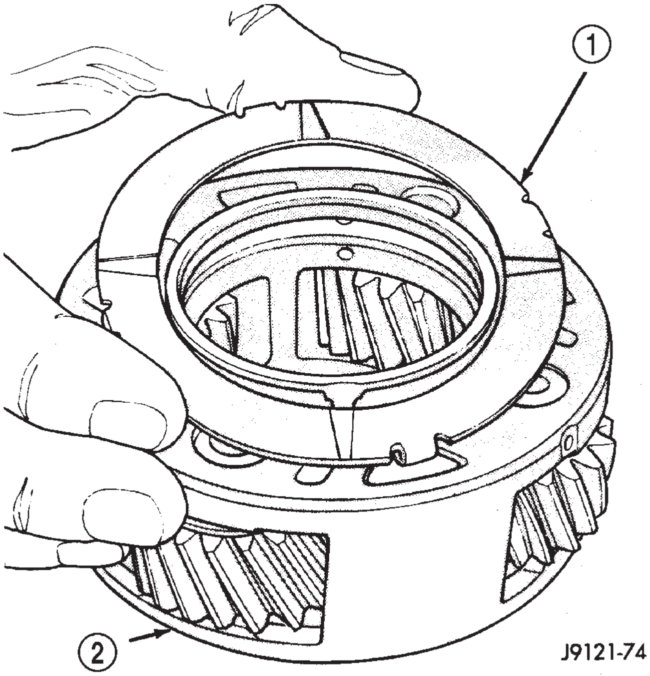


Fig. 242 Installing Thrust Washer On Front Planetary Gear

1 – TABBED THRUST WASHER
2 – FRONT PLANETARY GEAR

shown. End play should be 0.15 to 1.22 mm (0.006 to 0.048 in.).

(17) If end play is incorrect, install thinner/thicker planetary snap ring as needed.

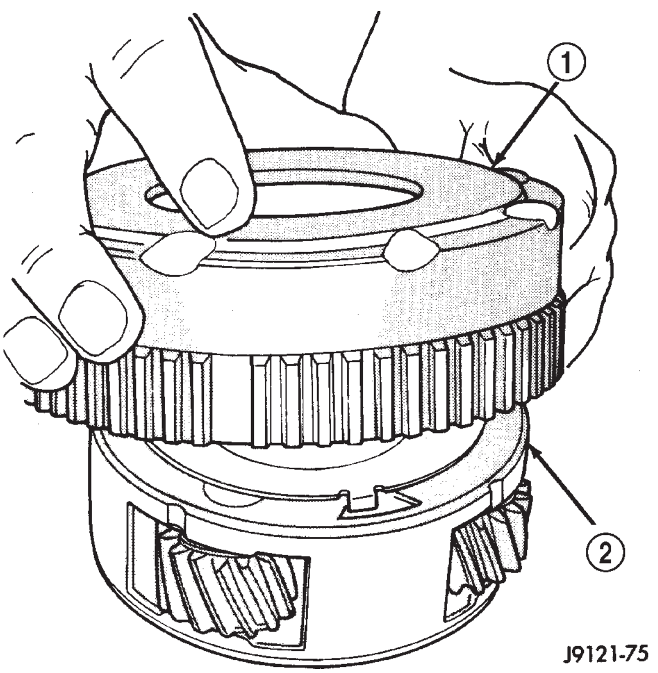


Fig. 243 Assembling Front Planetary And Annulus Gears

1 – FRONT ANNULUS GEAR
2 – FRONT PLANETARY GEAR

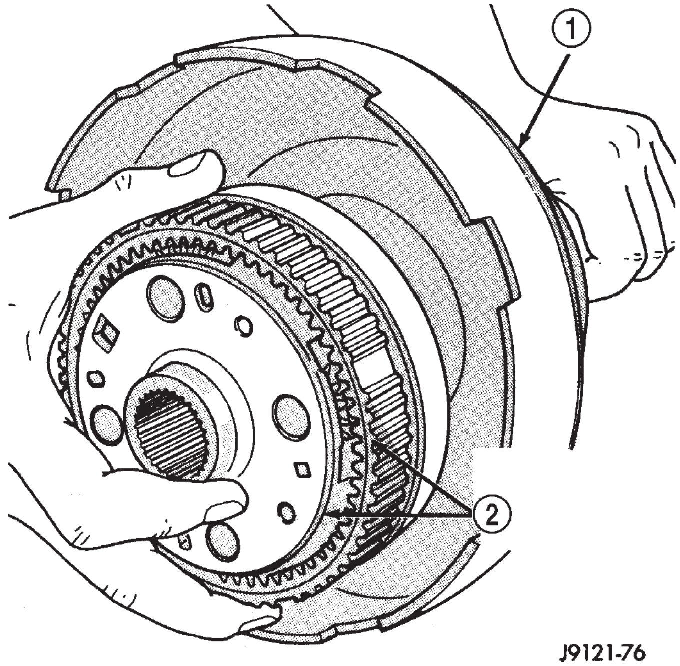


Fig. 244 Installing Front Planetary And Annulus Gear Assembly

1 – DRIVING SHELL
2 – ASSEMBLED FRONT PLANETARY AND ANNULUS GEARS

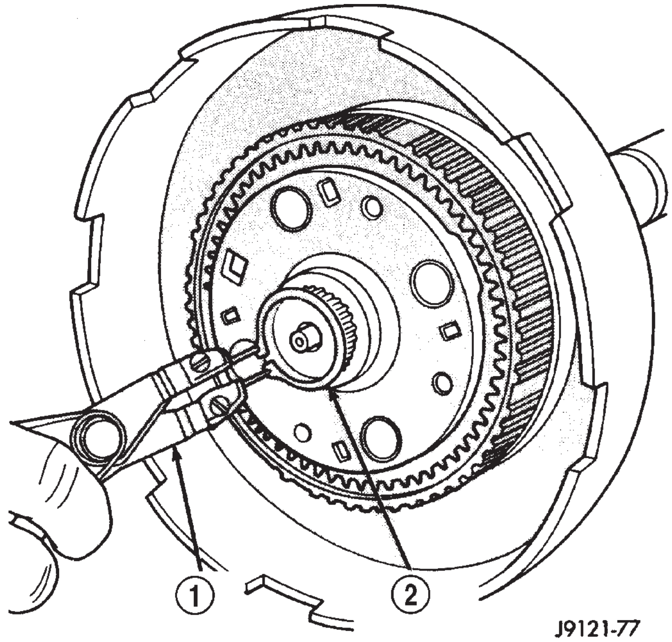


Fig. 245 Installing Planetary Snap Ring

1 – SNAP RING PLIERS
2 – PLANETARY SNAP RING

OVERDRIVE UNIT

DISASSEMBLY

(1) Remove transmission speed sensor and O-ring seal from overdrive case (Fig. 247).

DISASSEMBLY AND ASSEMBLY (Continued)

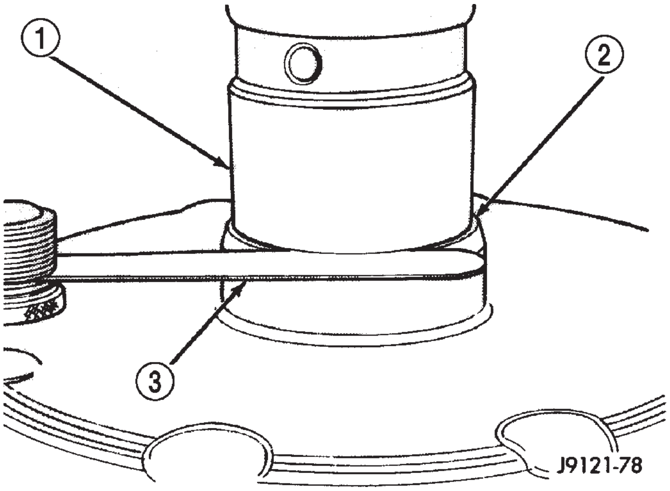


Fig. 246 Checking Planetary Geartrain End Play

1 – OUTPUT SHAFT
2 – REAR ANNULUS GEAR
3 – FEELER GAUGE

(2) Remove overdrive piston thrust bearing (Fig. 248).

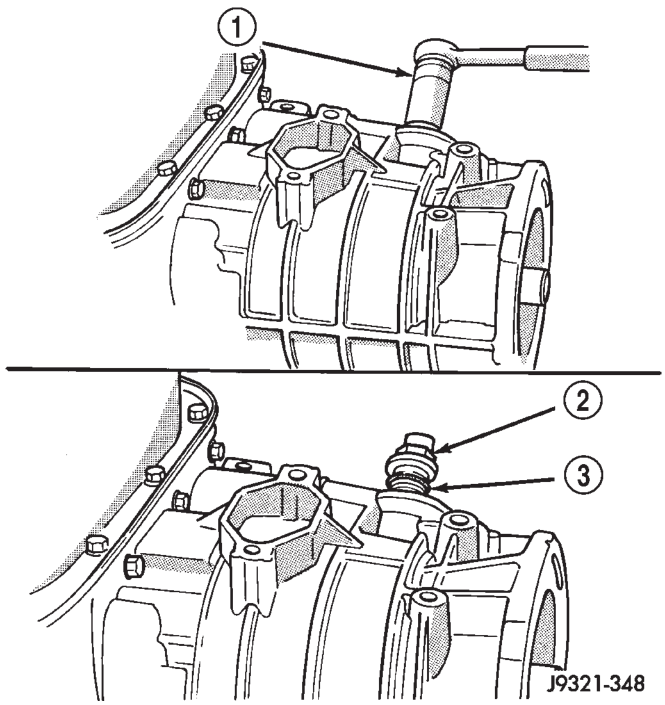


Fig. 247 Transmission Speed Sensor Removal/ Installation

1 – SOCKET AND WRENCH
2 – SPEED SENSOR
3 – O-RING

OVERDRIVE PISTON

(1) Remove overdrive piston thrust plate (Fig. 249). Retain thrust plate. It is a select fit part and may possibly be reused.

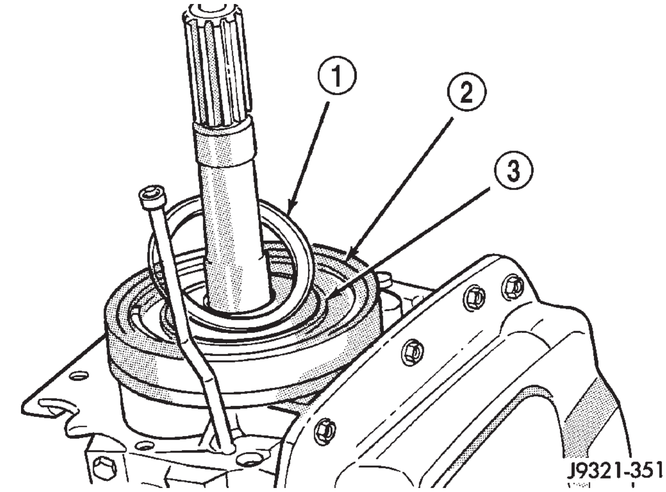


Fig. 248 Overdrive Piston Thrust Bearing Removal/ Installation

1 – THRUST BEARING
2 – OVERDRIVE PISTON
3 – THRUST PLATE

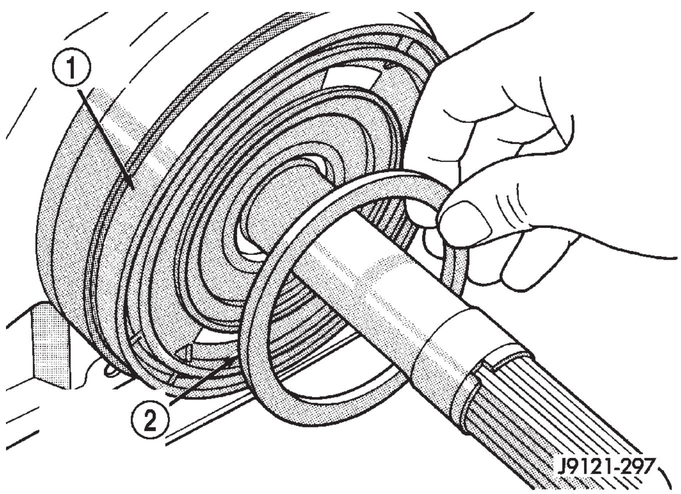


Fig. 249 Overdrive Piston Thrust Plate Removal/ Installation

1 – OVERDRIVE PISTON
2 – OVERDRIVE PISTON SPACER (SELECT FIT)

(2) Remove intermediate shaft spacer (Fig. 250). Retain spacer. It is a select fit part and may possibly be reused.

(3) Remove overdrive piston from retainer (Fig. 251).

OVERDRIVE CLUTCH PACK

(1) Remove overdrive clutch pack wire retaining ring (Fig. 252).

(2) Remove overdrive clutch pack (Fig. 253).

(3) Note position of clutch pack components for assembly reference (Fig. 254).

DISASSEMBLY AND ASSEMBLY (Continued)

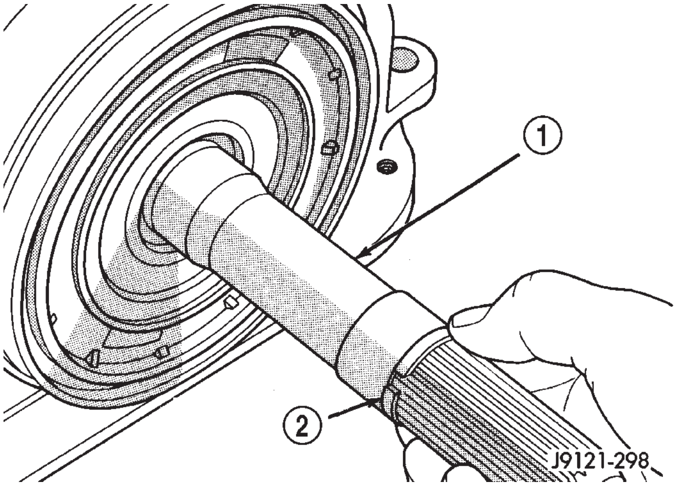


Fig. 250 Intermediate Shaft Spacer Location

1 – INTERMEDIATE SHAFT
2 – INTERMEDIATE SHAFT SPACER (SELECT FIT)

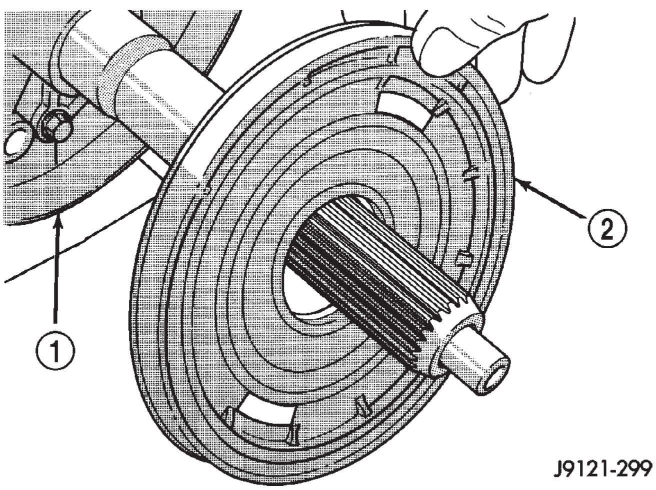


Fig. 251 Overdrive Piston Removal

1 – PISTON RETAINER
2 – OVERDRIVE PISTON

OVERDRIVE GEARTRAIN

(1) Remove overdrive clutch wave spring (Fig. 255).

(2) Remove overdrive clutch reaction snap ring (Fig. 256). Note that snap ring is located in same groove as wave spring.

(3) Remove Torx head screws that attach access cover and gasket to overdrive case (Fig. 257).

(4) Remove access cover and gasket (Fig. 258).

(5) Expand output shaft bearing snap ring with expanding-type snap ring pliers. Then push output shaft forward to release shaft bearing from locating ring (Fig. 259).

(6) Lift gear case up and off geartrain assembly (Fig. 260).

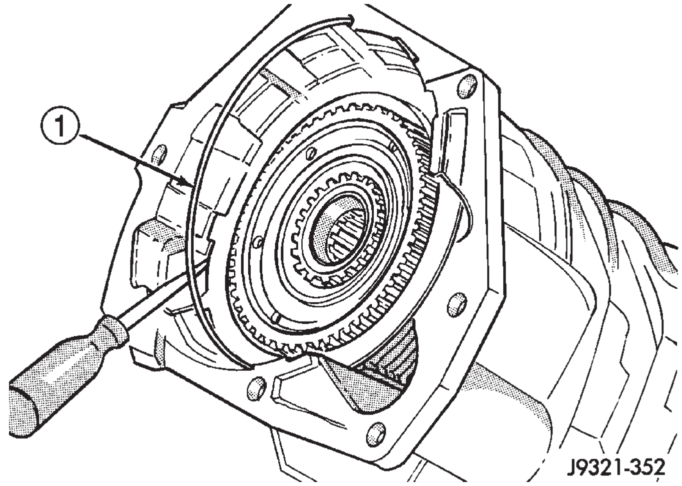


Fig. 252 Removing Overdrive Clutch Pack Retaining Ring

1 – OVERDRIVE CLUTCH PACK RETAINING RING

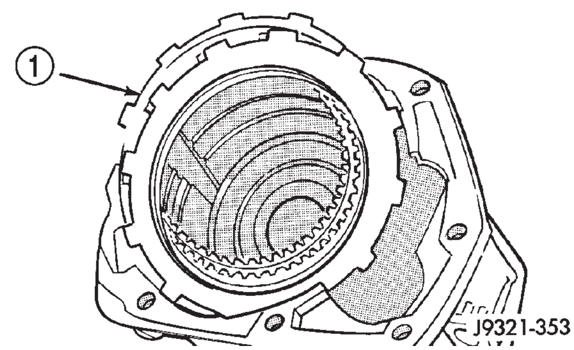


Fig. 253 Overdrive Clutch Pack Removal

1 – OVERDRIVE CLUTCH PACK

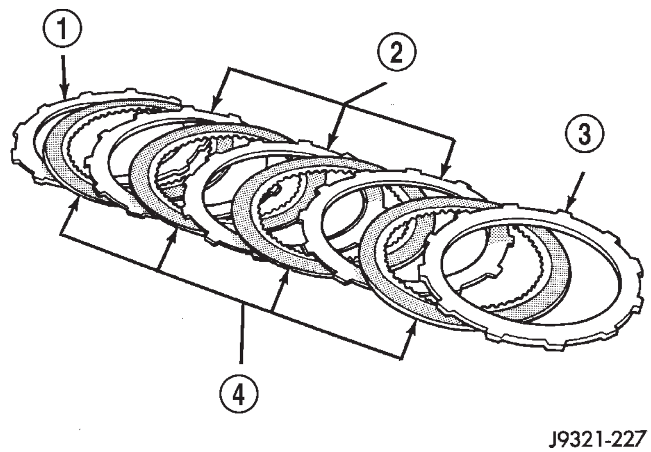


Fig. 254 46RE Overdrive Clutch Component Position

1 – REACTION PLATE
2 – CLUTCH PLATES (3)
3 – PRESSURE PLATE
4 – CLUTCH DISCS (4)

DISASSEMBLY AND ASSEMBLY (Continued)

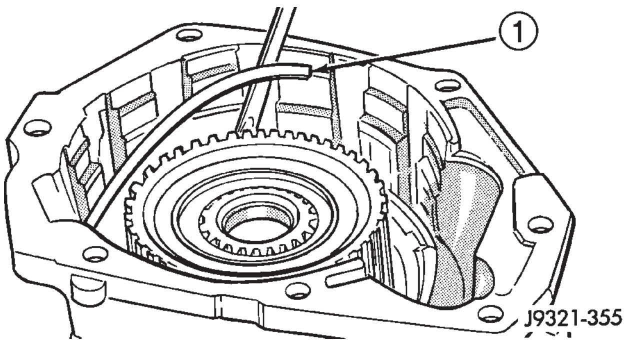


Fig. 255 Overdrive Clutch Wave Spring Removal/ Installation

1 – WAVE SPRING

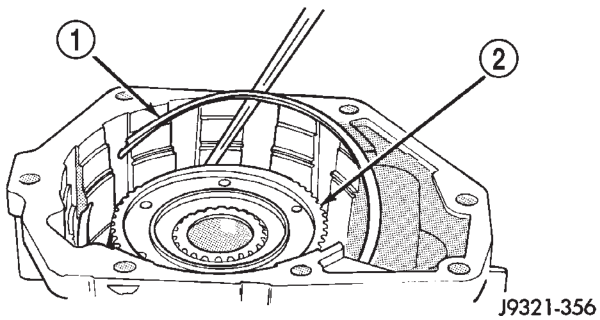


Fig. 256 Overdrive Clutch Reaction Snap Ring Removal/Installation

1 – REACTION RING
2 – CLUTCH HUB

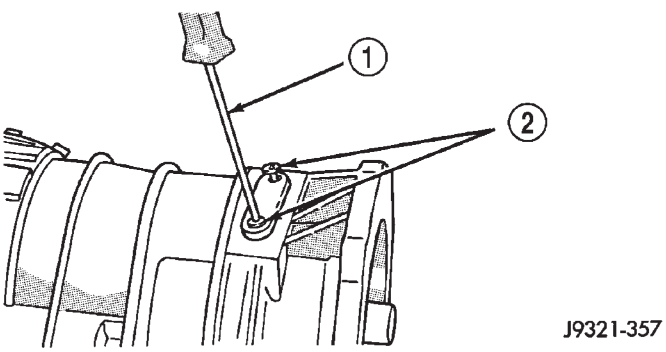


Fig. 257 Access Cover Screw Removal/Installation

1 – TORX SCREWDRIVER (T25)
2 – ACCESS COVER SCREWS

(7) Remove snap ring that retains rear bearing on output shaft.

(8) Remove rear bearing from output shaft (Fig. 261).

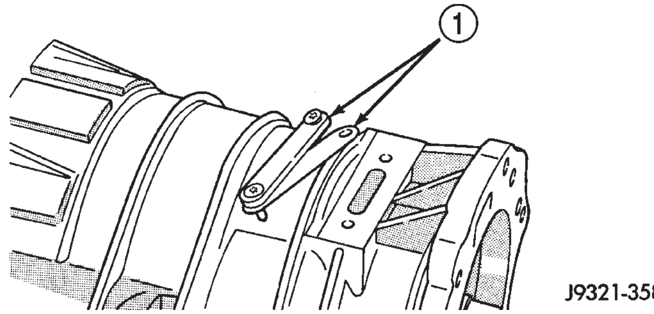


Fig. 258 Access Cover And Gasket Removal/ Installation

1 – ACCESS COVER AND GASKET

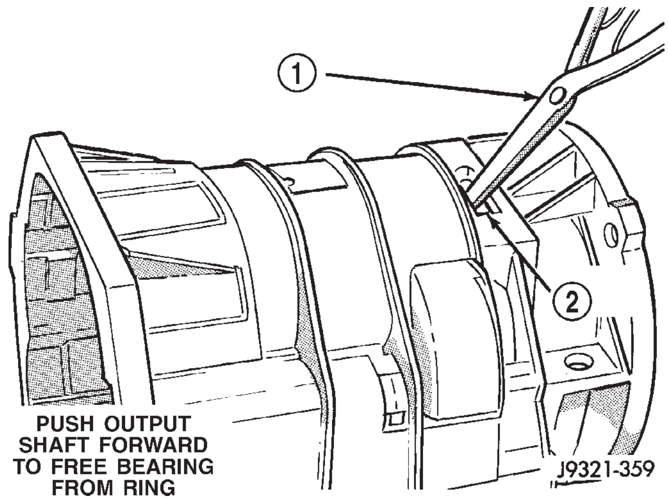


Fig. 259 Releasing Bearing From Locating Ring

1 – EXPAND BEARING LOCATING RING WITH SNAP RING PLIERS
2 – ACCESS HOLE

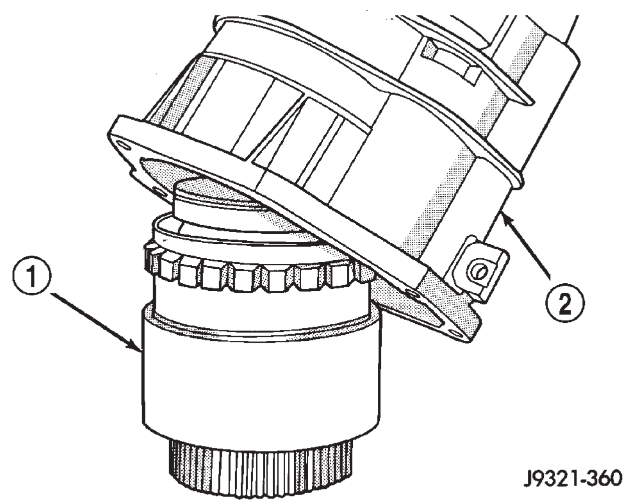


Fig. 260 Removing Gear Case From Geartrain Assembly

1 – GEARTRAIN ASSEMBLY
2 – GEAR CASE

DISASSEMBLY AND ASSEMBLY (Continued)

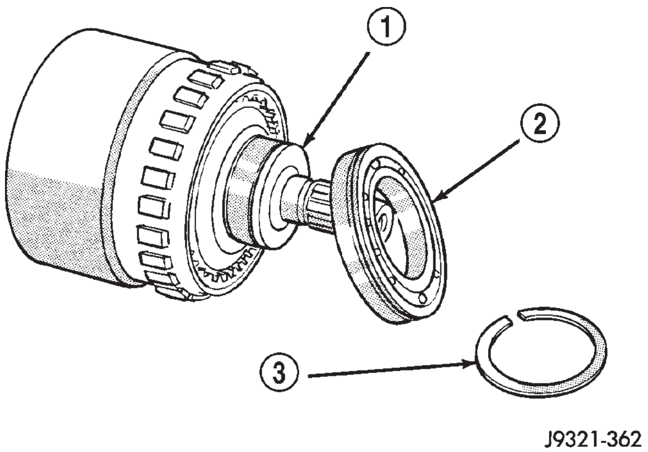


Fig. 261 Rear Bearing Removal

1 – OUTPUT SHAFT
2 – REAR BEARING
3 – SNAP RING

DIRECT CLUTCH, HUB AND SPRING

WARNING: THE NEXT STEP IN DISASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE SPRING COMPRESSOR TOOL 6227-1 AND A HYDRAULIC SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 5-6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

(1) Mount geartrain assembly in shop press (Fig. 262).

(2) Position Compressor Tool 6227-1 on clutch hub (Fig. 262). Support output shaft flange with steel press plates as shown and center assembly under press ram.

(3) Apply press pressure slowly. Compress hub and spring far enough to expose clutch hub retaining ring and relieve spring pressure on clutch pack snap ring (Fig. 262).

(4) Remove direct clutch pack snap ring (Fig. 263).

(5) Remove direct clutch hub retaining ring (Fig. 264).

(6) Release press load slowly and completely (Fig. 265).

(7) Remove Special Tool 6227-1. Then remove clutch pack from hub (Fig. 265).

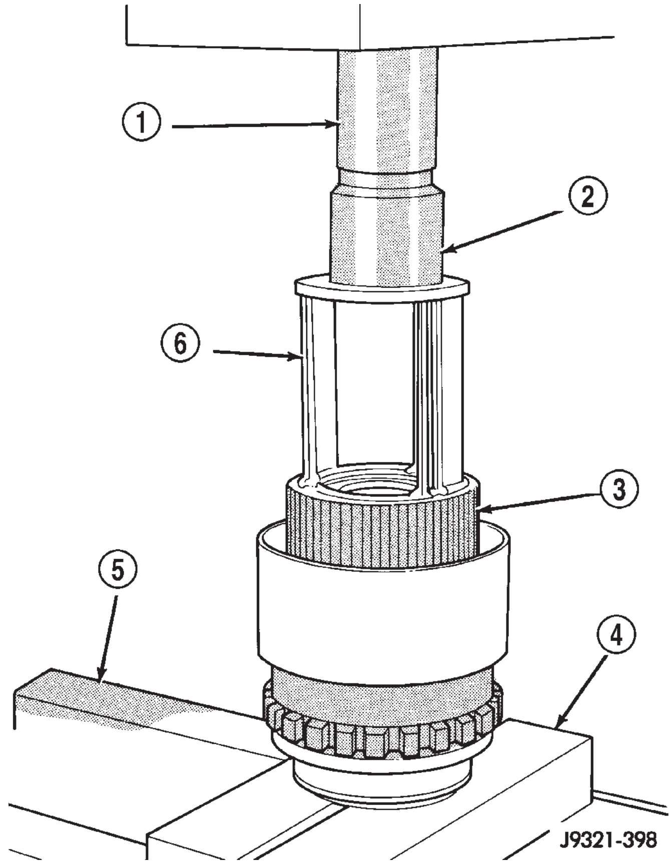


Fig. 262 Geartrain Mounted In Shop Press

1 – PRESS RAM
2 – SPECIAL TOOL C-3995–A (OR SIMILAR TOOL)
3 – CLUTCH HUB
4 – PLATES
5 – PRESS BED
6 – SPECIAL TOOL 6227–1

Geartrain

(1) Remove direct clutch hub and spring (Fig. 266).

(2) Remove sun gear and spring plate. Then remove planetary thrust bearing and planetary gear (Fig. 267).

DISASSEMBLY AND ASSEMBLY (Continued)

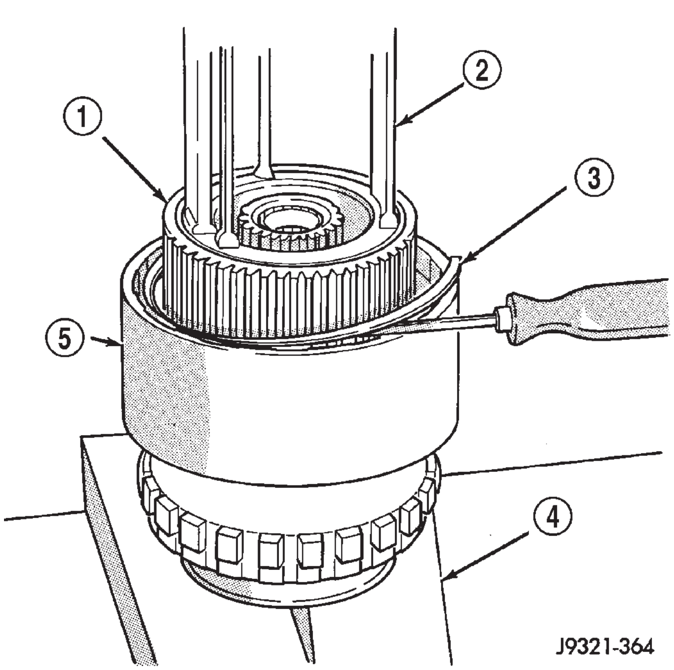


Fig. 263 Direct Clutch Pack Snap Ring Removal

1 – CLUTCH HUB
2 – SPECIAL TOOL 6227–1
3 – DIRECT CLUTCH PACK SNAP RING
4 – PRESS PLATES
5 – CLUTCH DRUM

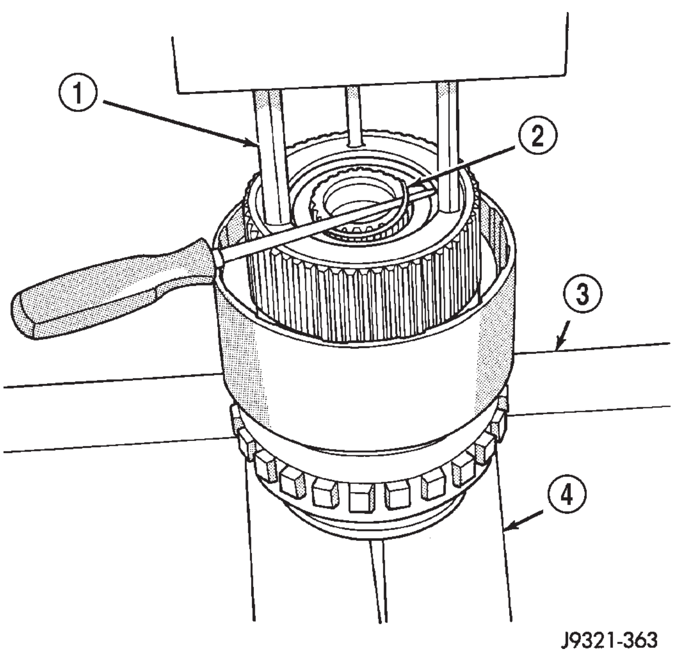


Fig. 264 Direct Clutch Hub Retaining Ring Removal

1 – SPECIAL TOOL 6227–1
2 – CLUTCH HUB RETAINING RING
3 – PRESS BED
4 – PRESS PLATES

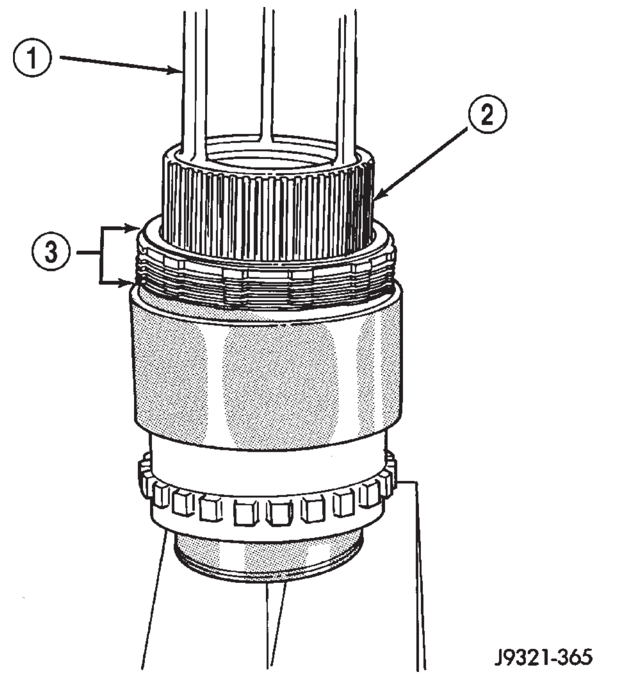


Fig. 265 Direct Clutch Pack Removal

1 – SPECIAL TOOL 6227–1
2 – DIRECT CLUTCH HUB
3 – DIRECT CLUTCH PACK

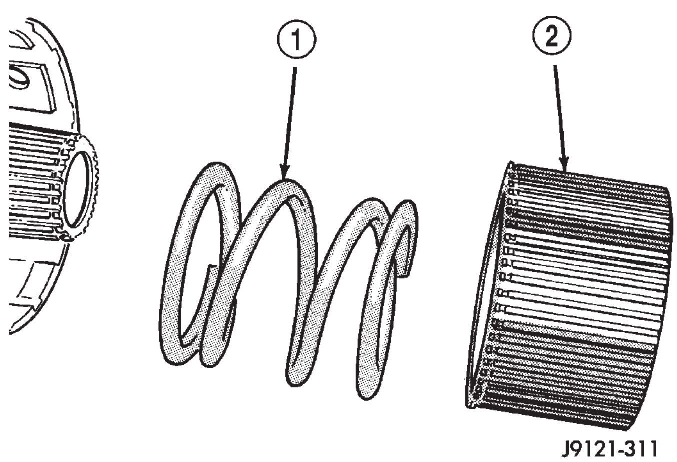


Fig. 266 Direct Clutch Hub And Spring Removal

1 – DIRECT CLUTCH SPRING
2 – DIRECT CLUTCH HUB

(3) Remove overrunning clutch assembly with expanding type snap ring pliers (Fig. 268). Insert pliers into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

(4) Remove thrust bearing from overrunning clutch hub.

(5) Remove overrunning clutch from hub.

(6) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 269).

DISASSEMBLY AND ASSEMBLY (Continued)

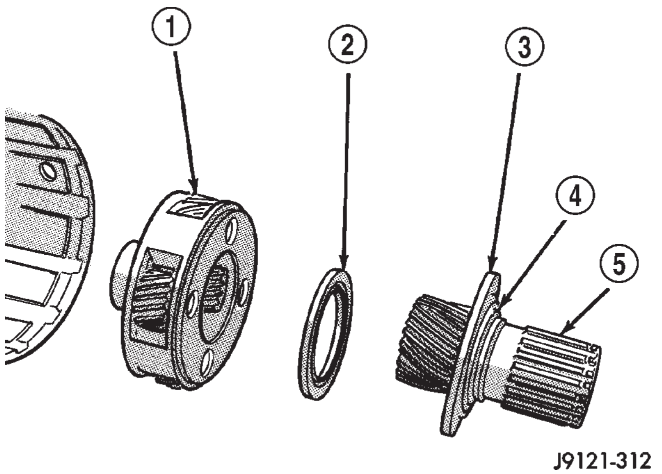


Fig. 267 Removing Sun Gear, Thrust Bearing And Planetary Gear

1 – PLANETARY GEAR
2 – PLANETARY THRUST BEARING
3 – CLUTCH SPRING PLATE
4 – SPRING PLATE SNAP RING
5 – SUN GEAR

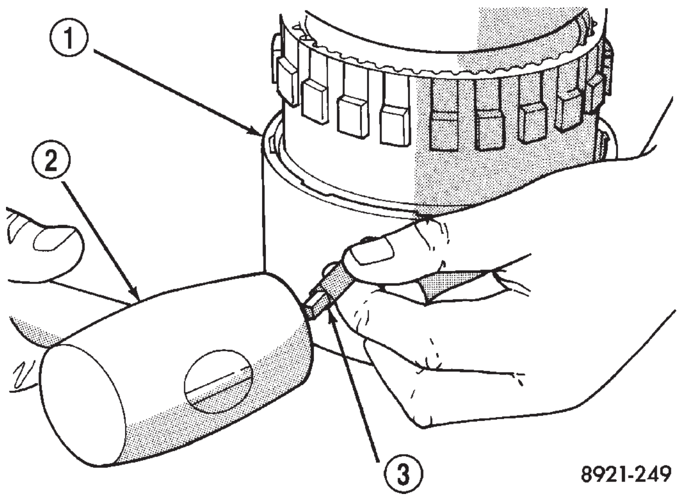


Fig. 269 Marking Direct Clutch Drum And Annulus Gear For Assembly Alignment

1 – DIRECT CLUTCH DRUM
2 – HAMMER
3 – PUNCH

Use small center punch or scriber to make alignment marks.

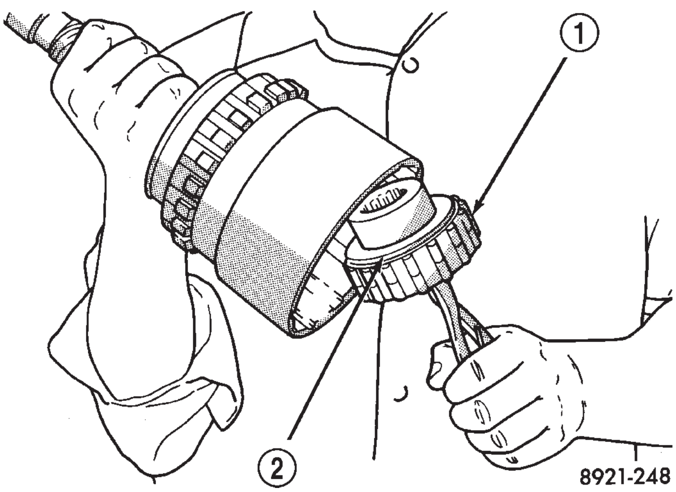


Fig. 268 Overrunning Clutch Assembly Removal/ Installation

1 – OVERRUNNING CLUTCH
2 – NEEDLE BEARING

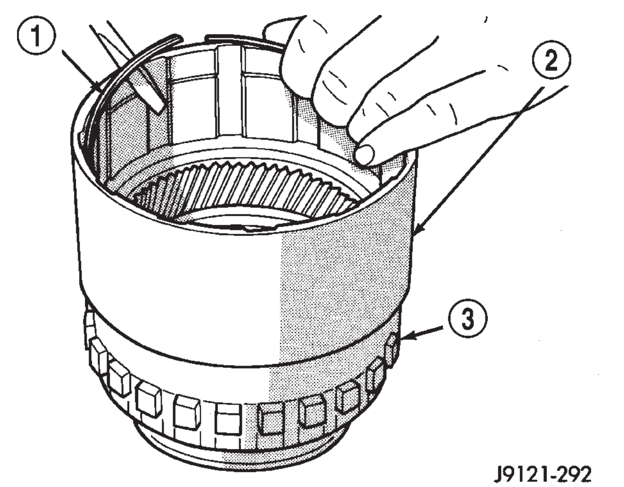


Fig. 270 Clutch Drum Inner Retaining Ring Removal

1 – INNER RETAINING RING
2 – DIRECT CLUTCH DRUM
3 – ANNULUS GEAR

(7) Remove direct clutch drum rear retaining ring (Fig. 270).

(8) Remove direct clutch drum outer retaining ring (Fig. 271).

(9) Mark annulus gear and output shaft for assembly alignment reference (Fig. 272). Use punch or scriber to mark gear and shaft.

(10) Remove snap ring that secures annulus gear on output shaft (Fig. 273). Use two screwdrivers to unseat and work snap ring out of groove as shown.

(11) Remove annulus gear from output shaft (Fig. 274). Use rawhide or plastic mallet to tap gear off shaft.

GEAR CASE AND PARK LOCK

(1) Remove locating ring from gear case.

(2) Remove park pawl shaft retaining bolt and remove shaft, pawl and spring.

(3) Remove reaction plug snap ring and remove reaction plug.

(4) Remove output shaft seal.

DISASSEMBLY AND ASSEMBLY (Continued)

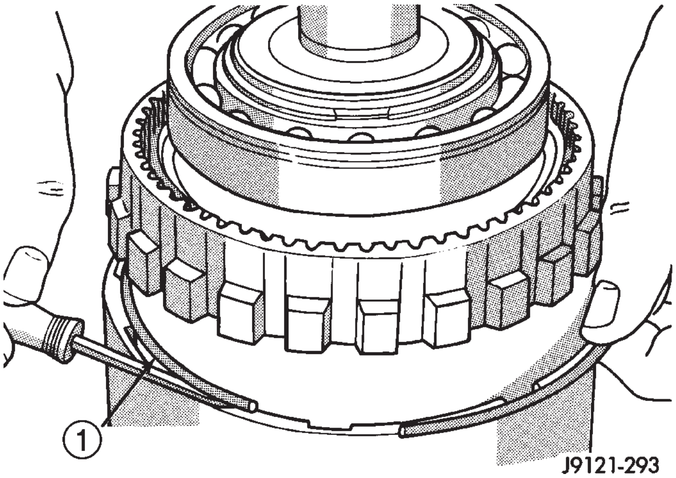


Fig. 271 Clutch Drum Outer Retaining Ring Removal

1 – OUTER RETAINING RING

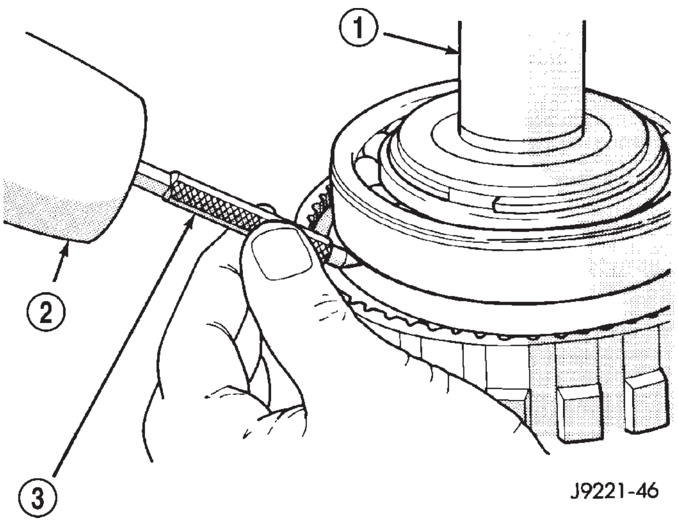


Fig. 272 Marking Annulus Gear And Output Shaft For Assembly Alignment

1 – OUTPUT SHAFT
2 – HAMMER
3 – PUNCH

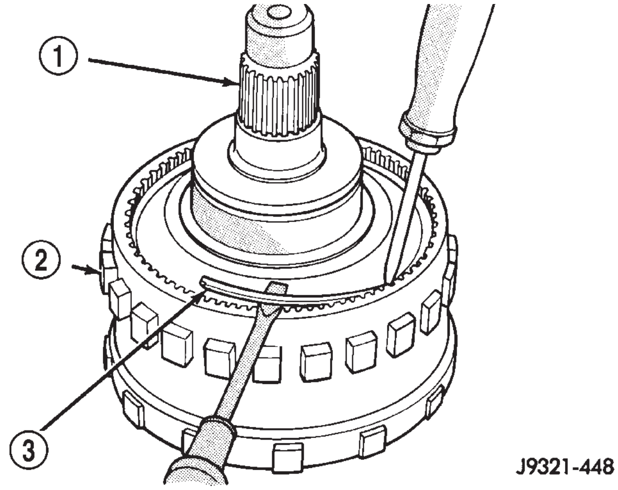


Fig. 273 Annulus Gear Snap Ring Removal

1 – OUTPUT SHAFT
2 – ANNULUS GEAR
3 – SNAP RING

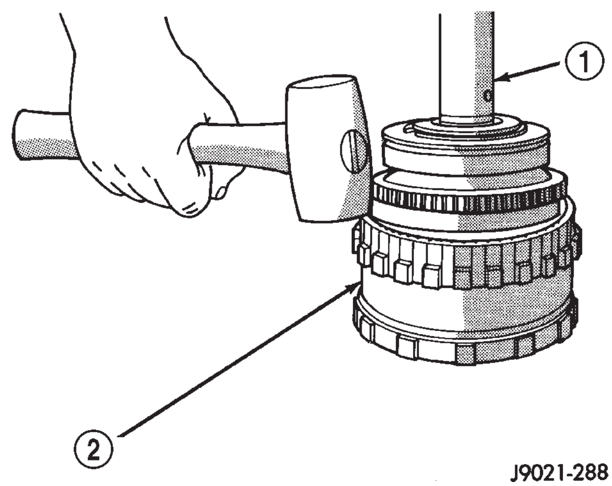


Fig. 274 Annulus Gear Removal

1 – OUTPUT SHAFT
2 – ANNULUS GEAR

ASSEMBLY

GEARTRAIN AND DIRECT CLUTCH

(1) Soak direct clutch and overdrive clutch discs in Mopar® ATF Plus 3, type 7176, transmission fluid. Allow discs to soak for 10-20 minutes.

(2) Install new pilot bushing and clutch hub bushing in output shaft if necessary (Fig. 275). Lubricate bushings with petroleum jelly, or transmission fluid.

(3) Install annulus gear on output shaft, if removed. Then install annulus gear retaining snap ring (Fig. 276).

(4) Align and install clutch drum on annulus gear (Fig. 277). Be sure drum is engaged in annulus gear lugs.

(5) Install clutch drum outer retaining ring (Fig. 277).

(6) Slide clutch drum forward and install inner retaining ring (Fig. 278).

DISASSEMBLY AND ASSEMBLY (Continued)

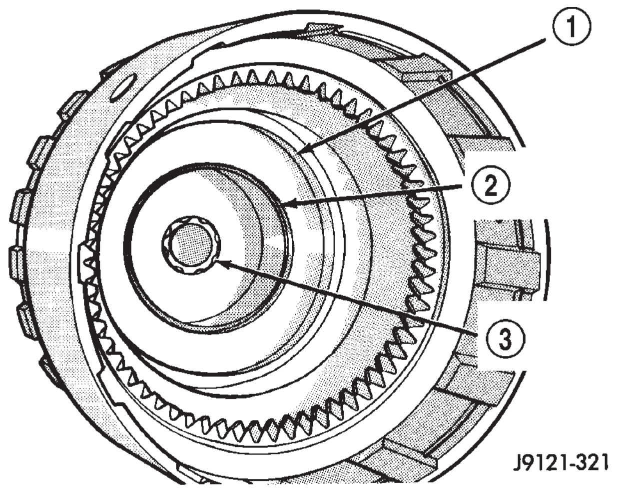


Fig. 275 Output Shaft Pilot Bushing

1 – OUTPUT SHAFT HUB
2 – OVERRUNNING CLUTCH HUB BUSHING
3 – INTERMEDIATE SHAFT PILOT BUSHING

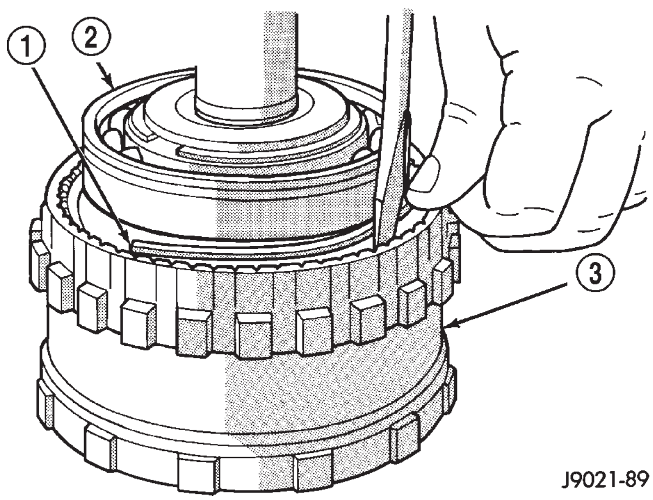


Fig. 276 Annulus Gear Installation

1 – SNAP RING
2 – OUTPUT SHAFT FRONT BEARING
3 – ANNULUS GEAR

(7) Install rear bearing and snap ring on output shaft (Fig. 279). Be sure locating ring groove in bearing is toward rear.

(8) Install overrunning clutch on hub (Fig. 280). **Note that clutch only fits one way. Shoulder on clutch should seat in small recess at edge of hub.**

(9) Install thrust bearing on overrunning clutch hub. Use generous amount of petroleum jelly to hold bearing in place for installation. **Bearing fits one way only. Be sure bearing is seated squarely against hub. Reinstall bearing if it does not seat squarely.**

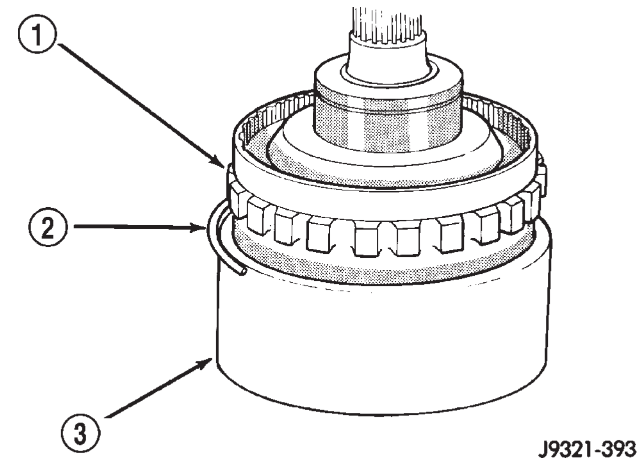


Fig. 277 Clutch Drum And Outer Retaining Ring Installation

1 – ANNULUS GEAR
2 – OUTER SNAP RING
3 – CLUTCH DRUM

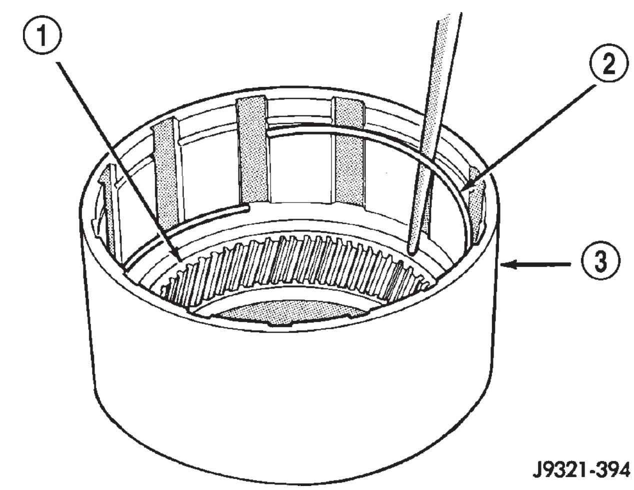


Fig. 278 Clutch Drum Inner Retaining Ring Installation

1 – ANNULUS GEAR
2 – INNER SNAP RING
3 – CLUTCH DRUM

(10) Install overrunning clutch in output shaft (Fig. 281). Insert snap ring pliers in hub splines. Expand pliers to grip hub. Then install assembly with counterclockwise, twisting motion.

(11) Install planetary gear in annulus gear (Fig. 282). **Be sure planetary pinions are fully seated in annulus gear before proceeding.**

(12) Coat planetary thrust bearing and bearing contact surface of spring plate with generous amount of petroleum jelly. This will help hold bearing in place during installation.

(13) Install planetary thrust bearing on sun gear (Fig. 283). Slide bearing onto gear and seat it against

DISASSEMBLY AND ASSEMBLY (Continued)

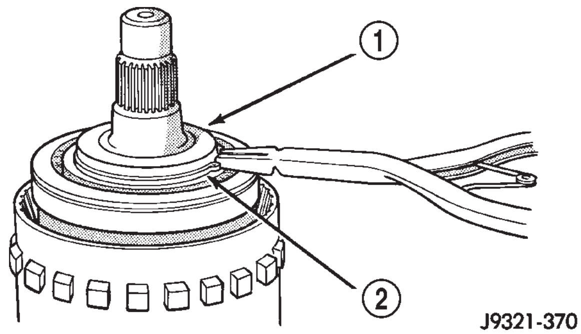


Fig. 279 Rear Bearing And Snap Ring Installation

1 – REAR BEARING
2 – SNAP RING

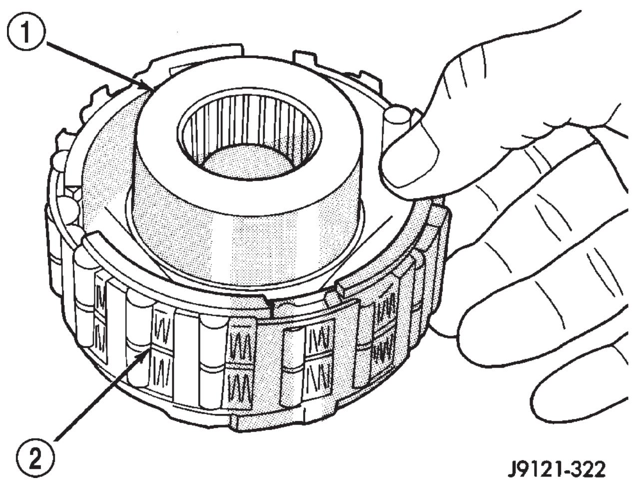


Fig. 280 Assembling Overrunning Clutch And Hub

1 – CLUTCH HUB
2 – OVERRUNNING CLUTCH

spring plate as shown. **Bearing fits one way only. If it does not seat squarely against spring plate, remove and reposition bearing.**

(14) Install assembled sun gear, spring plate and thrust bearing (Fig. 284). Be sure sun gear and thrust bearing are fully seated before proceeding.

(15) Mount assembled output shaft, annulus gear, and clutch drum in shop press. Direct clutch spring, hub and clutch pack are easier to install with assembly mounted in press.

(16) Align splines in hubs of planetary gear and overrunning clutch with Alignment tool 6227-2 (Fig. 285). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.

(17) Install direct clutch spring (Fig. 286). Be sure spring is properly seated on spring plate.

(18) Assemble and install direct clutch pack on hub as follows:

(a) Assemble clutch pack components (Fig. 287).

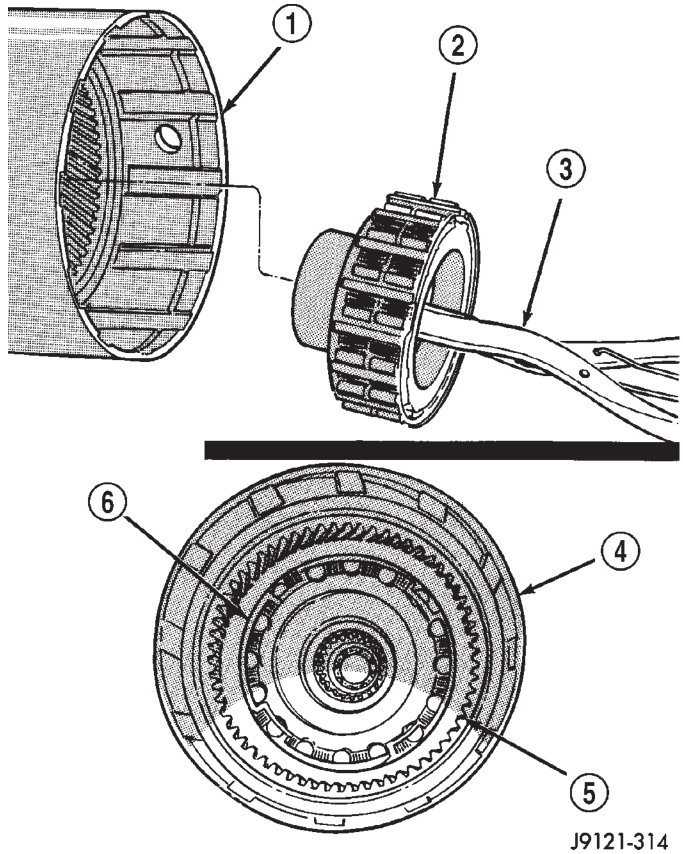


Fig. 281 Overrunning Clutch Installation

1 – CLUTCH DRUM
2 – OVERRUNNING CLUTCH ASSEMBLY
3 – EXPANDING-TYPE SNAP RING PLIERS
4 – CLUTCH DRUM
5 – ANNULUS GEAR
6 – OVERRUNNING CLUTCH ASSEMBLY SEATED IN OUTPUT SHAFT

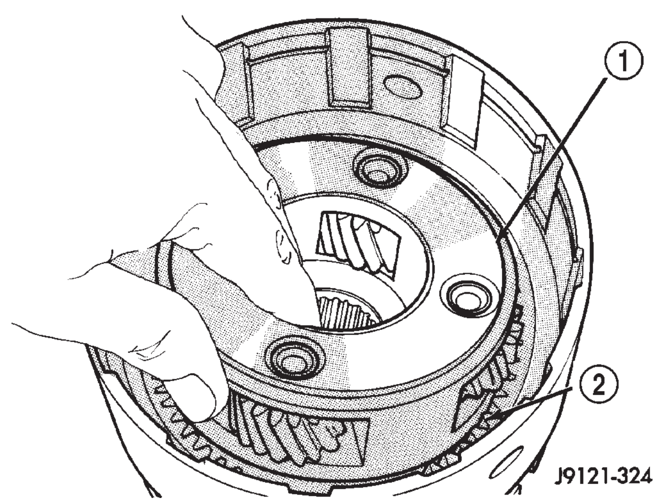


Fig. 282 Planetary Gear Installation

1 – PLANETARY GEAR
2 – ANNULUS GEAR

DISASSEMBLY AND ASSEMBLY (Continued)

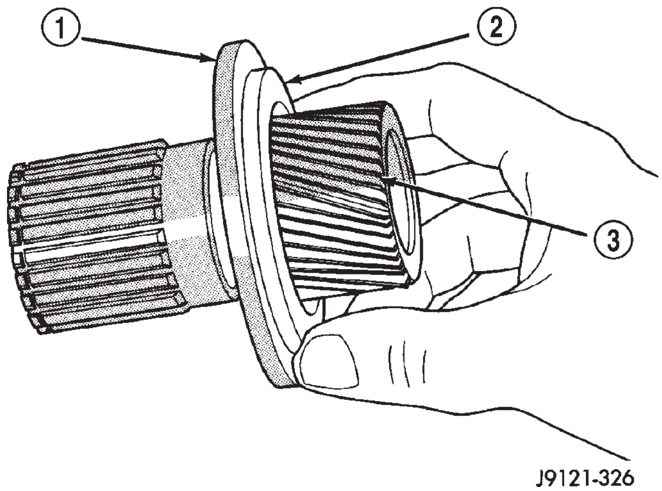


Fig. 283 Planetary Thrust Bearing Installation

1 – SPRING PLATE
2 – PLANETARY THRUST BEARING
3 – SUN GEAR

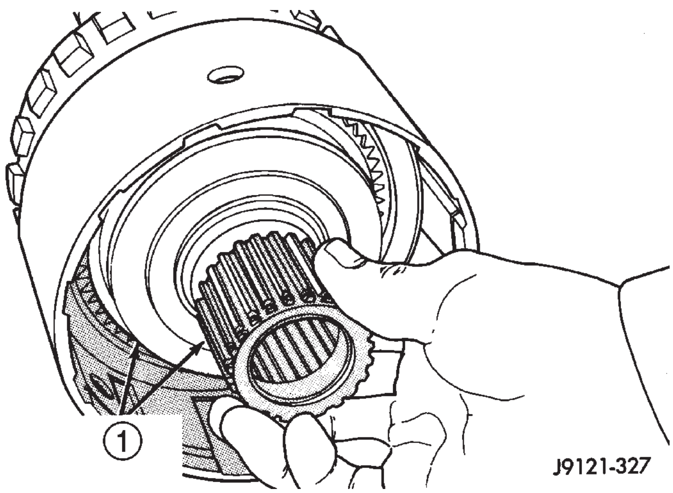


Fig. 284 Sun Gear Installation

1 – SUN GEAR AND SPRING PLATE ASSEMBLY

(b) Install direct clutch reaction plate on clutch hub first. **Note that one side of reaction plate is counterbored. Be sure this side faces rearward. Splines at rear of hub are raised slightly. Counterbore in plate fits over raised splines. Plate should be flush with this end of hub (Fig. 288).**

(c) Install first clutch disc followed by a steel plate until all discs and plates have been installed.

(d) Install pressure plate. This is last clutch pack item to be installed. **Be sure plate is installed with shoulder side facing upward (Fig. 289).**

(19) Install clutch hub and clutch pack on direct clutch spring (Fig. 290). **Be sure hub is started on sun gear splines before proceeding.**

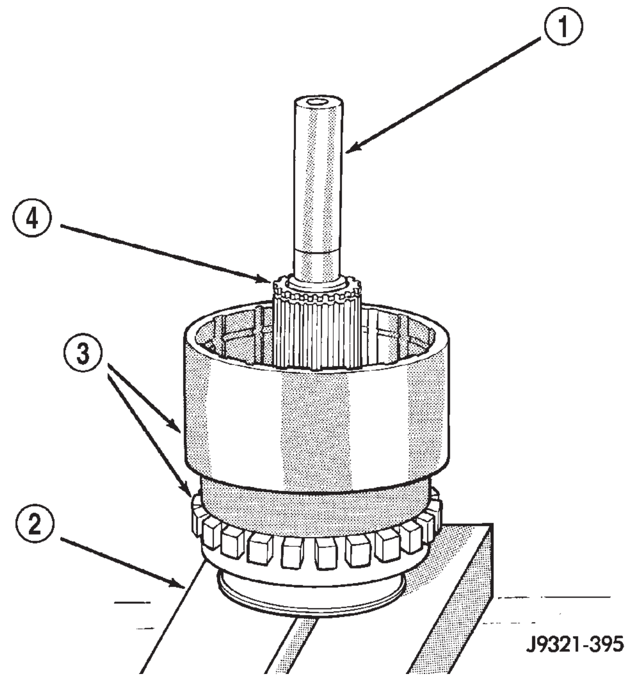


Fig. 285 Alignment Tool Installation

1 – SPECIAL TOOL 6227–2
2 – PRESS PLATES
3 – ASSEMBLED DRUM AND ANNULUS GEAR
4 – SUN GEAR

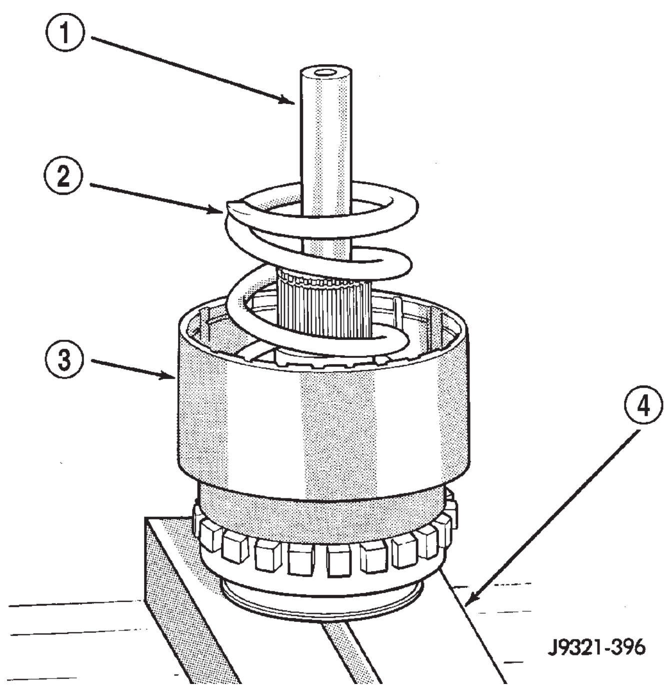


Fig. 286 Direct Clutch Spring Installation

1 – SPECIAL TOOL 6227–2
2 – DIRECT CLUTCH SPRING
3 – CLUTCH HUB
4 – PRESS PLATES

DISASSEMBLY AND ASSEMBLY (Continued)

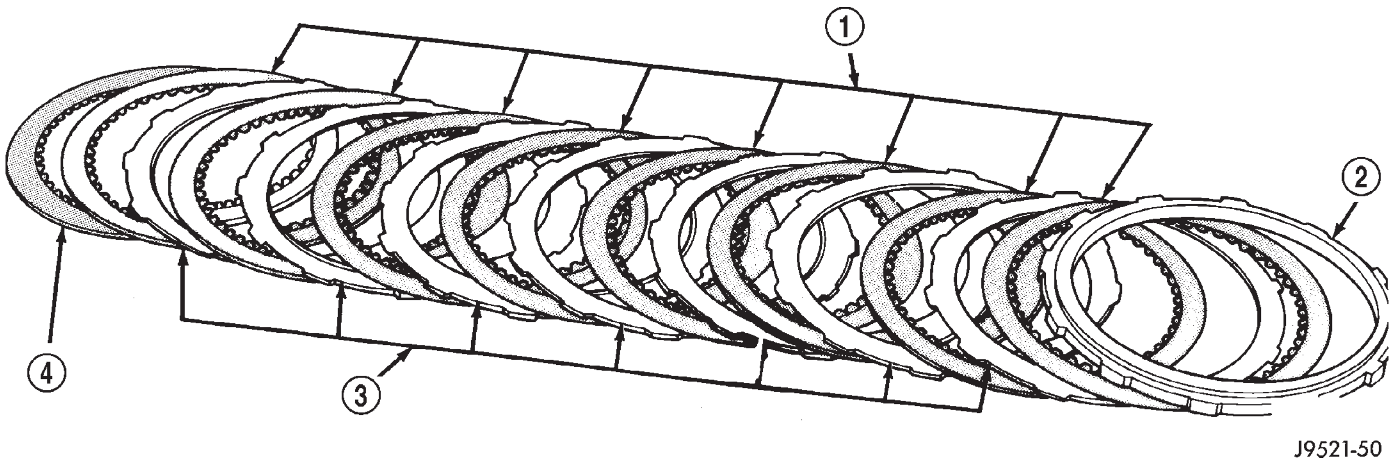


Fig. 287 46RE Direct Clutch Pack Components

1 – CLUTCH DISCS (8)
2 – PRESSURE PLATE
3 – CLUTCH PLATES (7)
4 – REACTION PLATE

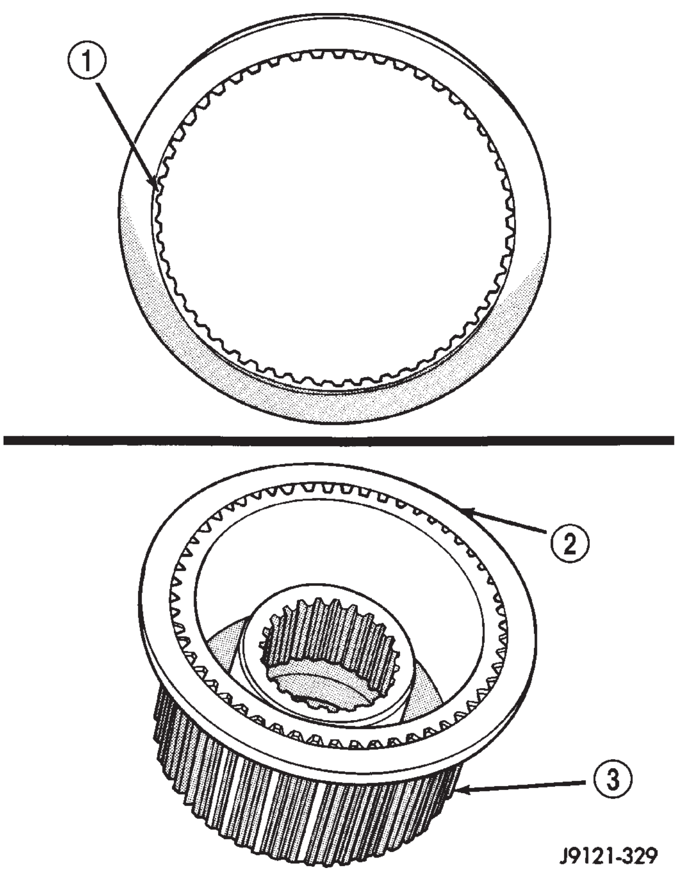


Fig. 288 Correct Position Of Direct Clutch Reaction Plate

1 – REACTION PLATE COUNTERBORE
2 – DIRECT CLUTCH REACTION PLATE (FLUSH WITH END OF HUB)
3 – CLUTCH HUB

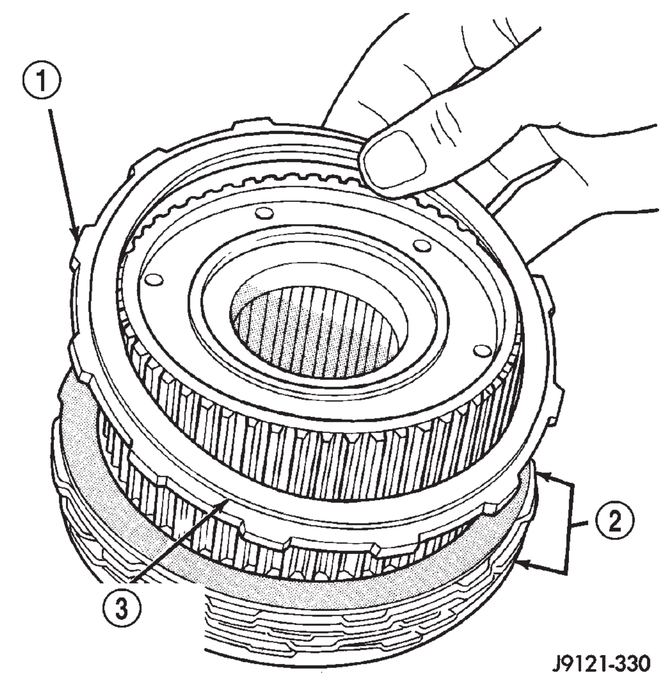


Fig. 289 Correct Position Of Direct Clutch Pressure Plate

1 – DIRECT CLUTCH PRESSURE PLATE
2 – CLUTCH PACK
3 – BE SURE SHOULDER SIDE OF PLATE FACES UPWARD

DISASSEMBLY AND ASSEMBLY (Continued)

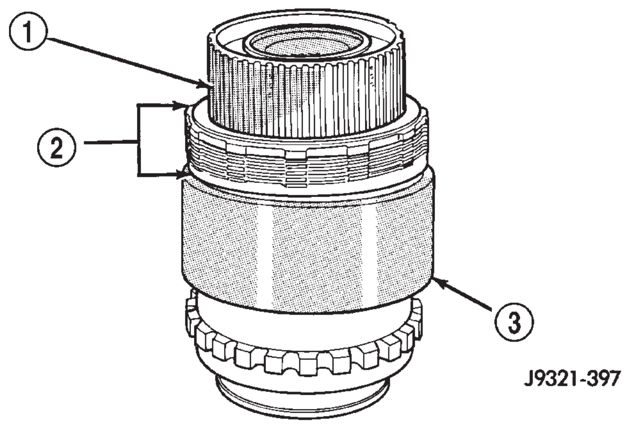


Fig. 290 Direct Clutch Pack And Clutch Hub Installation

1 – CLUTCH HUB
2 – DIRECT CLUTCH PACK
3 – CLUTCH DRUM

WARNING: THE NEXT STEP IN GEARTRAIN ASSEMBLY INVOLVES COMPRESSING THE DIRECT CLUTCH HUB AND SPRING. IT IS EXTREMELY IMPORTANT THAT PROPER EQUIPMENT BE USED TO COMPRESS THE SPRING AS SPRING FORCE IS APPROXIMATELY 830 POUNDS. USE COMPRESSOR TOOL C-6227-1 AND A HYDRAULIC-TYPE SHOP PRESS WITH A MINIMUM RAM TRAVEL OF 6 INCHES. THE PRESS MUST ALSO HAVE A BED THAT CAN BE ADJUSTED UP OR DOWN AS REQUIRED. RELEASE CLUTCH SPRING TENSION SLOWLY AND COMPLETELY TO AVOID PERSONAL INJURY.

(20) Position Compressor Tool 6227-1 on clutch hub.

(21) Compress clutch hub and spring just enough to place tension on hub and hold it in place.

(22) Slowly compress clutch hub and spring. Compress spring and hub only enough to expose ring grooves for clutch pack snap ring and clutch hub retaining ring.

(23) Realign clutch pack on hub and seat clutch discs and plates in clutch drum.

(24) Install direct clutch pack snap ring (Fig. 291). **Be very sure snap ring is fully seated in clutch drum ring groove.**

(25) Install clutch hub retaining ring (Fig. 292). **Be very sure retaining ring is fully seated in sun gear ring groove.**

(26) Slowly release press ram, remove compressor tools and remove geartrain assembly.

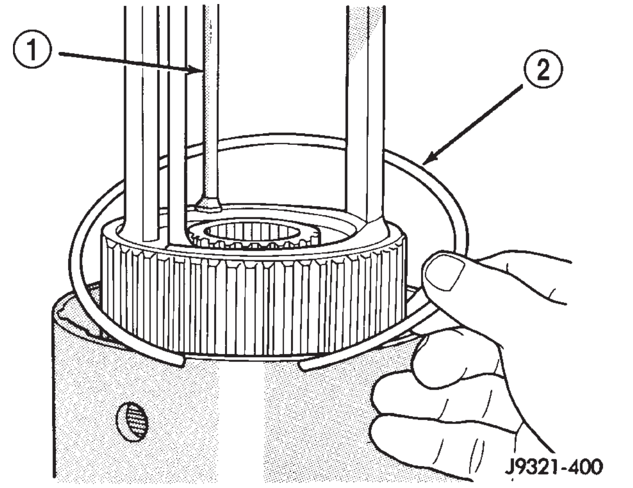


Fig. 291 Direct Clutch Pack Snap Ring Installation

1 – SPECIAL TOOL 6227–1
2 – DIRECT CLUTCH PACK SNAP RING

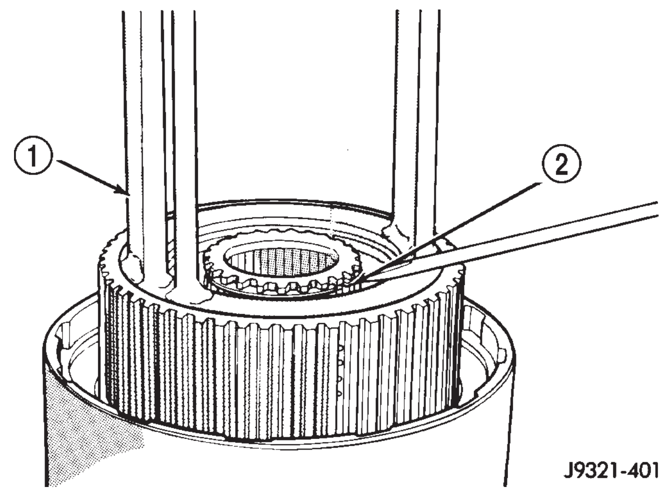


Fig. 292 Clutch Hub Retaining Ring Installation

1 – SPECIAL TOOL 6227–1
2 – CLUTCH HUB RETAINING RING

GEAR CASE

(1) Position park pawl and spring in case and install park pawl shaft. Verify that end of spring with 90° bend is hooked to pawl and straight end of spring is seated against case.

(2) Install pawl shaft retaining bolt. Tighten bolt to 27 N·m (20 ft. lbs.) torque.

(3) Install park lock reaction plug. **Note that plug has locating pin at rear (Fig. 293). Be sure pin is seated in hole in case before installing snap ring.**

(4) Install reaction plug snap-ring (Fig. 294). **Compress snap ring only enough for installation; do not distort it.**

(5) Install new seal in gear case. Use Handle C-4171 and Installer C-3995-A to seat seal in case.

DISASSEMBLY AND ASSEMBLY (Continued)

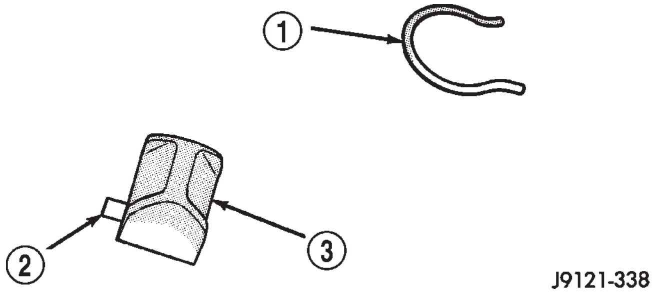


Fig. 293 Reaction Plug Locating Pin And Snap-Ring

1 – REACTION PLUG SNAP RING (DO NOT OVERCOMPRESS TO INSTALL)
2 – LOCATING PIN
3 – PARK LOCK REACTION PLUG

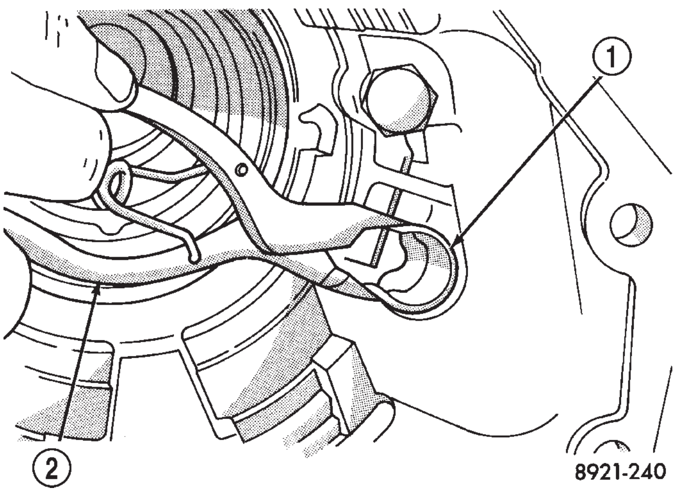


Fig. 294 Reaction Plug And Snap-Ring Installation

1 – REACTION PLUG SNAP RING
2 – SNAP RING PLIERS

(6) Verify that tab ends of rear bearing locating ring extend into access hole in gear case (Fig. 295).

(7) Support geartrain on Tool 6227-1 (Fig. 296). Be sure tool is securely seated in clutch hub.

(8) Install overdrive gear case on geartrain (Fig. 296).

(9) Expand front bearing locating ring with snap ring pliers (Fig. 297). Then slide case downward until locating ring locks in bearing groove and release snap ring.

(10) Install locating ring access cover and gasket in overdrive unit case (Fig. 298).

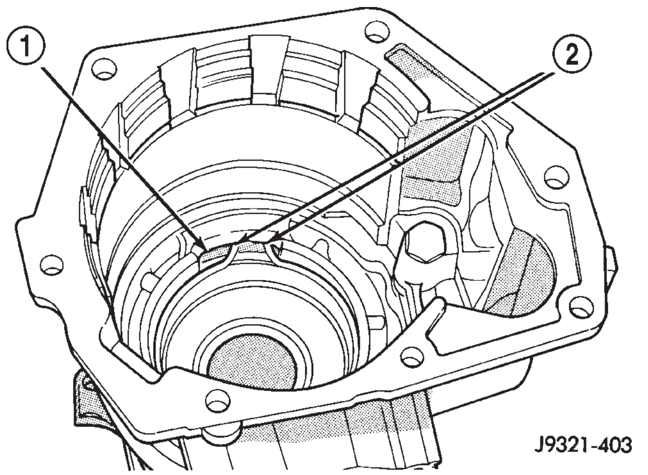


Fig. 295 Correct Rear Bearing Locating Ring Position

1 – CASE ACCESS HOLE
2 – TAB ENDS OF LOCATING RING

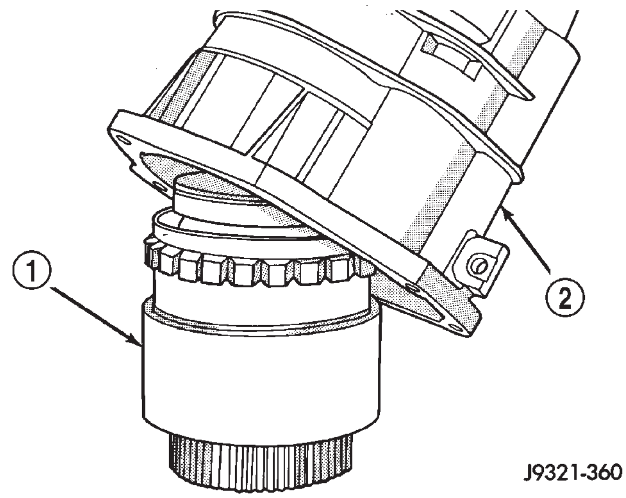


Fig. 296 Overdrive Gear Case Installation

1 – GEARTRAIN ASSEMBLY
2 – GEAR CASE

OVERDRIVE CLUTCH

(1) Install overdrive clutch reaction ring first. Reaction ring is flat with notched ends (Fig. 299).

(2) Install wave spring on top of reaction ring (Fig. 300). **Reaction ring and wave ring both fit in same ring groove.** Use screwdriver to seat each ring securely in groove. Also ensure that the ends of the two rings are offset from each other.

DISASSEMBLY AND ASSEMBLY (Continued)

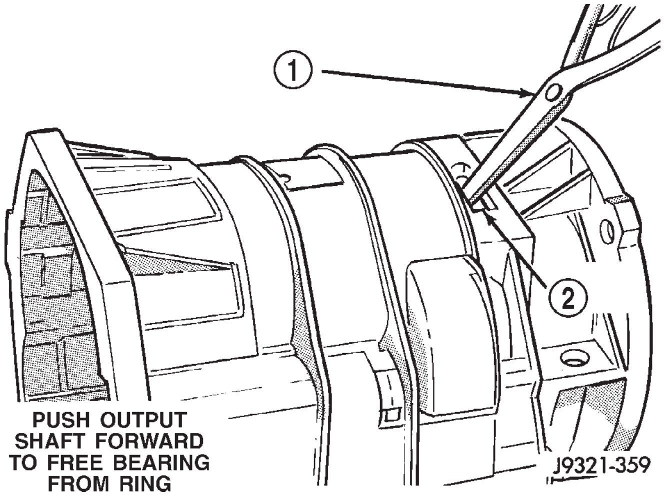


Fig. 297 Seating Locating Ring In Rear Bearing

1 – EXPAND BEARING LOCATING RING WITH SNAP RING PLIERS
2 – ACCESS HOLE

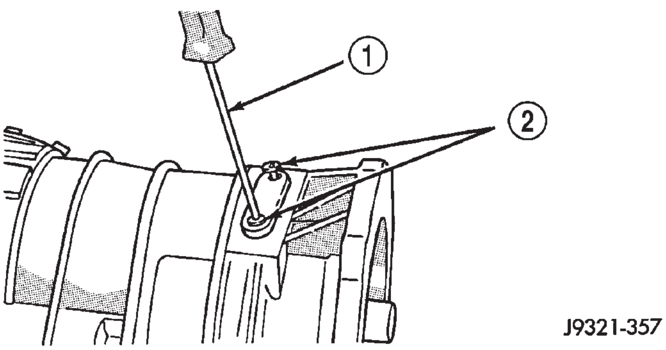


Fig. 298 Locating Ring Access Cover And Gasket Installation

1 – TORX SCREWDRIVER (T25)
2 – ACCESS COVER SCREWS

(3) Assemble overdrive clutch pack (Fig. 301).

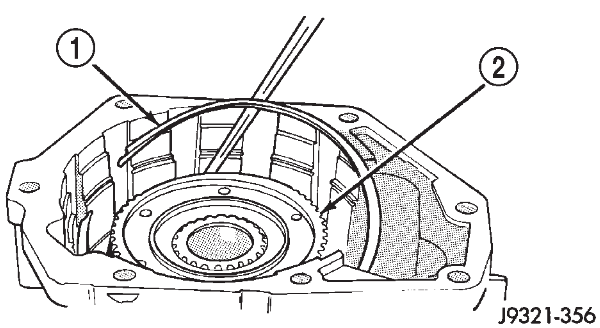


Fig. 299 Overdrive Clutch Reaction Ring Installation

1 – REACTION RING
2 – CLUTCH HUB

(4) Install overdrive clutch reaction plate first.

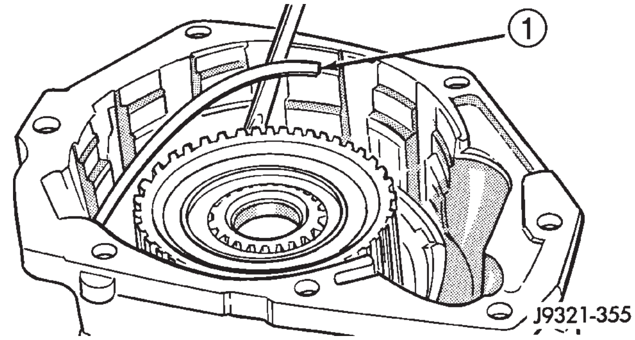


Fig. 300 Overdrive Clutch Wave Spring Installation

1 – WAVE SPRING

(5) Install first clutch disc followed by first clutch plate. Then install remaining clutch discs and plates in same order.

(6) Install clutch pack pressure plate.

(7) Install clutch pack wire-type retaining ring (Fig. 302).

INTERMEDIATE SHAFT SPACER SELECTION

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness intermediate shaft spacer as follows:

(a) Insert Special Tool 6312 through sun gear, planetary gear and into pilot bushing in output shaft. Be sure tool bottoms against planetary shoulder.

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 303). Then position Dial Caliper C-4962 over gauge tool.

(c) Extend sliding scale of dial caliper downward through gauge tool slot until scale contacts end of Gauge Alignment Tool 6312. Lock scale in place. Remove dial caliper tool and note distance measured (Fig. 303).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 304).

(e) Remove Gauge Alignment Tool 6312.

OD THRUST PLATE SELECTION

(1) Place overdrive unit in vertical position. Mount it on blocks, or in workbench with appropriate size mounting hole cut into it. Be sure unit is facing upward for access to direct clutch hub. Also be sure output shaft is not loaded and internal components are moved rearward for accurate measurement.

(2) Determine correct thickness overdrive piston thrust plate as follows:

DISASSEMBLY AND ASSEMBLY (Continued)

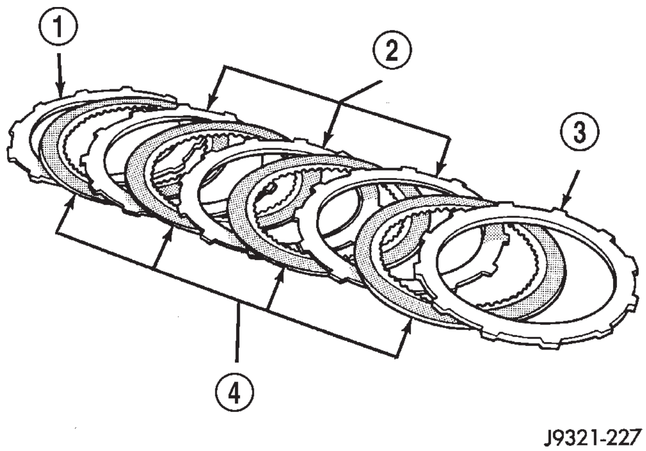


Fig. 301 46RE Overdrive Clutch Components

1 – REACTION PLATE
2 – CLUTCH PLATES (3)
3 – PRESSURE PLATE
4 – CLUTCH DISCS (4)

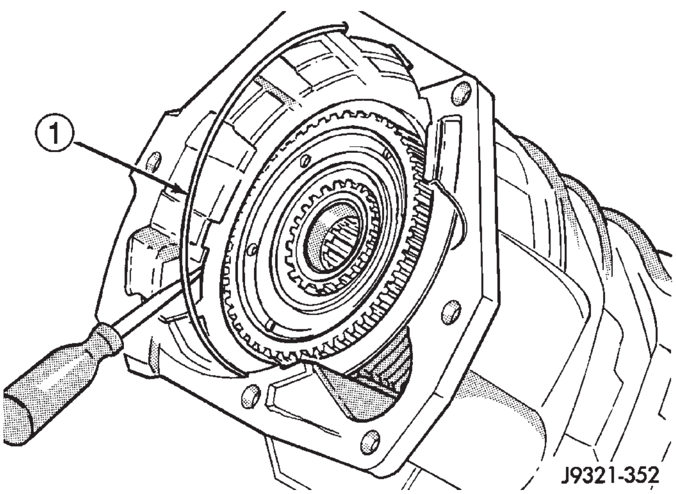


Fig. 302 Overdrive Clutch Pack Retaining Ring Installation

1 – OVERDRIVE CLUTCH PACK RETAINING RING

(a) Position Gauge Tool 6311 across face of overdrive case. Then position Dial Caliper C-4962 over gauge tool (Fig. 305).

(b) Measure distance to clutch hub thrust bearing seat at four points 90° apart. Then average measurements by adding them and dividing by 4.

(c) Select and install required thrust plate from information in thrust plate chart (Fig. 306).

(3) Leave Alignment Tool 6227-2 in place. Tool will keep planetary and clutch hub splines in alignment until overdrive unit is ready for installation on transmission.

(4) Transmission speed sensor can be installed at this time if desired. However, it is recommended that sensor not be installed until after overdrive unit is secured to transmission.

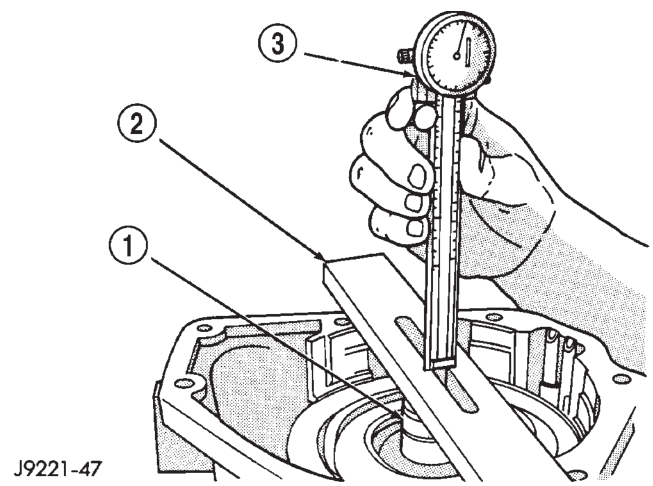


Fig. 303 Shaft End Play Measurement

1 – SPECIAL TOOL 6312
2 – SPECIAL TOOL 6311
3 – SPECIAL TOOL C-4962

End Play Measurement (Inches)	Spacer Thickness (Inches)
.7336 - .7505	.158 - .159
.7506 - .7675	.175 - .176
.7676 - .7855	.193 - .194
.7856 - .8011	.211 - .212

J9121-341

Fig. 304 Intermediate Shaft End Play Spacer Selection

OVERDRIVE PISTON

(1) Install new seals on overdrive piston.

DISASSEMBLY AND ASSEMBLY (Continued)

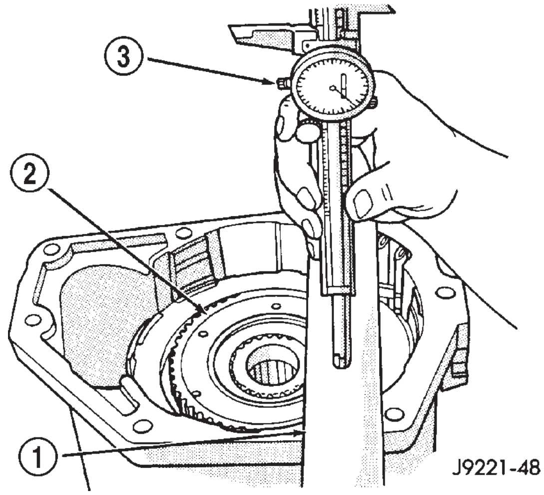


Fig. 305 Overdrive Piston Thrust Plate Measurement

1 – SPECIAL TOOL 6311
2 – DIRECT CLUTCH HUB THRUST BEARING SEAT
3 – SPECIAL TOOL C-4962

End Play Measurement (Inches)	Spacer Thickness (Inches)
1.7500 - 1.7649	.108 - .110
1.7650 - 1.7799	.123 - .125
1.7800 - 1.7949	.138 - .140
1.7950 - 1.8099	.153 - .155
1.8100 - 1.8249	.168 - .170
1.8250 - 1.8399	.183 - .185
1.8400 - 1.8549	.198 - .200
1.8550 - 1.8699	.213 - .215
1.8700 - 1.8849	.228 - .230
1.8850 - 1.8999	.243 - .245

J9121-342

Fig. 306 Overdrive Piston Thrust Plate Selection

(2) Stand transmission case upright on bellhousing.

(3) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(4) Position Seal Guide 8114-3 on inner edge of overdrive piston retainer.

(5) Install overdrive piston in overdrive piston retainer by:

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114–3 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

(6) Install intermediate shaft spacer on intermediate shaft.

(7) Install overdrive piston thrust plate on overdrive piston.

(8) Install overdrive piston thrust bearing on overdrive piston.

(9) Install transmission speed sensor and O-ring seal in overdrive case (Fig. 247).

CLEANING AND INSPECTION

VALVE BODY

Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the governor solenoid and sensor and the dual solenoid and harness assembly by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

Wipe the governor pressure sensor and solenoid valve with dry, lint free shop towels only. The O-rings on the sensor and solenoid valve are the only serviceable components. Be sure the vent ports in the solenoid valve are open and not blocked by dirt or debris. Replace the valve and/or sensor only when DRB scan tool diagnosis indicates this is necessary. Or, if either part has sustained physical damage (dented, deformed, broken, etc.).

CAUTION: Do not turn the small screw at the end of the solenoid valve for any reason. Turning the screw in either direction will ruin solenoid calibration and result in solenoid failure. In addition, the filter on the solenoid valve is NOT serviceable. Do not try to remove the filter as this will damage the valve housing.

Inspect the throttle and manual valve levers and shafts (Fig. 307). Do not attempt to straighten a bent shaft or correct a loose lever. Replace these components if worn, bent, loose or damaged in any way.

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a

CLEANING AND INSPECTION (Continued)

sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

CAUTION: Many of the valves and plugs, such as the throttle valve, shuttle valve plug, 1-2 shift valve and 1-2 governor plug, are made of coated aluminum. Aluminum components are identified by the dark color of the special coating applied to the surface (or by testing with a magnet). Do not sand aluminum valves or plugs under any circumstances. This practice could damage the special coating causing the valves/plugs to stick and bind.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Check the two separator plates for distortion or damage of any kind. Inspect the upper housing, lower housing, 3-4 accumulator housing, and transfer plate carefully. Be sure all fluid passages are clean and clear. Check condition of the upper housing and transfer plate check balls as well. The check balls and ball seats must not be worn or damaged.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

The only serviceable valve body components are listed below. The remaining valve body components are serviced only as part of a complete valve body assembly. Serviceable parts are:

- dual solenoid and harness assembly
- solenoid gasket
- solenoid case connector O-rings and shoulder bolt
- switch valve and spring
- pressure adjusting screw and bracket assembly
- throttle lever
- manual lever and shaft seal
- throttle lever shaft seal, washer, and E-clip
- fluid filter and screws
- detent ball and spring
- valve body screws
- governor pressure solenoid
- governor pressure sensor and retaining clip
- park lock rod and E-clip

CLEANING AND INSPECTION (Continued)

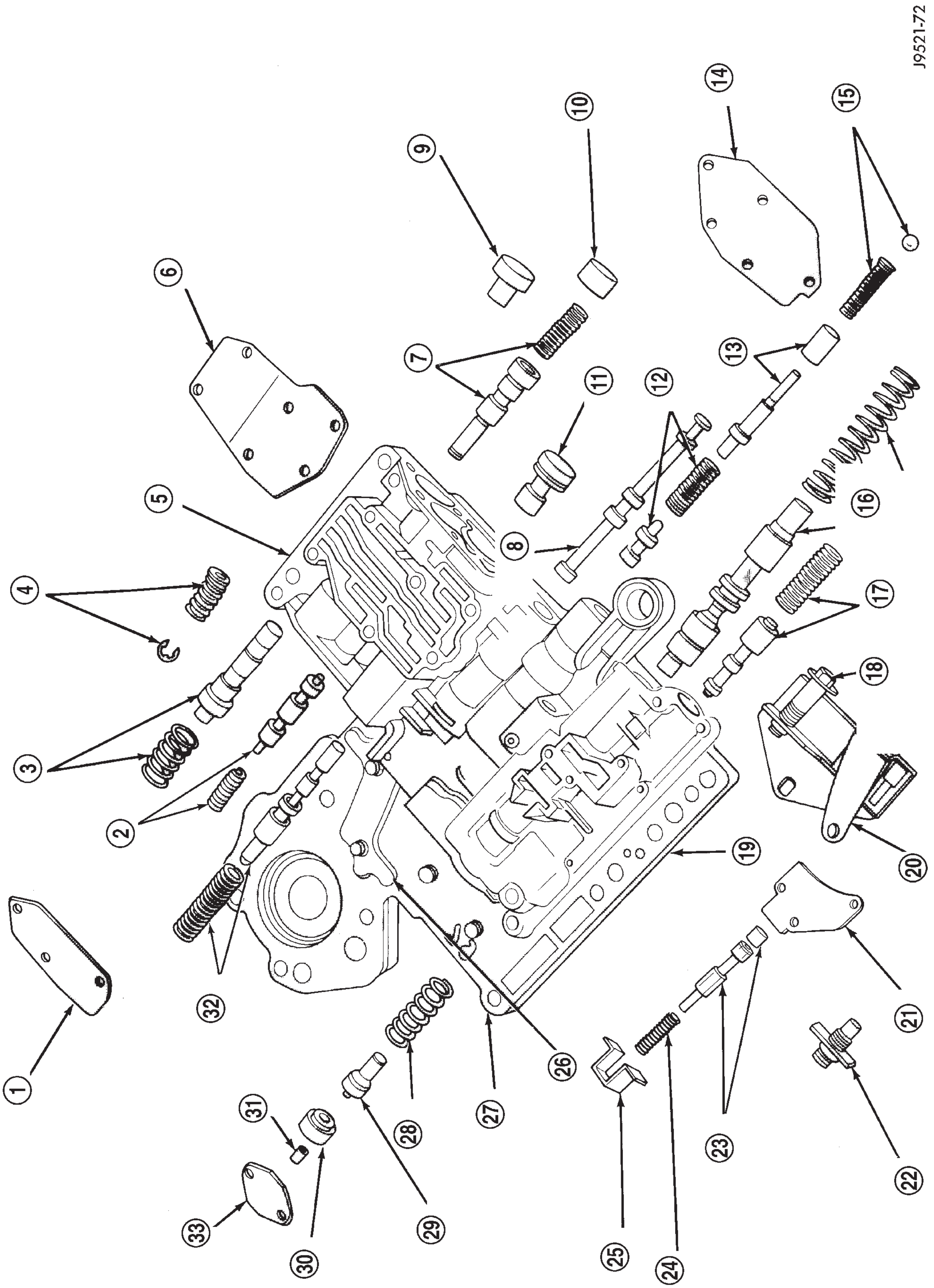


Fig. 307 Upper Housing Valves, Plug, Springs And Brackets

CLEANING AND INSPECTION (Continued)

1 – SHIFT VALVE COVER
2 – 1–2 SHIFT VALVE AND SPRING
3 – 2–3 SHIFT VALVE AND SPRING
4 – SHUTTLE VALVE SECONDARY SPRING, GUIDES, E-CLIP
5 – VALVE BODY
6 – SHUTTLE VALVE COVER
7 – SHUTTLE VALVE AND PRIMARY SPRING
8 – MANUAL VALVE
9 – 2–3 SHIFT VALVE GOVERNOR PLUG
10 – SHUTTLE VALVE PLUG
11 – 1–2 SHIFT VALVE GOVERNOR PLUG
12 – THROTTLE VALVE AND SPRING
13 – KICKDOWN VALVE AND DETENT
14 – VALVE AND PLUG COVER
15 – MANUAL LEVER DETENT BALL AND SPRING
16 – PRESSURE REGULATOR VALVE AND SPRING
17 – SWITCH VALVE AND SPRING
18 – THROTTLE PRESSURE ADJUSTING SCREW
19 – TRANSFER PLATE
20 – ADJUSTING SCREW BRACKET
21 – BOOST VALVE COVER
22 – LINE PRESSURE ADJUSTING SCREW
23 – BOOST VALVE AND PLUG
24 – BOOST VALVE SPRING
25 – VALVE AND SPRING RETAINER
26 – STIFFENER PLATE
27 – SEPARATOR PLATE
28 – SPRING
29 – REGULATOR VALVE THROTTLE PRESSURE PLUG
30 – SLEEVE
31 – REGULATOR VALVE PRESSURE PLUG
32 – 1–2 SHIFT CONTROL VALVE AND SPRING
33 – REGULATOR VALVE COVER

TRANSMISSION

GENERAL INFORMATION

Inspect the transmission bushings during overhaul. Bushing condition is important as worn, scored bushings contribute to low pressures, clutch slip and accelerated wear of other components. However, do not replace bushings as a matter of course. Replace bushings only when they are actually worn, or scored.

Use recommended tools to replace bushings. The tools are sized and designed to remove, install, and seat bushings correctly. The bushing replacement tools are included in Bushing Tool Set C-3887-B.

Pre-sized service bushings are available for replacement purposes. Only the sun gear bushings are not serviced. Low cost of the sun gear assembly makes it easier to simply replace the gear and bushings as an assembly.

Heli-Coil inserts can be used to repair damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive parts suppliers. Stainless steel inserts are recommended.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

Lubricate transmission parts with Mopar® ATF Plus 3, Type 7176, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

TRANSMISSION CASE CLEANING AND INSPECTION

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

Lubricate the front band adjusting screw threads with petroleum jelly and thread the screw part-way into the case. Be sure the screw turns freely.

OVERRUNNING CLUTCH/LOW-REVERSE DRUM/OVERDRIVE PISTON RETAINER

Clean the overrunning clutch assembly, clutch cam, low-reverse drum, and overdrive piston retainer in solvent. Dry them with compressed air after cleaning.

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or dam-

CLEANING AND INSPECTION (Continued)

aged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse drum if the clutch race, roller surface or inside diameter is scored, worn or damaged. **Do not remove the clutch race from the low-reverse drum under any circumstances. Replace the drum and race as an assembly if either component is damaged.**

Examine the overdrive piston retainer carefully for wear, cracks, scoring or other damage. Be sure the retainer hub is a snug fit in the case and drum. Replace the retainer if worn or damaged.

ACCUMULATOR

Inspect the accumulator piston and seal rings (Fig. 308). Replace the seal rings if worn or cut. Replace the piston if chipped or cracked.

Check condition of the accumulator inner and outer springs (Fig. 308). Replace the springs if the coils are cracked, distorted or collapsed.

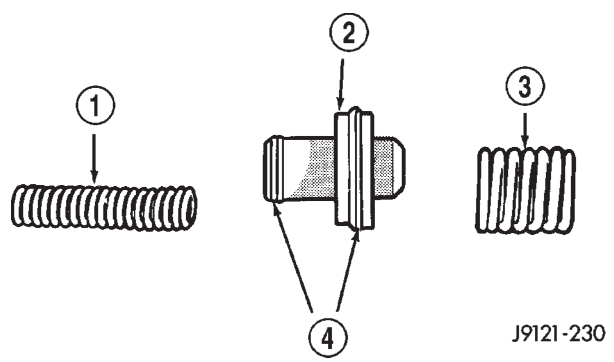


Fig. 308 Accumulator Components

1 – INNER SPRING
2 – ACCUMULATOR PISTON
3 – OUTER SPRING
4 – SEAL RINGS

FRONT SERVO

Clean the servo piston components with solvent and dry them with compressed air. Wipe the band clean with lint free shop towels.

Replace the front band if distorted, lining is burned, flaking off, or worn to the point where the grooves in the lining material are no longer visible.

Inspect the servo components. Replace the springs if collapsed, distorted or broken. Replace the guide, rod and piston if cracked, bent, or worn. Discard the servo snap ring if distorted or warped.

Check the servo piston bore for wear. If the bore is severely scored, or damaged, it will be necessary to replace the case.

Replace any servo component if doubt exists about condition. Do not reuse suspect parts.

REAR SERVO

Remove and discard the servo piston seal ring (Fig. 309). Then clean the servo components with solvent and dry with compressed air. Replace either spring if collapsed, distorted or broken. Replace the plug and piston if cracked, bent, or worn. Discard the servo snap rings and use a new ones at assembly.

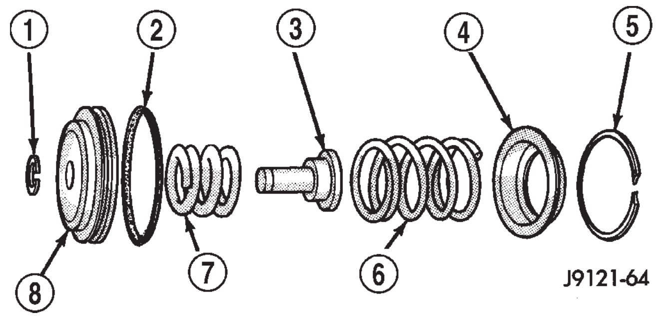


Fig. 309 Rear Servo Components

1 – SNAP RING
2 – PISTON SEAL
3 – PISTON PLUG
4 – SPRING RETAINER
5 – SNAP RING
6 – PISTON SPRING
7 – CUSHION SPRING
8 – PISTON

OIL PUMP AND REACTION SHAFT SUPPORT

Clean pump and support components with solvent and dry them with compressed air.

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Check the pump vent. The vent must be secure. Replace the pump body if the vent is cracked, broken, or loose.

Inspect the pump bushing. Then check the reaction shaft support bushing. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

(1) Install the gears in the pump body and measure pump component clearances as follows:

(a) Clearance between outer gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Clearance between inner gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Both clearances can be measured at the same time by:

CLEANING AND INSPECTION (Continued)

(I) Installing the pump gears in the pump housing.

(II) Position an appropriate piece of Plastigage™ across both gears.

(III) Align the plastigage to a flat area on the reaction shaft housing.

(IV) Install the reaction shaft to the pump housing.

(V) Separate the reaction shaft housing from the pump housing and measure the Plastigage™ following the instructions supplied with it.

(b) Clearance between inner gear tooth and outer gear should be 0.08 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge (Fig. 310).

(c) Clearance between outer gear and pump housing should also be 0.010 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

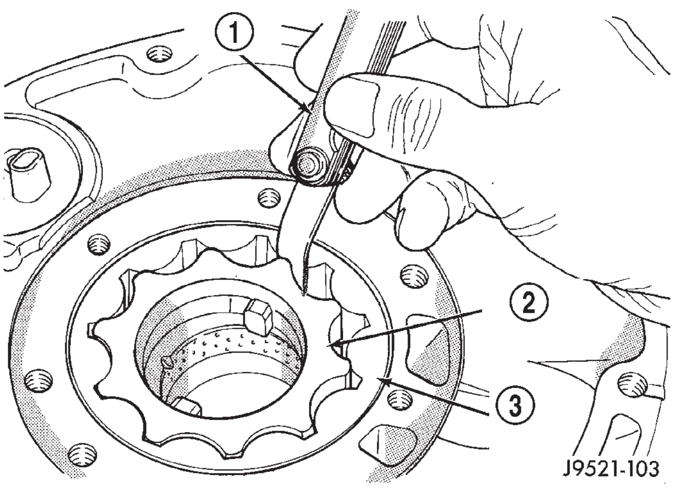


Fig. 310 Checking Pump Gear Tip Clearance

1 – FEELER GAUGE
2 – INNER GEAR
3 – OUTER GEAR

FRONT CLUTCH

Clean and inspect the front clutch components. Replace the clutch discs if warped, worn, scored, burned or charred, the lugs are damaged, or if the facing is flaking off. Replace the steel plates and reaction plate if heavily scored, warped, or broken. Be sure the driving lugs on the discs and plate are also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston springs and spring retainer if either are distorted, warped or broken.

Check the lug grooves in the clutch piston retainer. The steel plates should slide freely in the slots. Replace the piston retainer if the grooves are worn or damaged. Also check action of the check ball in the piston retainer. The ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or there is any doubt about bushing condition.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously scored.

Check the clutch piston check ball. The ball should be securely in place. Replace the piston if the ball is missing, or seized in place.

REAR CLUTCH

Clean the clutch components with solvent and dry them with compressed air.

Check condition of the input shaft seal rings. It is not necessary to remove or replace rings unless they are broken, cracked, or no longer securely hooked together.

Inspect the input shaft splines and machined surfaces. Very minor nicks or scratches can be smoothed off with crocus cloth. replace the shaft if the splines are damaged, or any of the machined surfaces are severely scored.

Replace the clutch discs if warped, worn, scored, burned/charred, the lugs are damaged, or if the facing is flaking off.

Replace the steel plates and the pressure plate if heavily scored, warped, or broken. Be sure the driving lugs on the discs and plates are also in good condition. The lugs must not be bent, cracked or damaged in any way.

Replace the piston spring and wave spring if either part is distorted, warped or broken.

Check the lug grooves in the clutch retainer. The steel plates should slide freely in the slots. Replace the retainer if the grooves are worn or damaged. Also check action of the retainer check ball. The ball must move freely and not stick.

Inspect the piston and retainer seal surfaces for nicks or scratches. Minor scratches can be removed with crocus cloth. However, replace the piston and/or retainer if the seal surfaces are seriously damaged.

Check thrust washer condition. Washer thickness should be 1.55 to 1.60 mm (0.061 to 0.063 in.). Replace the washer if worn or damaged.

Check condition of the two seal rings on the input shaft and the single seal ring on the piston retainer hub. Replace the seal rings only if severely worn, cracked, or cannot be hooked together.

PLANETARY GEARTRAIN/OUTPUT SHAFT

Clean the intermediate shaft and planetary components in solvent and dry them with compressed air.

Inspect the planetary gear sets and annulus gears. The planetary pinions, shafts, washers, and retaining

CLEANING AND INSPECTION (Continued)

pins are serviceable. However, if a pinion carrier is damaged, the entire planetary gear set must be replaced as an assembly.

Replace the annulus gears if the teeth are chipped, broken, or worn, or the gear is cracked. Replace the planetary thrust plates and the tabbed thrust washers if cracked, scored or worn.

Inspect the machined surfaces of the intermediate shaft. Be sure the oil passages are open and clear. Replace the shaft if scored, pitted, or damaged.

Inspect the sun gear and driving shell. If either component is worn or damaged, remove the sun gear rear retaining ring and separate the sun gear and thrust plate from the driving shell. Then replace the necessary component.

Replace the sun gear as an assembly if the gear teeth are chipped or worn. Also replace the gear as an assembly if the bushings are scored or worn. The sun gear bushings are not serviceable. Replace the thrust plate if worn, or severely scored. Replace the driving shell if distorted, cracked, or damaged in any way.

Replace all snap rings during geartrain assembly. Reusing snap rings is not recommended.

OVERDRIVE UNIT

Clean the geartrain and case components with solvent. Dry all parts except the bearings with compressed air. Allow bearings to air dry.

Do not use shop towels for wiping parts dry unless the towels are made from a lint-free material. A sufficient quantity of lint (from shop towels, cloths, rags, etc.) could plug the transmission filter and fluid passages.

Discard the old case gasket and seals. Do not attempt to salvage these parts. They are not reusable. Replace any of the overdrive unit snap rings if distorted or damaged.

Minor nicks or scratches on components can be smoothed with crocus cloth. However, do not attempt to reduce severe scoring on any components with abrasive materials. Replace severely scored components; do not try to salvage them.

Check condition of the park lock components and the overdrive case.

Replace the case if cracked, scored, or damaged. Replace the park lock pawl, plug, or spring if worn or damaged. Be sure the bullet at the end of the park lock rod is in good condition. Replace the rod if the bullet is worn or the rod itself is bent or distorted. Do not attempt to straighten the rod.

Check the bushings in the overdrive case. Replace the bushings if severely scored or worn. Also replace the case seal if loose, distorted, or damaged.

Examine the overdrive and direct clutch discs and plates. Replace the discs if the facing is worn, severely scored, or burned and flaking off. Replace the clutch plates if worn, heavily scored, or cracked. Check the lugs on the clutch plates for wear. The plates should slide freely in the drum. Replace the plates or drum if binding occurs.

Check condition of the annulus gear, direct clutch hub, clutch drum and clutch spring. Replace the gear, hub and drum if worn or damaged. Replace the spring if collapsed, distorted, or cracked.

Be sure the splines and lugs on the gear, drum and hub are in good condition. The clutch plates and discs should slide freely in these components.

Inspect the thrust bearings and spring plate. Replace the plate if worn or scored. Replace the bearings if rough, noisy, brinnelled, or worn.

Inspect the planetary gear assembly and the sun gear and bushings. If either the sun gear or the bushings are damaged, replace the gear and bushings as an assembly. The gear and bushings are not serviced separately.

The planetary carrier and pinions must be in good condition. Also be sure the pinion pins are secure and in good condition. Replace the carrier if worn or damaged.

Inspect the overrunning clutch and race. The race surface should be smooth and free of scores. Replace the overrunning clutch assembly or the race if either assembly is worn or damaged in any way.

Inspect the output shaft and governor components. Replace the shaft pilot bushing and inner bushing if damaged. Replace either shaft bearing if rough or noisy. Replace the bearing snap rings if distorted or cracked.

Check the machined surfaces on the output shaft. These surfaces should clean and smooth. Very minor nicks or scratches can be smoothed with crocus cloth. Replace the shaft if worn, scored or damaged in any way.

Inspect the output shaft bushings. The small bushing is the intermediate shaft pilot bushing. The large bushing is the overrunning clutch hub bushing. Replace either bushing if scored, pitted, cracked, or worn.

ADJUSTMENTS

TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT

The transmission throttle valve is operated by a cam on the valve body throttle lever. The throttle lever is actuated by a cable connected to the engine throttle body lever (Fig. 311). A retaining clip at the engine-end of the cable is removed to provide for cable adjustment. The retaining clip is then installed

ADJUSTMENTS (Continued)

back onto the throttle valve cable to lock in the adjustment.

A correctly adjusted throttle valve cable, will cause the throttle lever on the transmission to move simultaneously with the throttle body lever from the idle position. Proper adjustment allows simultaneous movement without causing the transmission throttle lever to move ahead of, or lag behind the throttle body lever.

THROTTLE VALVE CABLE ADJUSTMENT CHECK

(1) Turn ignition key to OFF position.

(2) Remove air cleaner.

(3) Slide cable off attachment stud on throttle body lever (Fig. 311).

(4) Verify that throttle body lever is at curb idle position. Then verify that transmission throttle lever is also at idle (full forward) position.

(5) Compare position of cable end to attachment stud on throttle body lever:

(a) Cable end and attachment stud should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction.

(b) If cable end and attachment stud are misaligned (off center), cable will have to be adjusted as described in following procedure.

(6) Reconnect cable end to attachment stud. Then with aid of a helper, observe movement of transmission throttle lever and lever on throttle body.

(a) If both levers move simultaneously from idle to half-throttle and back to idle position, adjustment is correct.

(b) If transmission throttle lever moves ahead of, or lags behind throttle body lever, cable adjustment will be necessary. Or, if throttle body lever prevents transmission lever from returning to closed position, cable adjustment will be necessary.

THROTTLE VALVE CABLE ADJUSTMENT PROCEDURE

(1) Turn ignition switch to OFF position and shift into Park.

(2) Remove air cleaner.

(3) Disconnect cable end from attachment stud on throttle body. **Carefully slide cable off stud. Do not pull or pry cable off.**

(4) Verify that transmission throttle lever is in idle (full forward) position. Then be sure lever on throttle body is at curb idle position.

(5) Insert a small screwdriver under edge of retaining clip and remove retaining clip.

(6) Center cable end on attachment stud to within 1 mm (0.039 in.).

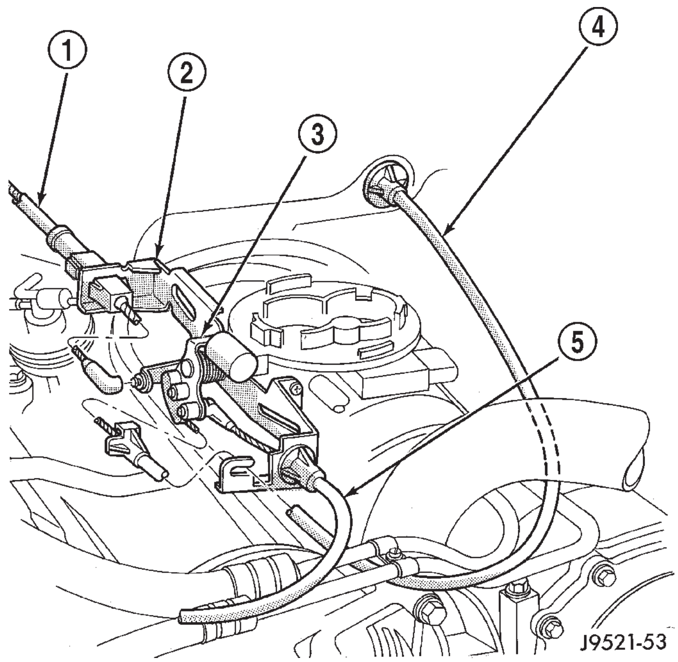


Fig. 311 Throttle Valve Cable Attachment —At Engine

1 – THROTTLE VALVE CABLE
2 – CABLE BRACKET
3 – THROTTLE BODY LEVER
4 – ACCELERATOR CABLE
5 – SPEED CONTROL CABLE

NOTE: Be sure that as the cable is pulled forward and centered on the throttle lever stud, the cable housing moves smoothly with the cable. Due to the angle at which the cable housing enters the spring housing, the cable housing may bind slightly and create an incorrect adjustment.

(7) Install retaining clip onto cable housing.

(8) Check cable adjustment. Be sure transmission throttle lever and lever on throttle body move simultaneously and as described in cable adjustment checking procedure.

GEARSHIFT CABLE

Check adjustment by starting the engine in Park and Neutral. Adjustment is OK if the engine starts only in these positions. Adjustment is incorrect if the engine starts in one but not both positions. If the engine starts in any position other than Park or Neutral, or if the engine will not start at all, the park/neutral position switch may be faulty.

ADJUSTMENTS (Continued)

Gearshift Adjustment Procedure

(1) Shift transmission into Park.

(2) Release cable adjuster lock (underneath the power brake booster) (Fig. 312) to unlock cable.

(3) Raise vehicle.

(4) Slide cable eyelet off transmission shift lever.

(5) Verify transmission shift lever is in Park detent by moving lever fully rearward. Last rearward detent is Park position.

(6) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(7) Slide cable eyelet onto transmission shift lever.

(8) Lower vehicle and check engine starting. Engine should start only in Park and Neutral.

(9) Lock shift cable by pressing cable adjuster clamp down until it snaps into place.

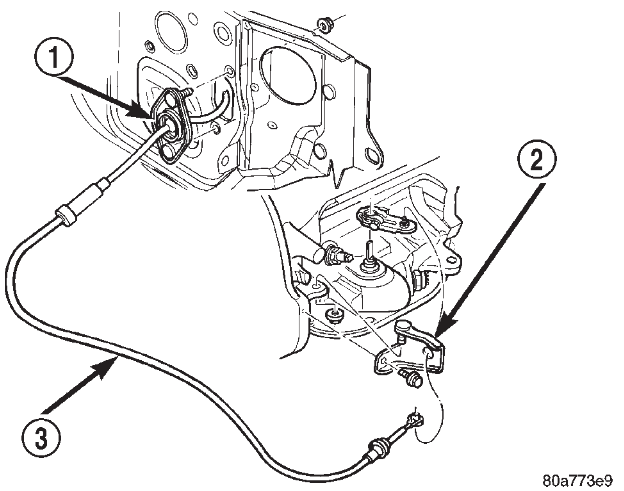


Fig. 312 Gearshift Cable Routing

1 – CABLE MOUNTING
2 – CABLE BRACKET AT TRANS.
3 – GEARSHIFT CABLE

FRONT BAND ADJUSTMENT

The front (kickdown) band adjusting screw is located on the left side of the transmission case above the manual valve and throttle valve levers.

(1) Raise vehicle.

(2) Loosen band adjusting screw locknut (Fig. 313). Then back locknut off 3-5 turns. Be sure adjusting screw turns freely in case. Apply lubricant to screw threads if necessary.

(3) Tighten band adjusting screw to 8 N·m (72 in. lbs.) torque with Inch Pound Torque Wrench C-3380-A, a 3-in. extension and an appropriate Torx™ socket.

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw, tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

(4) Back off front band adjusting screw 2-7/8 turns.

(5) Hold adjuster screw in position and tighten locknut to 41 N·m (30 ft. lbs.) torque.

(6) Lower vehicle.

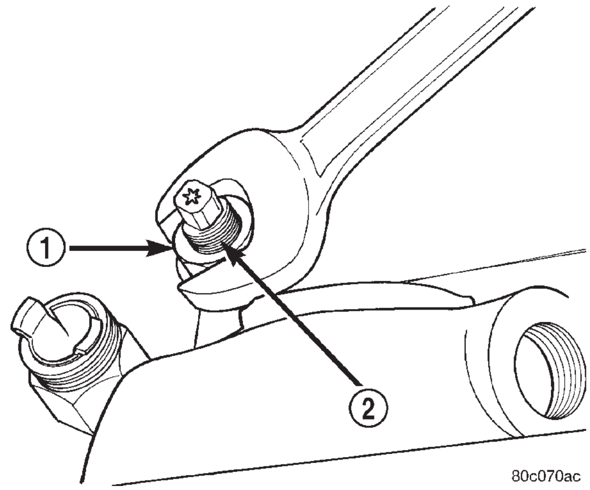


Fig. 313 Front Band Adjustment Screw Location

1 – LOCK-NUT
2 – FRONT BAND ADJUSTER

REAR BAND ADJUSTMENT

The transmission oil pan must be removed for access to the rear band adjusting screw.

(1) Raise vehicle.

(2) Remove transmission oil pan and drain fluid.

(3) Loosen band adjusting screw locknut 5-6 turns. Be sure adjusting screw turns freely in lever.

(4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque (Fig. 314).

(5) Back off adjusting screw 2 turns.

(6) Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.

(7) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(8) Lower vehicle and refill transmission with Mopar® ATF Plus, Type 7176 fluid.

VALVE BODY

CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body;

- Line Pressure
- Throttle Pressure

Line and throttle pressures are interdependent because each affects shift quality and timing. As a result, both adjustments must be performed properly and in the correct sequence. Adjust line pressure first and throttle pressure last.

ADJUSTMENTS (Continued)

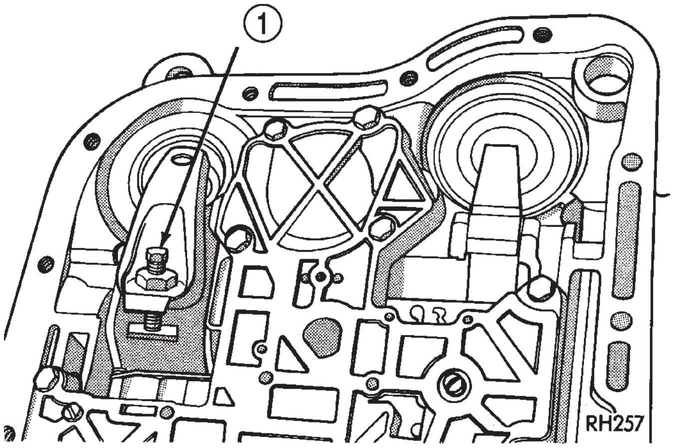


Fig. 314 Rear Band Adjustment Screw Location

1 – LOW-REVERSE BAND ADJUSTMENT

LINE PRESSURE ADJUSTMENT

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 315).

Distance should be 33.4 mm (1-5/16 in.).

If adjustment is required, turn the adjusting screw in, or out, to obtain required distance setting.

NOTE: The 33.4 mm (1-5/16 in.) setting is an approximate setting. Manufacturing tolerances may make it necessary to vary from this dimension to obtain desired pressure.

One complete turn of the adjusting screw changes line pressure approximately 1-2/3 psi (9 kPa).

Turning the adjusting screw counterclockwise increases pressure while turning the screw clockwise decreases pressure.

THROTTLE PRESSURE ADJUSTMENT

Insert Gauge Tool C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 316).

Push the gauge tool inward to compress the kickdown valve against the spring and bottom the throttle valve.

Maintain pressure against kickdown valve spring. Turn throttle lever stop screw until the screw head touches throttle lever tang and the throttle lever cam touches gauge tool.

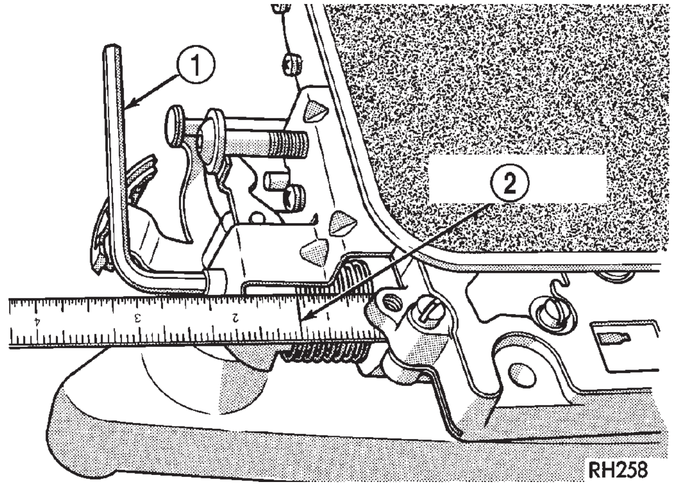


Fig. 315 Line Pressure Adjustment

1 – WRENCH
2 – 1–5/16 INCH

NOTE: The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.

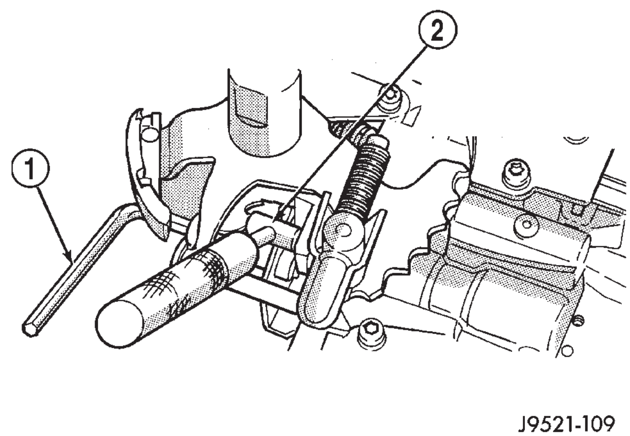


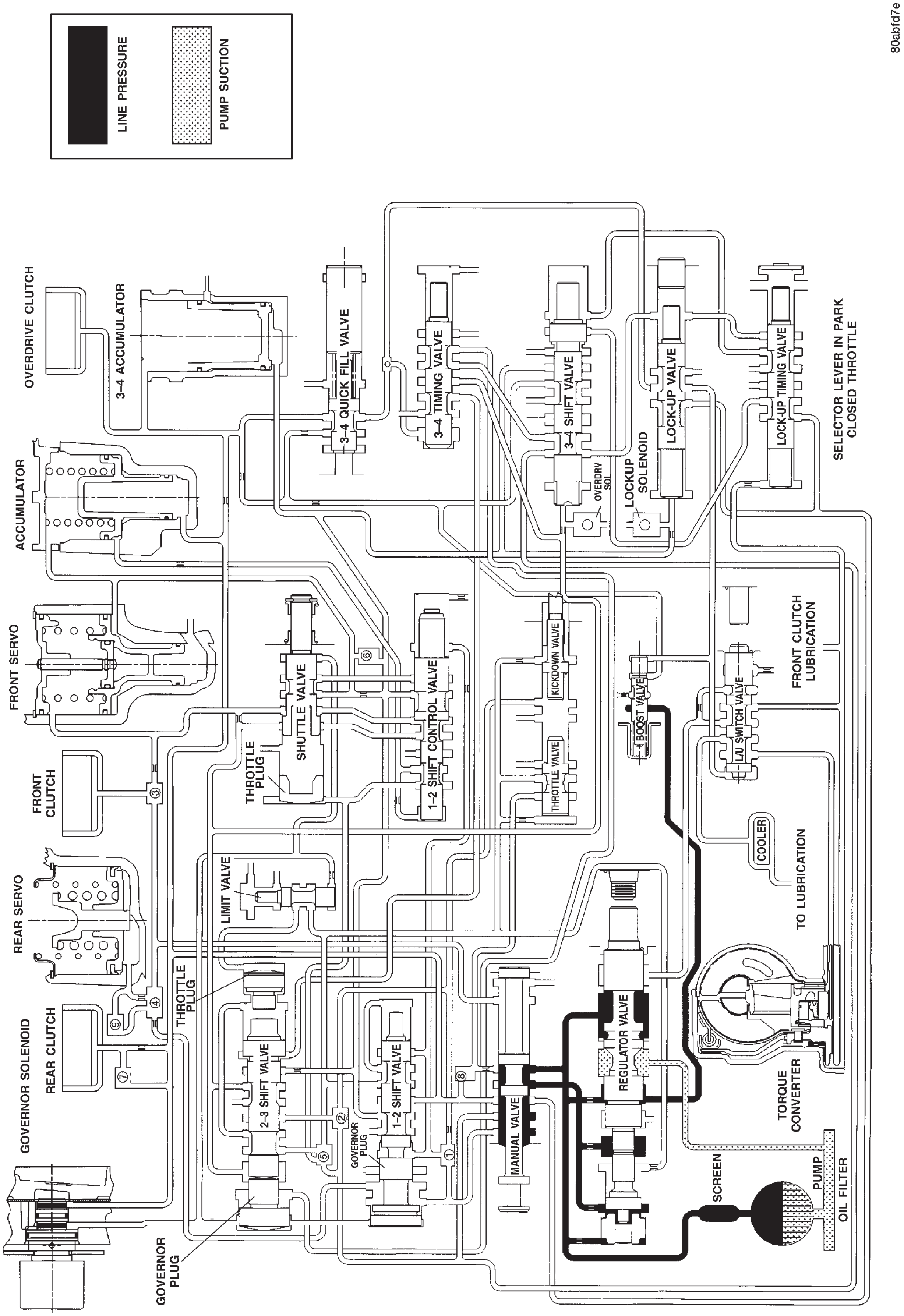
Fig. 316 Throttle Pressure Adjustment

1 – HEX WRENCH (IN THROTTLE LEVER ADJUSTING SCREW)
2 – SPECIAL TOOL C-3763 (POSITIONED BETWEEN THROTTLE LEVER AND KICKDOWN VALVE)

SCHEMATICS AND DIAGRAMS

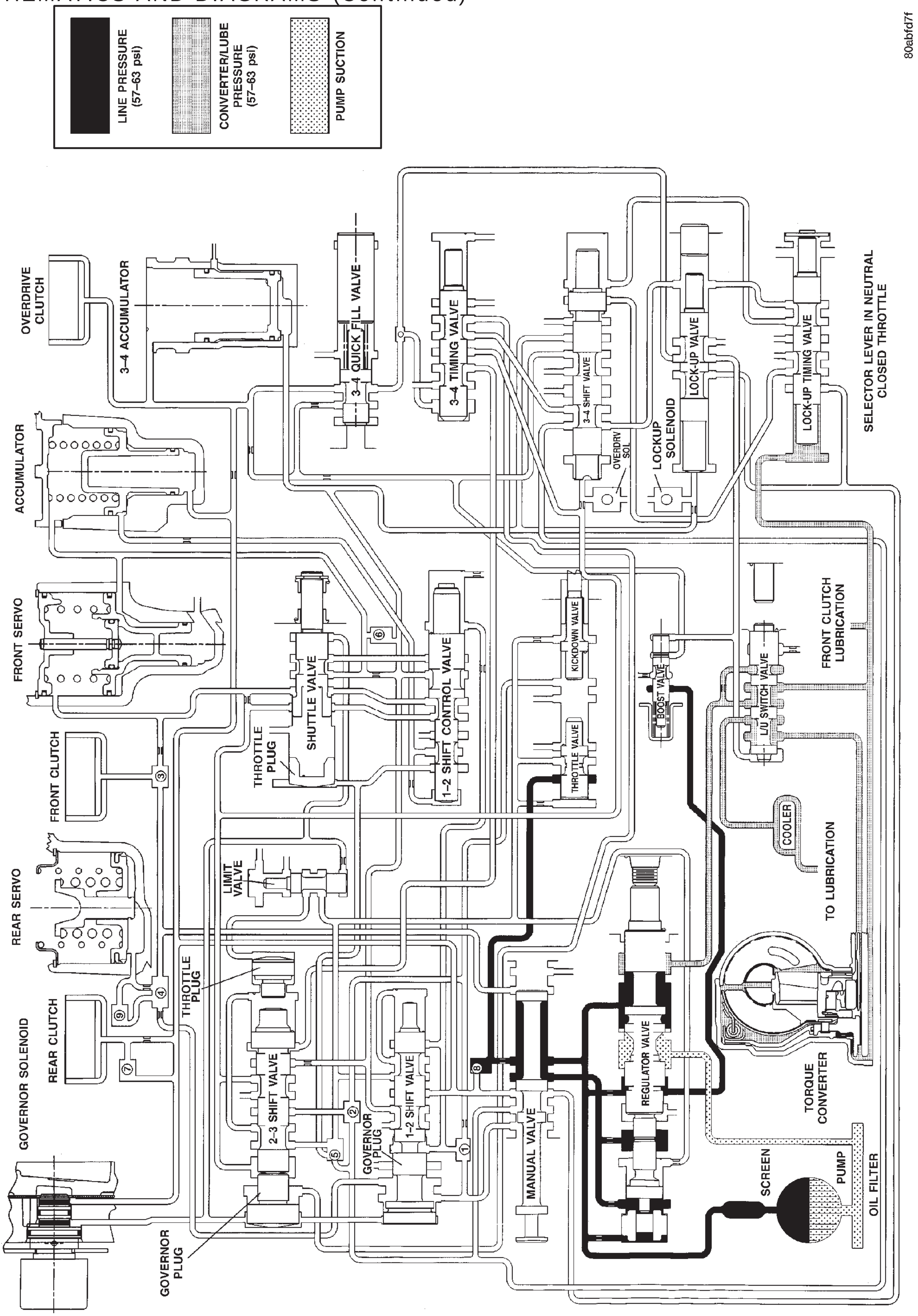
HYDRAULIC SCHEMATICS

SCHEMATICS AND DIAGRAMS (Continued)



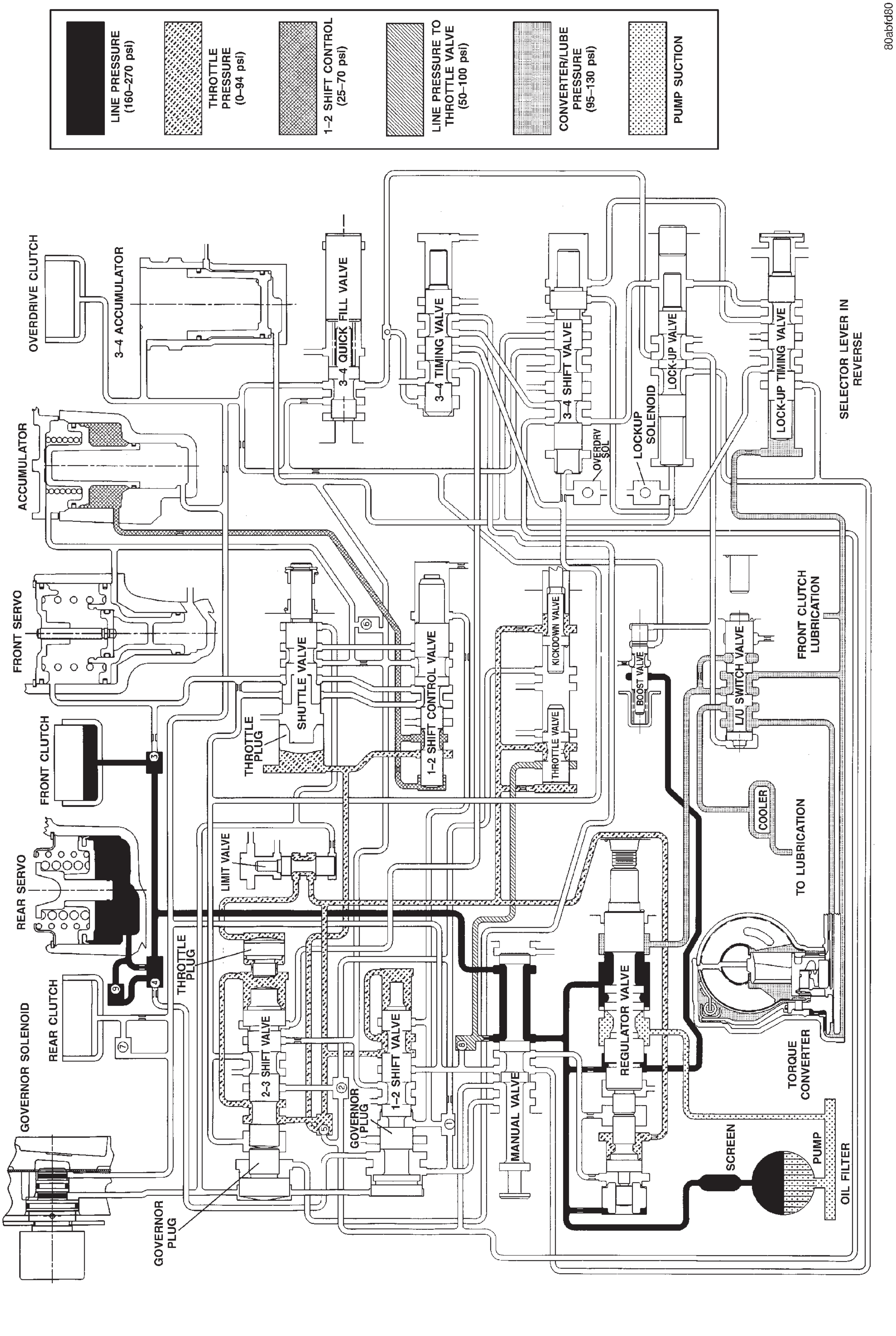
HYDRAULIC FLOW IN PARK

SCHEMATICS AND DIAGRAMS (Continued)



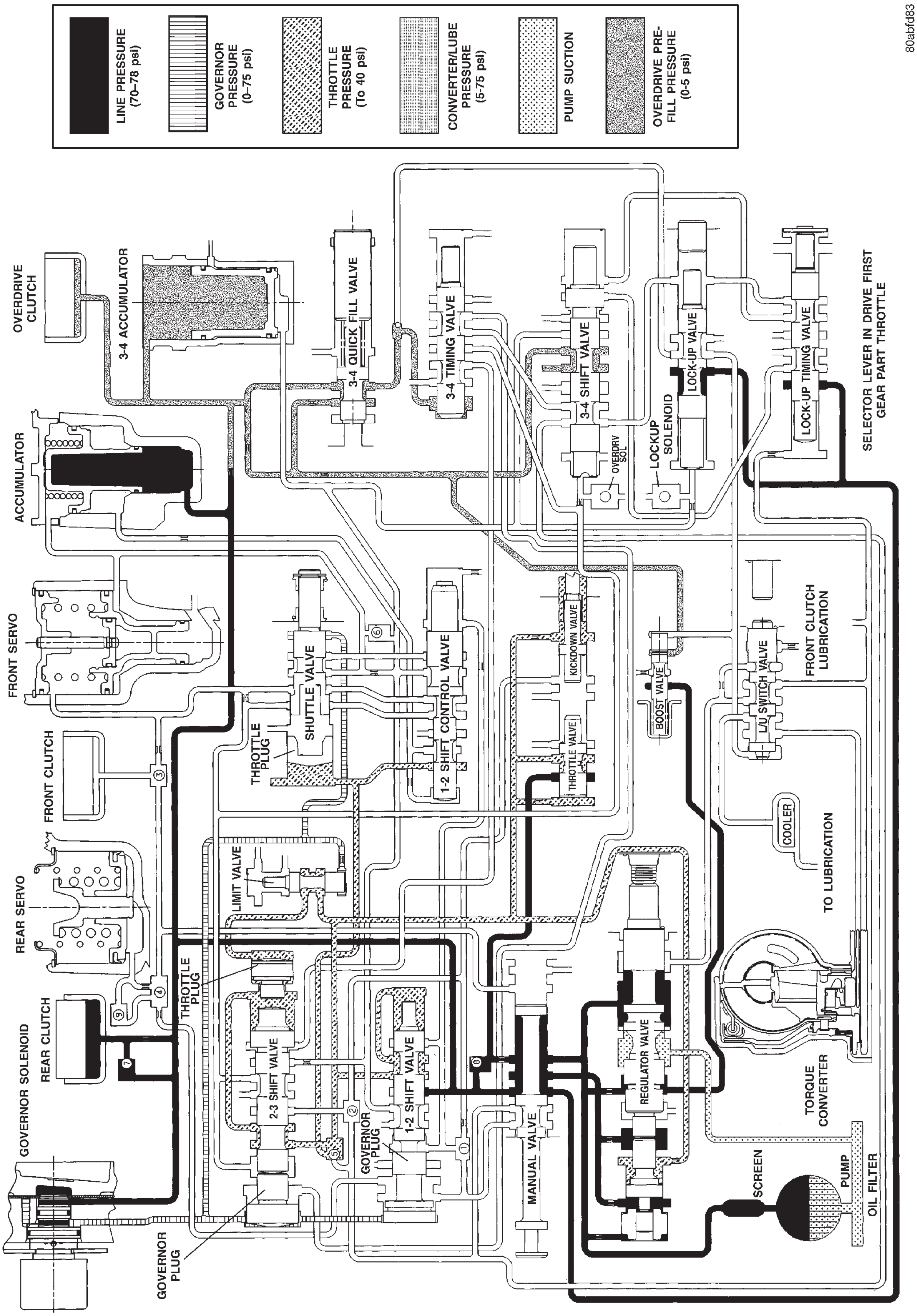
HYDRAULIC FLOW IN NEUTRAL

SCHEMATICS AND DIAGRAMS (Continued)



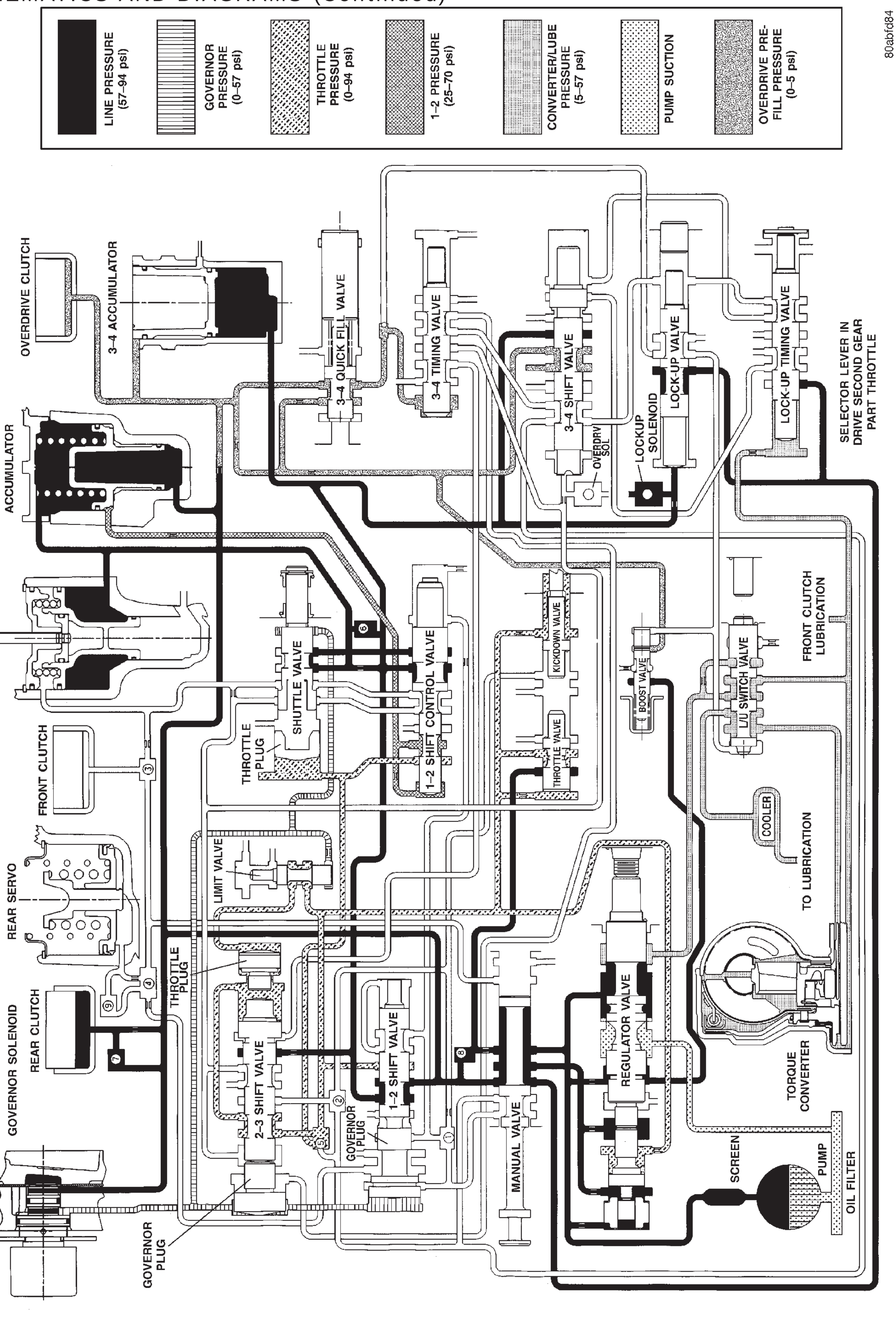
HYDRAULIC FLOW IN REVERSE

SCHEMATICS AND DIAGRAMS (Continued)



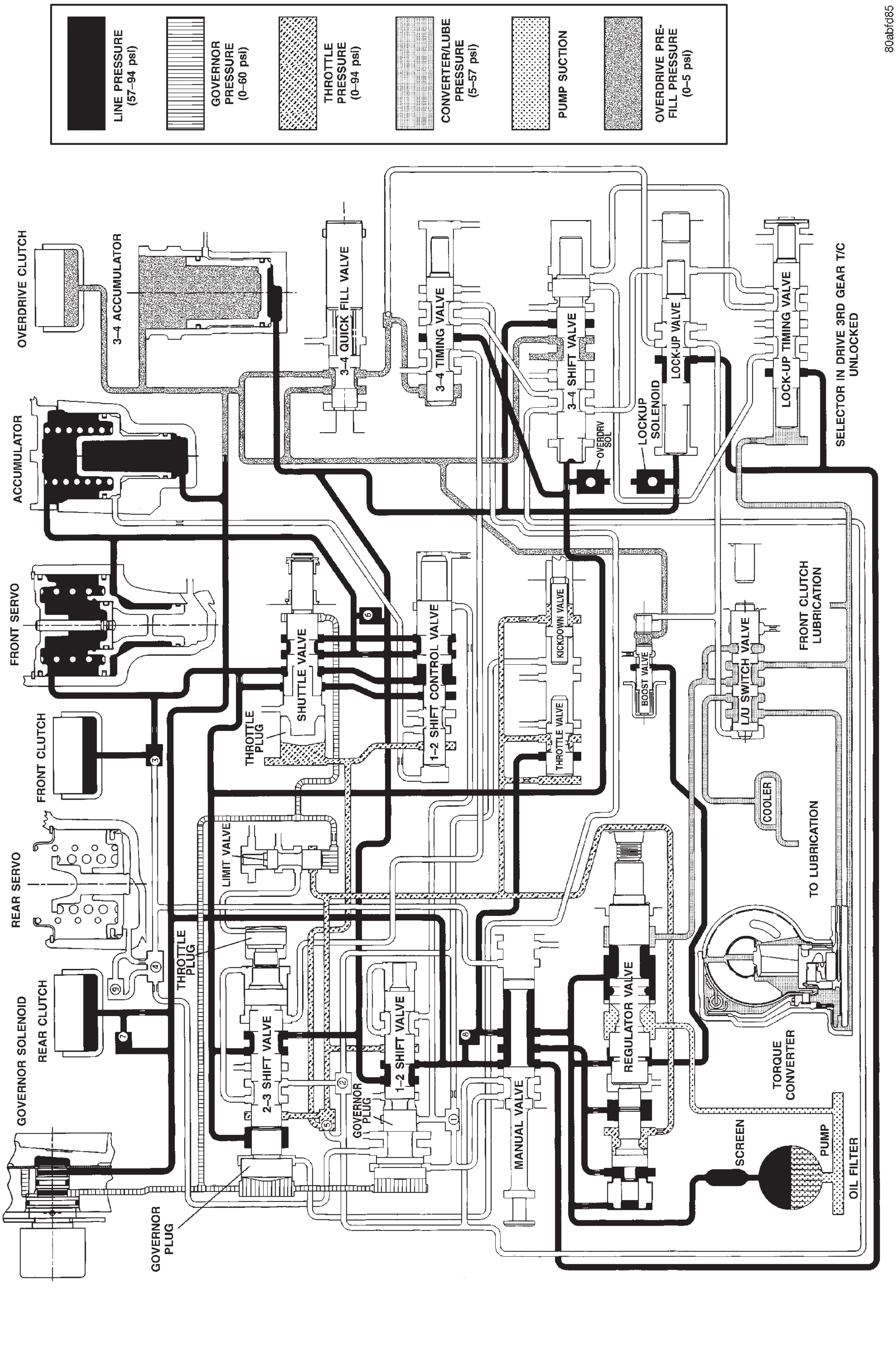
HYDRAULIC FLOW IN DRIVE FIRST GEAR

SCHEMATICS AND DIAGRAMS (Continued)



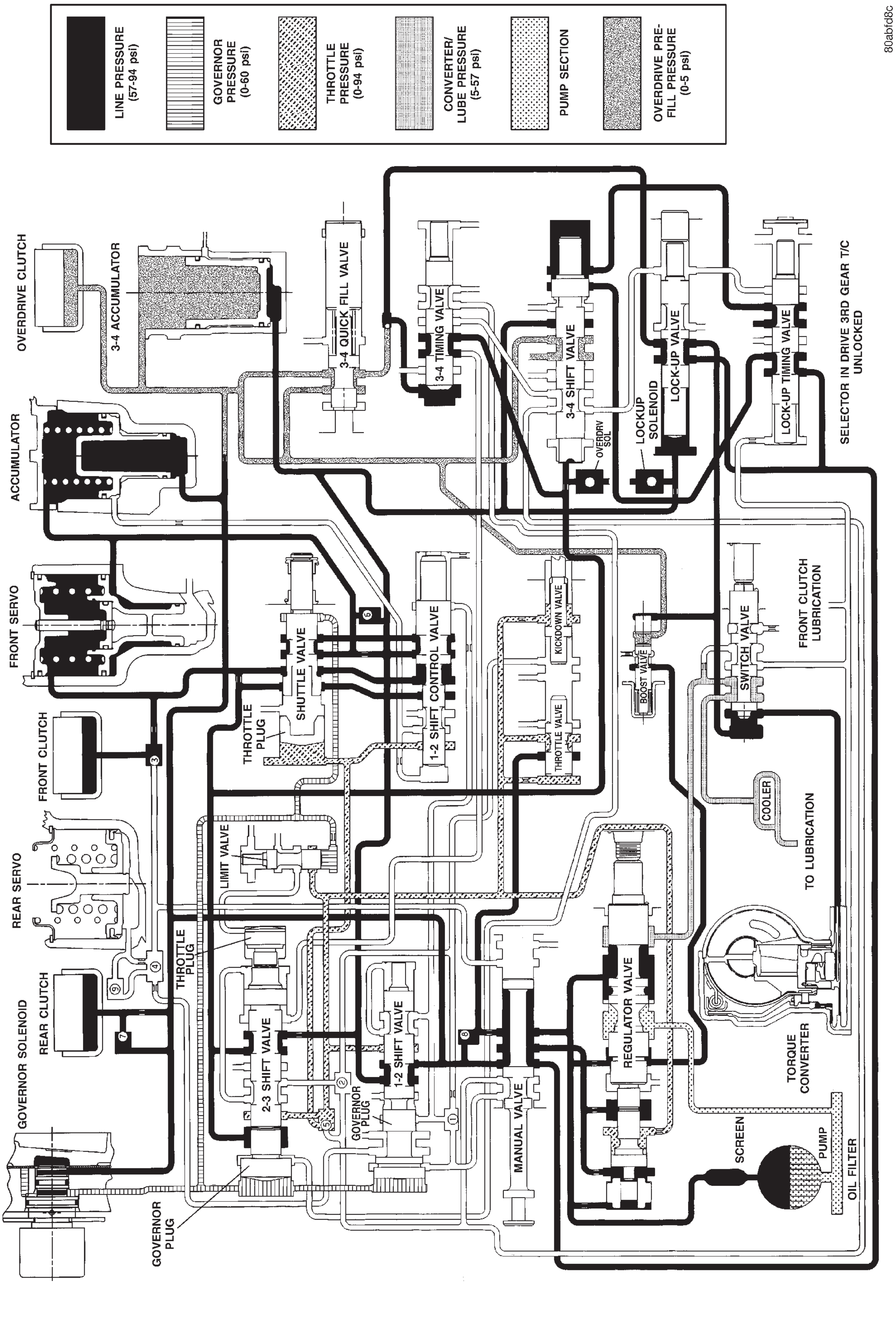
HYDRAULIC FLOW IN DRIVE SECOND GEAR

SCHEMATICS AND DIAGRAMS (Continued)



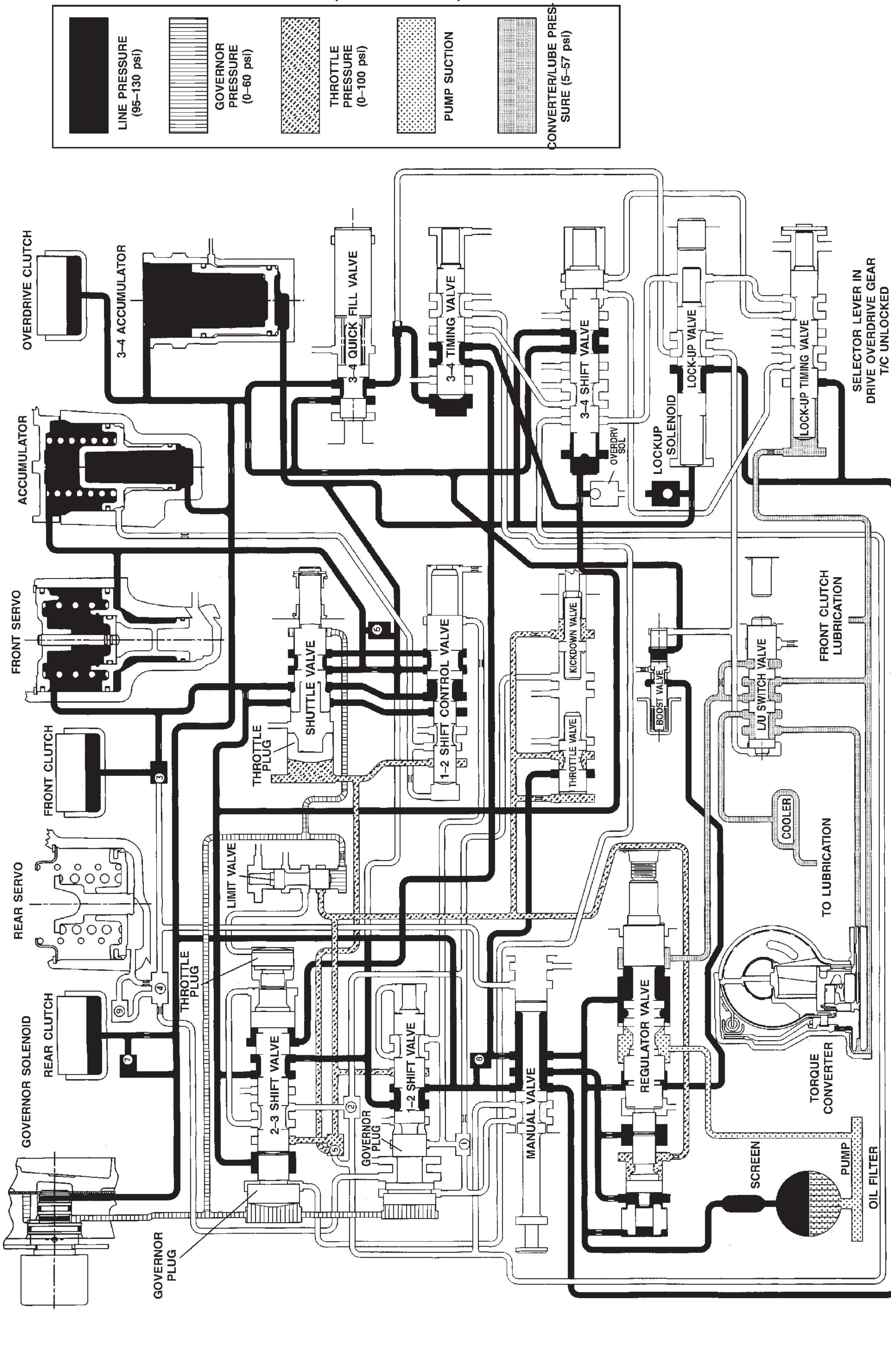
HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH NOT APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



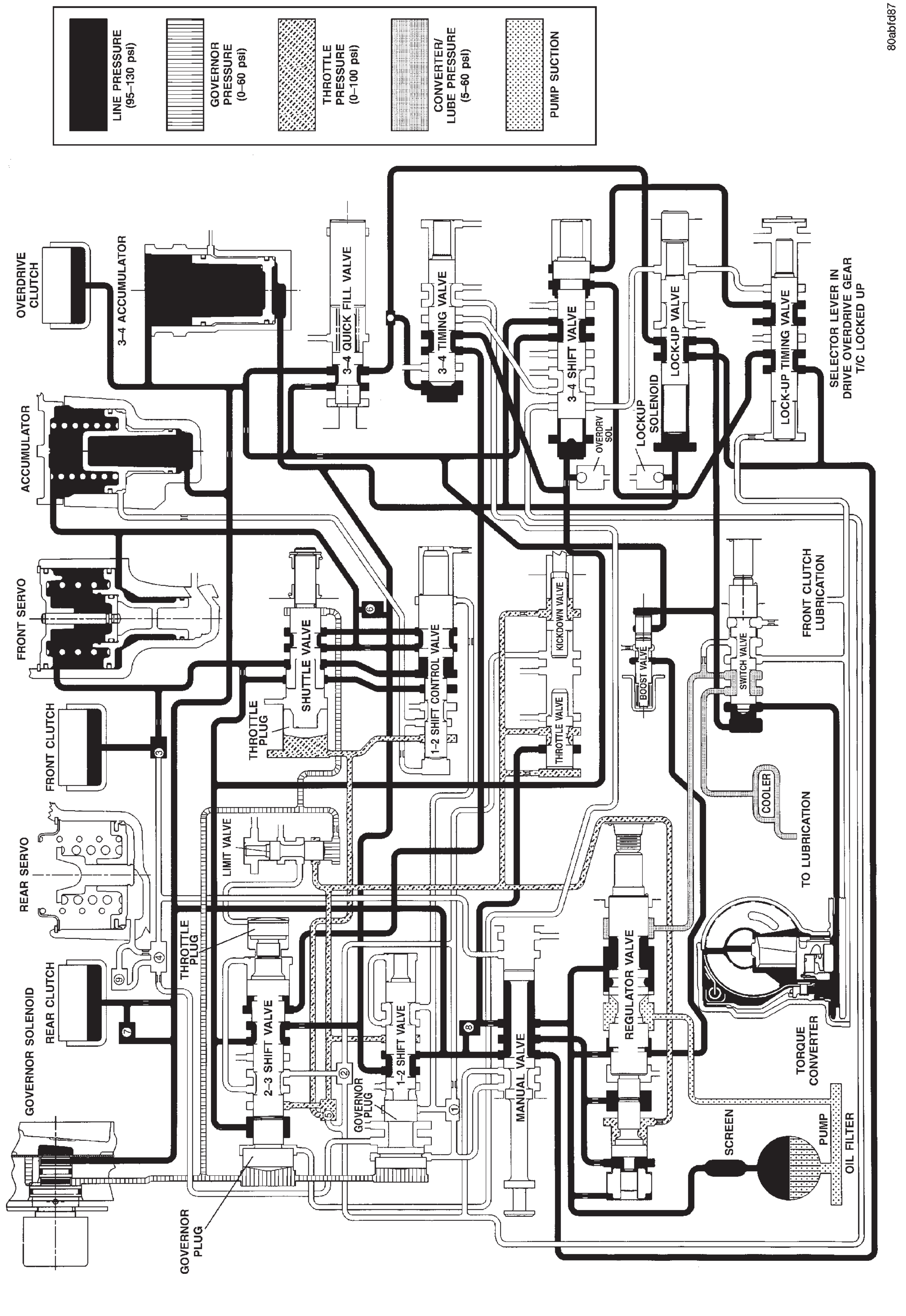
HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



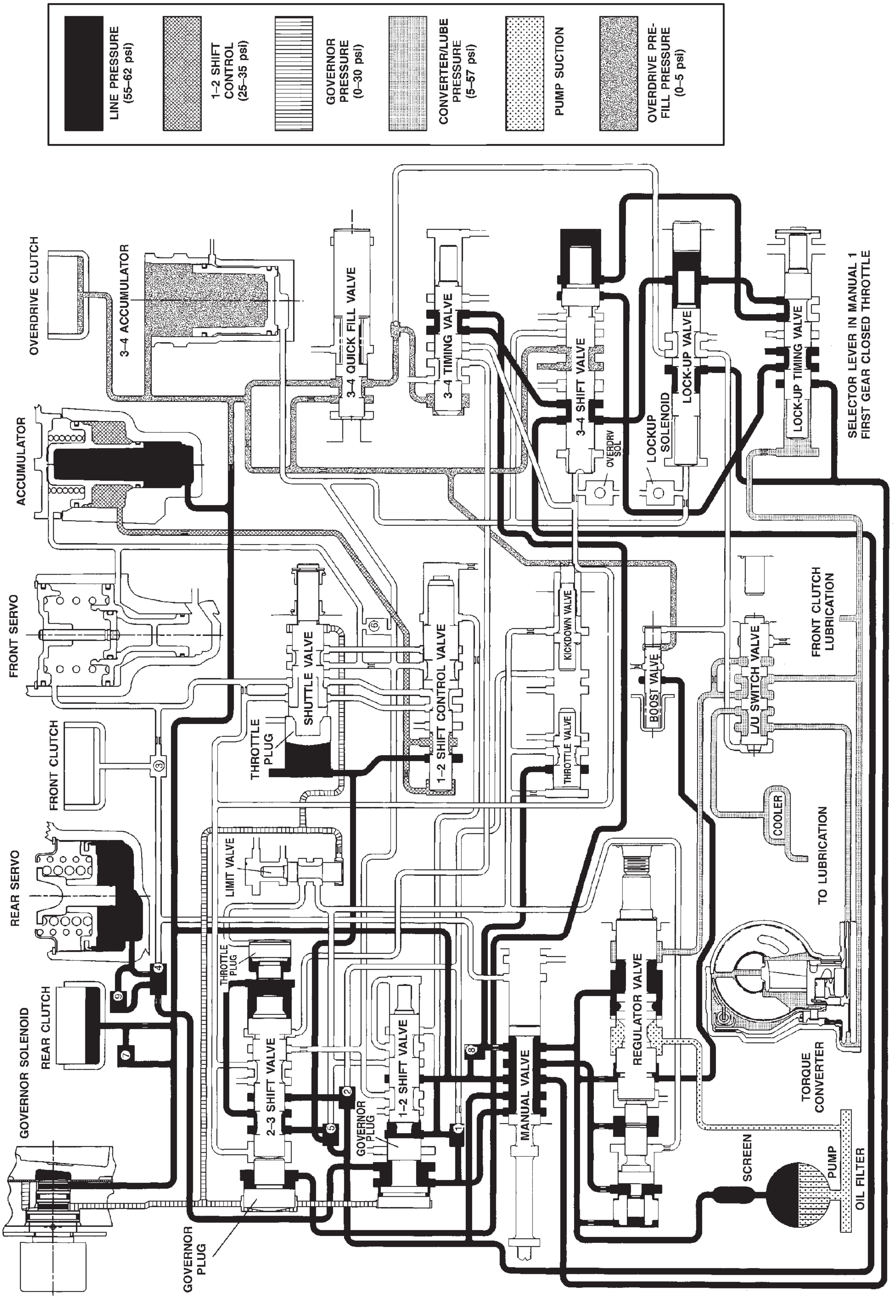
HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH NOT APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH APPLIED)

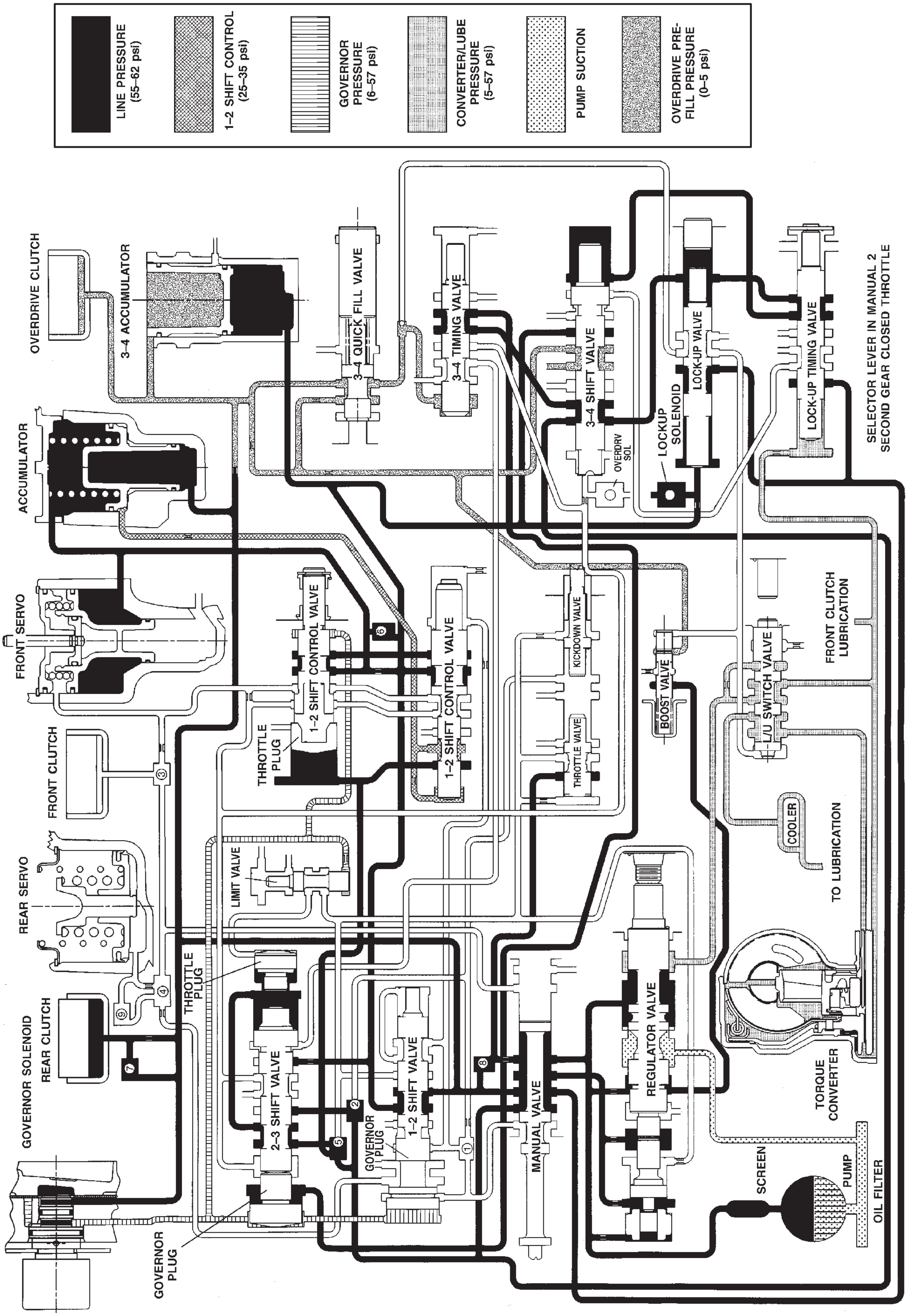
SCHEMATICS AND DIAGRAMS (Continued)



80abfd88

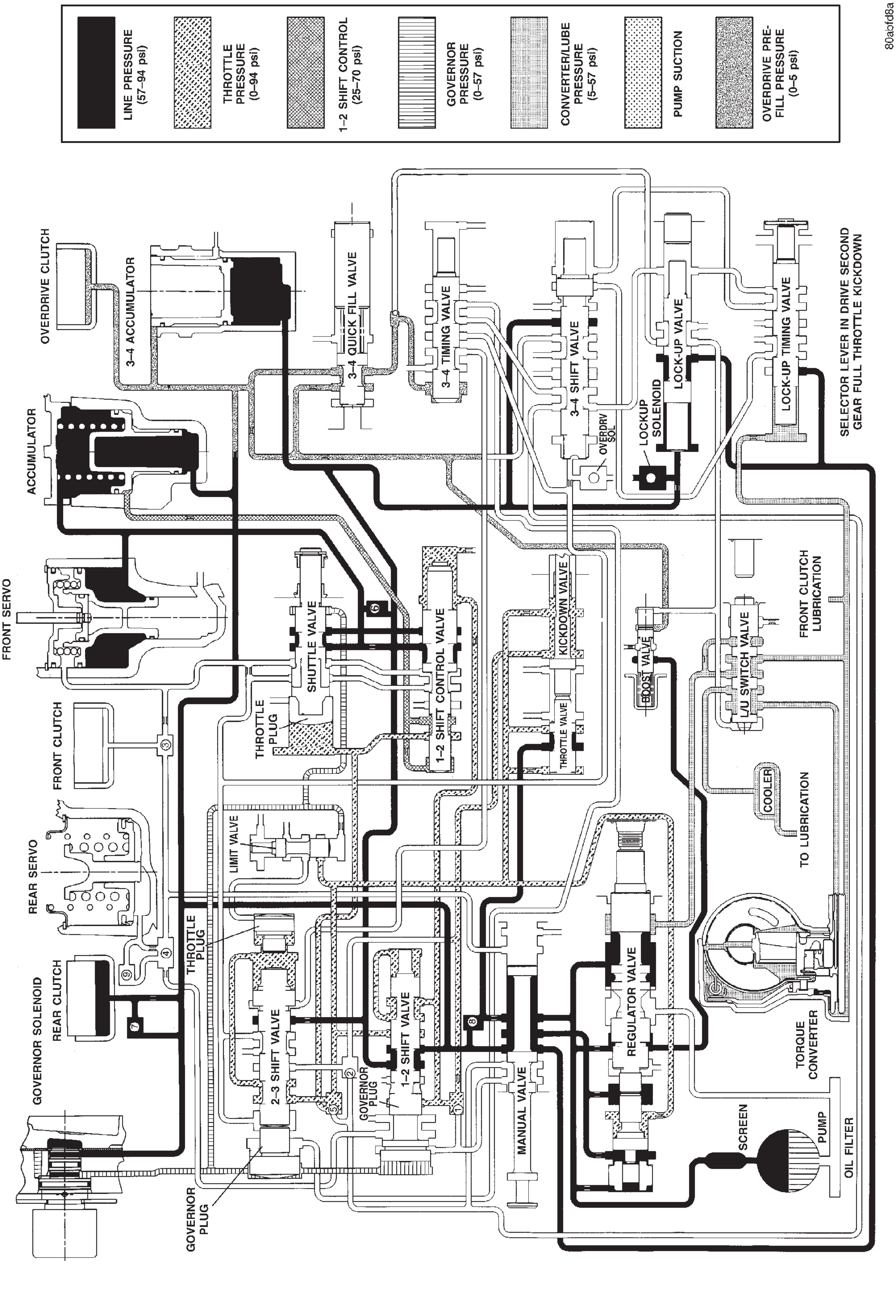
HYDRAULIC FLOW IN MANUAL LOW (1)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW IN MANUAL SECOND (2)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW DURING FULL THROTTLE 3–2 DOWNSHIFT (PASSING GEAR)

SPECIFICATIONS

RE TRANSMISSION

GENERAL

Oil pump gear tip clearance	0.089-0.190 mm	0.004-0.008 in.
Planetary end play	0.150-1.22 mm	0.006-0.048 in.
Input shaft end play	0.86-2.13 mm	0.034-0.084 in.
Clutch pack clearance/ Front 3-disc.	1.78-3.28mm	0.070-0.129 in.
Clutch pack clearance/ Rear 4-disc.	0.635-0.914 mm	0.025-0.036 in.
Overdrive clutch disc usage	4 discs	
Direct clutch disc usage	8 discs	
Front clutch spring usage	9 spring	
Band adjustment from 72 in. lbs.		
Front band	Back off 2-7/8 turns	
Rear band	Back off 2 turns	
Recommended fluid	Mopar® ATF Plus 3, type 7176	

TORQUE

DESCRIPTION	TORQUE
Bolt, torque convertor	31 N·m (23 ft. lbs.)
Bolt/nut, crossmember	68 N·m (50 ft. lbs.)
Bolt, driveplate to crankshaft	75 N·m (55 ft. lbs.)
Plug, front band reaction	17 N·m (13 ft. lbs.)
Locknut, front band adj.	34 N·m (25 ft. lbs.)
Switch, park/neutral	34 N·m (25 ft. lbs.)
Bolt, fluid pan	17 N·m (13 ft. lbs.)
Bolt, oil pump	20 N·m (15 ft. lbs.)
Bolt, overrunning clutch cam	17 N·m (13 ft. lbs.)
Bolt, O/D to trans.	34 N·m (25 ft. lbs.)
Bolt, O/D piston retainer	17 N·m (13 ft. lbs.)
Plug, pressure test port	14 N·m (10 ft. lbs.)
Bolt, reaction shaft support	20 N·m (15 ft. lbs.)
Locknut, rear band	41 N·m (30 ft. lbs.)
Screw, fluid filter	4 N·m (35 in. lbs.)
Bolt, valve body to case	12 N·m (100 in. lbs.)

SPECIFICATIONS (Continued)

THRUST WASHER/SPACER/SNAP RING DIMENSIONS

Front clutch thrust washer (reaction shaft support hub)	1.55 mm 2.15 mm	0.061 in. 0.084 in. 0.102 in.
Rear clutch thrust washer (clutch retainer)	1.55 mm	0.061 in.
Output shaft thrust plate (output shaft pilot hub)	1.5-1.6 mm	0.060-0.063 in.
Output shaft thrust washer (rear clutch hub)	1.3-1.4 mm 1.75-1.8 mm 2.1-2.2 mm	0.052-0.054 in. 0.068-0.070 in. 0.083-0.085 in.
Rear clutch pack snap ring	1.5-1.6 mm 1.9-1.95 mm	0.060-0.062 in. 0.074-0.076 in.
Planetary geartrain snap ring (at front of output shaft)	1.4-1.5 mm 1.6-1.7 mm	0.055-0.059 in. 0.062-0.066 in.

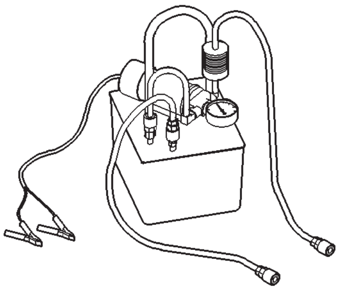
Overdrive piston thrust plate	Thrust plate and spacer are select fit components. Refer to size charts and selection procedures in Overdrive Unit disassembly and assembly section.
Intermediate shaft spacer	

PRESSURE TEST

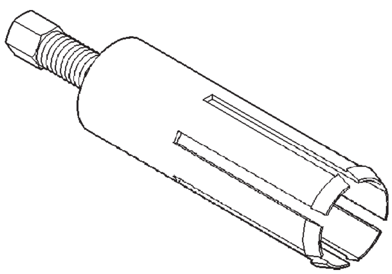
Overdrive clutch	Fourth gear only	Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-896 kPa (90-130 psi) at 1/2 to 3/4 throttle.
Line pressure (at accumulator)	Closed throttle	372-414 kPa (54-60 psi).
Front servo	Third gear only	No more than 21 kPa (3 psi) lower than line pressure.
Rear servo	1 range R range	No more than 21 kPa (3 psi) lower than line pressure. 1103 kPa (160 psi) at idle, builds to 1862 kPa (270 psi) at 1600 rpm.
Governor	D range closed throttle	Pressure should respond smoothly to changes in mph and return to 0-7 kPa (0-1.5 psi) when stopped with transmission in D, 1, 2. Pressure above 7 kPa (1.5 psi) at stand still will prevent transmission from downshifting.

SPECIAL TOOLS

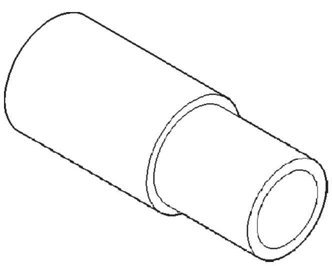
RE TRANSMISSION



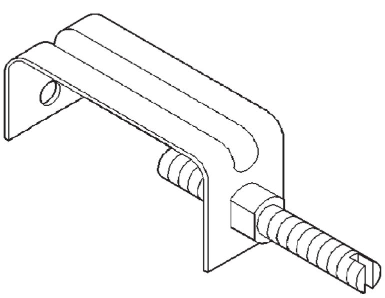
Oil Cooler Flusher—6906



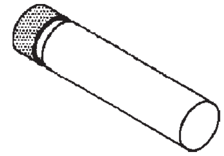
Remover—6957



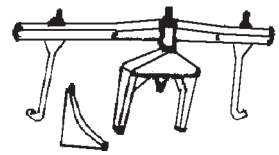
Installer—6951



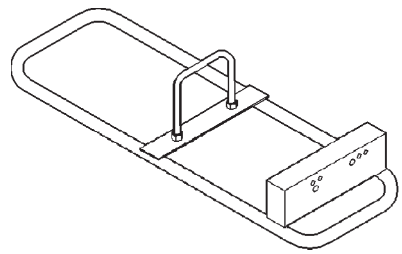
Retainer, Detent Ball and Spring—6583



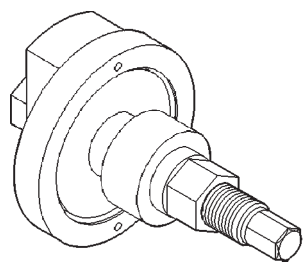
Gauge Block—6312



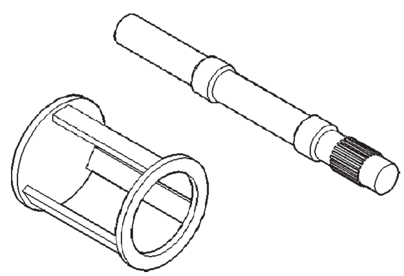
Fixture, Engine Support—C-3487-A



Transmission Repair Stand—C-3750-B

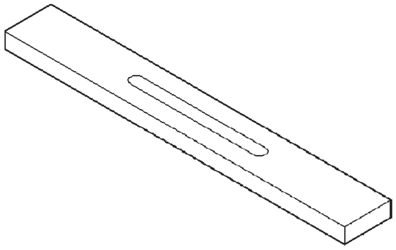


Spring Compressor—C-3863-A

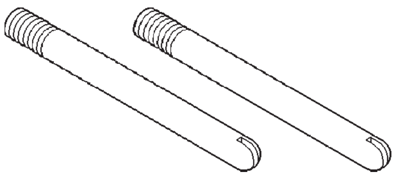


Spring Compressor and Alignment Shaft—6227

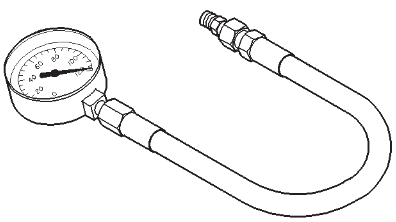
SPECIAL TOOLS (Continued)



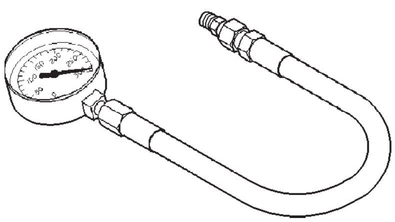
Gauge Bar—6311



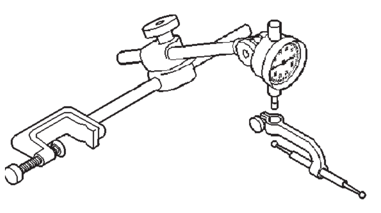
Extension Housing Pilot—C-3288-B



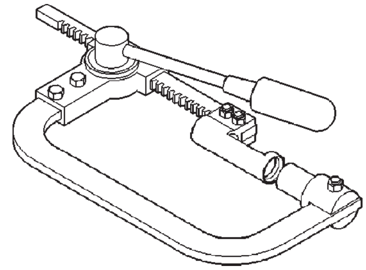
Pressure Gauge—C-3292



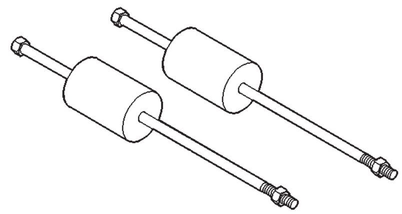
Pressure Gauge—C-3293SP



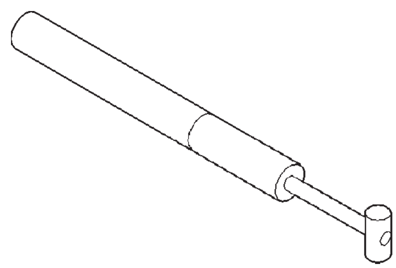
Dial Indicator—C-3339



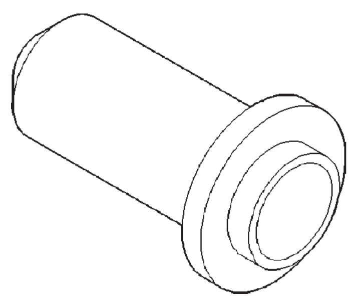
Spring Compressor—C-3422-B



Puller, Slide Hammer—C-3752

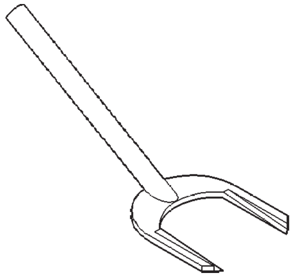


Gauge, Throttle Setting—C-3763

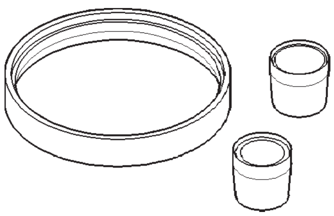


Seal Installer—C-3860–A

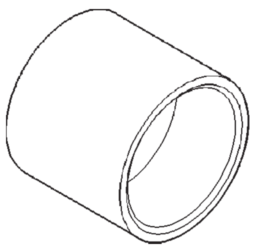
SPECIAL TOOLS (Continued)



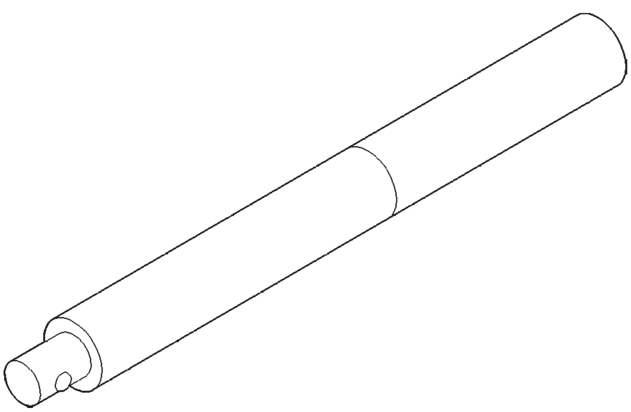
Seal Remover—C-3985-B



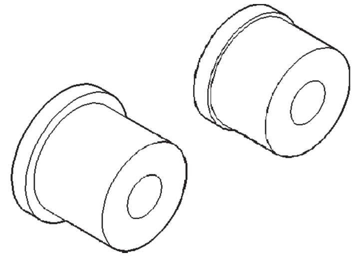
Overdrive Piston Seal Installer—8114



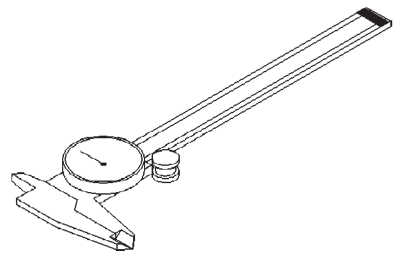
Installer—C-3995-A



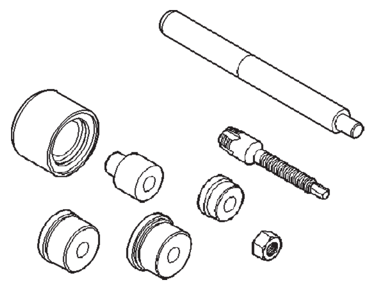
Universal Handle—C-4171



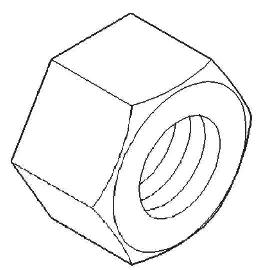
Remover/Installer—C-4470



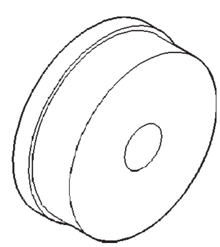
Dial Caliper—C-4962



Bushing Remover/Intsaller Set—C-3887-J

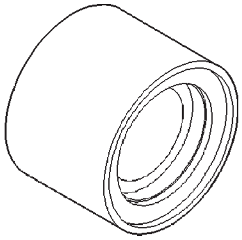


Nut, Bushing Remover—SP-1191, From kit C-3887-J

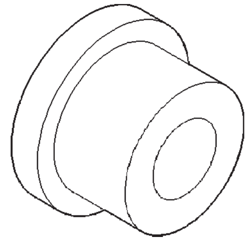


Remover, Front Clutch Bushing—SP-3629, From kit C-3887-J

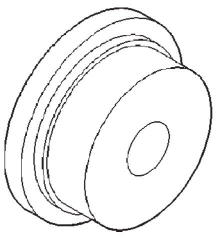
SPECIAL TOOLS (Continued)



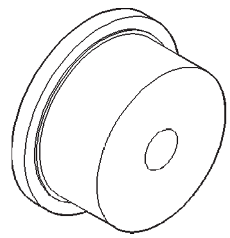
Cup, Bushing Remover—SP-3633, From kit C-3887-J



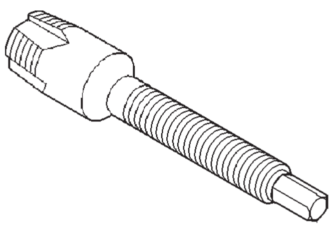
Installer, Reaction Shaft Bushing—SP-5302, From kit C-3887-J



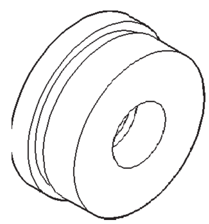
Installer, Oil Pump Bushing—SP-5118, From kit C-3887-J



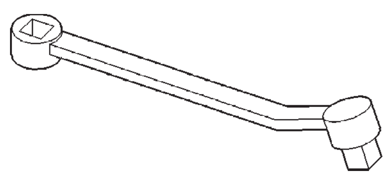
Installer, Front Clutch Bushing—SP-5511, From kit C-3887-J



Remover, Reaction Shaft Bushing—SP-5301, From kit C-3887-J



Remover, Bushing—SP-3550, From kit C-3887-J



Adapter, Band Adjuster—C-3705

45RFE AUTOMATIC TRANSMISSION

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
45RFE AUTOMATIC TRANSMISSION	417
FLUID	418
TORQUE CONVERTER	418
ELECTRONICALLY MODULATED CONVERTER CLUTCH ENGAGEMENT	423
OIL PUMP	423
VALVE BODY	424
PISTONS	427
INPUT CLUTCHES	428
HOLDING CLUTCHES	431
PLANETARY GEARTRAIN	433
GEARSHIFT MECHANISM	435
OVERDRIVE OFF SWITCH	435
TRANSMISSION CONTROL MODULE	435
SOLENOID AND PRESSURE SWITCH ASSEMBLY	438
BATTERY FEED (TCM)	438
TRANSMISSION CONTROL RELAY	438
PRESSURE SWITCHES	438
INPUT AND OUTPUT SPEED SENSORS	439
LINE PRESSURE CONTROL	439
THROTTLE POSITION SENSOR	439
TRANSMISSION RANGE SENSOR	439
TRANSMISSION TEMPERATURE SENSOR	440
SOLENOIDS	440
SOLENOID SWITCH VALVE	440
DIAGNOSIS AND TESTING	
EFFECTS OF INCORRECT FLUID LEVEL	440
CAUSES OF BURNT FLUID	441
FLUID CONTAMINATION	441
45RFE AUTOMATIC TRANSMISSION GENERAL DIAGNOSIS	441
PRELIMINARY DIAGNOSIS	441
GEARSHIFT CABLE	442
ROAD TESTING	442
HYDRAULIC PRESSURE TEST	443
AIR TESTING TRANSMISSION CLUTCH OPERATION	444
CONVERTER HOUSING FLUID LEAK DIAGNOSIS	444
SERVICE PROCEDURES	
FLUID LEVEL CHECK	445
FLUID AND FILTER REPLACEMENT	445
TRANSMISSION FILL PROCEDURE	446
OIL PUMP VOLUME CHECK	447
FLUSHING COOLERS AND TUBES	447
TRANSMISSION QUICK LEARN PROCEDURE	447
ALUMINUM THREAD REPAIR	448
REMOVAL AND INSTALLATION	
INPUT SPEED SENSOR	448
OUTPUT SPEED SENSOR	448
LINE PRESSURE SENSOR	449
VALVE BODY	449
SOLENOID AND PRESSURE SWITCH ASSEMBLY	450
TRANSMISSION	450
TORQUE CONVERTER	453
OIL PUMP FRONT SEAL	453
ADAPTER HOUSING SEAL	453
GEARSHIFT CABLE	454
DISASSEMBLY AND ASSEMBLY	
TRANSMISSION	455
VALVE BODY	464
OIL PUMP	467
INPUT CLUTCH ASSEMBLY	470
4C RETAINER/BULKHEAD	474
PLANETARY GEAR SET	476
LOW/REVERSE CLUTCH	478
CLEANING AND INSPECTION	
VALVE BODY	479
TRANSMISSION	480
LOW/REVERSE CLUTCH ASSEMBLY	481
ACCUMULATOR	481
OIL PUMP AND REACTION SHAFT SUPPORT	481
PLANETARY GEARTRAIN	481
ADJUSTMENTS	
GEARSHIFT CABLE	482
SCHEMATICS AND DIAGRAMS	
HYDRAULIC SCHEMATICS	482
SPECIFICATIONS	
TRANSMISSION	502
SPECIAL TOOLS	
45RFE TRANSMISSION	502

DESCRIPTION AND OPERATION

45RFE AUTOMATIC TRANSMISSION

DESCRIPTION

The 45RFE automatic transmission is a sophisticated, multi-range, electronically controlled transmission which combines optimized gear ratios for responsive performance, state of the art efficiency features and low NVH. Other features include driver adaptive shifting and three planetary gear sets to provide wide ratio capability with precise ratio steps for optimum driveability. The three planetary gear sets also make available a unique alternate second gear ratio. The primary 2nd gear ratio fits between 1st and 3rd gears for normal through-gear accelerations. The alternate second gear ratio (2prime) allows smoother 4–2 kickdowns at high speeds to provide 2nd gear passing performance over a wider highway cruising range.

The hydraulic portion of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components.

The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Three multiple disc holding clutches
- Five hydraulic accumulators
- Three planetary gear sets
- Dual Stage Hydraulic oil pump
- Valve body
- Solenoid pack

The TCM is the “heart” or “brain” of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

TRANSMISSION IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 1). Refer to this information when ordering replacement parts. A label is attached to the transmission case above the stamped numbers. The label gives additional information which may also be necessary for identification purposes.

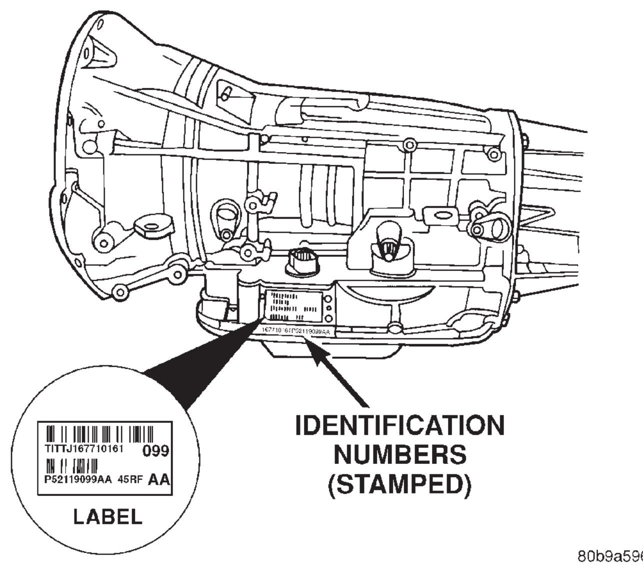


Fig. 1 Transmission Part And Serial Number Location

GEAR RATIOS

The 45RFE gear ratios are:

1st	3.00:1
2nd	1.67:1
2nd Prime	1.50:1
3rd	1.00:1
4th	0.75:1
Reverse	3.00:1

OPERATION

The 45RFE offers full electronic control of all automatic up and downshifts, and features real-time adaptive closed-loop shift and pressure control. Electronic shift and torque converter clutch controls help protect the transmission from damage due to high temperatures, which can occur under severe operating conditions. By altering shift schedules, line pressure, and converter clutch control, these controls reduce heat generation and increase transmission cooling.

To help reduce efficiency-robbing parasitic losses, the transmission includes a dual-stage transmission fluid pump with electronic output pressure control. Under most driving conditions, pump output pressure greatly exceeds that which is needed to keep the clutches applied. The 45RFE pump-pressure control system monitors input torque and adjusts the pump

pressure accordingly. The primary stage of the pump works continuously; the second stage is bypassed when demand is low. The control system also monitors input and output speed and, if incipient clutch slip is observed, the pressure control solenoid duty cycle is varied, increasing pressure in proportion to demand.

A high-travel torque converter damper assembly allow earlier torque converter clutch engagement to reduce slippage. Needle-type thrust bearings reduce internal friction. The 45RFE is packaged in a one-piece die-cast aluminum case. To reduce NVH, the case has high lateral, vertical and torsional stiffness. It is also designed to maximize the benefit of the structural dust cover that connects the bottom of the bell housing to the engine bedplate, enhancing overall power train stiffness. Dual filters protect the pump and other components. A pump return filter is added to the customary main sump filter. Independent lubrication and cooler circuits assure ample pressure for normal transmission operation even if the cooler is obstructed or the fluid cannot flow due to extremely low temperatures.

The hydraulic control system design (without electronic assist) provides the transmission with PARK, REVERSE, NEUTRAL, SECOND, and THIRD gears, based solely on driver shift lever selection. This design allows the vehicle to be driven (in “limp-in” mode) in the event of a electronic control system failure, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transmission.

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC’s, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the DRB scan tool.

FLUID

NOTE: Refer to the maintenance schedules in Group 0, Lubrication and Maintenance for the recommended maintenance (fluid/filter change) intervals for this transmission.

NOTE: Refer to Service Procedures in this group for fluid level checking procedures.

DESCRIPTION

Mopar® ATF Plus 3, Type 7176, automatic transmission fluid is the recommended fluid for DaimlerChrysler automatic transmissions.

Dexron II fluid IS NOT recommended. Clutch chatter can result from the use of improper fluid.

Mopar® ATF Plus 3, Type 7176, automatic transmission fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** A dark brown/black fluid accompanied with a burnt odor and/or deterioration in shift quality may indicate fluid deterioration or transmission component failure.

FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

OPERATION

The automatic transmission fluid is selected based upon several qualities. The fluid must provide a high level of protection for the internal components by providing a lubricating film between adjacent metal components. The fluid must also be thermally stable so that it can maintain a consistent viscosity through a large temperature range. If the viscosity stays constant through the temperature range of operation, transmission operation and shift feel will remain consistent. Transmission fluid must also be a good conductor of heat. The fluid must absorb heat from the internal transmission components and transfer that heat to the transmission case.

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 2) is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller and an electronically applied converter clutch. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The converter

DESCRIPTION AND OPERATION (Continued)

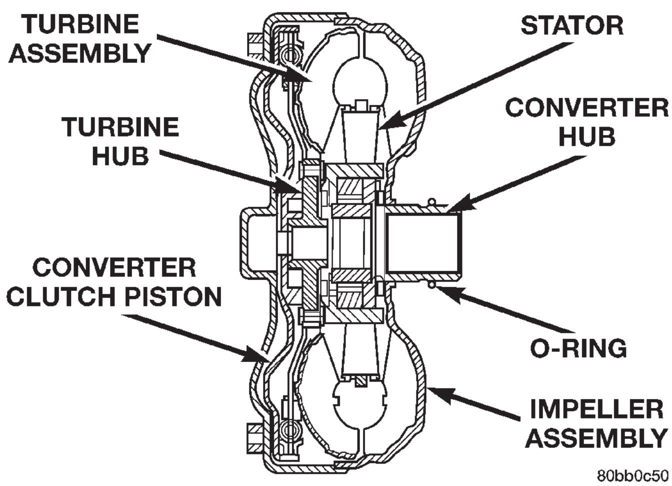


Fig. 2 Torque Converter Assembly

clutch engages in third gear. The torque converter hub drives the transmission oil (fluid) pump and contains an o-ring seal to better control oil flow.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure resulted in large amounts of metal or fiber contamination in the fluid. If the fluid is contaminated, flush the fluid cooler and lines.

IMPELLER

The impeller (Fig. 3) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving member of the system.

TURBINE

The turbine (Fig. 4) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the

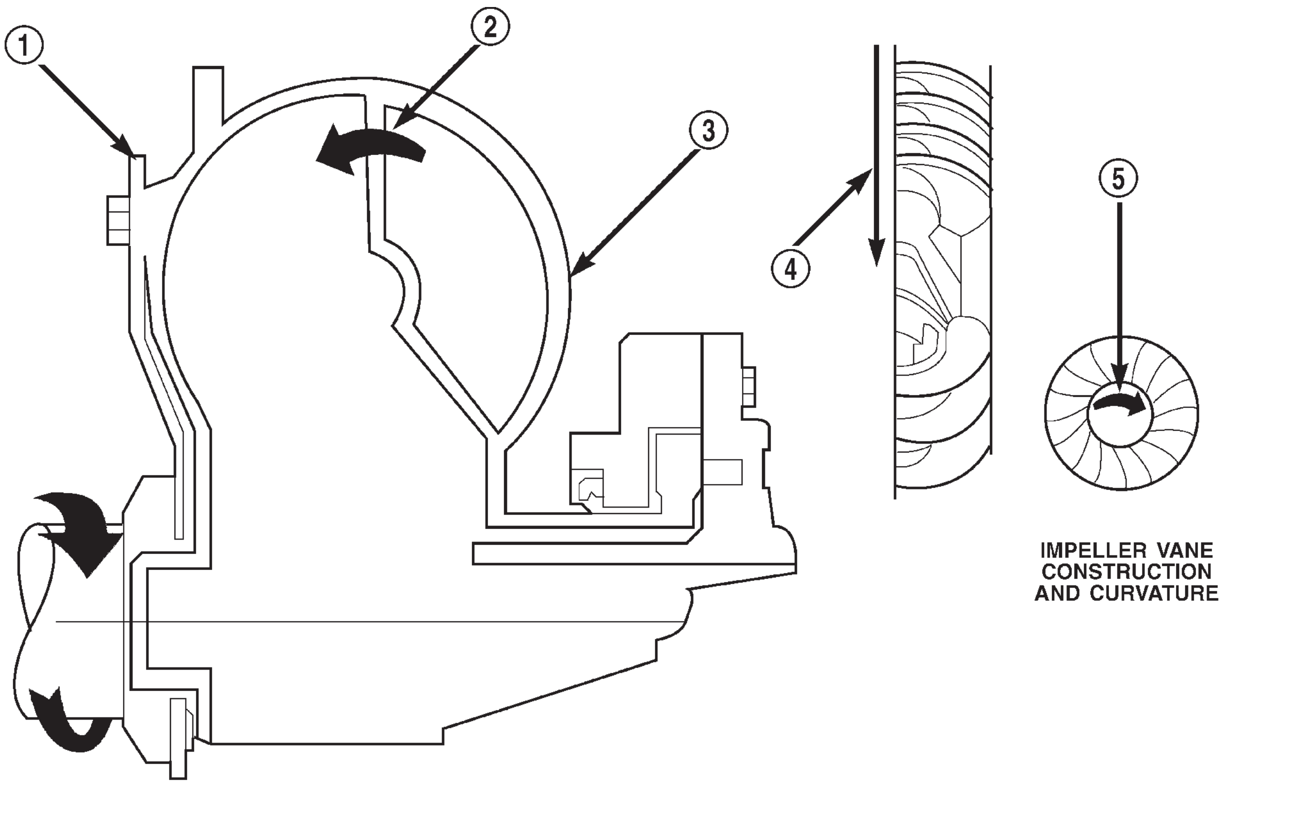


Fig. 3 Impeller

1 – ENGINE FLEXPLATE
2 – OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 – IMPELLER VANES AND COVER ARE INTEGRAL
4 – ENGINE ROTATION
5 – ENGINE ROTATION

DESCRIPTION AND OPERATION (Continued)

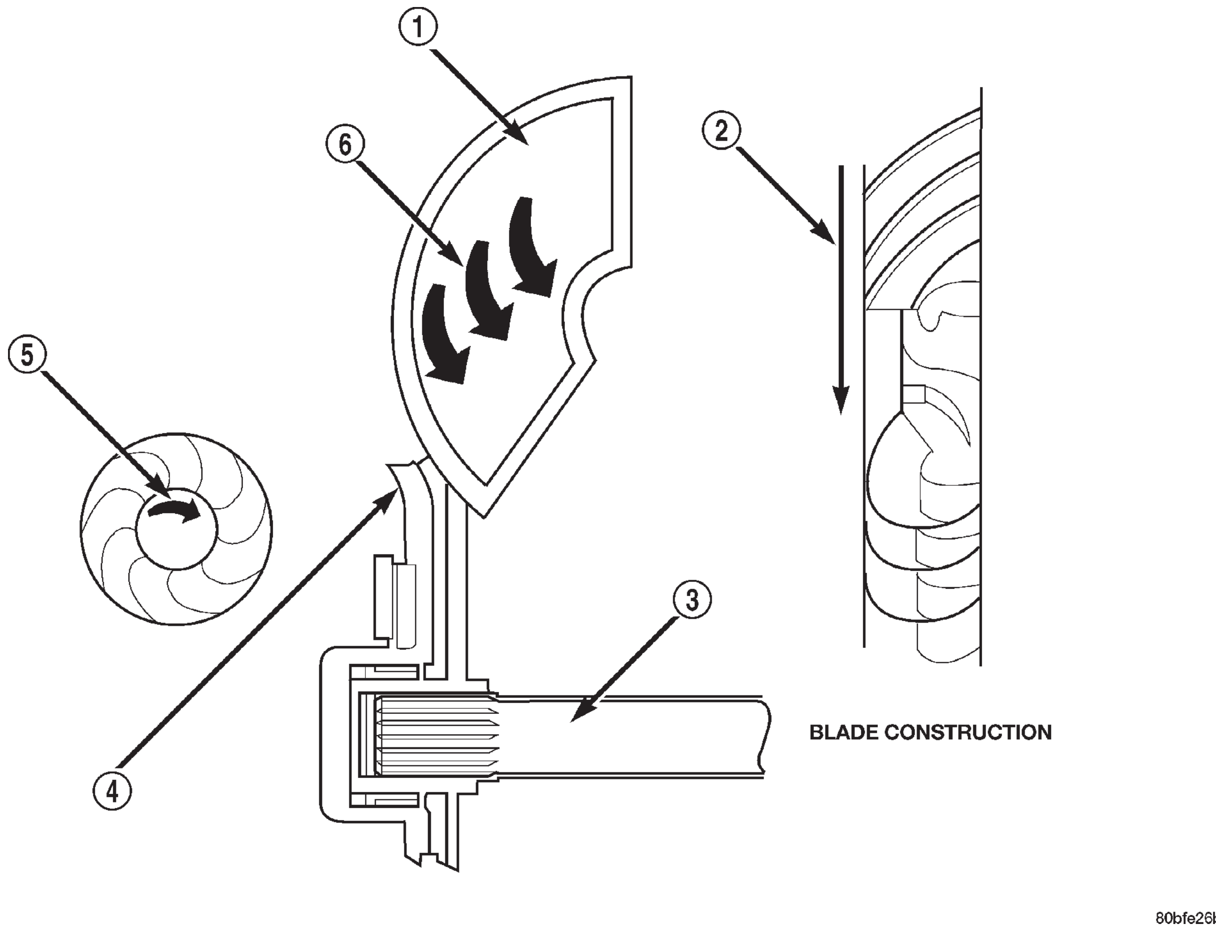


Fig. 4 Turbine

1 – TURBINE VANE
2 – ENGINE ROTATION
3 – INPUT SHAFT
4 – PORTION OF TORQUE CONVERTER COVER
5 – ENGINE ROTATION
6 – OIL FLOW WITHIN TURBINE SECTION

impeller, except the blades of the turbine are curved in the opposite direction.

STATOR

The stator assembly (Fig. 5) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 6). The stator contains an over-running clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the over-running clutch, the torque multiplication feature of the torque converter is operational.

DESCRIPTION AND OPERATION (Continued)

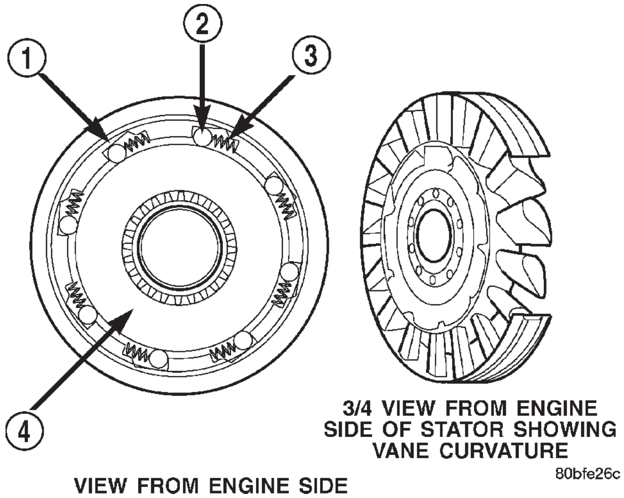


Fig. 5 Stator Components

1 – CAM (OUTER RACE)
2 – ROLLER
3 – SPRING
4 – INNER RACE

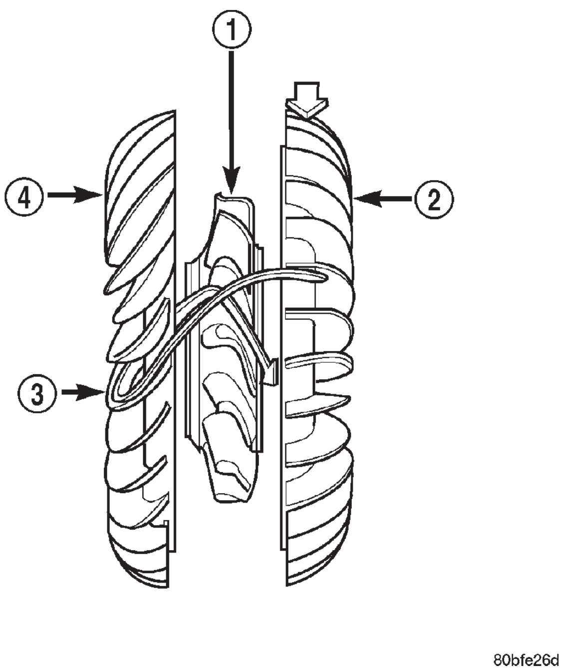


Fig. 6 Stator Location

1 – STATOR
2 – IMPELLER
3 – FLUID FLOW
4 – TURBINE

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 7) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock–free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston was added to the turbine, and a friction material was added to the inside of the front cover to provide this mechanical lock-up.

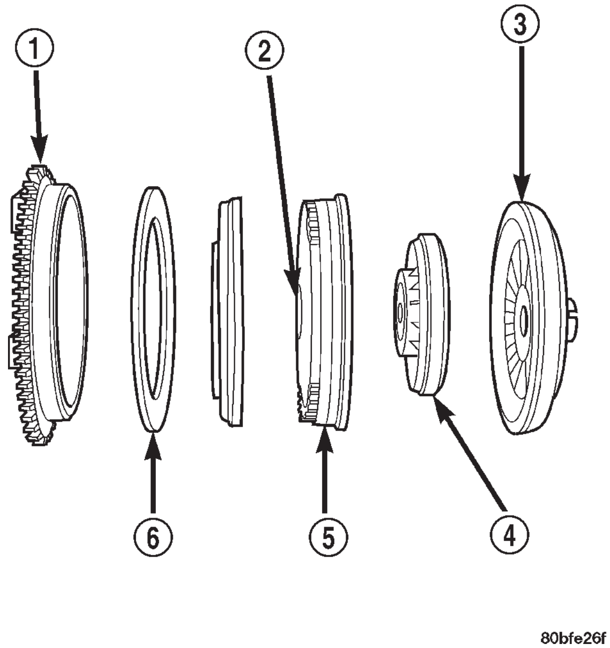


Fig. 7 Torque Converter Clutch (TCC)

1 – IMPELLER FRONT COVER
2 – THRUST WASHER ASSEMBLY
3 – IMPELLER
4 – STATOR
5 – TURBINE
6 – FRICTION DISC

OPERATION

The converter impeller (Fig. 8) (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

DESCRIPTION AND OPERATION (Continued)

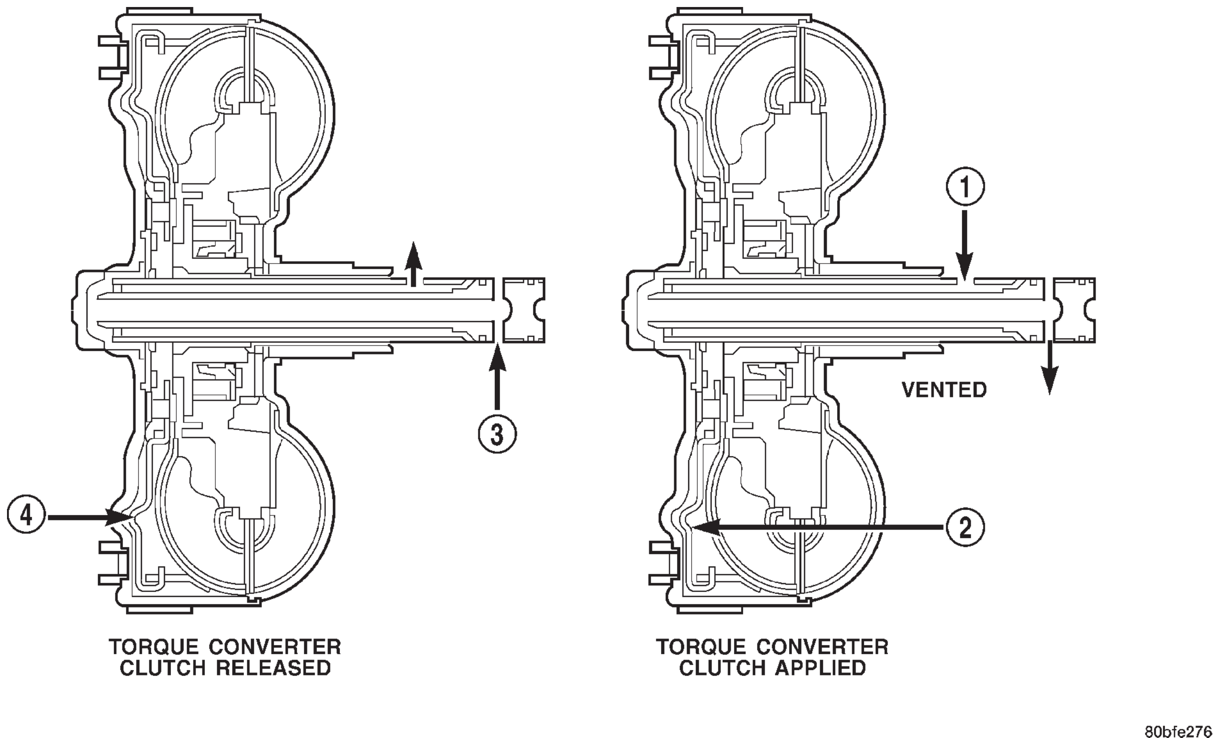


Fig. 8 Torque Converter Fluid Operation

1 – APPLY PRESSURE
2 – THE PISTON MOVES SLIGHTLY FORWARD
3 – RELEASE PRESSURE
4 – THE PISTON MOVES SLIGHTLY REARWARD

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 9). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counterclockwise direction. When this happens the over–running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.4:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock–up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

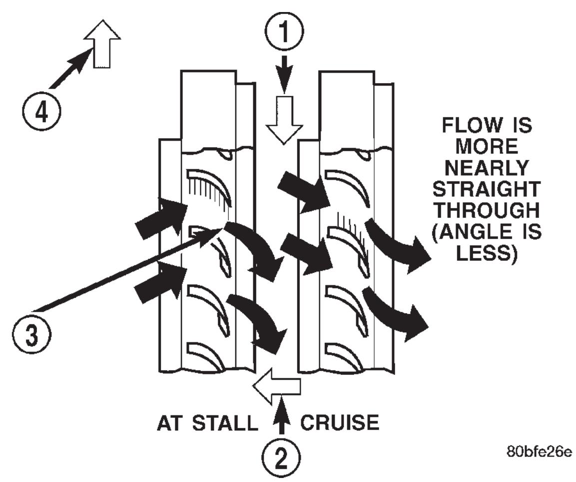


Fig. 9 Stator Operation

1 – DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 – FRONT OF ENGINE
3 – INCREASED ANGLE AS OIL STRIKES VANES
4 – DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

DESCRIPTION AND OPERATION (Continued)

TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston to the front cover's friction material, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

Converter clutch engagement in third or fourth gear range is controlled by sensor inputs to the powertrain control module. Inputs that determine clutch engagement are: coolant temperature, engine rpm, vehicle speed, throttle position, and manifold vacuum. The torque converter clutch is engaged by the clutch solenoid on the valve body. The clutch can be engaged in third and fourth gear ranges depending on overdrive control switch position. If the overdrive control switch is in the normal ON position, the clutch will engage after the shift to fourth gear, and above approximately 72 km/h (45 mph). If the control switch is in the OFF position, the clutch will engage after the shift to third gear, at approximately 56 km/h (35 mph) at light throttle.

ELECTRONICALLY MODULATED CONVERTER CLUTCH ENGAGEMENT

DESCRIPTION

In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

OPERATION

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

OIL PUMP

DESCRIPTION

The oil pump (Fig. 10) is located at the front of the transmission inside the bell housing and behind the transmission front cover. The oil pump consists of two independent pumps (Fig. 11), a number of valves (Fig. 12), a front seal (Fig. 13), and a bolt on reaction shaft. The converter clutch switch and regulator valves, pressure regulator valve, and converter pressure limit valve are all located in the oil pump housing.

OPERATION

As the torque converter rotates, the converter hub rotates the oil pump drive gear. As the drive gear rotates both driven gears, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the oil pump valves.

At low speeds, both pumps supply fluid to the transmission. As the speed of the torque converter increases, the pressure output of both pumps increases until the primary pump pressure reaches

DESCRIPTION AND OPERATION (Continued)

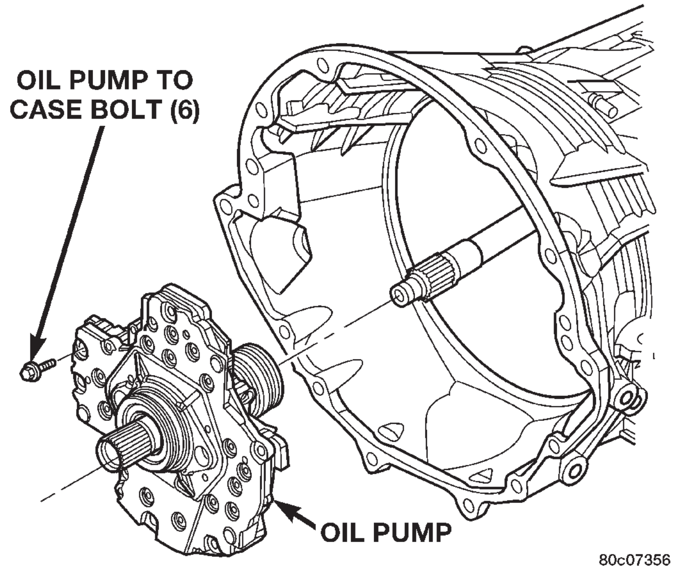


Fig. 10 Oil Pump

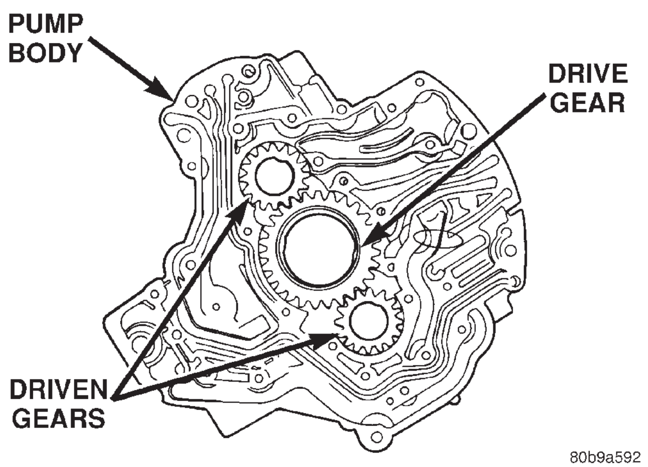


Fig. 11 Oil Pump Gears

the point where it can close off the check valve located between the two pumps. When the check valve is closed, the secondary pump is shut down and the primary pump supplies all the fluid to the transmission.

CONVERTER CLUTCH SWITCH VALVE

The converter clutch switch valve is used to control the hydraulic pressure supplied to the front (OFF) side of the torque converter clutch.

CONVERTER CLUTCH REGULATOR VALVE

The converter clutch regulator valve is used to control the hydraulic pressure supplied to the back (ON) side of the torque converter clutch.

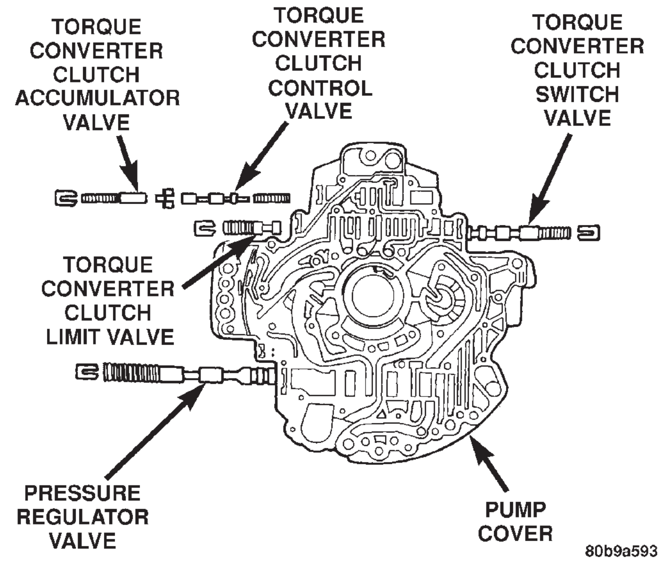


Fig. 12 Oil Pump Valves

TORQUE CONVERTER LIMIT VALVE

The torque converter limit valve serves to limit the available line pressure to the torque converter clutch to approximately 120 psi.

VALVE BODY

DESCRIPTION

The valve body consists of a cast aluminum valve body, a separator plate, and a transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, bands, and frictional clutches. The valve body contains the following components (Fig. 14) and (Fig. 15):

- Solenoid switch valve
- Manual valve
- Low/reverse switch valve
- 5 Accumulators
- 7 check balls

OPERATION

NOTE: Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

SOLENOID SWITCH VALVE

The Solenoid Switch Valve (SSV) controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

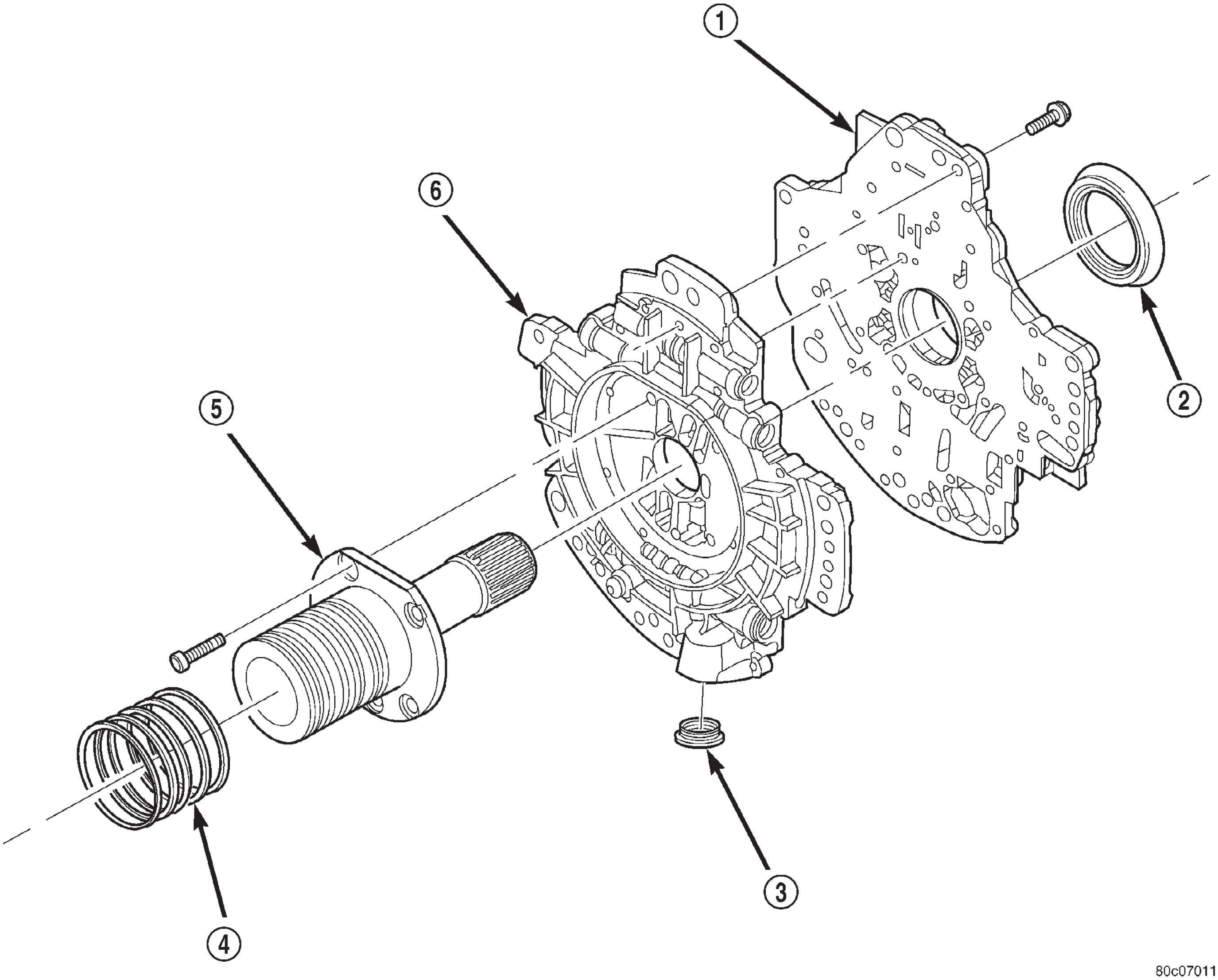


Fig. 13 Oil Pump Reaction Shaft and Seal

DESCRIPTION AND OPERATION (Continued)

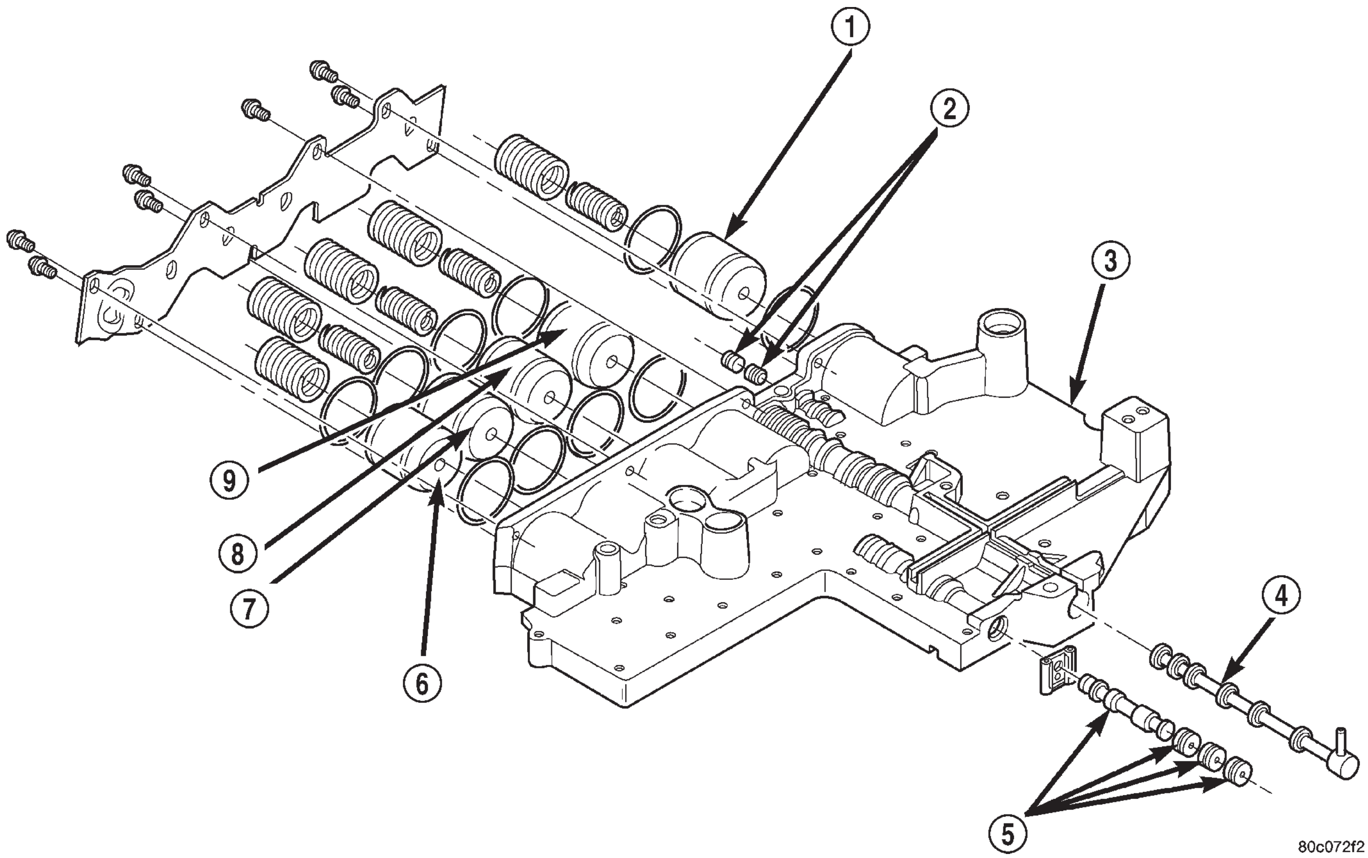


Fig. 14 Valve Body Components

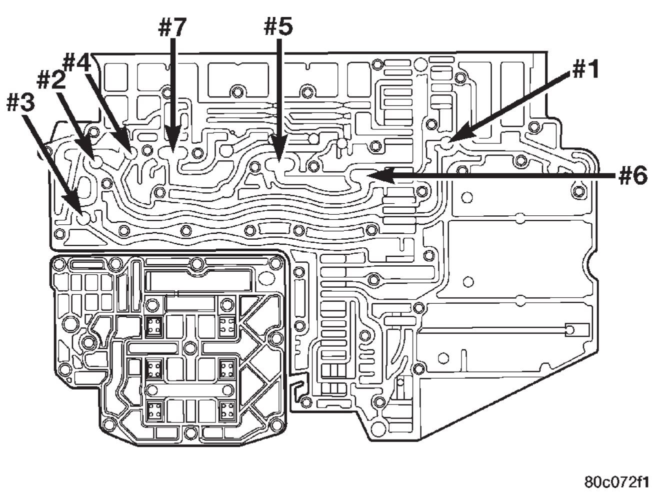


Fig. 15 Check Ball Locations

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, and 4th, it will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

MANUAL VALVE

The manual valve is a relay valve. The purpose of the manual valve is to direct fluid to the correct circuit needed for a specific gear or driving range. The manual valve, as the name implies, is manually operated by the driver with a lever located on the top of the valve body. The valve is connected mechanically by a cable to the gearshift mechanism. The valve is held in each of its positions by a roller detent spring

DESCRIPTION AND OPERATION (Continued)

(Fig. 16) that engages the "roostercomb" of the TRS selector plate.

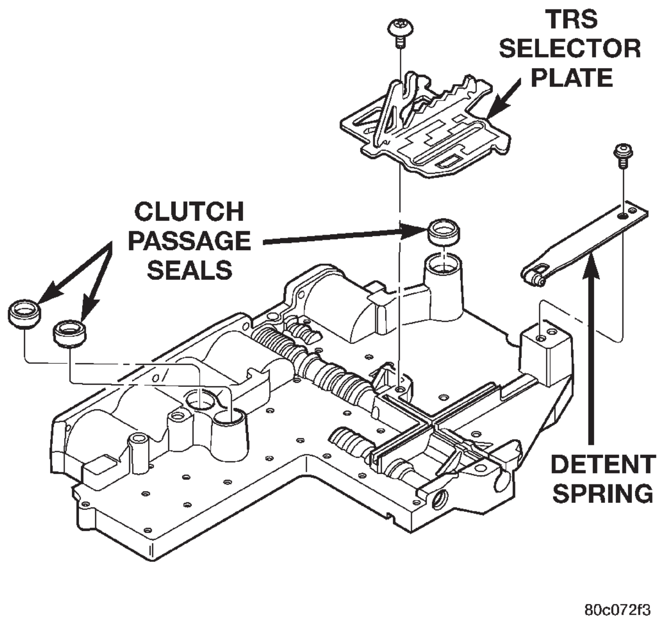


Fig. 16 TRS Selector Plate and Detent Spring

LOW/REVERSE SWITCH VALVE

Allows the low/reverse clutch to be operated by either the LR/CC solenoid or the MS solenoid.

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches, while others are used to apply bands. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PRESSURE

Pressure (Fig. 17) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in or 1 pound per square inch, or PSI as it is commonly referred to.

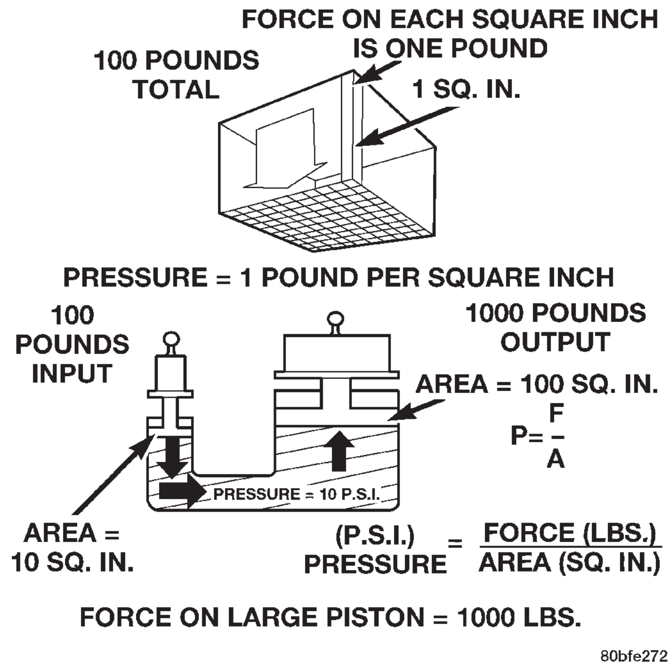


Fig. 17 Force and Pressure Relationship

PRESSURE ON A CONFINED FLUID

Pressure is exerted on a confined fluid (Fig. 18) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply "leak" past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O–rings, D–rings, lip seals, sealing rings, or extremely close tolerances between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal's Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the pressure in the fluid is the same everywhere within the container.

FORCE MULTIPLICATION

Using the 10 PSI example used in the illustration (Fig. 19), a force of 1000 lbs. can be moved with a

DESCRIPTION AND OPERATION (Continued)

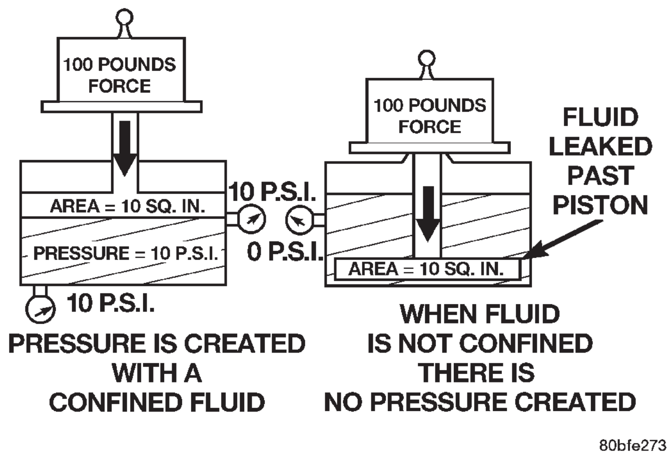


Fig. 18 Pressure on a Confined Fluid

force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 19), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept "pressure is the same everywhere" means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

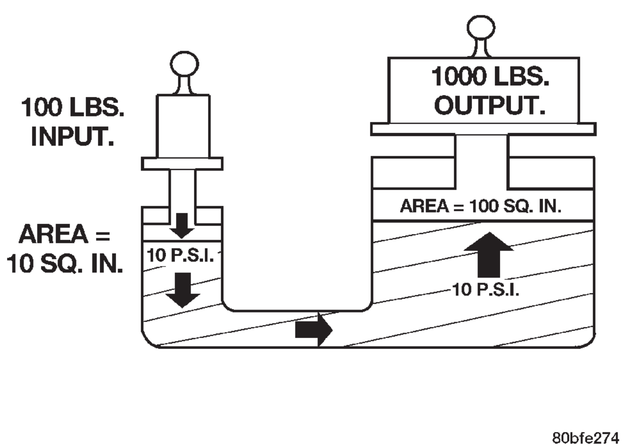


Fig. 19 Force Multiplication

PISTON TRAVEL

The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it's a weight–to–distance output rather than a pressure–to–area output. Using the same forces and areas as in the previous example, the smaller piston (Fig. 20) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

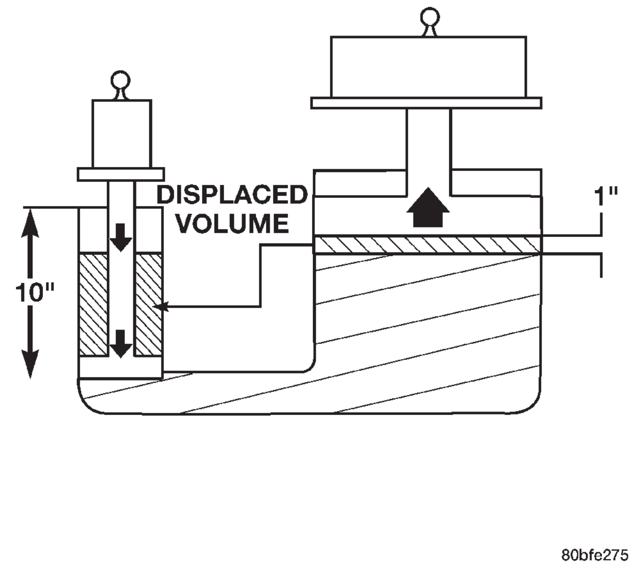


Fig. 20 Piston Travel

INPUT CLUTCHES

DESCRIPTION

Three hydraulically applied input clutches are used to drive planetary components. The underdrive, overdrive, and reverse clutches are considered input clutches and are contained within the input clutch assembly (Fig. 21) and (Fig. 22). The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston
- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

OPERATION

The three input clutches are responsible for driving different components of the planetary geartrain.

DESCRIPTION AND OPERATION (Continued)

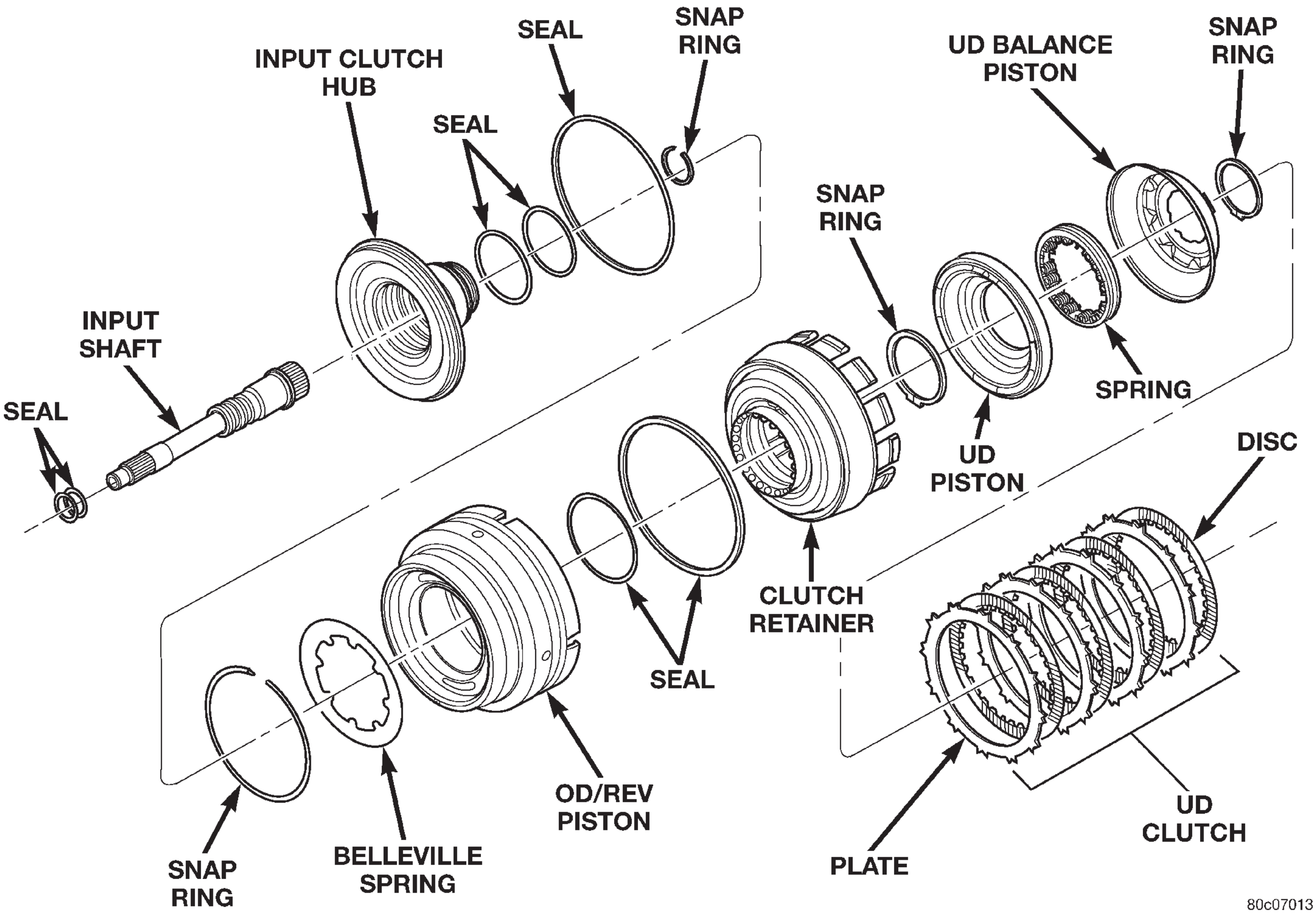


Fig. 21 Input Clutch Assembly-Part 1

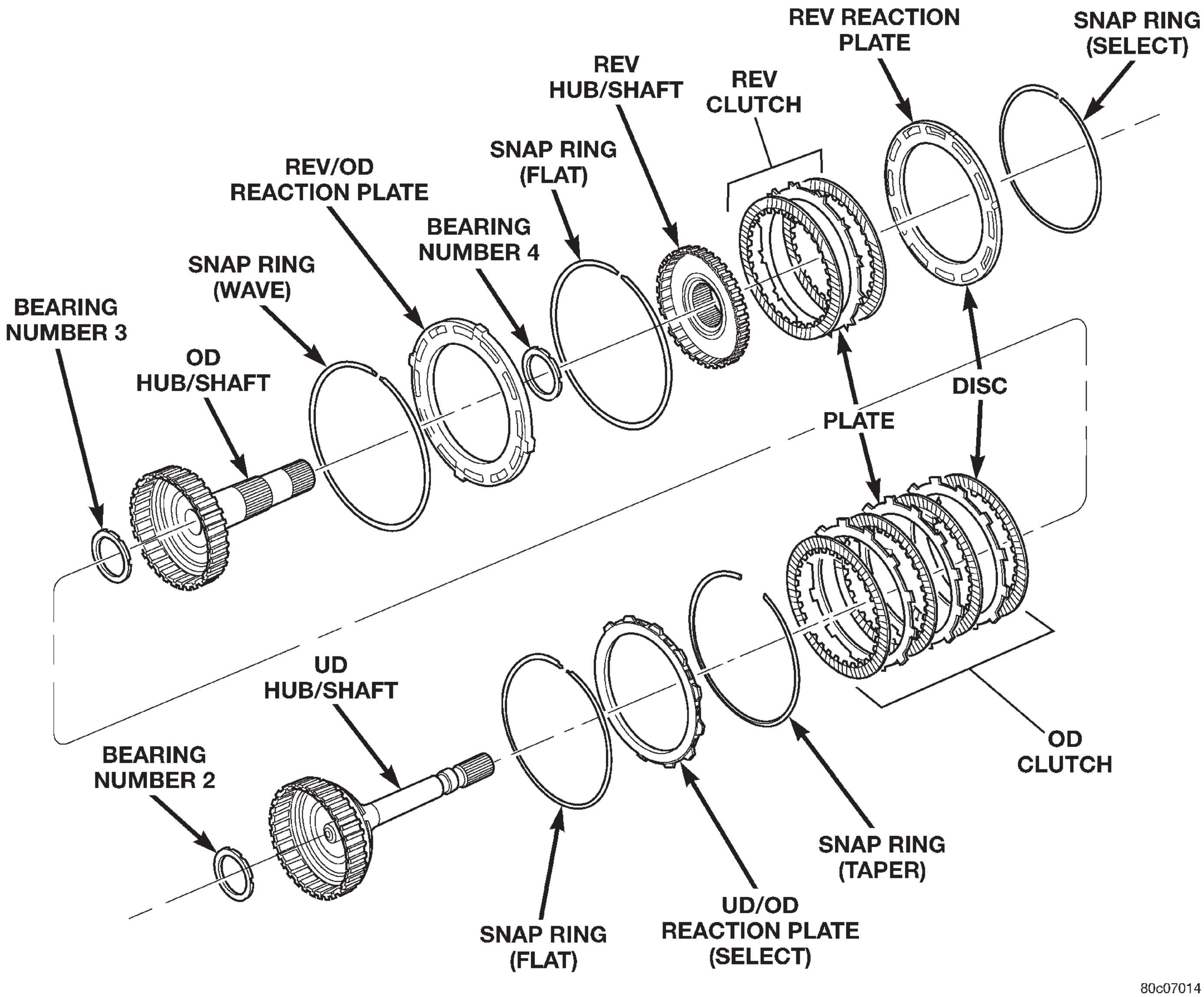


Fig. 22 Input Clutch Assembly-Part 2

DESCRIPTION AND OPERATION (Continued)

UNDERDRIVE CLUTCH

The underdrive clutch is hydraulically applied in first, second, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the input sun gear.

OVERDRIVE CLUTCH

The overdrive clutch is hydraulically applied in third (direct) and overdrive gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the reverse carrier/input annulus assembly.

REVERSE CLUTCH

The reverse clutch is hydraulically applied in reverse gear by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the reaction annulus gear is driven.

HOLDING CLUTCHES

DESCRIPTION

Three hydraulically applied multi-disc clutches are used to hold planetary geartrain components stationary while the input clutches drive others. The 2C, 4C, and Low/Reverse clutches are considered holding clutches. The 2C and 4C clutches are located in the 4C retainer/bulkhead (Fig. 23), while the Low/Reverse clutch is located at the rear of the transmission case (Fig. 24).

OPERATION

2C CLUTCH

The 2C clutch is hydraulically applied in second gear by pressurized fluid against the 2C piston. When the 2C clutch is applied, the reverse sun gear assembly is held or grounded to the transmission case by holding the reaction planetary carrier.

4C CLUTCH

The 4C clutch is hydraulically applied in fourth gear by pressurized fluid against the 4C clutch piston. When the 4C clutch is applied, the reaction annulus gear is held or grounded to the transmission case by holding the reaction planetary carrier.

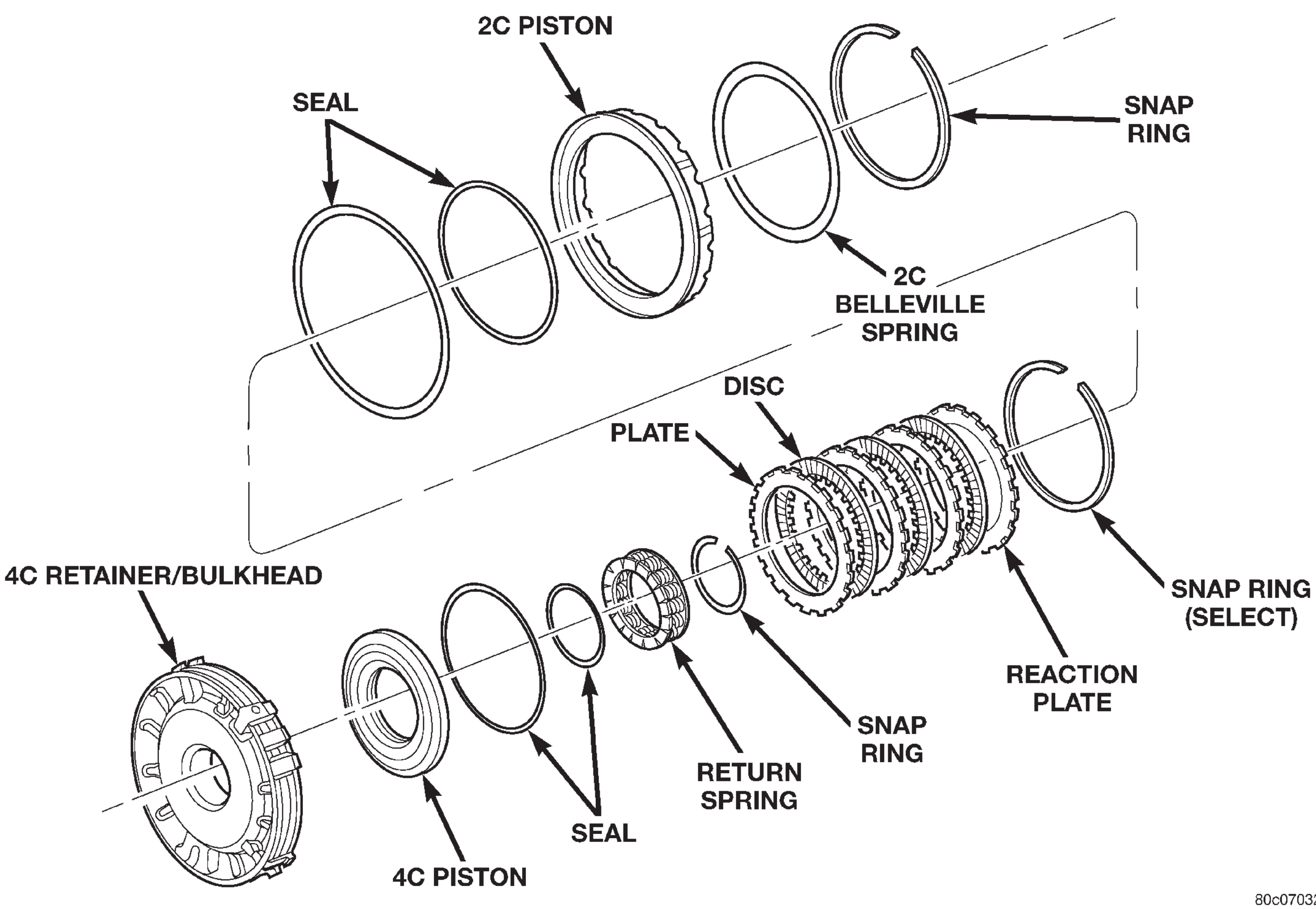


Fig. 23 2C and 4C Clutches

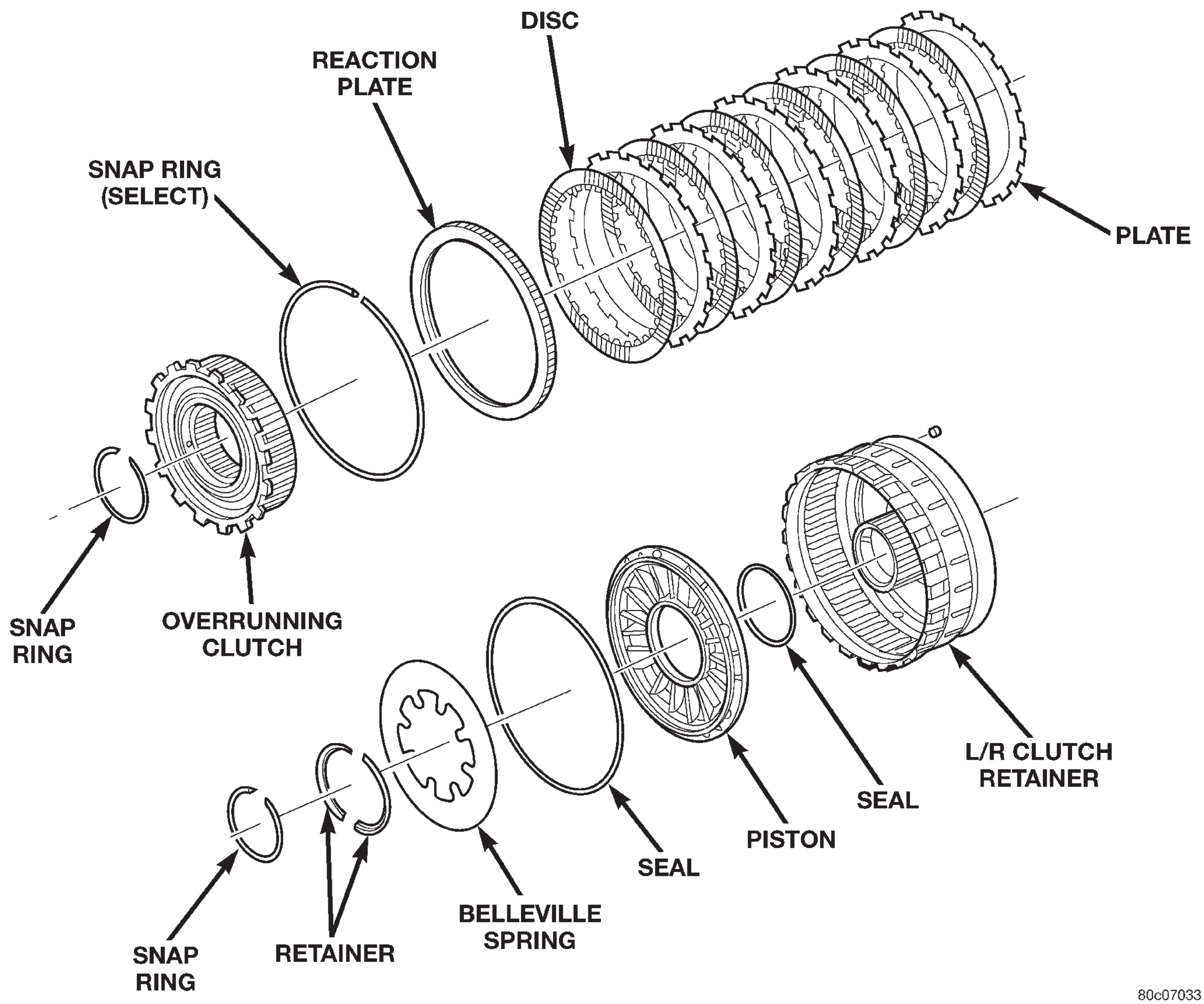


Fig. 24 Low/Reverse Clutch

DESCRIPTION AND OPERATION (Continued)

LOW/REVERSE CLUTCH

The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gears by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the input annulus assembly is held or grounded to the transmission case.

PLANETARY GEARTRAIN

DESCRIPTION

The planetary geartrain is located behind the 4C retainer/bulkhead, toward the rear of the transmission. The planetary geartrain consists of three primary assemblies:

- Reaction (Fig. 25).
- Reverse (Fig. 26).
- Input (Fig. 26).

OPERATION

REACTION PLANETARY GEARTRAIN

The reaction planetary carrier and reverse sun gear of the reaction planetary geartrain are a single component which is held by the 2C clutch when required. The reaction annulus gear is a stand alone component that can be driven by the reverse clutch or held by the 4C clutch. The reaction sun gear is driven by the overdrive clutch.

REVERSE PLANETARY GEARTRAIN

The reverse planetary geartrain is the middle of the three planetary sets. The reverse planetary carrier can be driven by the overdrive clutch as required. The reverse planetary carrier is also splined to the input annulus gear, which can be held by the low/reverse clutch. The reverse planetary annulus, input planetary carrier, and output shaft are all one piece.

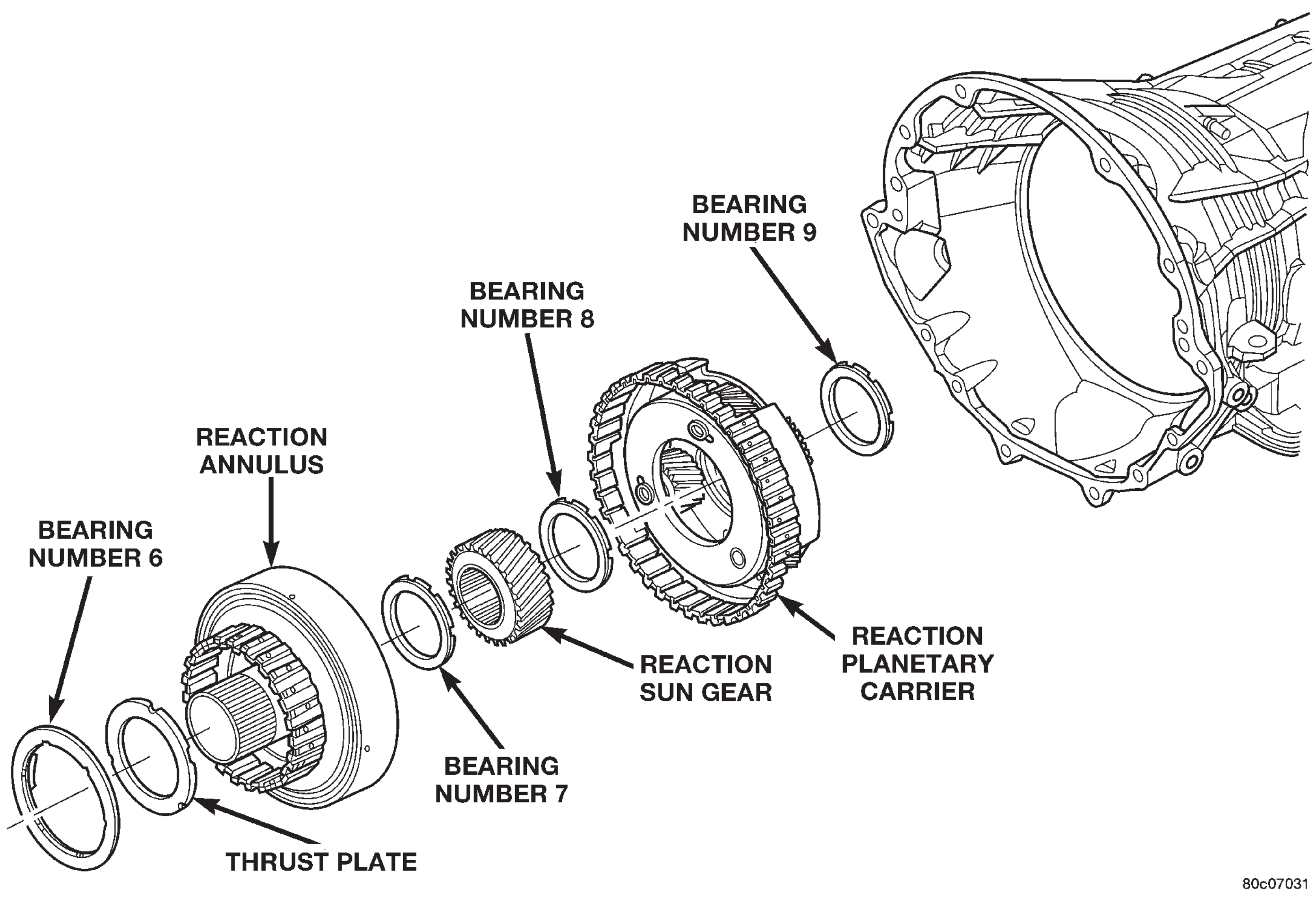


Fig. 25 Reaction Planetary Geartrain

DESCRIPTION AND OPERATION (Continued)

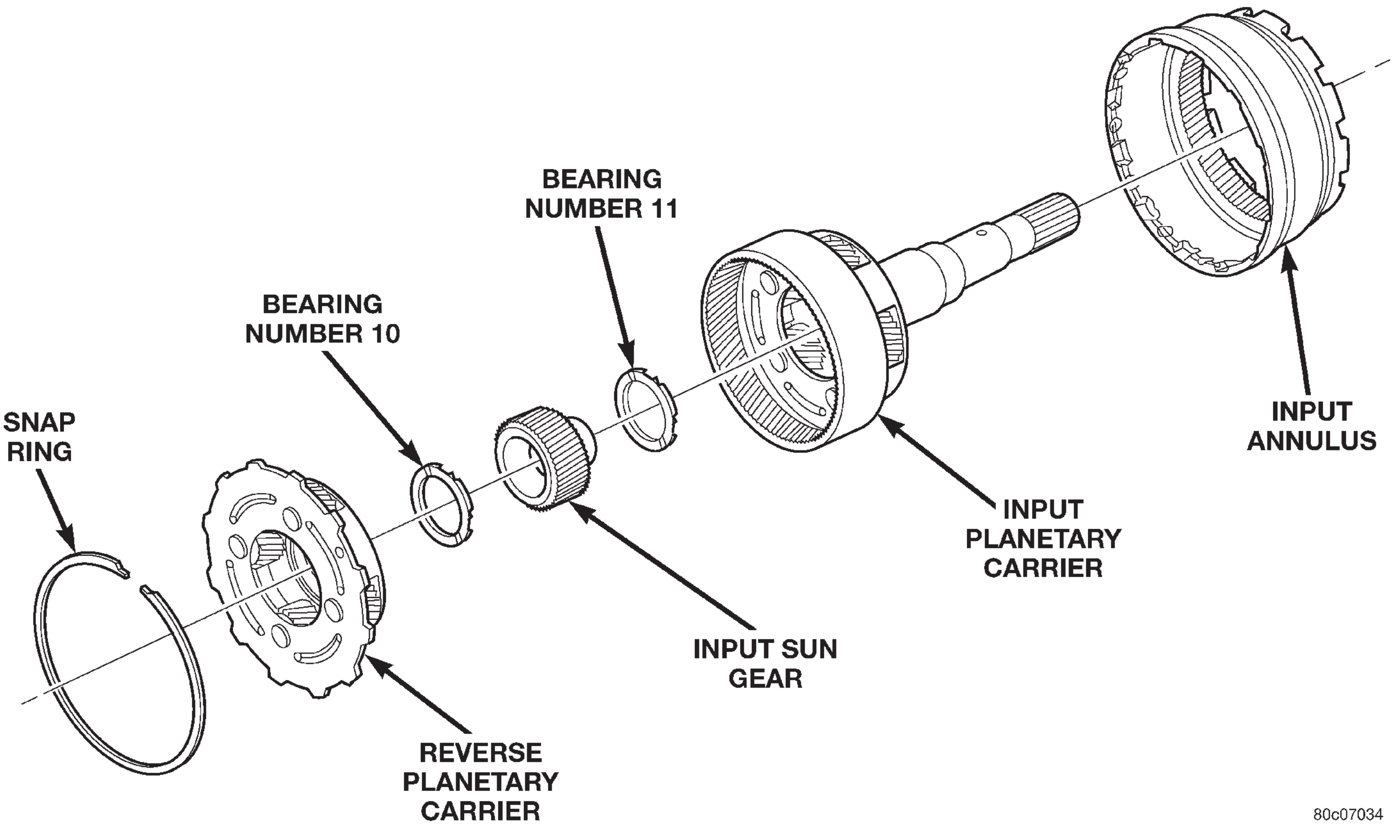


Fig. 26 Reverse/Input Planetary Geartrain

DESCRIPTION AND OPERATION (Continued)

INPUT PLANETARY GEARTRAIN

The input sun gear of the input planetary geartrain is driven by the underdrive clutch.

GEARSHIFT MECHANISM

DESCRIPTION

The gear shift mechanism provides six shift positions which are:

- Park (P)
- Reverse (R)
- Neutral (N)
- Drive (D)
- Manual second (2)
- Manual low (1)

OPERATION

Manual low (1) range provides first gear only. Overrun braking is also provided in this range. Manual second (2) range provides first and second gear only.

Drive range provides first, second third and overdrive fourth gear ranges. The shift into overdrive fourth gear range occurs only after the transmission has completed the shift into D third gear range. No further movement of the shift mechanism is required to complete the 3-4 shift.

The fourth gear upshift occurs automatically when the overdrive selector switch is in the ON position. No upshift to fourth gear will occur if any of the following are true:

- The transmission fluid temperature is below 10° C (50° F) or above 121° C (250° F).
- The shift to third is not yet complete.
- Vehicle speed is too low for the 3–4 shift to occur.
- Battery temperature is below –5° C (23° F).

OVERDRIVE OFF SWITCH

DESCRIPTION

The overdrive OFF (control) switch is located in the shift lever arm.

OPERATION

The switch is a momentary contact device that signals the PCM to toggle current status of the overdrive function. At key-on, overdrive operation is allowed. Pressing the switch once causes the overdrive OFF mode to be entered and the overdrive OFF switch lamp to be illuminated. Pressing the switch a second time causes normal overdrive operation to be restored and the overdrive lamp to be turned off. The overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. The normal position for the control switch is the ON position. The switch must be in this position to energize the solenoid and allow a 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

TRANSMISSION CONTROL MODULE

DESCRIPTION

The Transmission Control Module (TCM) is located in the engine compartment on the right (passenger) side and is mounted to the radiator core support (Fig. 27).

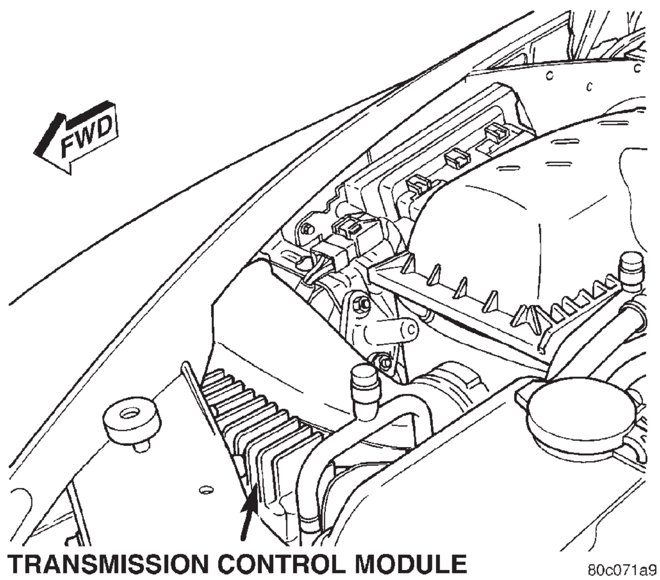


Fig. 27 Transmission Control Module Location

OPERATION

The TCM is the controlling unit for all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hardwired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the vehicle communication bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition “ON” voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor
- Transmission Range Sensor
- Pressure Switches
- Transmission Temperature Sensor
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- Line Pressure Sensor

DESCRIPTION AND OPERATION (Continued)

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Engine Coolant Temperature
- Ambient/Battery Temperature
- DRB Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids
- Torque Reduction Request

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indexes (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with DRB scan tool)

NOTE: If the TCM has been replaced, the "Quick Learn Procedure" must be performed. Refer to "Quick Learn Procedure" in Service Procedures of this group.

CLUTCH VOLUME INDEXES

An important function of the TCM is to monitor Clutch Volume Indexes (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur (Fig. 28).

Gear ratios can be determined by using the DRB Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

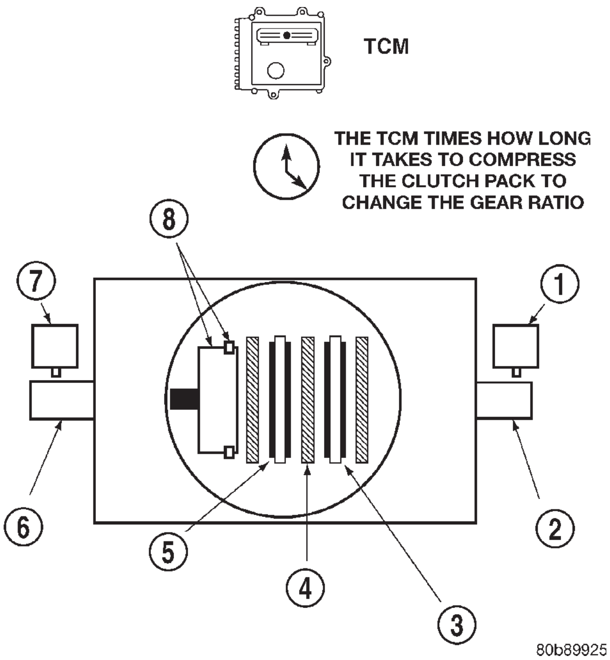


Fig. 28 Example of CVI Calculation

1 – OUTPUT SPEED SENSOR
2 – OUTPUT SHAFT
3 – CLUTCH PACK
4 – SEPARATOR PLATE
5 – FRICTION DISCS
6 – INPUT SHAFT
7 – INPUT SPEED SENSOR
8 – PISTON AND SEAL

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly (broken return springs, out of position snap rings, excessive clutch pack clearance, improper assembly, etc.) can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

DESCRIPTION AND OPERATION (Continued)

CLUTCH VOLUMES		
Clutch	**When Updated**	**Proper Clutch Volume**
L/R	2-1 or 3-1 downshift	45 to 134
2C	3-2 kickdown shift	25 to 85
OD	2-3 upshift	30 to 100
4C	3-4 upshift	30 to 85
UD	4-3 kickdown shift	30 to 100

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature below -16° F	–Park, Reverse, Neutral and 1st and 3rd gear only in D position, 2nd gear only in Manual 2 or L –No EMCC
Super Cold	Oil temperature between -12° F and 10° F	– Delayed 2-3 upshift – Delayed 3-4 upshift – Early 4-3 coastdown shift – High speed 4-2, 3-2, 2-1 kickdown shifts are prevented –Shifts at high throttle openings willl be early. – No EMCC
Cold	Oil temperature between 10° F and 36° F	–Shift schedule is the same as Super Cold except that the 2-3 upshifts are not delayed.
Warm	Oil temperature 40° F and 80° F	– Normal operation (upshift, kickdowns, and coastdowns) – No EMCC
Hot	Oil temperature above 80° F and 240° F	– Normal operation (upshift, kickdowns, and coastdowns) – Normal EMCC operation
Overheat	Oil temperature above 240° F or engine coolant temperature above 244° F	– Delayed 2-3 upshift – Delayed 3-4 upshift – 3rd gear FEMCC from 30-48 mph – 3rd gear PEMCC above 35 mph – Above 25 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made

DESCRIPTION AND OPERATION (Continued)

SOLENOID AND PRESSURE SWITCH ASSEMBLY

DESCRIPTION

The solenoid and pressure switch assembly is internal to the transmission and mounted on the valve body assembly (Fig. 29). The assembly consists of six solenoids that control hydraulic pressure to the six friction elements (transmission clutches), and the torque converter clutch. The pressure control solenoid is located on the side of the solenoid and pressure switch assembly. The solenoid assembly also contains five pressure switches that feed information to the TCM.

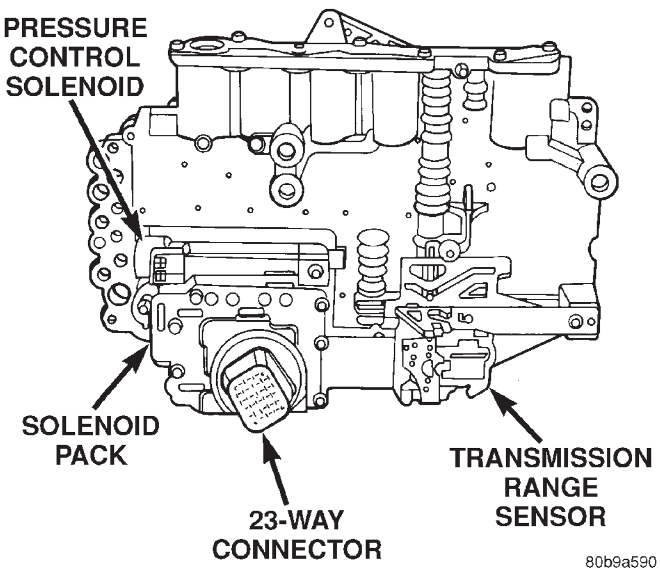


Fig. 29 SOLENOID AND PRESSURE SWITCH ASSEMBLY

OPERATION

The solenoids within the assembly are supplied voltage by the Transmission Control Relay. The solenoids are energized when the TCM grounds the return wire for the solenoid that is needed. The pressure switches simply tell the TCM whether or not pressure exists within a clutch circuit.

BATTERY FEED (TCM)

DESCRIPTION

A fused, direct battery feed to the TCM is used for continuous power.

OPERATION

This battery voltage is necessary to retain adaptive learn values in the TCM's RAM (Random Access Memory). When the battery (B+) is disconnected, this memory is lost. When the battery (B+) is restored, this memory loss is detected by the TCM and a Diagnostic Trouble Code (DTC) is set.

TRANSMISSION CONTROL RELAY

DESCRIPTION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode.

OPERATION

When the relay is "off", no power is supplied to the solenoid pack and the transmission is in "limp-in" mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

PRESSURE SWITCHES

DESCRIPTION

The pressure switches are located inside the solenoid and pressure switch assembly and are only serviced by replacing the assembly.

OPERATION

The TCM relies on five pressure switches to monitor fluid pressure in the L/R, 2C, 4C, UD, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The switches close at 23 psi and open at 11 psi, and simply indicate whether or not pressure exists. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

GEAR	L/R	2C	4C	UD	OD
R	OP	OP	OP	OP	OP
P/N	CL	OP	OP	OP	OP
1ST	CL*	OP	OP	CL	OP
2ND	OP	CL	OP	CL	OP
2ND PRIME	OP	OP	CL	CL	OP
D	OP	OP	OP	CL	CL
OD	OP	OP	CL	OP	CL

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.

A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

DESCRIPTION AND OPERATION (Continued)

INPUT AND OUTPUT SPEED SENSORS

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

LINE PRESSURE CONTROL

DESCRIPTION

The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid, mounted on the side of the solenoid and pressure switch assembly. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the sump. The system also contains a variable pressure style sensor, the Line Pressure Sensor, which is a direct input to the TCM. The line pressure solenoid monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.

OPERATION

The TCM calculates the desired line pressure based upon inputs from the transmission and engine. The TCM calculates the torque input to the transmission and uses that information as the primary input to the calculation. The line pressure is set to a predetermined value during shifts and when the transmission is in the PARK and NEUTRAL positions. This is done to ensure consistent shift quality. During all other operation, the actual line pressure is compared to the desired line pressure and adjustments are made to the pressure control solenoid duty cycle.

THROTTLE POSITION SENSOR

OPERATION

The Transmission Control Module (TCM) receives the throttle position signal and its ground from the Throttle Position Sensor (TPS). The TPS has a 5 volt pull up supplied by the engine controller. The throttle signal is checked by the TCM for out-of-range as well as intermittence (excessive signal changes).

TRANSMISSION RANGE SENSOR

DESCRIPTION

The Transmission Range Sensor (TRS) is mounted to the top of the valve body inside the transmission.

The Transmission Range Sensor (TRS) has six switch contacts that:

- Determine shift lever position
- Supply ground to the Starter Relay in Park and Neutral only.
- Supply ground to the TCM for backup lamp control in Reverse only.

The TRS also has an integrated temperature sensor (thermistor) that communicates transmission temperature to the TCM and PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

There are many possible combinations of open and closed switches (codes). Seven of these possible codes are related to gear position and five are recognized as “between gear” codes. This results in many codes which should **never occur**. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

DESCRIPTION AND OPERATION (Continued)

GEAR	C5	C4	C3	C2	C1
Park	CL	OP	OP	CL	CL
Temp 1	CL	OP	OP	CL	OP
Reverse	OP	OP	OP	CL	OP
Temp 2	OP	OP	CL	CL	OP
Neutral 1	OP	OP	CL	CL	CL
Neutral 2	OP	CL	CL	CL	CL
Temp 3	OP	CL	CL	CL	OP
Drive	OP	CL	CL	OP	OP
Temp 4	OP	CL	OP	OP	OP
Manual 2	CL	CL	OP	OP	OP
Temp 5	CL	OP	OP	OP	OP
Manual 1	CL	OP	CL	OP	OP

TRANSMISSION TEMPERATURE SENSOR

DESCRIPTION

The transmission temperature sensor is a thermistor that is integral to the Transmission Range Sensor (TRS).

OPERATION

The transmission temperature sensor is used by the TCM to sense the temperature of the fluid in the sump. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in.

Calculated Temperature

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

SOLENOIDS

DESCRIPTION

Solenoids are used to control the L/R, 2C, 4C, OD, and UD friction elements. The reverse clutch is controlled by line pressure and the position of the manual valve in the valve body. All the solenoids are contained within the Solenoid and Pressure Switch Assembly. The solenoid and pressure switch assembly contains one additional solenoid, Multi-Select (MS), which serves primarily to provide 2nd and 3rd gear limp-in operation.

OPERATION

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid as necessary. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The MS and UD solenoids are normally applied to allow transmission limp-in in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

SOLENOID SWITCH VALVE

DESCRIPTION

The Solenoid Switch Valve (SSV) is located in the valve body controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

OPERATION

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, and 4th, it will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

DIAGNOSIS AND TESTING

EFFECTS OF INCORRECT FLUID LEVEL

A low fluid level allows the pump to take in air along with the fluid. Air in the fluid will cause fluid pressures to be low and develop slower than normal. If the transmission is overfilled, the gears churn the fluid into foam. This aerates the fluid and causing the same conditions occurring with a low level. In either case, air bubbles cause fluid overheating, oxi-

DIAGNOSIS AND TESTING (Continued)

dation and varnish buildup which interferes with valve, clutch and servo operation. Foaming also causes fluid expansion which can result in fluid overflow from the transmission vent or fill tube. Fluid overflow can easily be mistaken for a leak if inspection is not careful.

CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or damaged main/auxiliary cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(2) Heavy duty operation with a vehicle not properly equipped for this type of operation. Trailer towing or similar high load operation will overheat the transmission fluid if the vehicle is improperly equipped. Such vehicles should have an auxiliary transmission fluid cooler, a heavy duty cooling system, and the engine/axle ratio combination needed to handle heavy loads.

FLUID CONTAMINATION

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the fluid
- internal failure that generates debris
- overheat that generates sludge (fluid breakdown)
- failure to reverse flush cooler and lines after repair
- failure to replace contaminated converter after repair

The use of non recommended fluids can result in transmission failure. The usual results are erratic shifts, slippage, abnormal wear and eventual failure due to fluid breakdown and sludge formation. Avoid this condition by using recommended fluids only.

The dipstick cap and fill tube should be wiped clean before checking fluid level. Dirt, grease and other foreign material on the cap and tube could fall into the tube if not removed beforehand. Take the time to wipe the cap and tube clean before withdrawing the dipstick.

Engine coolant in the transmission fluid is generally caused by a cooler malfunction. The only remedy is to replace the radiator as the cooler in the radiator is not a serviceable part. If coolant has circulated through the transmission for some time, an overhaul may also be necessary; especially if shift problems had developed.

The transmission cooler and lines should be reverse flushed whenever a malfunction generates sludge and/or debris. The torque converter should also be replaced at the same time.

Failure to flush the cooler and lines will result in recontamination. Flushing applies to auxiliary coolers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

45RFE AUTOMATIC TRANSMISSION GENERAL DIAGNOSIS

CAUTION: Before attempting any repair on a 45RFE automatic transmission, check for Diagnostic Trouble Codes with the DRB scan tool.

Transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

(1) Check for transmission fault codes using DRB scan tool.

(2) Check fluid level and condition.

(3) Adjust gearshift cable if complaint was based on delayed, erratic, or harsh shifts.

(4) Road test and note how transmission upshifts, downshifts, and engages.

(5) Perform stall test if complaint is based on sluggish acceleration. Or, if abnormal throttle opening is needed to maintain normal speeds with a properly tuned engine.

(6) Perform hydraulic pressure test if shift problems were noted during road test.

DIAGNOSIS AND TESTING (Continued)

(7) Perform air-pressure test to check clutch operation.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken or disconnected gearshift cable.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, start engine, shift transmission into gear, and note following:

(a) If propeller shaft turns but wheels do not, problem is with differential or axle shafts.

(b) If propeller shaft does not turn and transmission is noisy, stop engine. Remove oil pan, and check for debris. If pan is clear, remove transmission and check for damaged driveplate, converter, oil pump, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

GEARSHIFT CABLE

(1) The shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With shift lever handle in:

(a) PARK position—Apply forward force on center of lever and remove pressure. Engine starts must be possible.

(b) PARK position—Apply rearward force on center of lever and remove pressure. Engine starts must be possible.

(c) NEUTRAL position—Normal position. Engine starts must be possible.

(d) NEUTRAL position—Engine running and brakes applied, apply forward force on center of shift lever. Transmission shall not be able to shift from neutral to reverse.

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that all diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

Operate the transmission in all gear ranges. Check for shift variations and engine flare which indicates slippage. Note if shifts are harsh, spongy, delayed, early, or if part throttle downshifts are sensitive.

Slippage indicated by engine flare, usually means clutch or overrunning clutch problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

CLUTCH APPLICATION CHART

SLP	UD	OD	R	2C	4C	L/R	OVERRUNNING
P–PARK						ON	
R–REVERSE			ON			ON	
N-NEUTRAL						ON	
D–OVERDRIVE FIRST	ON					ON*	ON
SECOND	ON			ON			
SECOND PRIME	ON				ON		
THIRD	ON	ON					
FOURTH		ON			ON		
LIMP-IN	ON	ON					
2–FIRST	ON					ON*	ON
SECOND	ON			ON			
LIMP-IN	ON			ON			
1–LOW	ON					ON	ON

*L/R clutch is on only with the output shaft speed below 150 rpm.

DIAGNOSIS AND TESTING (Continued)

HYDRAULIC PRESSURE TEST

An accurate tachometer and pressure test gauges are required. Test Gauge C-3293-SP has a 300 psi range and is used at all locations where pressures exceed 100 psi.

Pressure Test Port Locations

Only two pressure ports are supplied on the transmission case. The torque converter ON and torque converter OFF ports are located on the right side of the transmission case (Fig. 30).

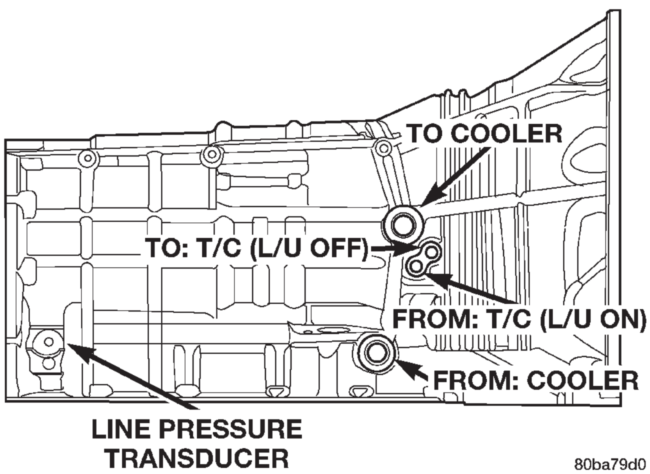


Fig. 30 Torque Converter Pressure Locations

To determine the line pressure, there are two available methods. The DRB scan tool can be used to read line pressure from the line pressure sensor. The second method is to install Line Pressure Adapter 8259 (Fig. 32) into the transmission case and then install the pressure gauge and the original sensor into the adapter. This will allow a comparison of the DRB readings and the gauge reading to make a determination regarding the accuracy of the feedback controls.

In order to access any other pressure tap locations, the transmission oil pan must be removed, the pressure port plugs removed and Valve Body Pressure Tap Adapter 8258 (Fig. 33) installed. The extensions supplied with Adapter 8258 will allow the installation of pressure gauges to the valve body. Refer to (Fig. 31) for correct pressure tap location identification.

TEST PROCEDURE

All pressure readings should be taken with the transmission fluid level full, transmission oil at the normal operating temperature, and the engine at 1500 rpm. Check the transmission for proper operation in each gear position that is in question or if a specific element is in question, check the pressure readings in at least two gear positions that employs that element. Refer to the Hydraulic Schematics at the rear of this section to determine the correct pressures for each element in a given gear position.

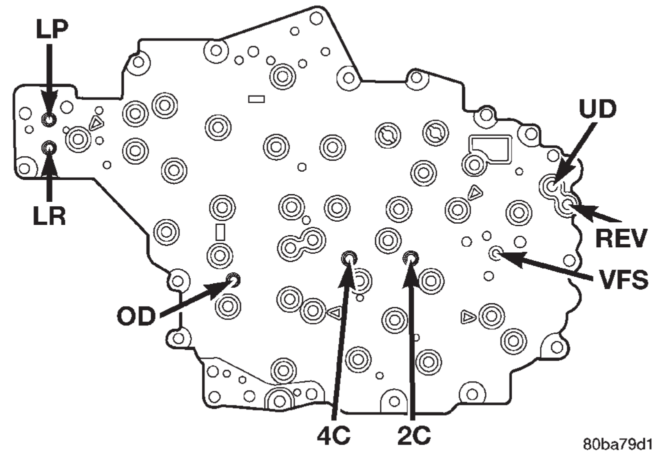


Fig. 31 Pressure Tap Locations

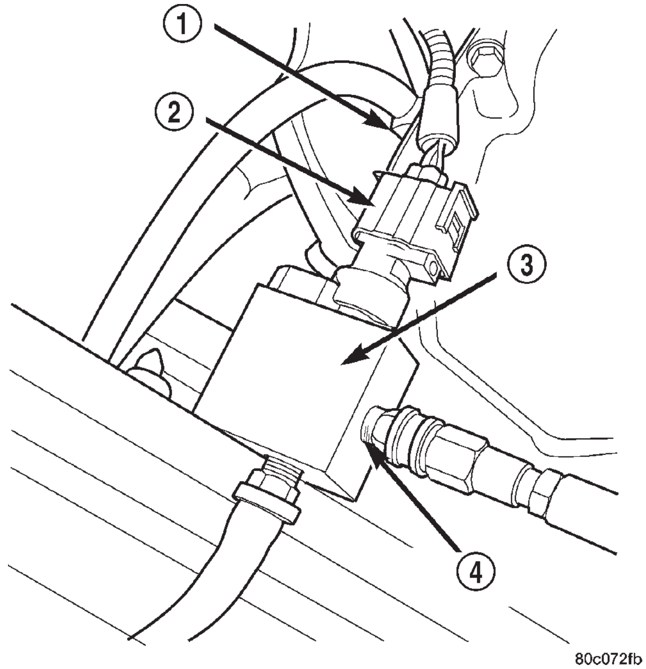


Fig. 32 Line Pressure Adapter 8259

NOTE: The 45RFE utilizes closed loop control of pump line pressure. The pressure readings may therefore vary greatly but should always follow line pressure.

Some common pressures that can be measured to evaluate pump and clutch performance are the upshift/downshift pressures and the garage shift pressures. The upshift/downshift pressure for all shifts except the 3–4, 4–3, and 4–2prime shifts is 120 psi. The upshift/downshift pressure for the 3–4, 4–3, and the 4–2prime shifts is 100 psi. The garage shift

DIAGNOSIS AND TESTING (Continued)

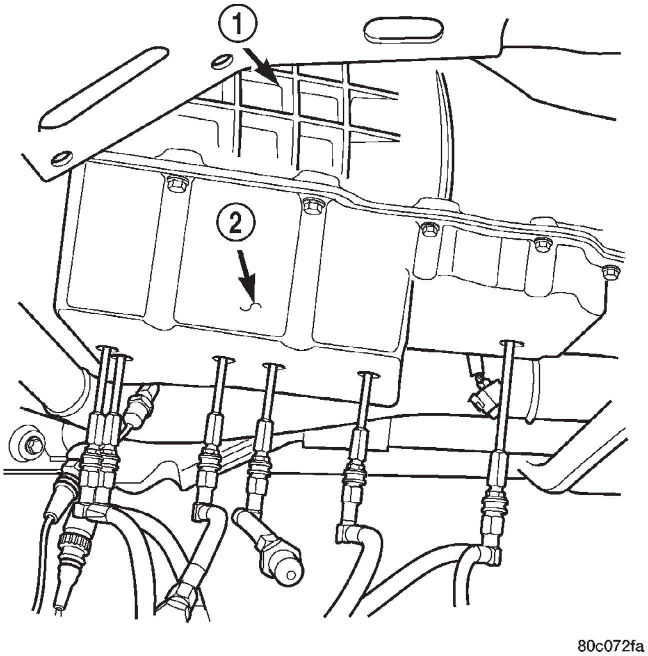


Fig. 33 Valve Body Pressure Tap Adapter 8258

pressure when performing a N–R shift is 220 psi. The garage shift pressure for the R–N and N–1 shifts is 120 psi.

AIR TESTING TRANSMISSION CLUTCH OPERATION

Air-pressure testing can be used to check transmission clutch operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The clutch apply passages are shown (Fig. 34).

NOTE: The air supply which is used must be free of moisture and dirt. Use a pressure of 30 psi to test clutch operation.

Apply air pressure at each port. If the clutch is functioning, a soft thump will be heard as the clutch is applied. The clutch application can also be felt by touching the appropriate element while applying air pressure. As the air pressure is released, the clutch should also release.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, two items must be established before repair.

(1) Verify that a leak condition actually exists.

(2) Determined the true source of the leak.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of

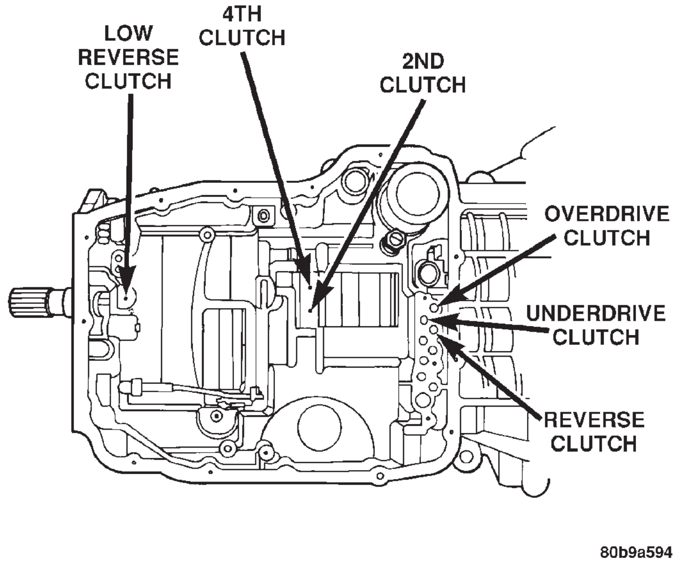


Fig. 34 Air Pressure Test Passages

residual fluid in the converter housing, or excess fluid spilled during factory fill or fill after repair. Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair. Pump seal leaks tend to move along the drive hub and onto the rear of the converter. Pump cover O-ring leaks follow the same path as a seal leak.

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 35).

(2) Leaks at the converter hub weld (Fig. 35).

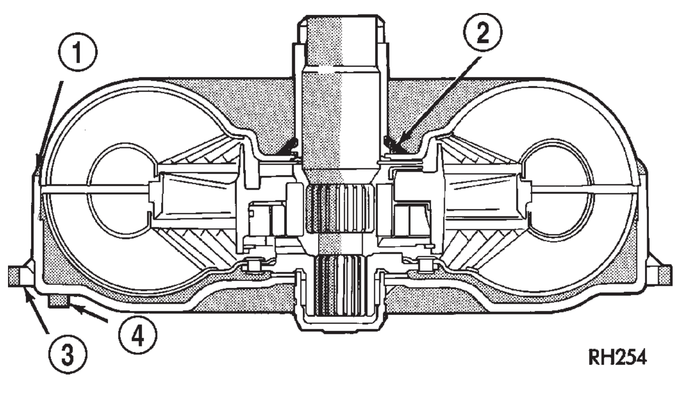


Fig. 35 Converter Leak Points—Typical

1 – OUTSIDE DIAMETER WELD
2 – TORQUE CONVERTER HUB WELD
3 – STARTER RING GEAR
4 – LUG

SERVICE PROCEDURES

FLUID LEVEL CHECK

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transmssion has too much fluid, the geartrain churns up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator operation. Foaming can also result in fluid escaping from the transmission vent where it may be mistaken for a leak.

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, and is contaminated with metal or friction material particles, a complete transmission recondition is needed. Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

The transmission fluid level should be inspected at least every six months.

FLUID LEVEL CHECK PROCEDURE

The transmission has a dipstick to check oil level. It is located on the right side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

The torque converter fills in both the P Park and N Neutral positions. Place the selector lever in P Park to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82 C. or 180 F.), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator. The fluid level will be approximately at the upper COLD hole of the dipstick at 70° F fluid temperature.

NOTE: Engine and Transmission should be at normal operating temperature before performing this procedure.

(1) Start engine and apply parking brake.
(2) Shift the transmission into Drive for approximately 2 seconds.
(3) Shift the transmission into Reverse for approximately 2 seconds.
(4) Shift the transmission into Park.
(5) Hook up DRBIII scan tool and select transmission.
(6) Select sensors.
(7) Read the transmission temperature value.
(8) Compare the fluid temperature value with the chart.
(9) Adjust transmission fluid level shown on the dipstick according to the chart.

NOTE: After adding any fluid to the transmission, wait a minimum of 2 minutes for the oil to fully drain from the fill tube into the transmission before rechecking the fluid level.

(10) Check transmission for leaks.

FLUID AND FILTER REPLACEMENT

Refer to the Maintenance Schedules in Group 0, Lubrication and Maintenance, for proper service intervals. The fluid capacity of the 45RFE is approximately 13.25 liters (14.0 quarts).

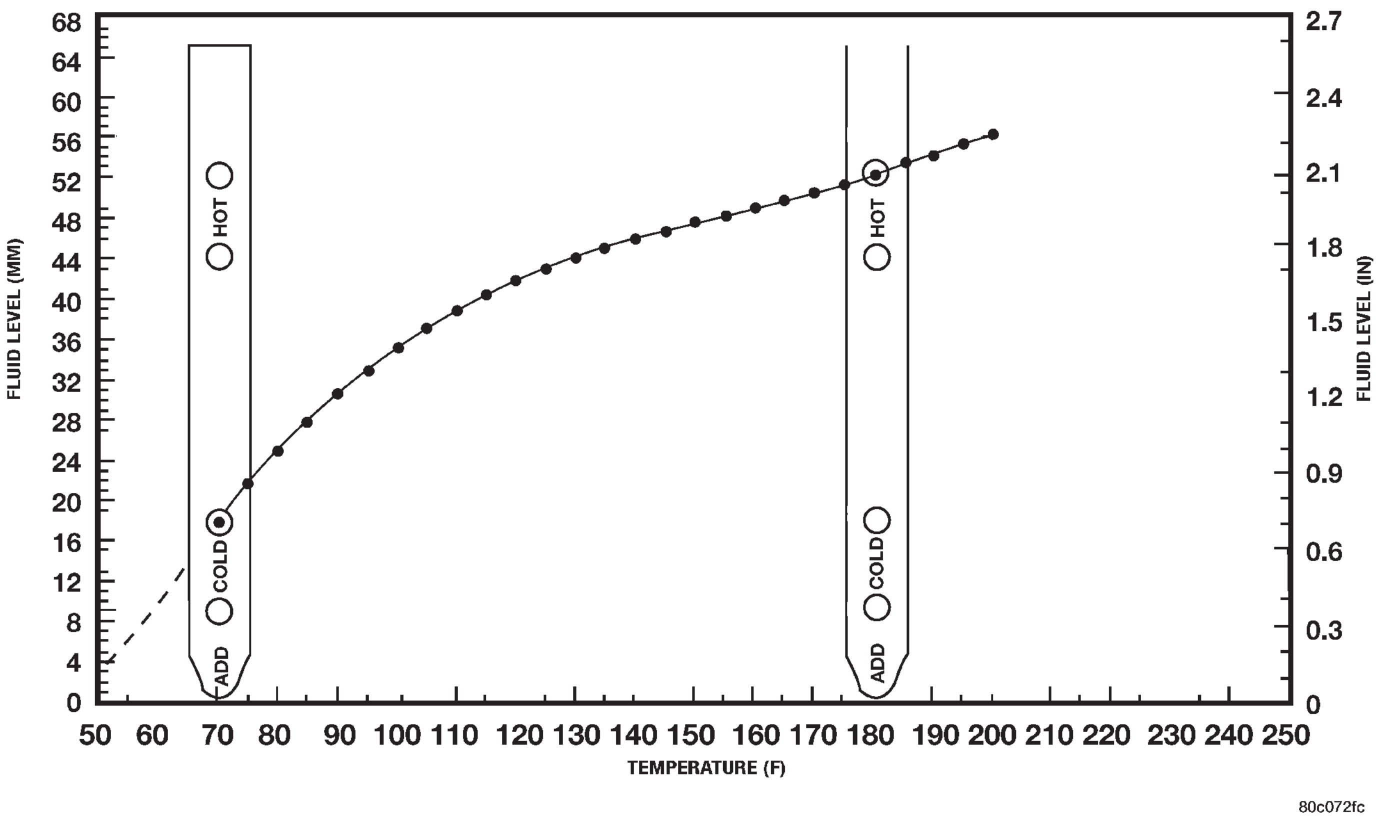
REMOVAL

(1) Hoist and support vehicle on safety stands.
(2) Place a large diameter shallow drain pan beneath the transmission pan.
(3) Remove bolts holding front and sides of pan to transmission.
(4) Loosen bolts holding rear of pan to transmission.
(5) Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.
(6) Hold up pan and remove remaining bolt holding pan to transmission.
(7) While holding pan level, lower pan away from transmission.
(8) Pour remaining fluid in pan into drain pan.
(9) Remove screws holding filter to valve body (Fig. 36).
(10) Separate filter from valve body and oil pump and pour fluid in filter into drain pan.
(11) Remove and discard the oil filter seal from the bottom of the oil pump.
(12) Using Oil Filter Wrench 8321, remove the cooler return filter from the transmission.
(13) Dispose of used trans fluid and filter properly.

INSPECTION

Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch material on the bottom of the pan does not indicate a problem unless accompanied by a slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts or debris, refer to the diagnosis section of this group.

SERVICE PROCEDURES (Continued)



Transmission Fluid Temperature Chart

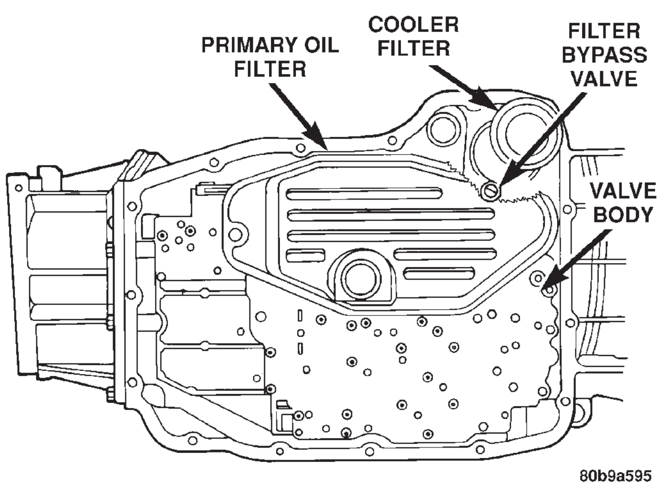


Fig. 36 Transmission Filters

CLEANING

(1) Using a suitable solvent, clean pan and magnet.

(2) Using a suitable gasket scraper, clean original sealing material from surface of transmission case and the transmission pan.

INSTALLATION

(1) Install a new oil filter seal into the bottom of the oi pump.

NOTE: Do not attempt to install the seal onto the oil filter first and then into the oil pump. An unsatisfactory seal between the oil pump and filter will result, allowing air to be drawn into the pump.

(2) Place replacement filter in position on valve body and into the oil pump.

(3) Install screws to hold filter to valve body (Fig. 36). Tighten screws to 4.5 N·m (40 in. lbs.) torque.

(4) Install new cooler return filter onto the transmission. Torque the filter to 14.12 N·m (125 in.lbs.).

(5) Place bead of Mopar® RTV sealant onto the transmission case sealing surface.

(6) Place pan in position on transmission.

(7) Install screws to hold pan to transmission. Tighten bolts to 11.8 N·m (105 in. lbs.) torque.

(8) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

TRANSMISSION FILL PROCEDURE

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

SERVICE PROCEDURES (Continued)

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF Plus 3 to transmission:

(a) If only fluid and filter were changed, add **10 pints (5 quarts)** of ATF Plus 3 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **24 pints (12 quarts)** of ATF Plus 3 to transmission.

(3) Refer to the Fluid Level Check information in this group for the proper fill procedures.

OIL PUMP VOLUME CHECK

Measuring the oil pump output volume will determine if sufficient oil flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

Verify that the transmission fluid is at the proper level. Refer to the Fluid Level Check procedure in this section. If necessary, fill the transmission to the proper level with Mopar® ATF+3, type 7176, Automatic Transmission Fluid.

(1) Disconnect the **To cooler** line at the cooler inlet and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If one quart of transmission fluid is collected in the container in 20 seconds or less, oil pump flow volume is within acceptable limits. If fluid flow is intermittent, or it takes more than 20 seconds to collect one quart of fluid, refer to the Hydraulic Pressure tests in this section for further diagnosis.

(4) Re-connect the **To cooler** line to the transmission cooler inlet.

(5) Refill the transmission to proper level.

FLUSHING COOLERS AND TUBES

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906A Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906A

(1) Remove cover plate filler plug on Tool 6906A. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906A.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF Plus 3, type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

TRANSMISSION QUICK LEARN PROCEDURE

The quick learn procedure requires the use of the DRB scan tool.

SERVICE PROCEDURES (Continued)

This program allows the electronic transmission system to recalibrate itself. This will provide the best possible transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:
- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:
- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRB indicates the procedure is complete
- The calculated oil temperature must be above 60° and below 200°

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL AND INSTALLATION

INPUT SPEED SENSOR

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the input speed sensor (Fig. 37).

(4) Remove the bolt holding the input speed sensor to the transmission case.

(5) Remove the input speed sensor from the transmission case.

INSTALLATION

(1) Install the input speed sensor into the transmission case.

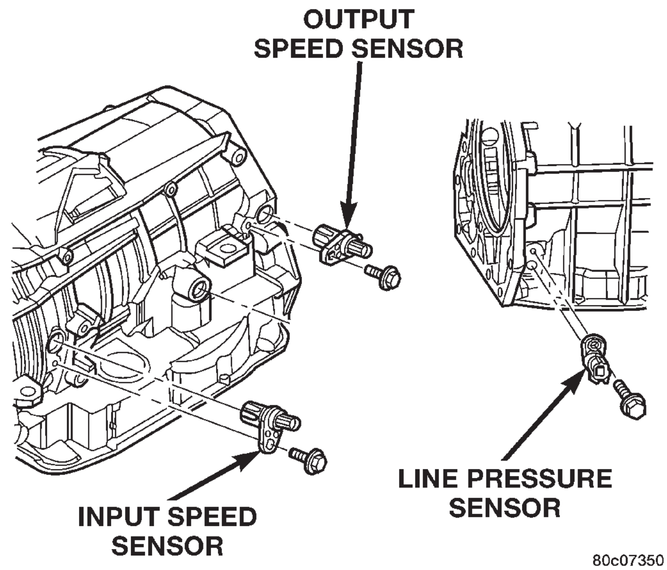


Fig. 37 Input Speed Sensor

(2) Install the bolt to hold the input speed sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).

(3) Install the wiring connector onto the input speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

OUTPUT SPEED SENSOR

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the output speed sensor (Fig. 38).

(4) Remove the bolt holding the output speed sensor to the transmission case.

(5) Remove the output speed sensor from the transmission case.

INSTALLATION

(1) Install the output speed sensor into the transmission case.

(2) Install the bolt to hold the output speed sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).

(3) Install the wiring connector onto the output speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

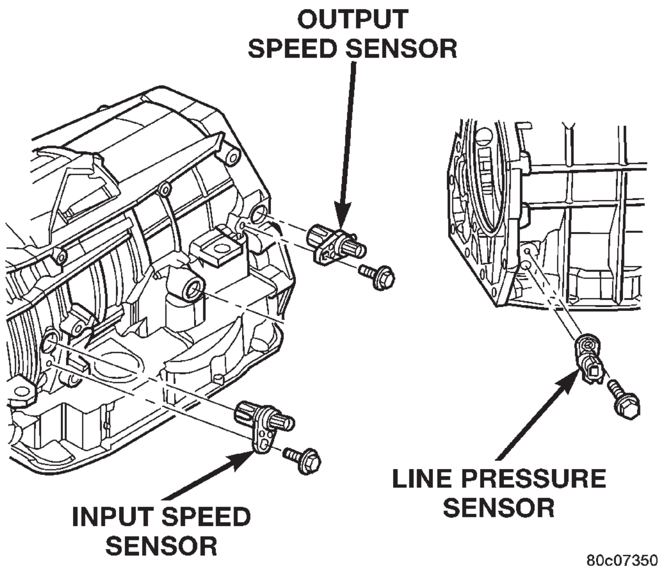


Fig. 38 Output Speed Sensor

LINE PRESSURE SENSOR

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the line pressure sensor (Fig. 39).

(4) Remove the bolt holding the line pressure sensor to the transmission case.

(5) Remove the line pressure sensor from the transmission case.

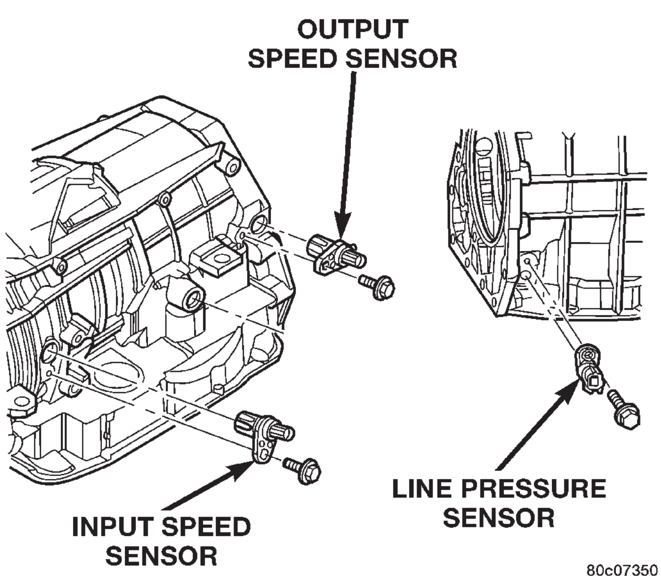


Fig. 39 Line Pressure Sensor

INSTALLATION

(1) Install the line pressure sensor into the transmission case.

(2) Install the bolt to hold the line pressure sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in.lbs.).

(3) Install the wiring connector onto the line pressure sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

VALVE BODY

The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to Disassembly and Assembly section for proper procedures.

REMOVAL

(1) Shift transmission into PARK.

(2) Raise vehicle.

(3) Remove any necessary skid plates. Refer to Group 13, Frame and Bumpers, for the appropriate procedures.

(4) Disconnect wires at the solenoid and pressure switch assembly connector.

(5) Position drain pan under transmission oil pan.

(6) Remove transmission oil pan.

(7) Remove the primary oil filter from valve body.

(8) Remove bolts attaching valve body to transmission case (Fig. 40).

(9) Lower the valve body and work the electrical connector out of transmission case.

(10) Separate the valve body from the transmission.

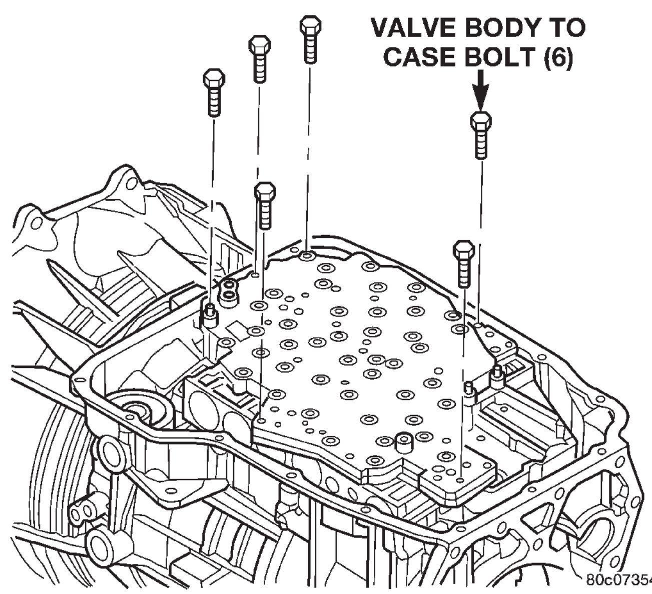


Fig. 40 Valve Body Bolts

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Check condition of seals on valve body and the solenoid and pressure switch assembly. Replace seals if cut or worn.

(2) Place TRS selector plate in the PARK position.

(3) Place the transmission in the PARK position.

(4) Lubricate seal on the solenoid and pressure switch assembly connector with petroleum jelly.

(5) Position valve body in transmission and align the manual lever on the valve body to the pin on the transmission manual shift lever.

(6) Seat valve body in case and install one or two bolts to hold valve body in place.

(7) Tighten valve body bolts alternately and evenly to 12 N·m (105 in. lbs.) torque.

(8) Install new fluid filter on valve body. Tighten filter screws to 4.5 N·m (40 in. lbs.) torque.

(9) Connect the solenoid and pressure switch assembly connector.

(10) Install oil pan. Tighten pan bolts to 12 N·m (105 in. lbs.) torque.

(11) Install any skid plates removed previously. Refer to Group 13, Frame and Bumpers, for the appropriate procedures.

(12) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

(13) Check and adjust gearshift cable, if necessary.

SOLENOID AND PRESSURE SWITCH ASSEMBLY

REMOVAL

(1) Remove the valve body from the transmission (Fig. 41).

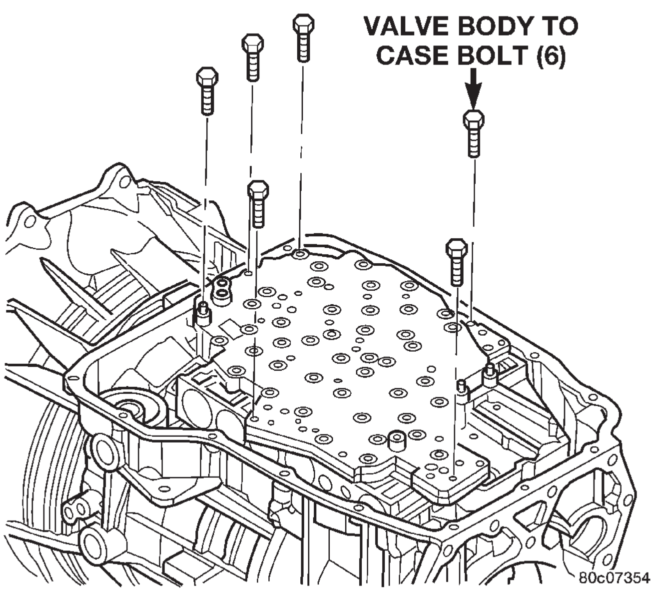


Fig. 41 Valve Body Bolts

(2) Remove the screws holding the solenoid and pressure switch assembly onto the valve body (Fig. 42).

(3) Separate the solenoid and pressure switch assembly from the valve body.

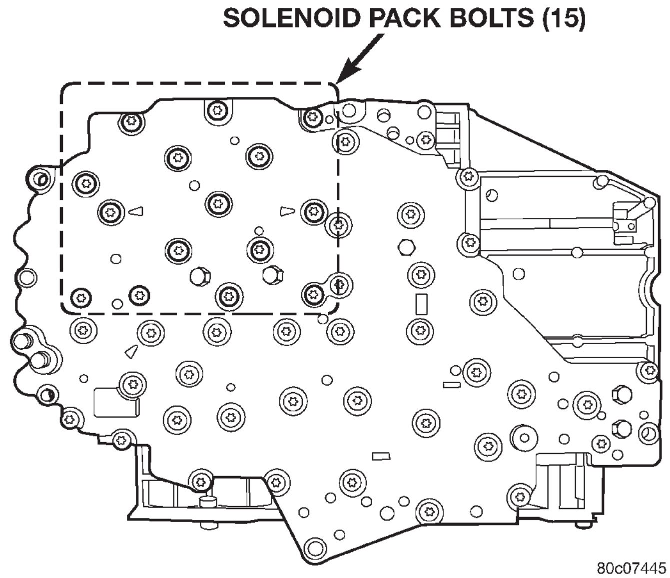


Fig. 42 Solenoid and Pressure Switch Assembly Screws

INSTALLATION

(1) Place TRS selector plate in the PARK position.

(2) Position the solenoid and pressure switch assembly onto the valve body. Be sure that both alignment dowels are fully seated in the valve body and that the TRS switch contacts are properly positioned in the selector plate

(3) Install the screws to hold the solenoid and pressure switch assembly onto the valve body.

(4) Tighten the solenoid assembly screws adjacent to the arrows cast into the bottom of the valve body first. Tighten the screws to 5.7 N·m (50 in.lbs.).

(5) Tighten the remainder of the solenoid assembly screws to 5.7 N·m (50 in.lbs.).

(6) Install the valve body into the transmission.

TRANSMISSION

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter driveplate, pump bushing, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and converter as an assembly.

REMOVAL

(1) Disconnect the negative battery cable.

(2) Raise and support the vehicle

REMOVAL AND INSTALLATION (Continued)

(3) Remove any necessary skid plates. Refer to Group 13, Frame and Bumpers, for the appropriate procedures.

(4) Mark propeller shaft and axle companion flanges for assembly alignment.

(5) Remove the rear propeller shaft

(6) Remove the front propeller shaft, if necessary.

(7) Remove the engine to transmission collar (Fig. 43).

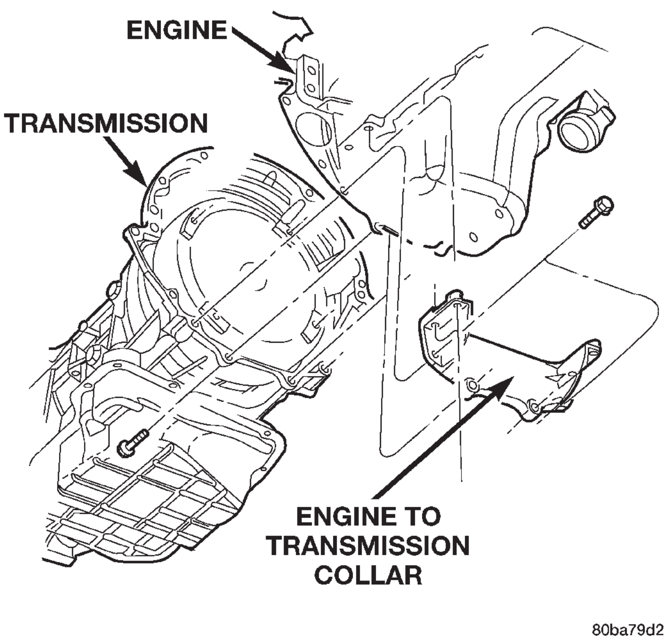


Fig. 43 Transmission Collar

(8) Remove the exhaust support bracket from the rear of the transmission.

(9) Disconnect and lower or remove any necessary exhaust components.

(10) Remove the starter motor.

(11) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(12) Disconnect wires from solenoid and pressure switch assembly, input and output speed sensors, and line pressure sensor.

(13) Disconnect gearshift cable from transmission manual valve lever (Fig. 44).

(14) Disconnect transmission fluid cooler lines at transmission fittings and clips.

(15) Disconnect the transmission vent hose from the transmission.

(16) Support rear of engine with safety stand or jack.

(17) Raise transmission slightly with service jack to relieve load on crossmember and supports.

(18) Remove bolts securing rear support and cushion to transmission and crossmember (Fig. 45).

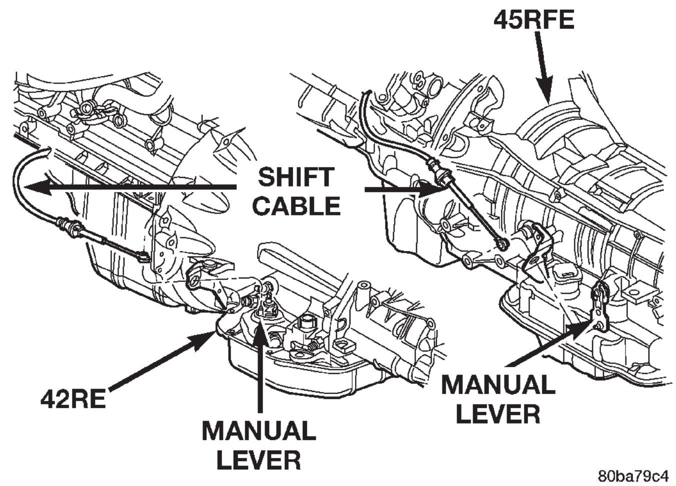


Fig. 44 Transmission Shift Cable

(19) Remove bolts attaching crossmember to frame and remove crossmember.

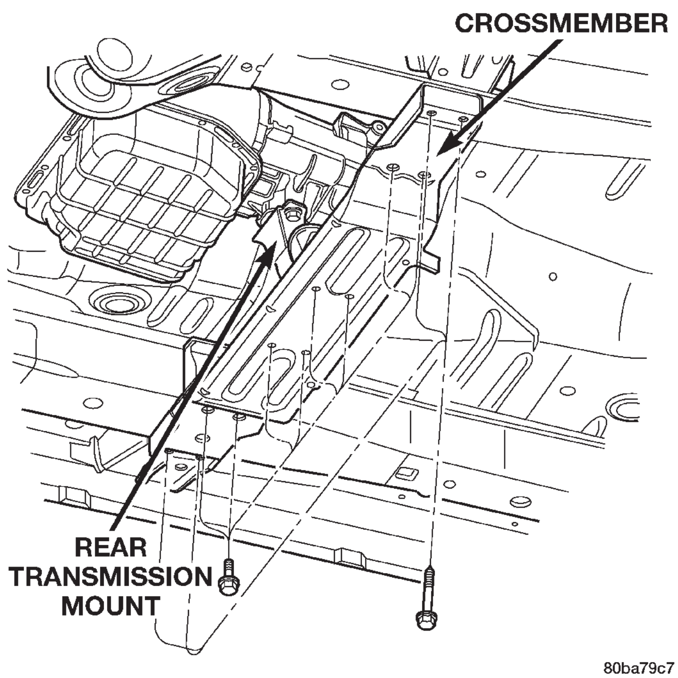


Fig. 45 Rear Transmission Crossmember

(20) Remove transfer case.

(21) Remove all remaining converter housing bolts.

(22) Carefully work transmission and torque converter assembly rearward off engine block dowels.

(23) Hold torque converter in place during transmission removal.

(24) Lower transmission and remove assembly from under the vehicle.

(25) To remove torque converter, carefully slide torque converter out of the transmission.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

(2) If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.

(3) Lubricate oil pump seal lip with transmission fluid.

(4) Align converter and oil pump.

(5) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(6) Check converter seating with steel scale and straightedge (Fig. 46). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) Temporarily secure converter with C-clamp.

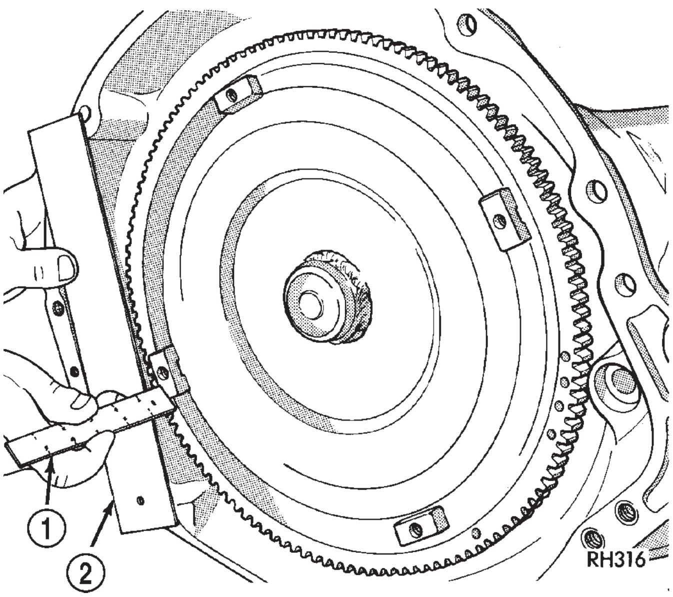


Fig. 46 Typical Method Of Checking Converter Seating

1 – SCALE
2 – STRAIGHTEDGE

(8) Position transmission on jack and secure it with chains.

(9) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

(10) Apply a light coating of Mopar® High Temp Grease to the torque converter hub pocket in the rear

(11) Raise transmission and align converter with drive plate and converter housing with engine block.

(12) Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

(13) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

(14) Install two bolts to attach converter housing to engine.

(15) Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft.lbs.).

(16) Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft.lbs.).

(17) Install rear support to transmission. Tighten bolts to 47 N·m (35 ft.lbs.).

(18) Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft.lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft.lbs.).

(19) Remove engine support fixture.

(20) Connect gearshift cable to transmission.

(21) Connect wires to solenoid and pressure switch assembly connector, input and output speed sensors, and line pressure sensor. Be sure transmission harnesses are properly routed.

CAUTION: It is essential that correct length bolts be used to attach the converter to the driveplate. Bolts that are too long will damage the clutch surface inside the converter.

(22) Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in. lbs.).

(23) Install starter motor and cooler line bracket.

(24) Connect cooler lines to transmission.

(25) Install transmission fill tube.

(26) Install exhaust components.

(27) Install transfer case. Tighten transfer case nuts to 35 N·m (26 ft.lbs.).

(28) Install the transmission collar onto the transmission and the engine. Tighten the bolts to 54 N·m (40 ft.lbs.).

(29) Align and connect propeller shaft(s).

(30) Adjust gearshift cable if necessary.

(31) Install any skid plates removed previously. Refer to Group 13, Frame and Bumpers, for the appropriate procedures.

(32) Lower vehicle.

(33) Fill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

REMOVAL AND INSTALLATION (Continued)

TORQUE CONVERTER

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition.

The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation. Check that the torque converter hub o-ring on the 45RFE torque converter hub is not damaged. Replace if necessary.

(1) Lubricate oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 47). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

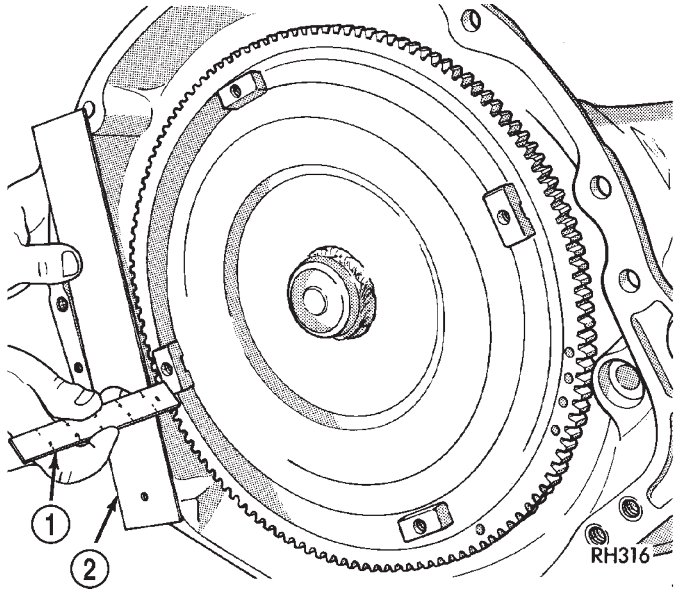


Fig. 47 Checking Torque Converter Seating–Typical

1 – SCALE
2 – STRAIGHTEDGE

OIL PUMP FRONT SEAL

REMOVAL

(1) Remove transmission from the vehicle.

(2) Remove the torque converter from the transmission.

(3) Using a screw mounted in a slide hammer, remove the oil pump front seal.

INSTALLATION

(1) Clean seal bore of the oil pump of any residue or particles from the original seal.

(2) Install new oil seal in the oil pump housing using Seal Installer C-3860-A (Fig. 48).

ADAPTER HOUSING SEAL

REMOVAL

(1) Remove the transfer case from the transmission.

(2) Using a screw mounted on a slide hammer, remove the adapter housing seal.

INSTALLATION

(1) Clean the adapter seal bore in the adapter housing of any residue or particles remaining from the original seal.

(2) Install new oil seal in the adapter housing using Seal Installer C-3860-A (Fig. 49).

(3) Install the transfer case onto the transmission.

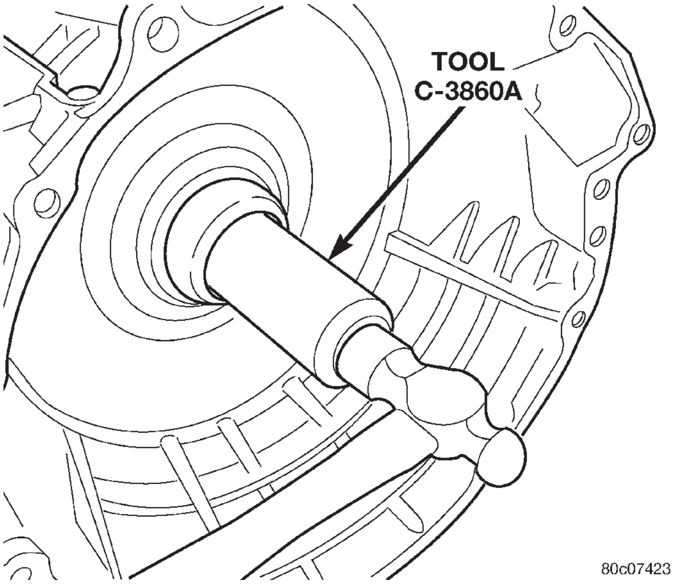


Fig. 48 Install Oil Pump Front Seal

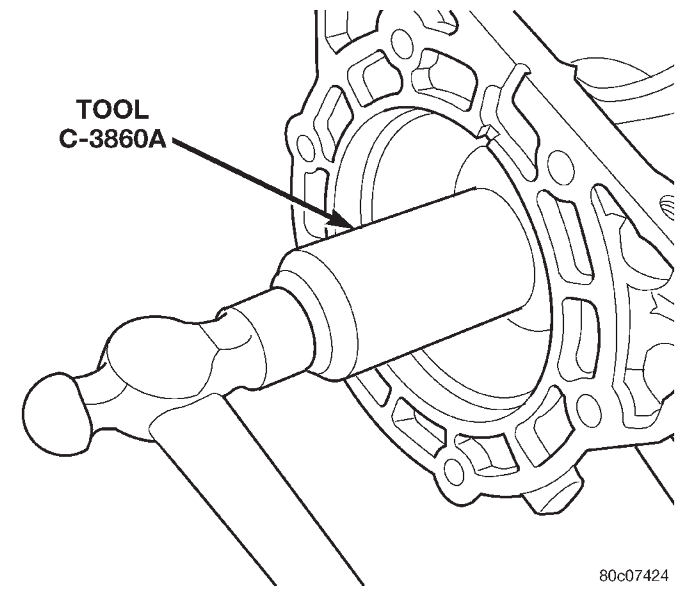


Fig. 49 Adapter Housing Seal Installation

GEARSHIFT CABLE

REMOVAL

(1) Shift transmission into Park.

(2) Remove nuts retaining the shift cable housing to the dash panel (Fig. 50).

(3) Disconnect cable at lower column lever and feed cable through dash panel opening to underside of vehicle (Fig. 51).

(4) Raise vehicle.

(5) Disengage cable eyelet at transmission shift lever and pull cable adjuster out of mounting bracket (Fig. 52). Remove old cable from vehicle.

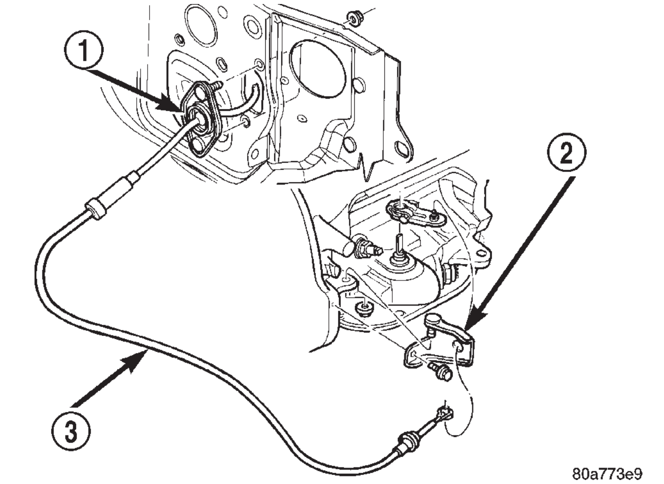


Fig. 50 Cable Mounting

1 – CABLE MOUNTING
2 – CABLE BRACKET AT TRANS.
3 – GEARSHIFT CABLE

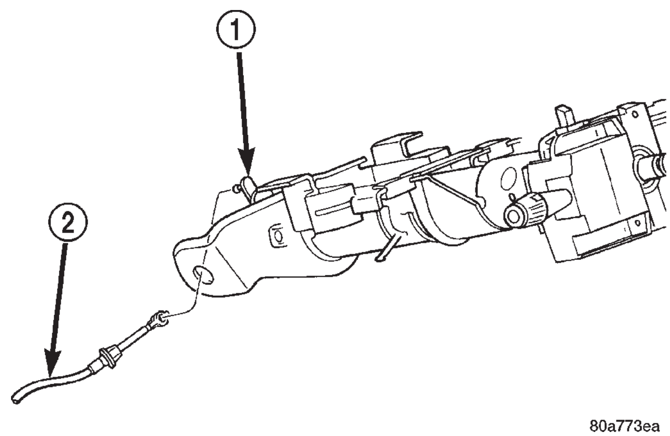


Fig. 51 Cable at Gearshift Lever

1 – GEARSHIFT LEVER
2 – GEARSHIFT CABLE

INSTALLATION

(1) Snap the cable into the transmission bracket so the retaining ears are engaged and connect cable end fitting onto the manual control lever ball stud.

(2) Lower vehicle.

(3) Route cable through hole in dash panel. Seat cable bracket to dash panel. Install retaining nuts to cable housing bracket studs inside the vehicle at the dash panel.

(4) Place the auto transmission manual shift control lever in “Park” detent (rearmost) position and rotate prop shaft to ensure transmission is in park.

(5) Connect shift cable to shifter lever by snapping cable retaining ears into shifter bracket and press cable end fitting into lever.

(6) Check for proper operation of Park/Neutral switch.

REMOVAL AND INSTALLATION (Continued)

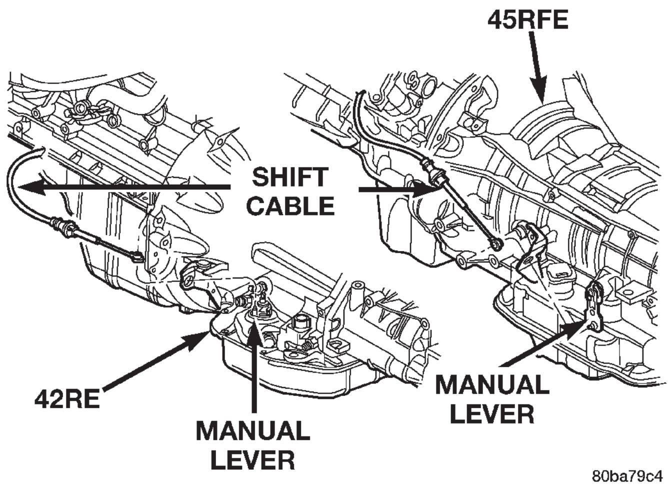


Fig. 52 Shift Cable at the Transmission

(7) If the gearshift cable is out of adjustment, refer to Adjustments section.

DISASSEMBLY AND ASSEMBLY

TRANSMISSION

DISASSEMBLY

(1) Drain fluid from transmission.

(2) Clean exterior of transmission with suitable solvent or pressure washer.

(3) Remove the torque converter from the transmission.

(4) Remove the manual shift lever from the transmission.

(5) Remove the input, output, and line pressure sensors from the transmission case (Fig. 53).

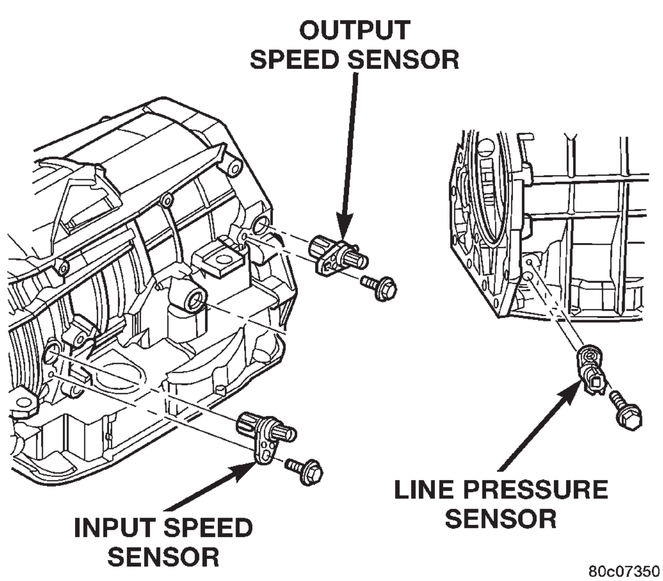


Fig. 53 Remove Input, Output, and Line Pressure Sensors

(6) Inspect the ends of the sensors for debris, which may indicate the nature of the transmission failure.

(7) Install Support Stand 8257 onto the transmission case (Fig. 54).

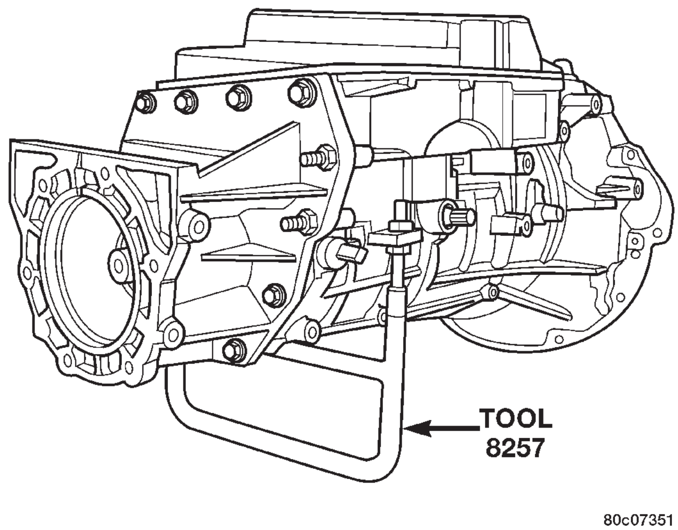


Fig. 54 Install Support Stand—Tool 8257

(8) Using Adapter 8266-1 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the input shaft end-play (Fig. 55).

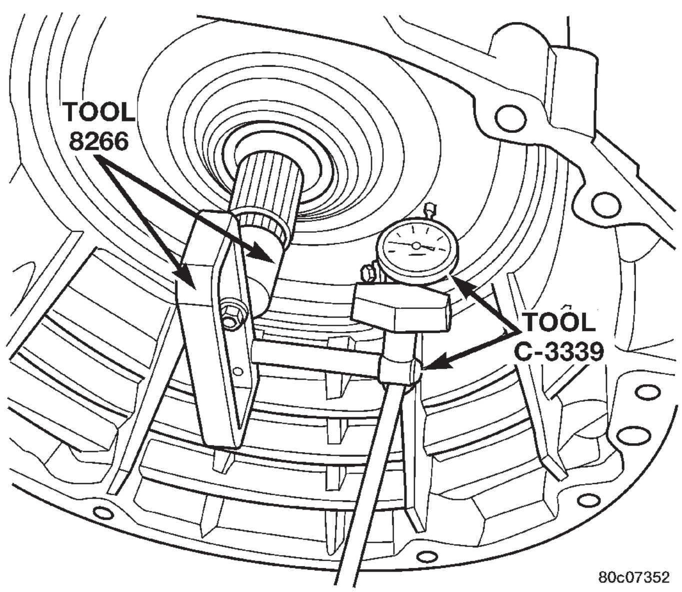


Fig. 55 Measure Input Shaft End Play

NOTE: When measuring the input shaft end-play, two “stops” will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop” felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.

DISASSEMBLY AND ASSEMBLY (Continued)

(9) Remove the bolts holding the transmission extension/adapter housing to the transmission case.

(10) Remove the extension/adapter housing from the transmission case.

(11) Using Alignment Plate 8261, Adapter 8266-17 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the output shaft end-play (Fig. 56).

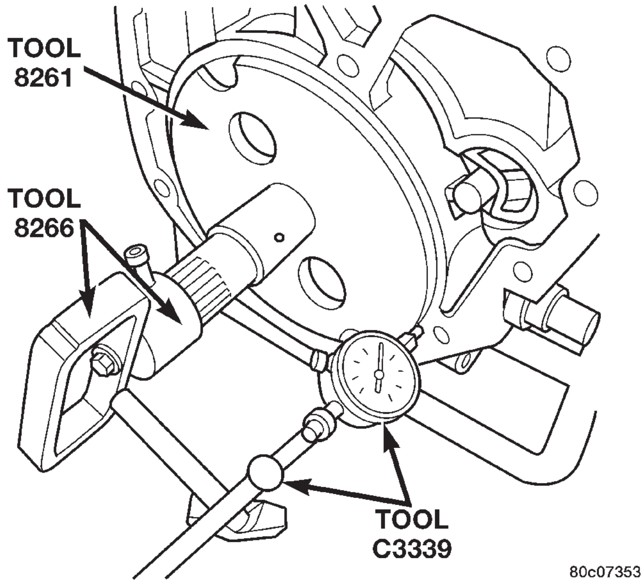


Fig. 56 Measure Output Shaft End Play

(12) Remove the bolts holding the transmission oil pan to the transmission case.

(13) Remove the transmission oil pan from the transmission case.

(14) Remove the primary oil filter and the oil cooler filter (Fig. 57).

(15) Remove the cooler bypass valve.

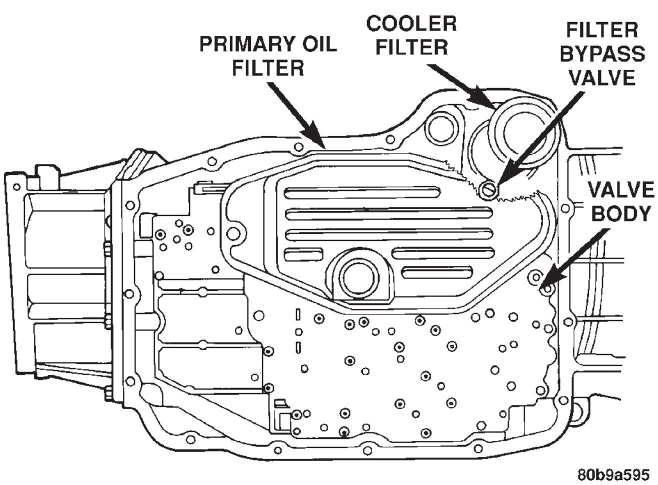


Fig. 57 Remove Primary Oil and Cooler Filters

(16) Remove the bolts holding the valve body to the transmission case (Fig. 58).

(17) Remove the valve body from the transmission case.

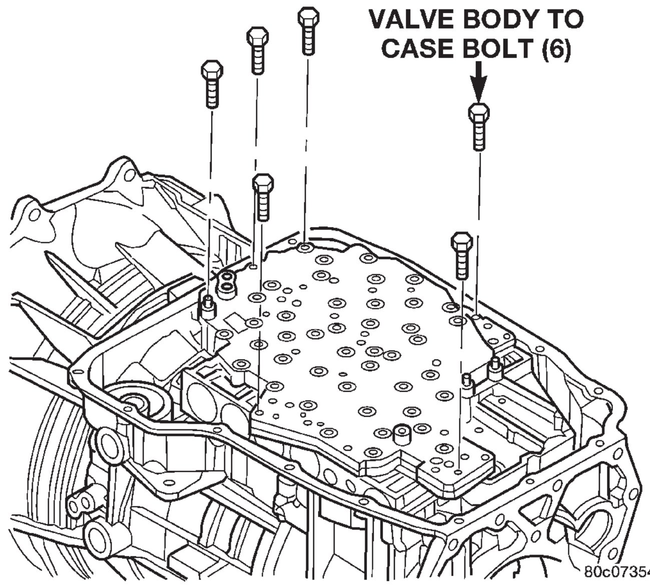


Fig. 58 Remove Valve Body Assembly

(18) Remove the outer snap-ring securing the transmission front cover into the transmission case (Fig. 59).

(19) Remove the inner snap-ring securing the transmission front cover to the oil pump (Fig. 59).

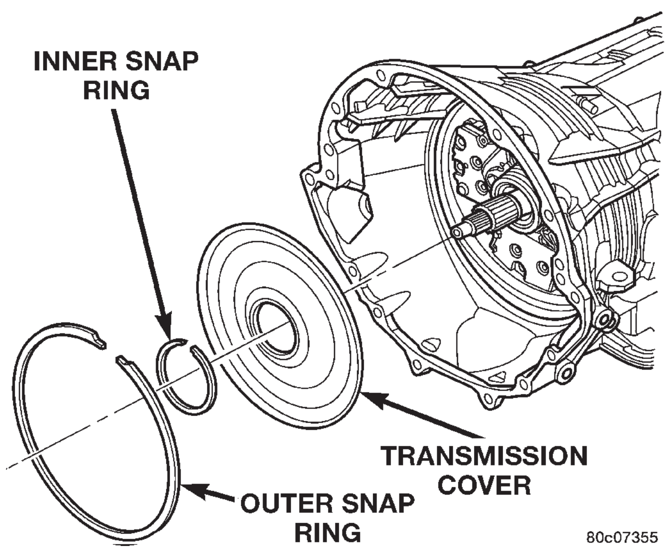


Fig. 59 Remove Transmission Front Cover

(20) Reaching through a case opening in the valve body area with a long blunted tool, remove the transmission front cover from the transmission case.

(21) Remove the bolts holding the oil pump into the transmission case (Fig. 60).

(22) Remove the oil pump. Hold inward on the input shaft to prevent pulling the input clutch assembly with the oil pump (Fig. 60).

DISASSEMBLY AND ASSEMBLY (Continued)

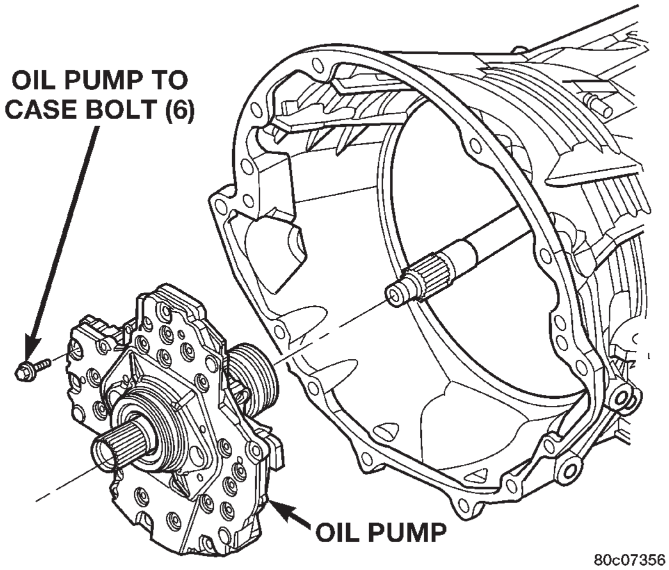


Fig. 60 Remove Oil Pump

(23) Remove the number 1 bearing from the input clutch assembly (Fig. 61).

(24) Remove the input clutch assembly from the transmission case (Fig. 61).

(25) Remove the number 5 bearing and selective thrust plate from the input clutch assembly (Fig. 61), or the 4C clutch retainer/bulkhead.

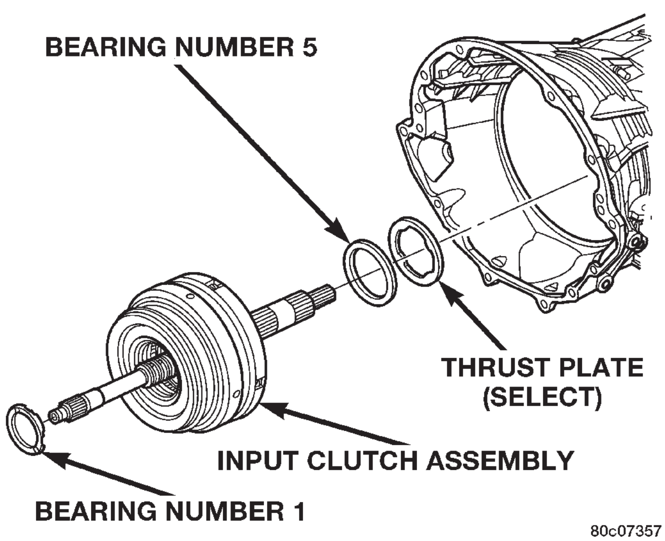


Fig. 61 Remove Input Clutch Assembly

(26) Remove the 4C clutch retainer/bulkhead tapered snap-ring from the transmission case (Fig. 62).

(27) Remove the 4C clutch retainer/bulkhead from the transmission case (Fig. 62).

(28) Remove the front 2C clutch pack snap-ring from the transmission case (Fig. 63).

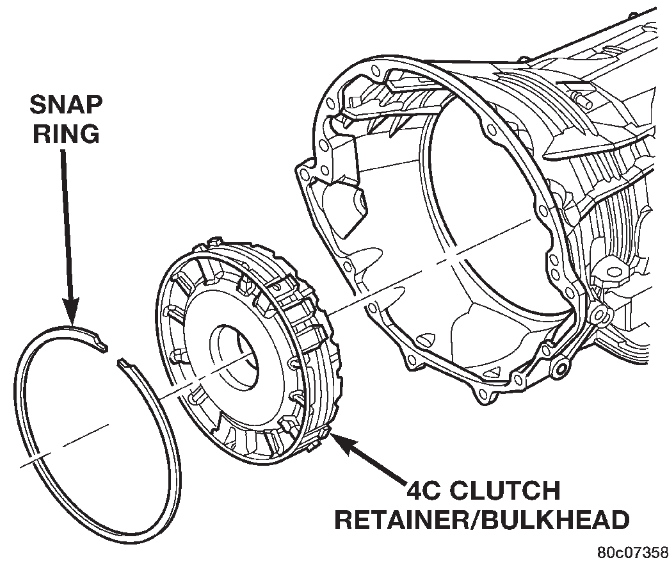


Fig. 62 Remove 4C Clutch Retainer/Bulkhead

(29) Remove the 2C clutch pack from the transmission case (Fig. 63).

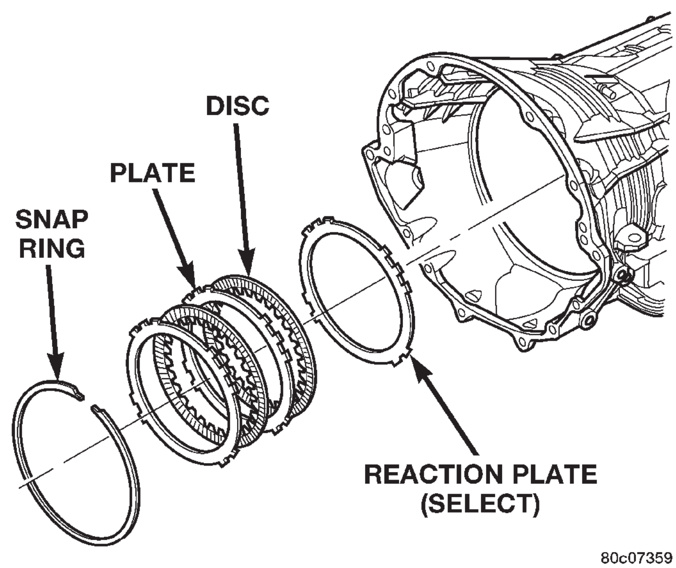


Fig. 63 Remove 2C Clutch Pack

(30) Remove the rear selective plate and number 6 bearing from the reaction annulus (Fig. 64).

(31) Remove the reaction annulus from the reaction planetary carrier (Fig. 64).

(32) Remove the number 7 bearing (Fig. 64).

(33) Remove the reaction sun gear (Fig. 64).

(34) Remove the number 8 bearing from the reaction planetary carrier (Fig. 64).

(35) Remove the reaction planetary carrier (Fig. 64). Note that this planetary gear set has three pinion gears.

(36) Remove the number 9 bearing from the reverse planetary gear set (Fig. 64).

DISASSEMBLY AND ASSEMBLY (Continued)

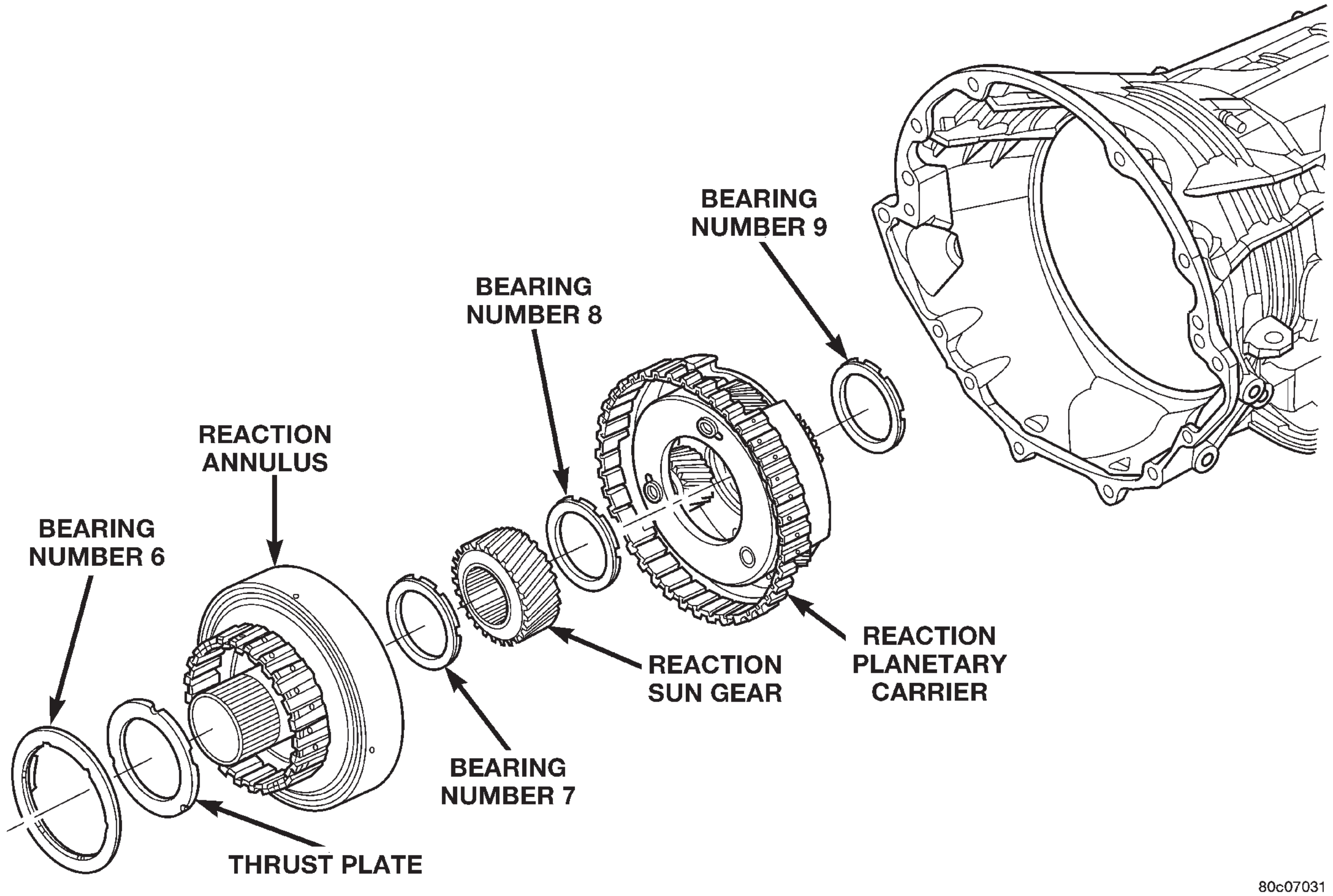


Fig. 64 Remove Reaction Annulus and Carrier

(37) Remove the snap-ring holding the park sprag gear onto the output shaft (Fig. 65).

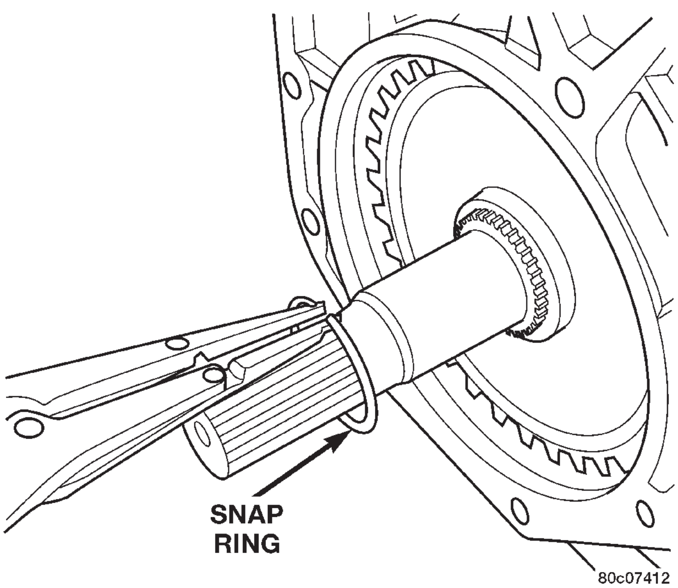


Fig. 65 Remove Park Sprag Snap Ring

(38) Remove the park sprag gear from the output shaft (Fig. 66).

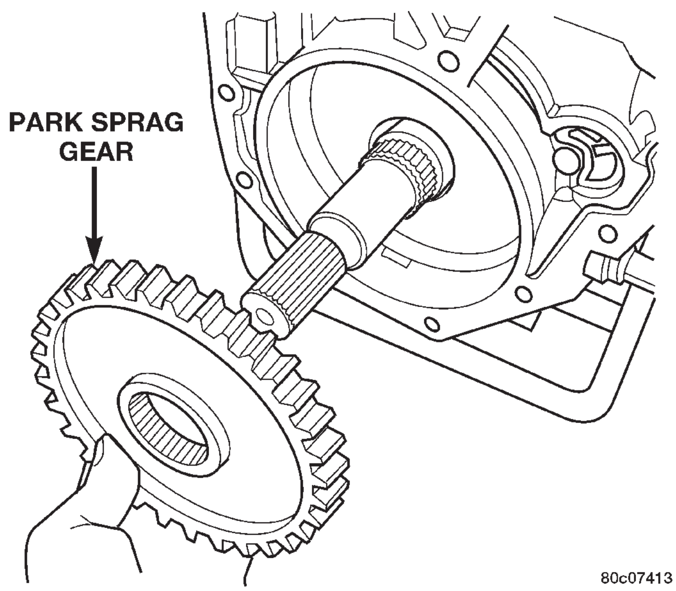


Fig. 66 Remove Park Sprag Gear

DISASSEMBLY AND ASSEMBLY (Continued)

(39) Remove the input/reverse planetary assembly (Fig. 67).

(40) Remove the number 12 bearing from the input/reverse planetary assembly (Fig. 67).

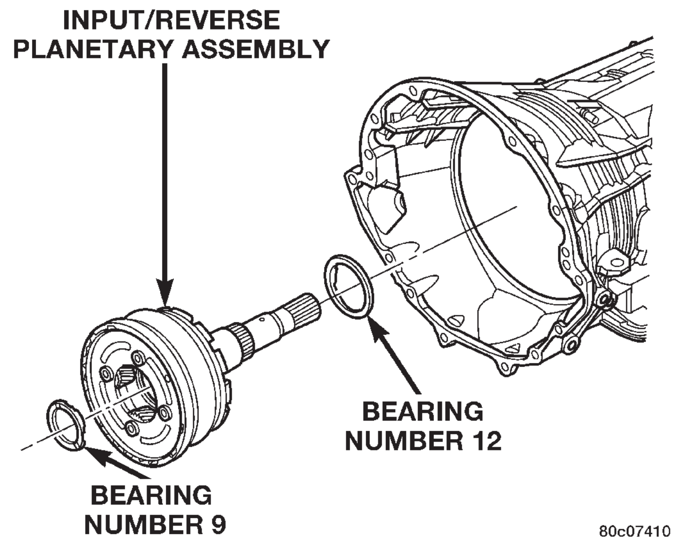


Fig. 67 Remove Input/Reverse Planetary Assembly

(41) Remove the snap-ring holding the low/reverse clutch retainer into the transmission case (Fig. 68).

(42) Remove the low/reverse clutch retainer from the transmission case (Fig. 68).

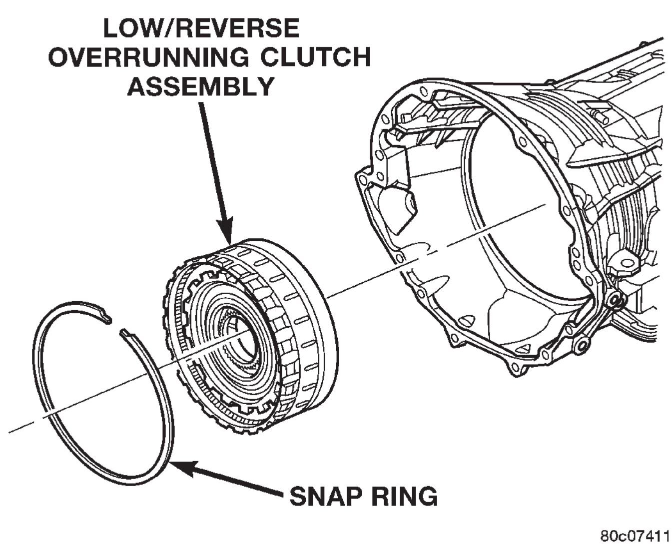


Fig. 68 Remove Low/Reverse Clutch Retainer

(43) Remove the park pawl rod and e-clip (Fig. 69).

(44) Remove the park pawl rod guide snap-ring (Fig. 69).

(45) Remove the park pawl rod guide (Fig. 69).

(46) Remove the park pawl pivot shaft, park pawl, and spring (Fig. 69).

(47) Remove the manual selector shaft (Fig. 69).

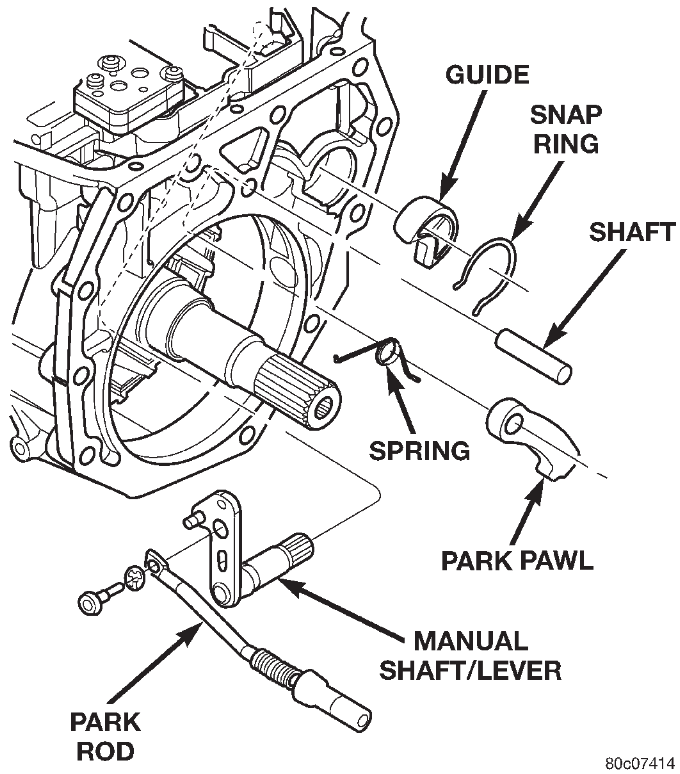


Fig. 69 Manual Shaft/Park Lock Components

(48) Remove the manual selector shaft seal.

(49) Remove the dipstick tube seal.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install the cooler filter bypass valve.

(3) Torque the bypass valve to specification. The valve uses a tapered pipe thread and excessive torque can damage the transmission case. Tighten the cooler filter bypass valve to 11.3 N·m (100 in.lbs.).

(4) Install a new selector shaft seal using Seal Installer 8253 (Fig. 70).

(5) Install the manual selector shaft and retaining screw. Tighten the manual selector shaft retaining screw to 28 N·m (250 in.lbs.).

(6) Install the park pawl, spring, and shaft (Fig. 69).

(7) Install the park rod and e-clip (Fig. 69).

(8) Install the park rod guide and snap-ring (Fig. 69).

(9) Install a new dipstick tube seal using Seal Installer 8254 (Fig. 71).

NOTE: Before final assembly of transmission centerline, the 2C/4C clutch components should be installed into position and measured/adjusted as follows:

DISASSEMBLY AND ASSEMBLY (Continued)

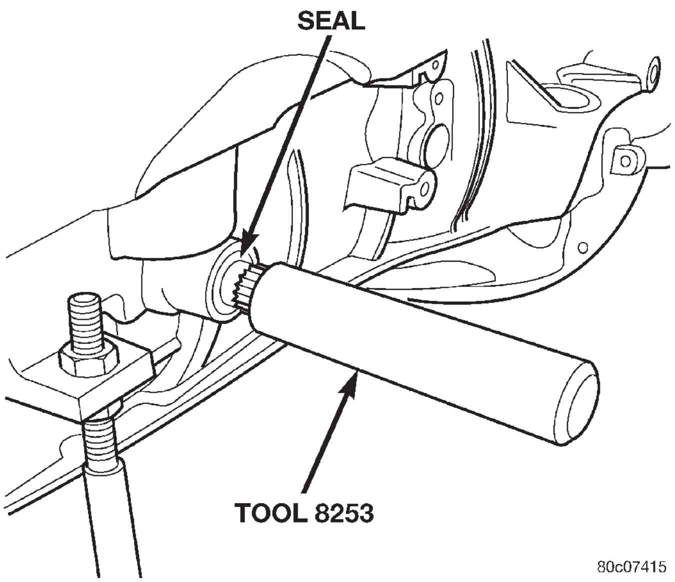


Fig. 70 Install Selector Shaft Seal Using Tool 8253

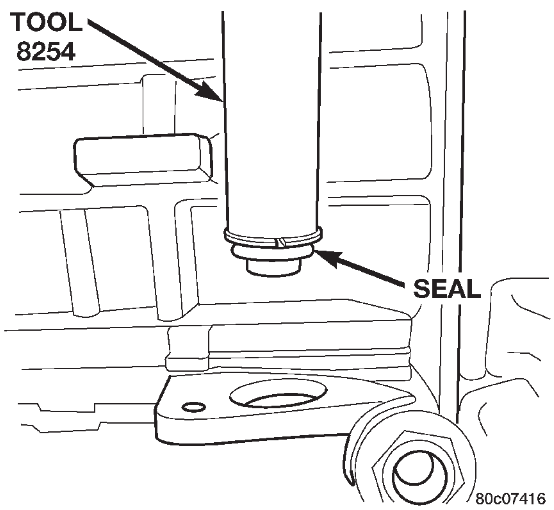


Fig. 71 Install Dipstick Tube Seal Using Tool 8254

(10) Install the 2C reaction plate into the transmission case (Fig. 63). The reaction plate is selective and directional. The plate must be installed with the flat side toward the front.

(11) Install the 2C clutch pack into the transmission case (Fig. 63).

(12) Install the flat 2C clutch snap-ring into the transmission case (Fig. 63).

(13) Install the 4C retainer/bulkhead into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area.

(14) Install the 4C retainer/bulkhead tapered snap-ring into the transmission case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.

(15) Using a feeler gauge through the opening in the rear of the transmission case, measure the 2C clutch pack clearance between the 2C reaction plate and the transmission case at four different points. The average of these measurements is the 2C clutch pack clearance. Adjust the clearance as necessary. The correct clutch clearance is 0.533–1.27 mm (0.021–0.050 in.). The reaction plate is selective. Install the chosen reaction plate and re-measure the clutch clearance to verify the selection.

(16) Remove the 4C retainer/bulkhead and all of the 2C clutch components from the transmission case.

(17) Install the low/reverse clutch assembly (Fig. 72). Make sure that the oil feed hole points toward the valve body area and that the bleed orifice is aligned with the notch in the rear of the transmission case.

(18) Install the snap-ring to hold the low/reverse clutch retainer into the transmission case (Fig. 72). The snap-ring is tapered and must be installed with the tapered side forward. Once installed, verify that the snap-ring is fully seated in the snap-ring groove.

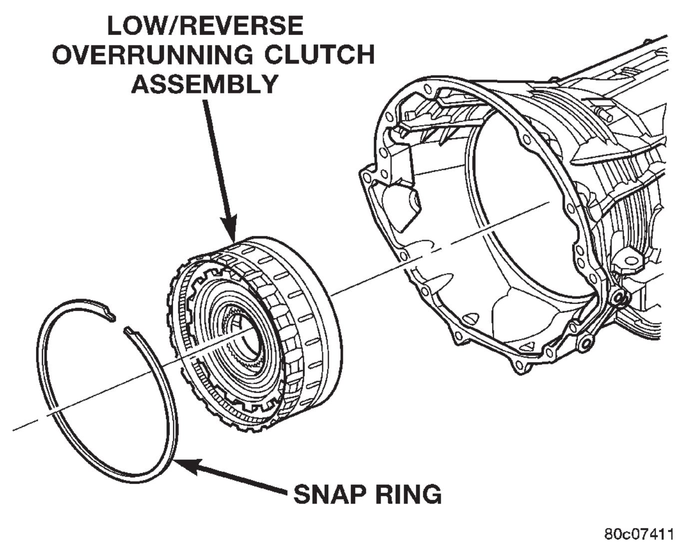


Fig. 72 Install Low/Reverse Clutch Retainer

(19) Air check the low/reverse clutch and verify correct overrunning clutch operation.

(20) Install the reverse/input planetary assembly through the low/reverse clutch assembly (Fig. 73).

(21) Install the number 12 bearing over the output shaft of the rear planetary gear set and onto the low/reverse clutch assembly. The flat side of the bearing goes toward the clutch assembly.

(22) Install the park sprag onto the output shaft (Fig. 74).

(23) Install the snap-ring to hold the park sprag onto the output shaft (Fig. 75).

(24) Install the 2C reaction plate into the transmission case (Fig. 76). The reaction plate is selective and directional. The plate must be installed with the flat side toward the front.

DISASSEMBLY AND ASSEMBLY (Continued)

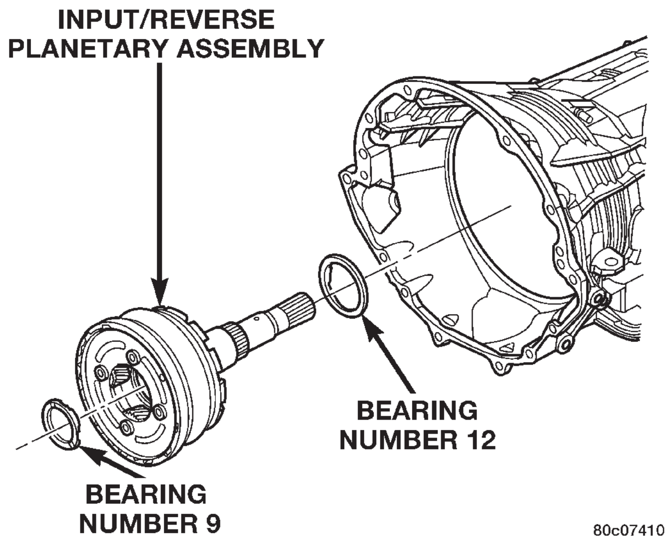


Fig. 73 Install Input/Reverse Planetary Assembly

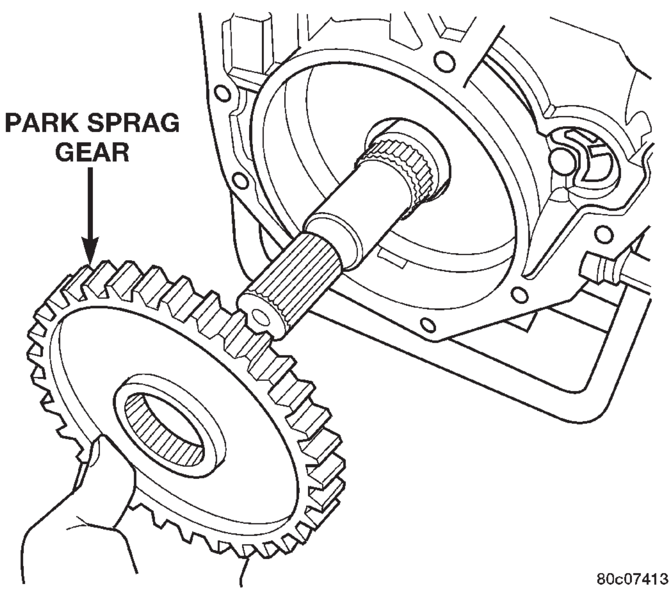


Fig. 74 Install Park Sprag Gear

(25) Install the 2C clutch pack into the transmission case (Fig. 76).

(26) Install the number 8 bearing inside the reaction carrier with the round side against the planetary carrier.

(27) Install the reaction planetary gear set and the number 9 bearing into the transmission case (Fig. 77).

(28) Install the flat 2C clutch snap-ring into the transmission case (Fig. 76).

(29) Install the reaction sun gear into the reaction planetary gear set with the small shoulder facing the front of the transmission (Fig. 77).

(30) Install the number 7 bearing onto the reaction sun gear with the flat side against the sun gear (Fig. 77).

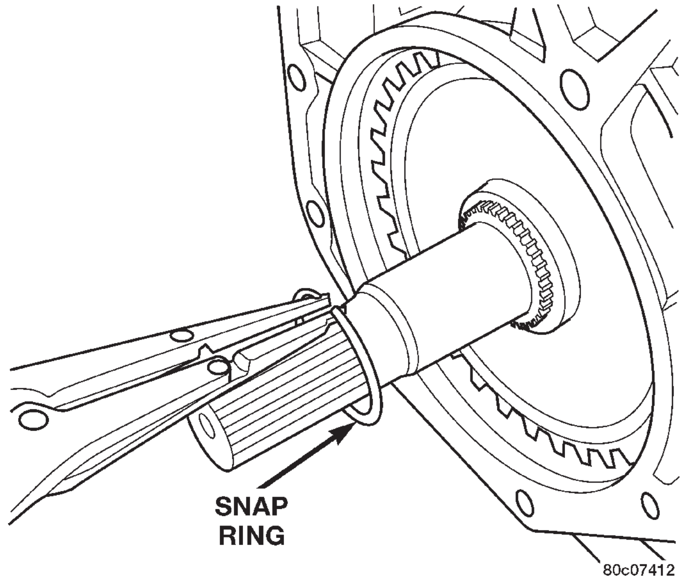


Fig. 75 Install Park Sprag Snap Ring

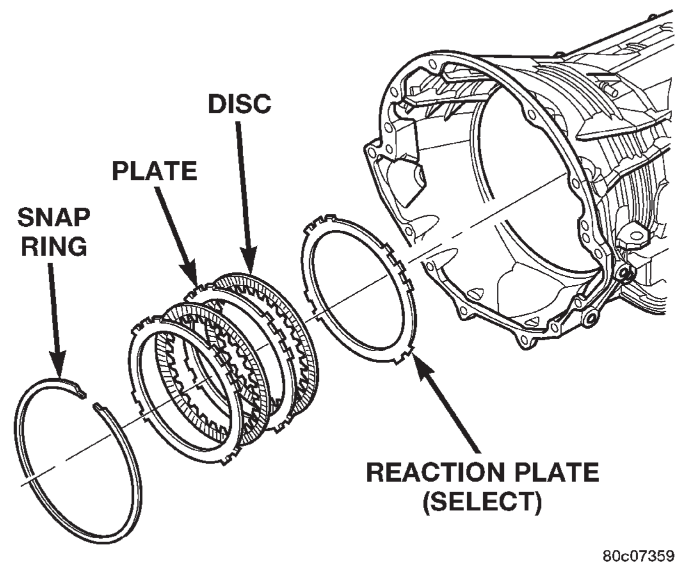


Fig. 76 Install 2C Clutch Pack

(31) Install the output shaft selective thrust plate onto the reaction annulus with the oil grooves facing the annulus gear and the tabs and notches aligned as shown in (Fig. 78).

(32) Install the number 6 bearing against the output shaft selective spacer with the flat side against the spacer (Fig. 77).

(33) Install the reaction annulus into the reaction planetary gear set (Fig. 77).

(34) Install the 4C retainer/bulkhead into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area. Rotate the reaction annulus during the installation of the 4C retainer/bulkhead to ease installation.

(35) Install the 4C retainer/bulkhead tapered snap-ring into the transmission case (Fig. 79). Make

DISASSEMBLY AND ASSEMBLY (Continued)

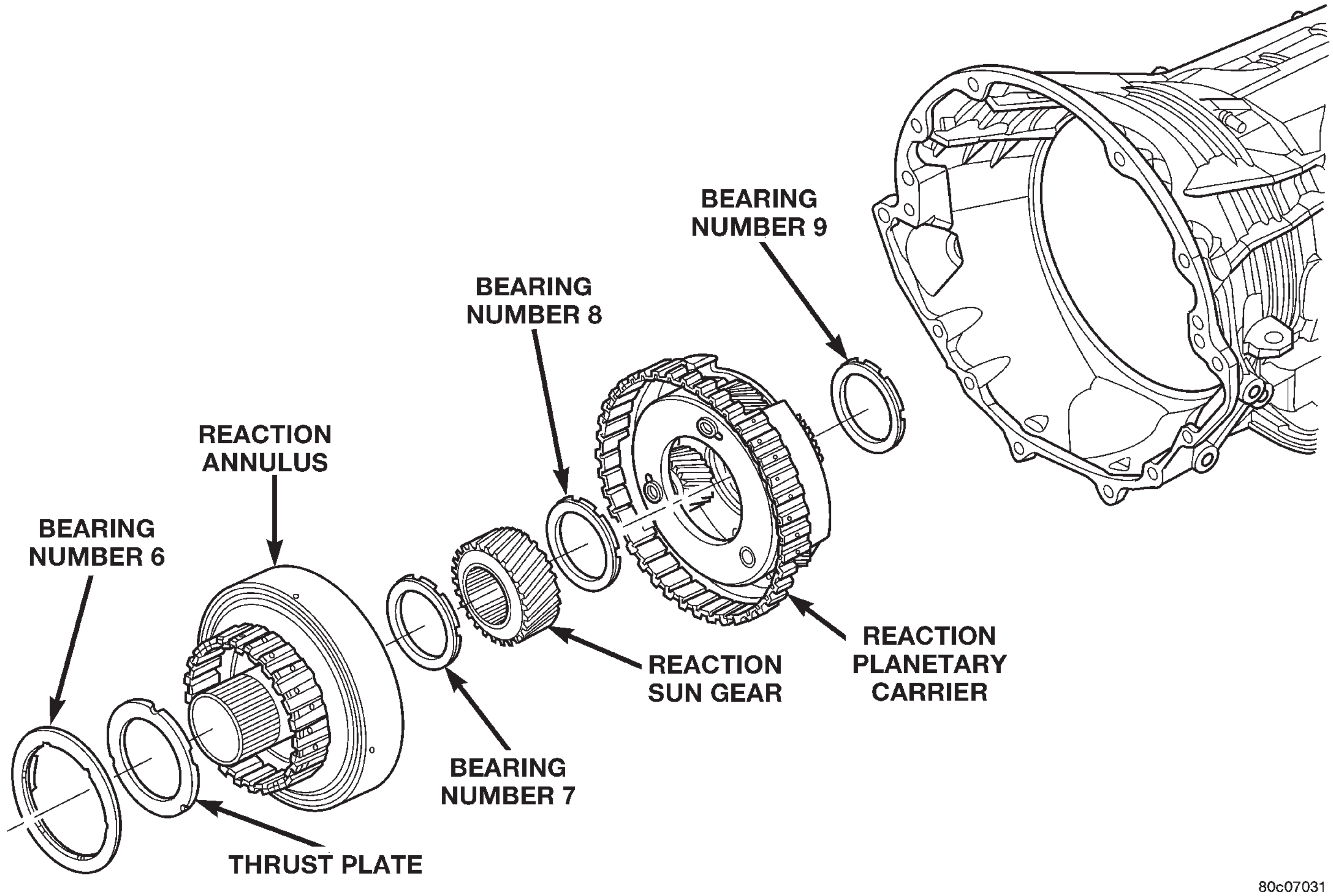


Fig. 77 Install Reaction Annulus and Carrier

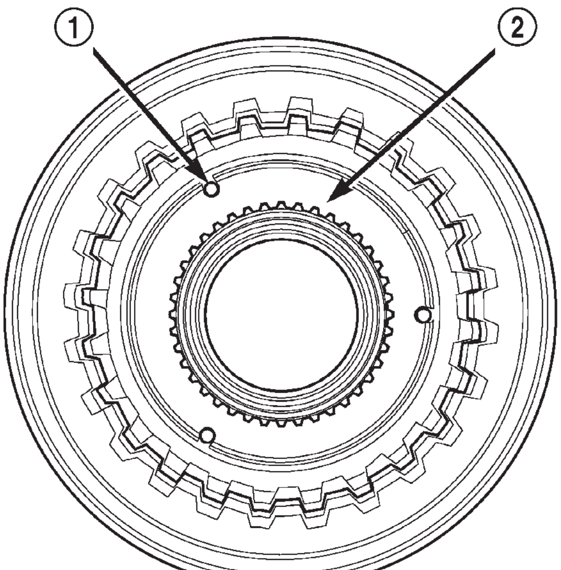


Fig. 78 Thrust Plate Alignment

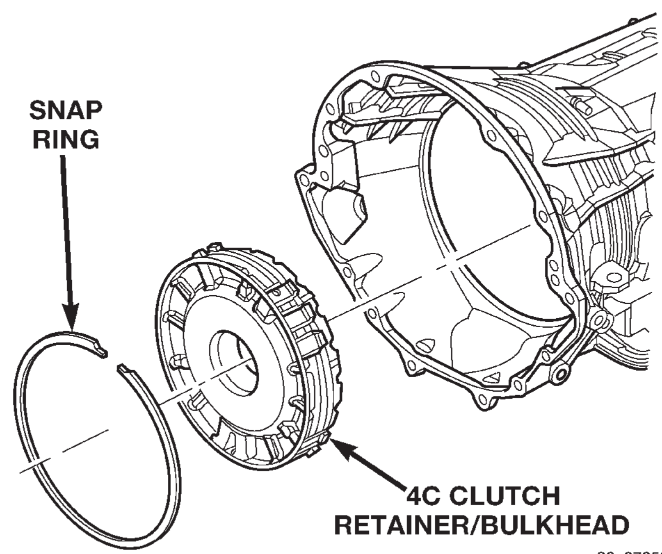


Fig. 79 Install 4C Clutch Retainer/Bulkhead

sure that the open ends of the snap-ring are located in the case opening toward the valve body area.

(36) Air check the 2C and 4C clutch operation.

(37) Using Alignment Plate 8261, Adapter 8266-17 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the output shaft end-play (Fig. 80). The correct output shaft end-play is 0.53–0.78 mm (0.021–0.031 in.). Adjust as necessary. Install the chosen output shaft selective spacer and re-measure end-play to verify selection.

DISASSEMBLY AND ASSEMBLY (Continued)

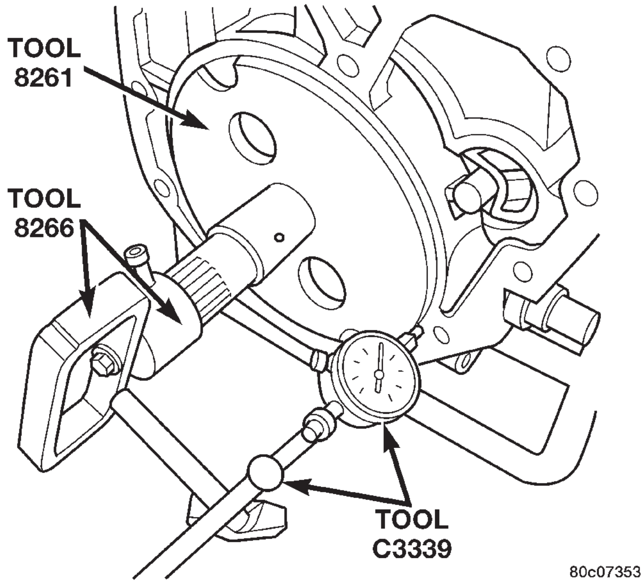


Fig. 80 Measure Output Shaft End Play

(38) Apply a bead of RTV silicone and install the extension/adapter housing onto the transmission case.

(39) Install and torque the bolts to hold the extension/adapter housing onto the transmission case. The correct torque is 54 N·m (40 ft.lbs.).

(40) Install the number 5 bearing and spacer onto the 4C retainer/bulkhead (Fig. 81).

(41) Install the input clutch assembly into the transmission case (Fig. 81). Make sure that the input clutch assembly is fully installed by performing a visual inspection through the input speed sensor hole. If the tone wheel on the input clutch assembly is visible, the assembly is fully installed.

(42) Install the number 1 bearing with the flat side down in the pocket of the input clutch assembly (Fig. 81).

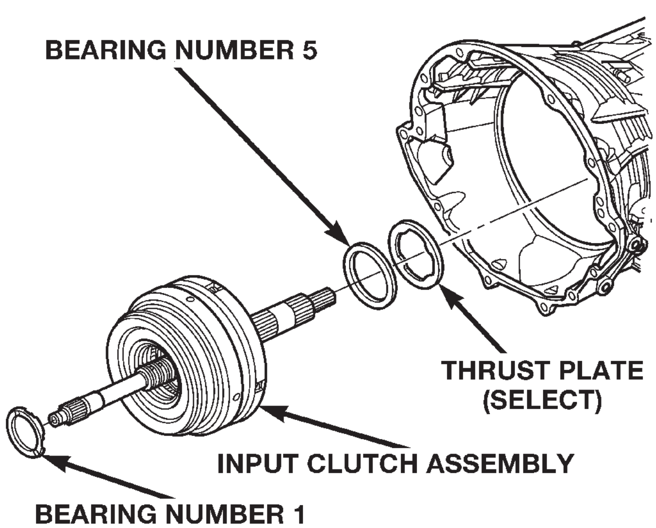


Fig. 81 Install Input Clutch Assembly

(43) Install the oil pump into the transmission case (Fig. 82).

(44) Install the bolts to hold the oil pump into the transmission case. Tighten the oil pump bolts to 28 N·m (250 in.lbs.).

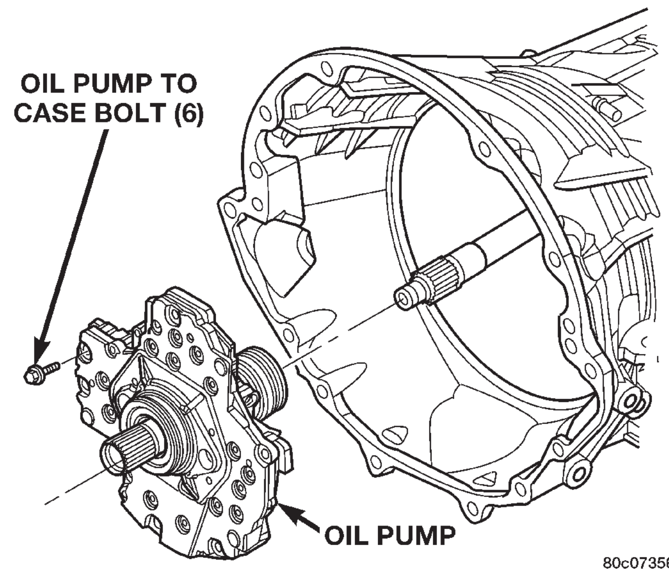


Fig. 82 Install Oil Pump

(45) Using Adapter 8266-1 from End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the input shaft end-play (Fig. 83). The correct end-play is 0.79–1.07 mm (0.031–0.042 in.). Adjust as necessary. Install the chosen spacer on the number 5 bearing and re-measure end-play to verify selection.

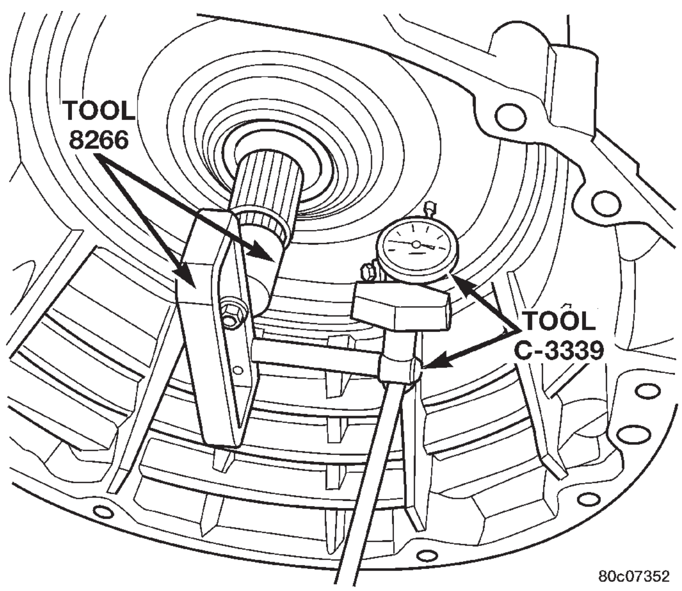


Fig. 83 Measure Input Shaft End Play

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: When measuring the input shaft end-play, two "stops" will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop" felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.

(46) Install the transmission front cover into the transmission case (Fig. 84).

(47) Install the outer snap-ring to hold the transmission front cover into the transmission case (Fig. 84).

(48) Partially install the inner transmission front cover snap-ring onto the oil pump (Fig. 84).

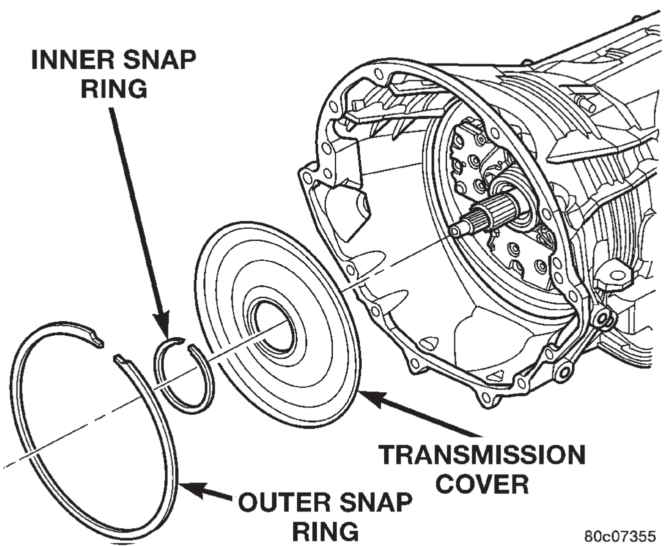


Fig. 84

(49) Using Installer 8255, install the inner transmission front cover snap-ring the remainder of the way onto the oil pump (Fig. 85).

(50) Install the valve body (Fig. 86). Tighten the valve body to transmission case bolts to 12 N·m (105 in.lbs.).

(51) Install the primary oil filter and the oil cooler filter (Fig. 87). Tighten the screws to hold the primary oil filter to the valve body to 4.5 N·m (40 in.lbs.). Using Oil Filter Wrench 8321, tighten the cooler return oil filter to the transmission case to 14 N·m (125 in.lbs.).

(52) Apply RTV silicone to the oil pan and install the transmission oil pan. Tighten the bolts to 12 N·m (105 in.lbs.).

(53) Install the input, output, and line pressure sensors (Fig. 88). Tighten the bolts to 12 N·m (105 in.lbs.).

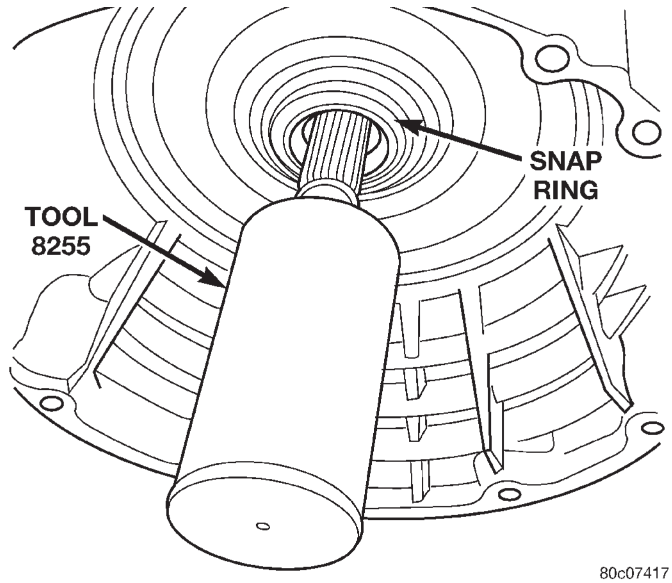


Fig. 85 Seat Snap Ring Using Tool 8255

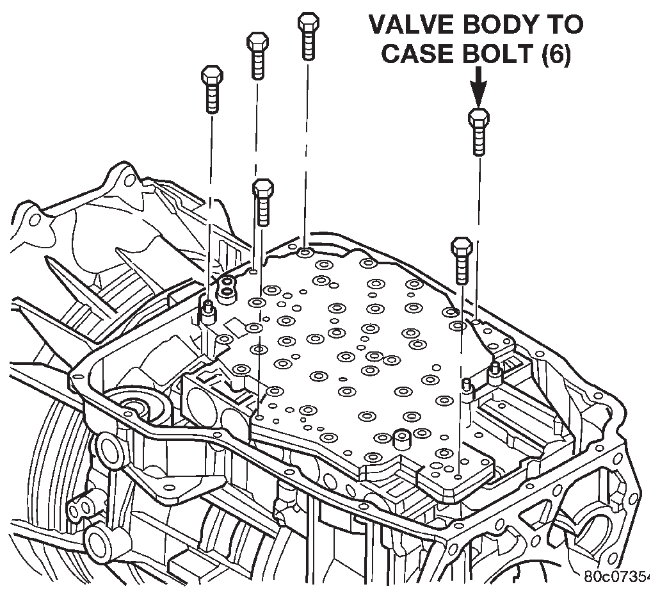


Fig. 86 Install Valve Body Assembly

(54) Install the manual shift lever from the transmission. Torque the retaining cross-bolt to 16 N·m (140 in.lbs.).

VALVE BODY

DISASSEMBLY

(1) Remove the screws holding the solenoid and pressure switch assembly to the valve body (Fig. 89). Do not remove the screws on the top of the solenoid and pressure switch assembly.

(2) Separate the solenoid and pressure switch assembly from the valve body.

(3) Remove the screw holding the detent spring (Fig. 90) onto the valve body.

DISASSEMBLY AND ASSEMBLY (Continued)

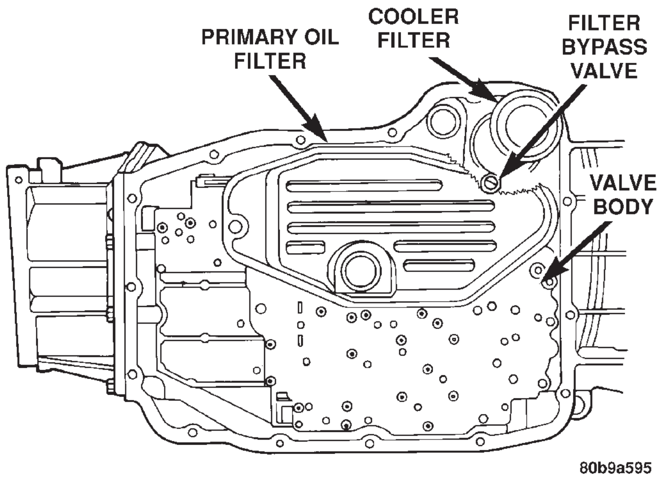


Fig. 87 Install Primary Oil and Cooler Filters

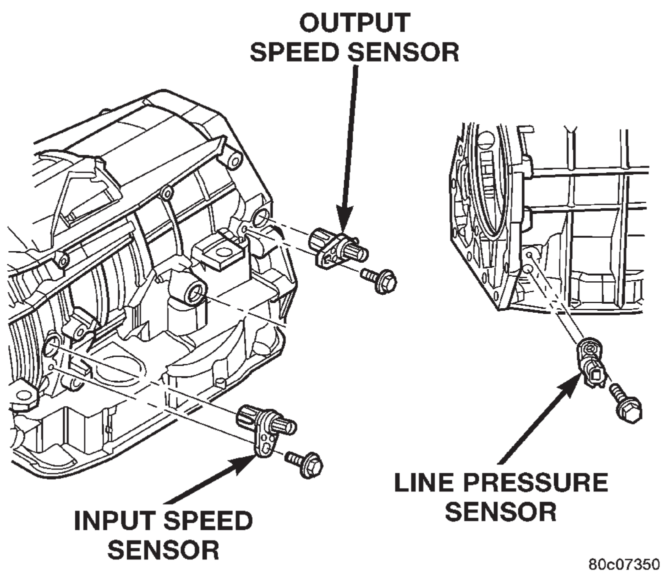


Fig. 88 Install Input, Output, and Line Pressure Sensors

(4) Remove the detent spring from the valve body.

(5) Remove the TRS selector plate from the valve body and the manual valve.

(6) Remove the clutch passage seals from the valve body, if necessary.

(7) Remove the screws holding the accumulator cover onto the valve body (Fig. 91).

(8) Remove the accumulator springs and pistons from the valve body. Note which accumulator piston and spring belong in each location.

(9) Place the valve body on the bench with the transfer plate upward.

NOTE: The valve body contains seven check balls. The transfer plate must be placed upward to prevent losing the check balls when the transfer plate is removed from the valve body.

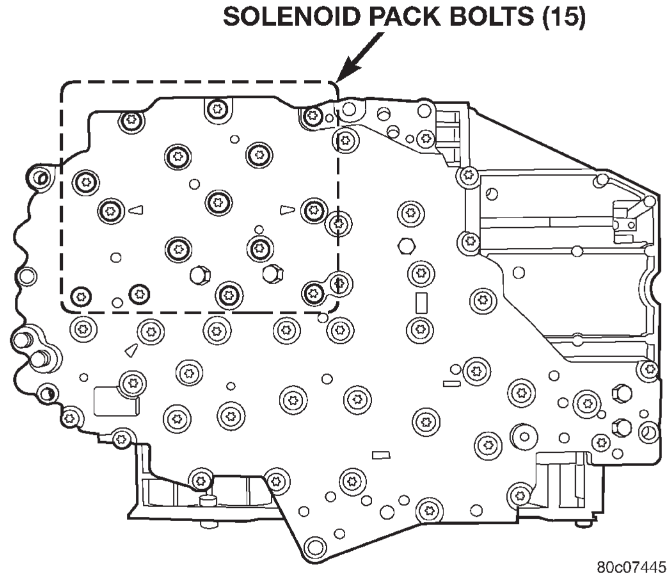


Fig. 89 Solenoid and Pressure Switch Assembly Screws

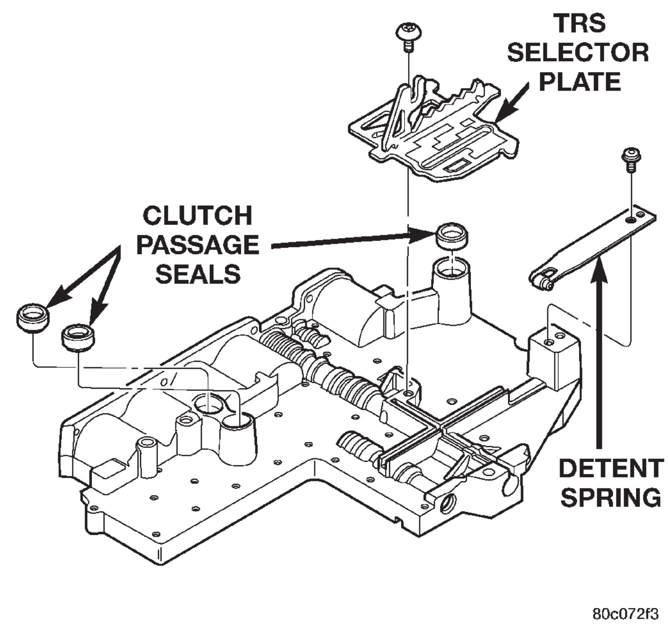


Fig. 90 Valve Body External Components

(10) Remove the screws holding the valve body to the valve body transfer plate.

(11) Remove the transfer plate from the valve body. Note the location of all check balls (Fig. 92).

(12) Remove the check balls from the valve body.

(13) Remove the retainers securing the solenoid switch valve, manual valve, and the low/reverse switch valve into the valve body and remove the associated valve and spring. Tag each valve and spring combination with location information to aid in assembly.

DISASSEMBLY AND ASSEMBLY (Continued)

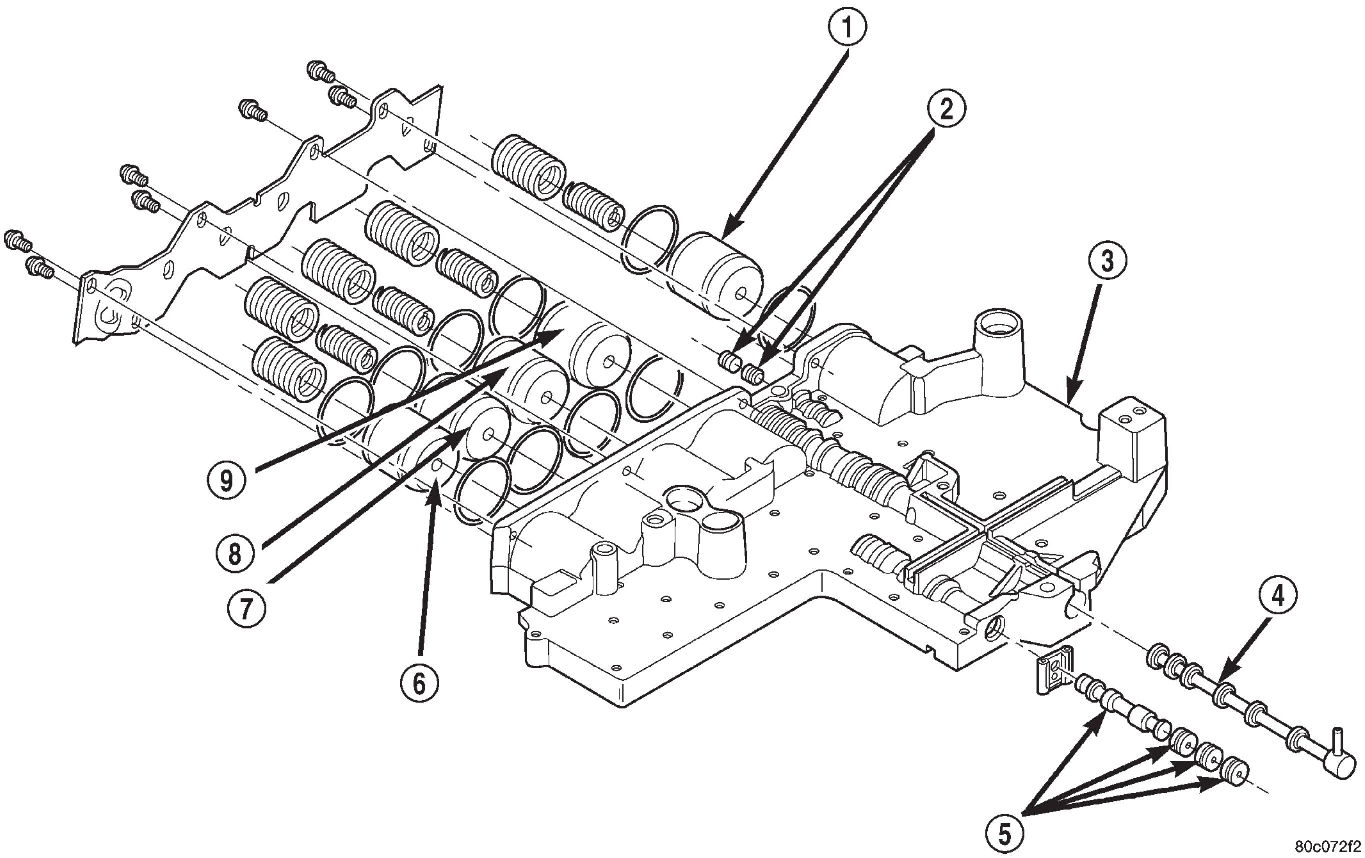


Fig. 91 Valve Body Components

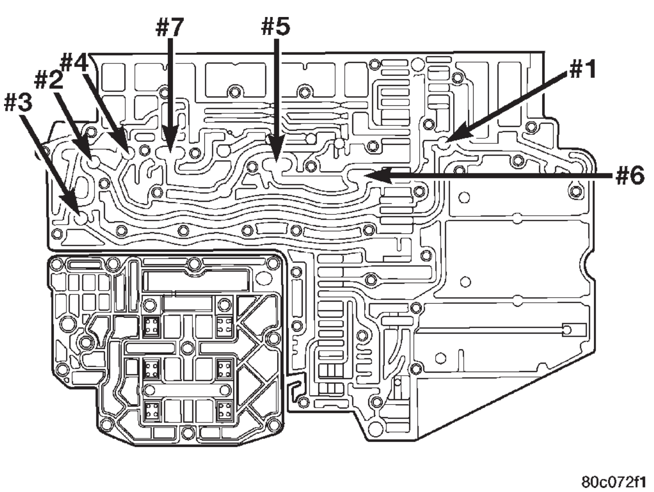


Fig. 92 Check Ball Locations

ASSEMBLY

(1) Lubricate valves, springs, and the housing valve bores with clean transmission fluid.

(2) Install solenoid switch valve, manual valve, and the low/reverse switch valve into the valve body.

(3) Install the retainers to hold each valve into the valve body.

(4) Install the valve body check balls into their proper locations.

(5) Position the transfer plate onto the valve body.

(6) Install the screws to hold the transfer plate to the valve body. Tighten the screws to 4.5 N·m (40 in. lbs.).

(7) Install the accumulator pistons and springs into the valve body in the location from which they were removed. Note that all accumulators except the overdrive have two springs. The overdrive accumulator piston has only one spring.

(8) Position the accumulator cover onto the valve body.

(9) Install the screws to hold the accumulator cover onto the valve body. Tighten the screws to 4.5 N·m (40 in. lbs.).

(10) Install the TRS selector plate onto the valve body and the manual valve.

(11) Install the solenoid and pressure switch assembly onto the valve body.

(12) Install the screws to hold the solenoid and pressure switch assembly onto the valve body. Tighten the screws to 5.7 N·m (50 in. lbs.). Tighten the screws adjacent to the arrows cast into the bottom of the transfer plate first.

(13) Position the detent spring onto the valve body.

(14) Install the screw to hold the detent spring onto the valve body. Tighten the screw to 4.5 N·m (40 in. lbs.).

(15) Install new clutch passage seals onto the valve body, if necessary

DISASSEMBLY AND ASSEMBLY (Continued)

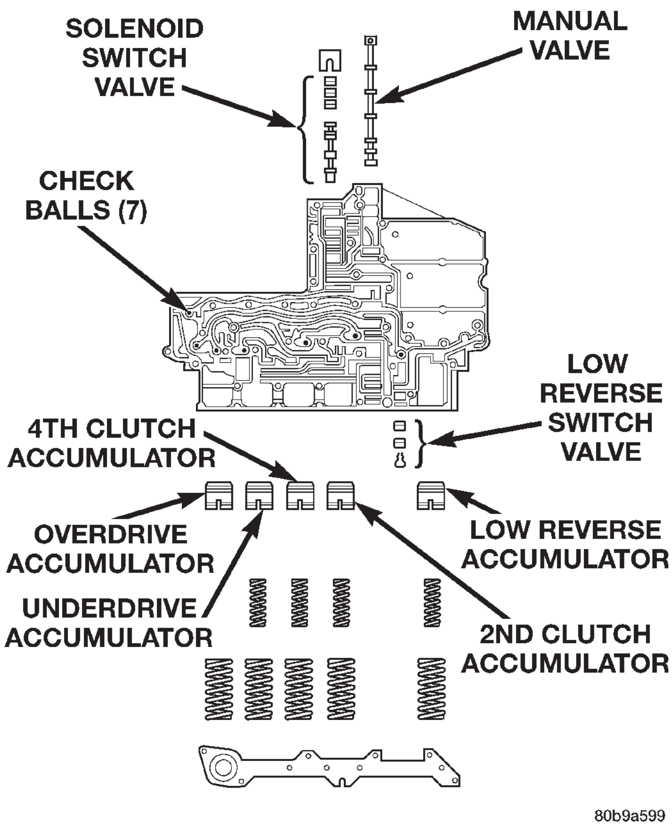


Fig. 93 Valve Body Components

OIL PUMP

DISASSEMBLY

(1) Remove the bolts holding the reaction shaft support to the oil pump (Fig. 94).

(2) Remove the reaction shaft support from the oil pump (Fig. 94).

(3) Remove all bolts holding the oil pump halves together (Fig. 94).

(4) Using suitable prying tools, separate the oil pump sections by inserting the tools in the supplied areas and prying the halves apart.

NOTE: The oil pump halves are aligned to each other through the use of two dowels. Be sure to pry upward evenly to prevent damage to the oil pump components.

(5) Remove the screws holding the separator plate onto the oil pump body (Fig. 95).

(6) Remove the separator plate from the oil pump body (Fig. 95).

(7) Mark all gears for location. The gears are select fit and if the oil pump is to be reused, the gears must be returned to their original locations.

(8) Remove the oil pump gears from the oil pump case (Fig. 95).

(9) Remove the oil pump valve retainers and associated valve and spring one at a time (Fig. 96) (Fig. 97). Mark the combination of components as a group and tag them as to the location from which they were removed.

DISASSEMBLY AND ASSEMBLY (Continued)

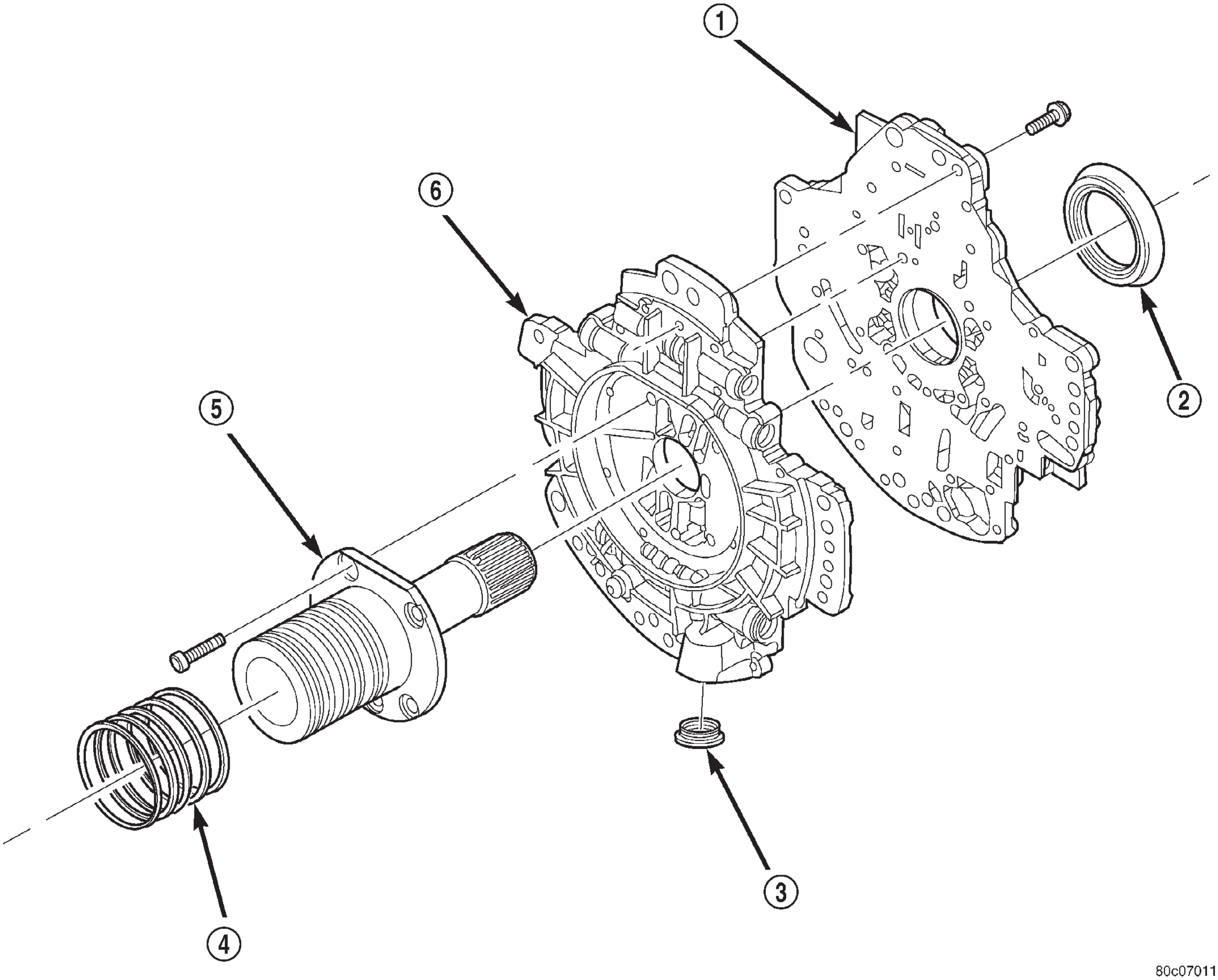


Fig. 94 Oil Pump Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

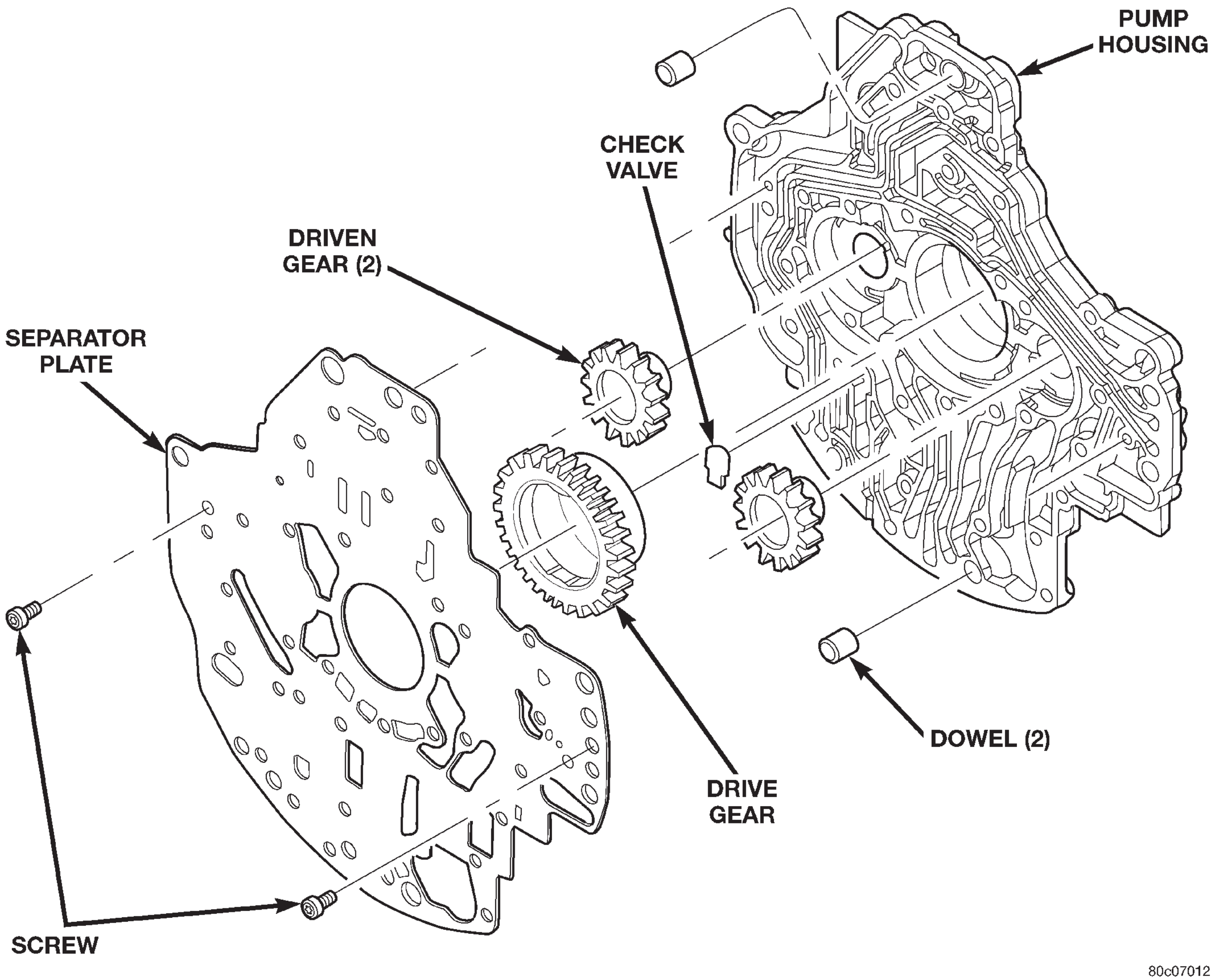


Fig. 95 Oil Pump Housing and Gears

ASSEMBLY

(1) Clean and inspect all components. Make sure that all passages are thoroughly cleaned and are free from dirt or debris. Make sure that all valves move freely in their proper bore. Make sure that all gear pockets and bushings are free from excessive wear and scoring. Replace the oil pump if any excessive wear or scoring is found.

(2) Coat the gears with Mopar® ATF+3, type 7176 and install into their original locations.

(3) Lubricate the oil pump valves with Mopar® ATF+3, type 7176 and install the valve, spring and retainer into the appropriate oil pump valve body bore (Fig. 96) (Fig. 97).

(4) Place the separator plate onto the oil pump body (Fig. 95).

(5) Install the screws to hold the separator plate onto the oil pump body (Fig. 95). Tighten the screws to 4.5 N·m (40 in.lbs.).

(6) Position the oil pump cover onto the locating dowels (Fig. 94).

(7) Seat the two oil pump halves together and install all bolts finger tight.

(8) Torque all bolts down slowly starting in the center and working outward. The correct torque is 4.5 N·m (40 in.lbs.).

(9) Verify that the oil pump gears rotate freely and smoothly.

(10) Position the reaction shaft support into the oil pump (Fig. 94).

(11) Install and torque the bolts to hold the reaction shaft support to the oil pump (Fig. 94). The correct torque is 12 N·m (105 in.lbs.).

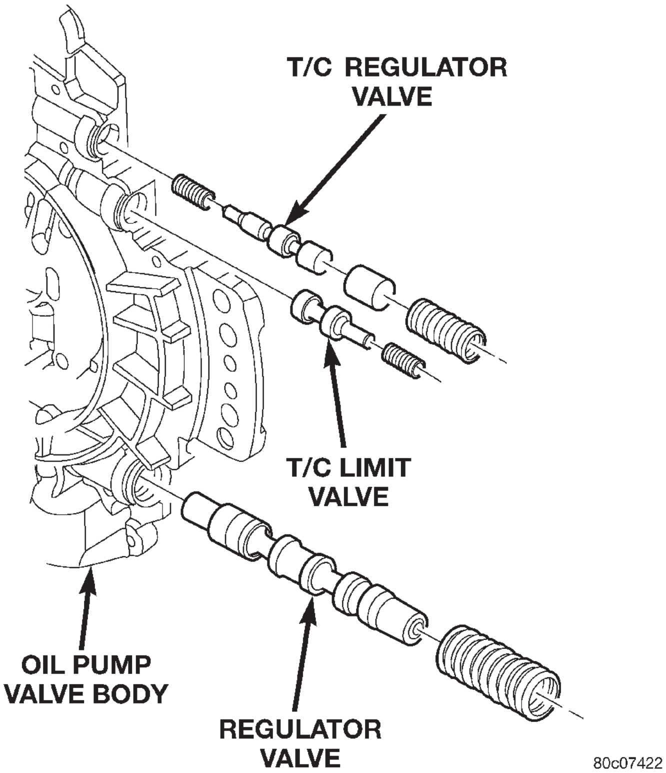


Fig. 96 Oil Pump Valve Body

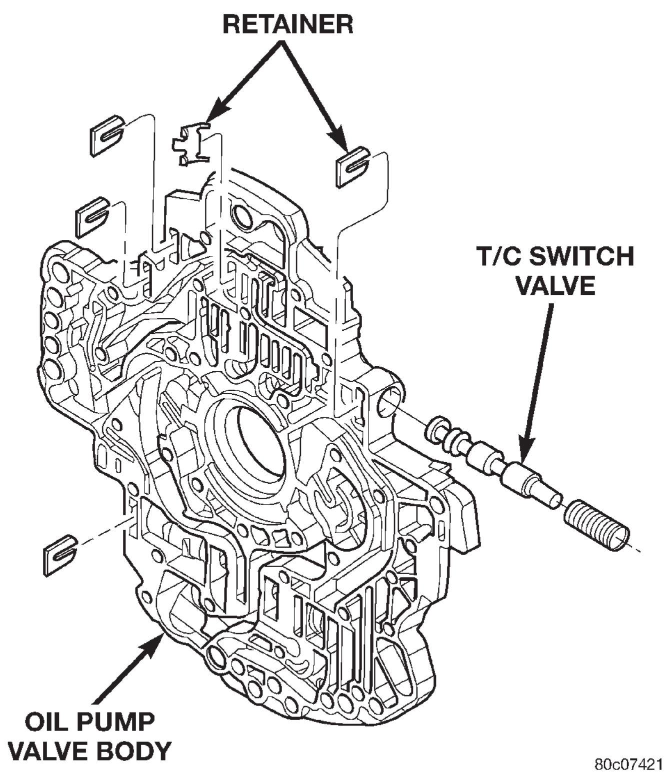


Fig. 97 T/C Switch Valve

INPUT CLUTCH ASSEMBLY

DISASSEMBLY

(1) Remove the reverse reaction plate selective snap-ring from the input clutch retainer (Fig. 98).

(2) Remove the reverse reaction plate from the input clutch retainer.

(3) Remove the reverse hub and reverse clutch pack from the input clutch retainer.

(4) Remove the number 4 bearing from the overdrive hub.

(5) Remove the overdrive hub from the input clutch retainer (Fig. 98).

(6) Remove the number 3 bearing from the underdrive hub.

(7) Remove the OD/reverse reaction plate snap-ring from the input clutch retainer.

(8) Remove the underdrive hub, overdrive clutch, and overdrive reaction plate from the input clutch retainer (Fig. 98).

NOTE: The overdrive friction discs and steel discs are thicker than the matching components in the underdrive and reverse clutches.

(9) Remove the number 2 bearing from the input clutch hub.

(10) Remove the overdrive clutch wave snap-ring from the input clutch retainer.

(11) Remove the UD/OD reaction plate tapered snap-ring from the input clutch retainer.

(12) Remove the UD/OD reaction plate from the input clutch retainer.

(13) Remove the UD/OD reaction plate flat snap-ring from the input clutch retainer (Fig. 98).

(14) Remove the underdrive clutch pack from the input clutch retainer (Fig. 100).

(15) Using Spring Compressor 8251, compress the UD/OD balance piston and remove the snap-ring from the input clutch hub (Fig. 99).

(16) Remove the UD/OD balance piston and piston return spring from the input clutch retainer (Fig. 100).

(17) Remove the underdrive piston from the input clutch retainer (Fig. 100).

NOTE: Both the UD/OD balance piston and the underdrive piston have seals molded onto them. If the seal is damaged, do not attempt to install a new seal onto the piston. The piston/seal must be replaced as an assembly.

(18) Remove the input clutch retainer tapered snap-ring.

DISASSEMBLY AND ASSEMBLY (Continued)

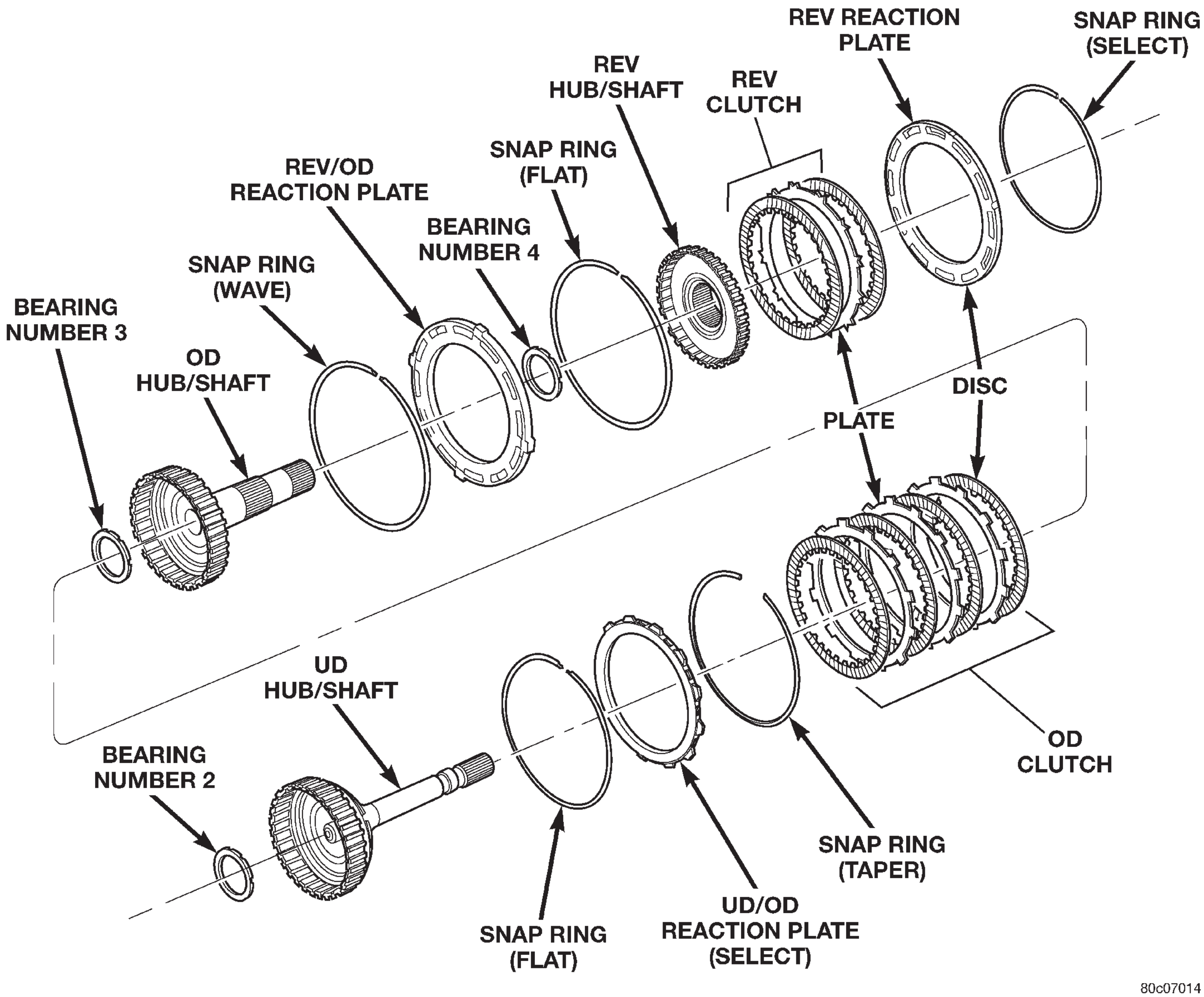


Fig. 98 Input Clutch Assembly—Part I

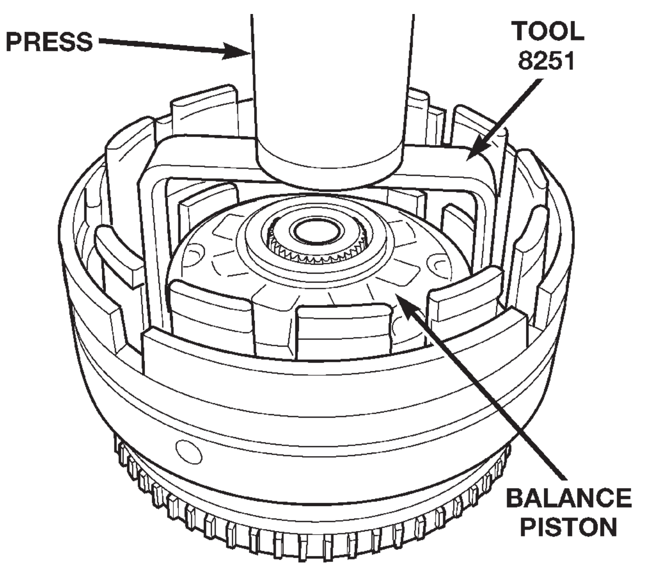


Fig. 99 Compressing UD/OD Balance Piston Using Tool 8251

(19) Separate input clutch retainer from input clutch hub.

(20) Separate OD/reverse piston from input clutch hub retainer (Fig. 100).

(21) Remove all seals and o-rings from the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to make note of which o-ring belongs in which location.

ASSEMBLY

(1) Install all new seals and o-rings onto the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to install the correct o-ring in the correct location.

(2) Lubricate all seals with Mopar® ATF+3, type 7176 prior to installation.

(3) Assemble the OD/reverse piston onto the input clutch hub (Fig. 100).

DISASSEMBLY AND ASSEMBLY (Continued)

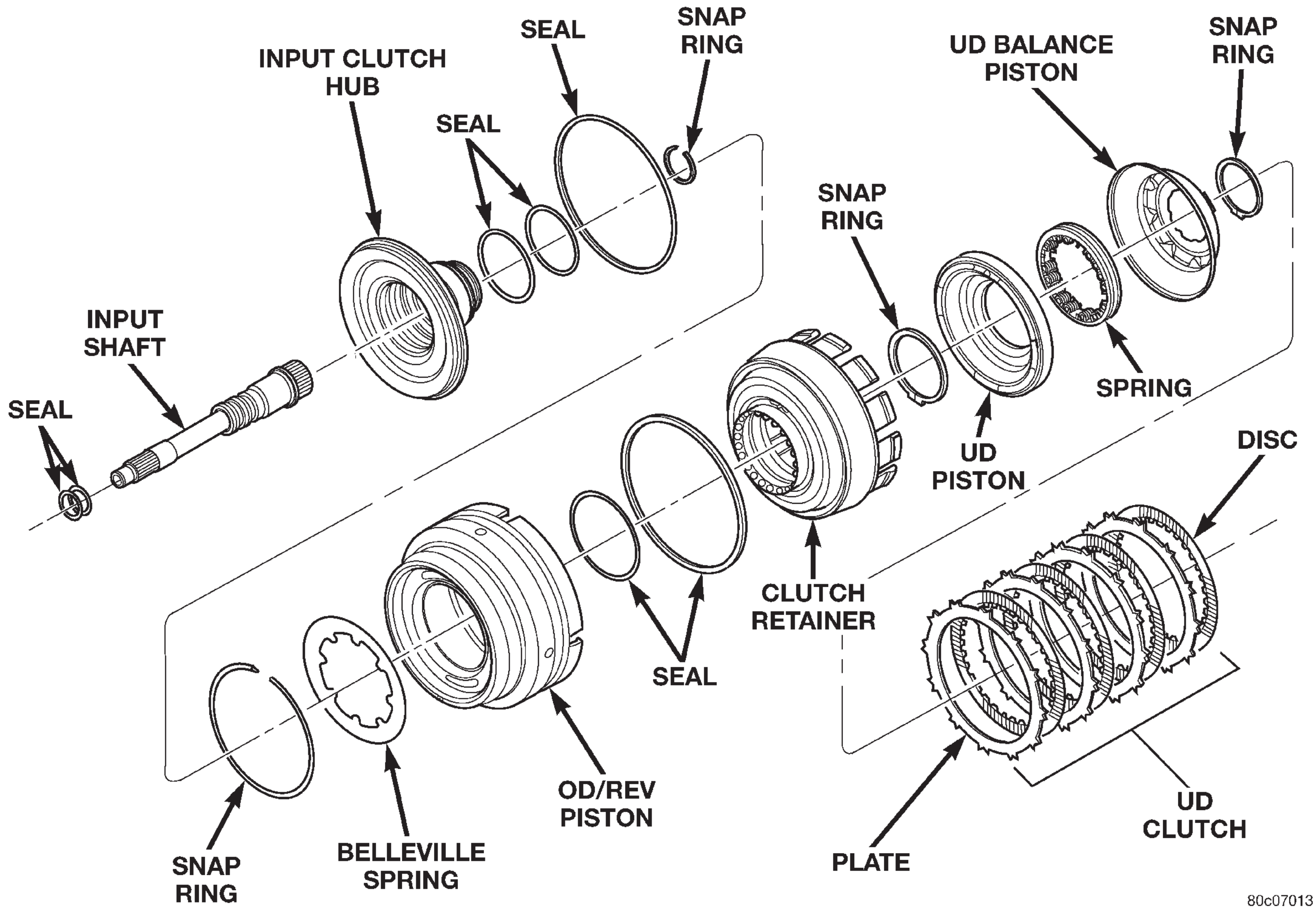


Fig. 100 Input Clutch Assembly—Part II

(4) Assemble the input clutch retainer onto the input clutch hub.

(5) Install the input clutch retainer tapered snap-ring with tapered side up onto the input clutch hub.

(6) Install Piston Guides 8504 into the input clutch retainer (Fig. 101) and onto the input clutch hub to guide the inner and outer underdrive piston seals into position.

(7) Install the underdrive piston into the input clutch retainer and over the input clutch hub (Fig. 100).

(8) Install the UD/OD balance piston return spring pack into the input clutch retainer.

(9) Install Piston Guide 8252 into the input clutch retainer (Fig. 102) to guide the UD/OD balance piston seal into position inside the underdrive piston.

(10) Install the UD/OD balance piston into the input clutch retainer and the underdrive piston.

(11) Using Spring Compressor 8251, compress the UD/OD return spring pack and secure the piston in place with the snap-ring (Fig. 103).

(12) Install the underdrive clutch pack into the input clutch retainer (Fig. 100).

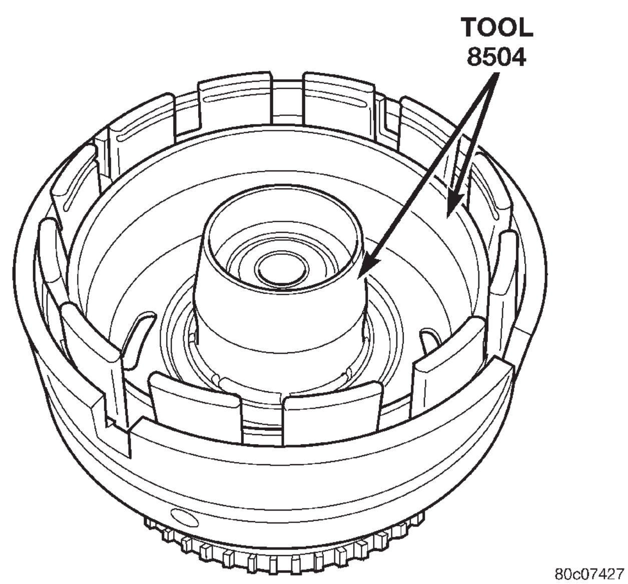


Fig. 101 Install Underdrive Piston Using Tool 8504

(13) Install the UD/OD reaction plate lower flat snap-ring (Fig. 98). The correct snap-ring can be identified by the two tabbed ears.

(14) Install the UD/OD reaction plate into the input clutch retainer. The reaction plate is to be

DISASSEMBLY AND ASSEMBLY (Continued)

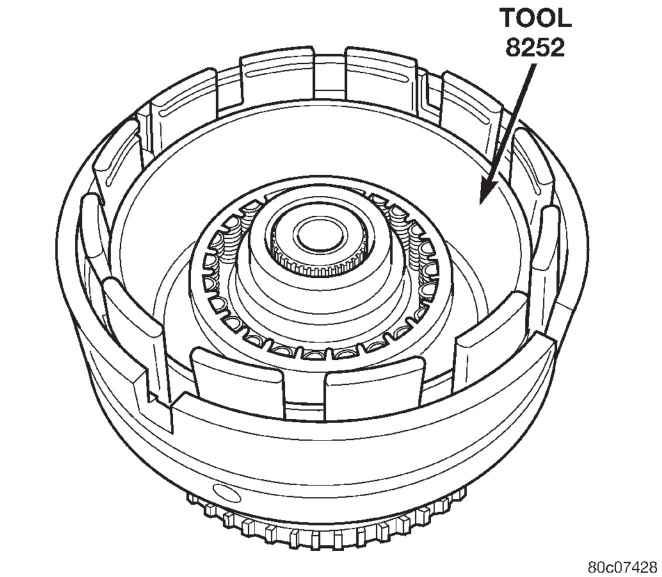


Fig. 102 Install Balance Piston Using Tool 8252

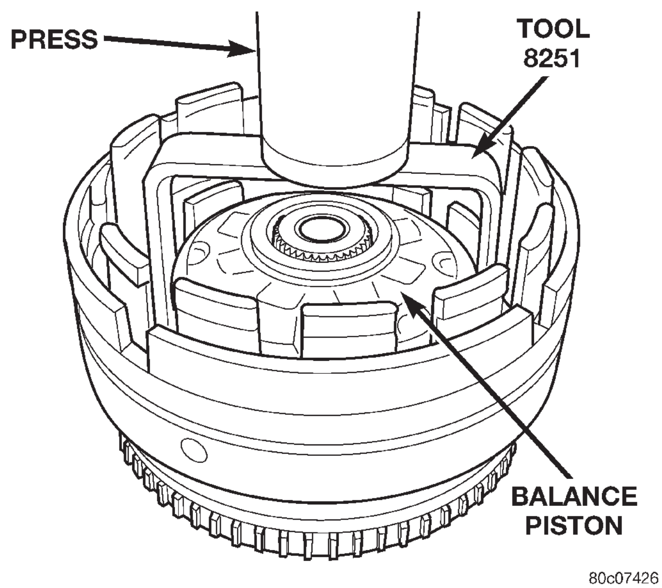


Fig. 103 Compressing UD/OD Balance Piston Using Tool 8251

installed with the big step down. The reaction plate is also selectable and should be changed to achieve the correct clutch clearances.

(15) Install the UD/OD reaction plate upper tapered snap-ring with tapered side up.

(16) Install the input clutch assembly into Input Clutch Pressure Fixture 8260 (Fig. 104). Mount a dial indicator to the assembly, push down on the clutch discs and zero the indicator against the underdrive clutch discs (Fig. 105). Apply 20 psi of air pressure to the underdrive clutch and record the dial indicator reading. Measure and record UD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with UD clutch pack clearance specification. The correct clutch clearance is 0.76–1.16 mm (0.030–0.063 in.). Adjust as necessary. Install the chosen reaction plate and re-measure to verify selection.

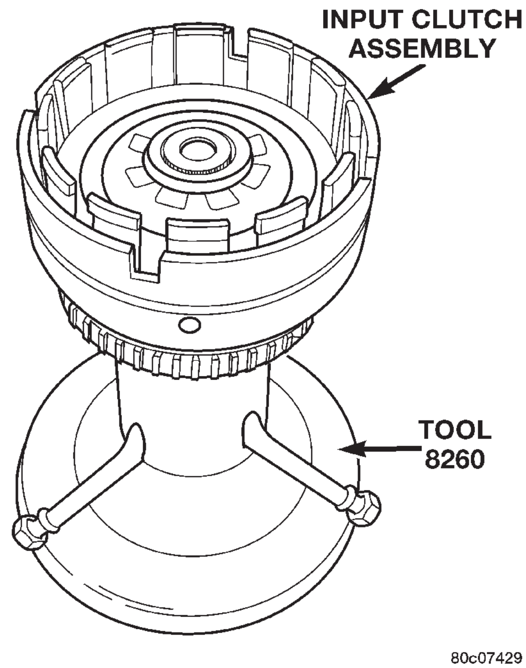


Fig. 104 Input Clutch Assembly Mounted on Tool 8260

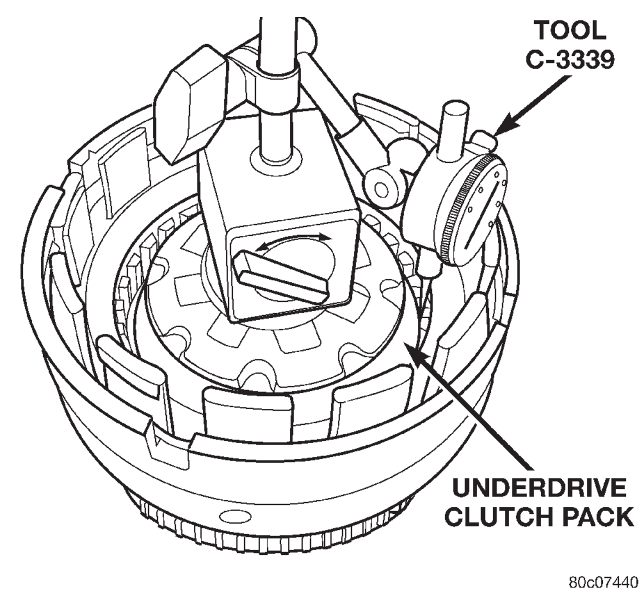


Fig. 105 Measuring UD Clutch Clearance

(17) Install the overdrive clutch pack into the input clutch retainer (Fig. 98). The overdrive steel separator plates can be identified by the lack of the half-moon cuts in the locating tabs.

(18) Install the overdrive clutch wavy snap-ring with the two tabbed ears into the input clutch retainer.

DISASSEMBLY AND ASSEMBLY (Continued)

(19) Install the OD/reverse reaction plate into the input clutch retainer. The reaction plate is non-directional (Fig. 98).

(20) Install the OD/reverse reaction plate flat snap-ring into the input clutch retainer.

(21) Mount a dial indicator to the assembly and zero the indicator against the OD/reverse reaction plate (Fig. 106). Apply 20 psi of air pressure to the overdrive clutch and record the dial indicator reading. Measure and record OD clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with OD clutch pack clearance specification.Verify that the clutch clearance is 1.016–1.65 mm (0.040–0.065 in.).

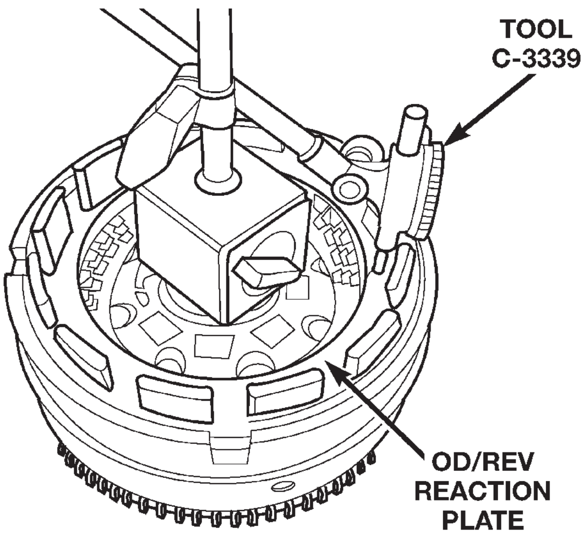


Fig. 106 Measuring OD Clutch Clearance

(22) Install the reverse clutch pack into the input clutch retainer (Fig. 98).

(23) Install the reverse reaction plate into the input clutch retainer.

(24) Install the reverse reaction plate selective snap-ring into the input clutch retainer.

(25) Mount a dial indicator to the assembly, push down on the clutch discs, pull up on the reaction plate to ensure the plate is properly seated and zero the indicator against the reverse clutch discs (Fig. 107). Apply 20 psi of air pressure to the reverse clutch and record the dial indicator reading. Measure and record Reverse clutch pack measurement in four (4) places, 90° apart. Take average of four measurements and compare with Reverse clutch pack clearance specification. The correct clutch clearance is 0.81–1.24 mm (0.032–0.049 in.). Adjust as necessary. Install the chosen snap-ring and re-measure to verify selection.

(26) Remove the reverse clutch pack from the input clutch retainer.

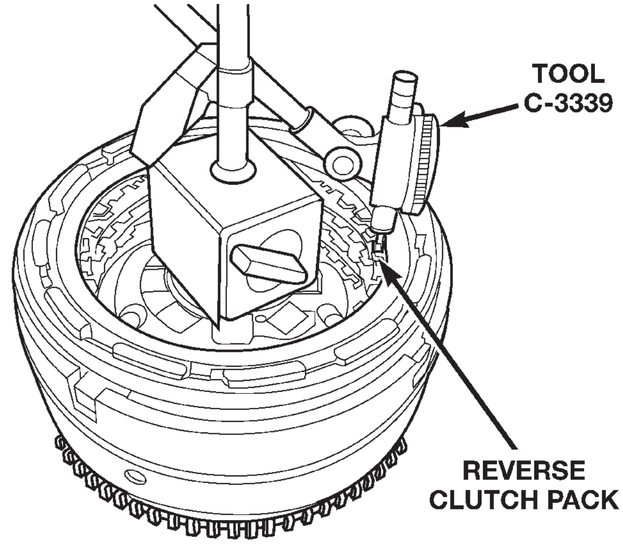


Fig. 107 Measuring Reverse Clutch Clearance

(27) Install the number 2 bearing onto the underdrive hub with flat side up/forward with petroleum jelly.

(28) Install the underdrive hub into the input clutch retainer.

(29) Install the number 3 bearing into the overdrive hub with the flat side up/forward with petroleum jelly.

(30) Install the overdrive hub into the input clutch retainer.

(31) Install the number 4 bearing into the reverse hub with flat side up/forward with petroleum jelly.

(32) Install the reverse hub into the input clutch retainer.

(33) Install the complete reverse clutch pack.

(34) Install the reverse reaction plate and snap-ring.

(35) Push up on reaction plate to allow reverse clutch to move freely.

4C RETAINER/BULKHEAD

DISASSEMBLY

(1) Remove the 2C piston belleville spring snap-ring from the 4C retainer /bulkhead (Fig. 108).

(2) Remove the 2C piston Belleville spring from the retainer/bulkhead (Fig. 108).

(3) Remove the 2C piston from the retainer/bulkhead. Use 20 psi of air pressure to remove the piston if necessary.

(4) Remove the 4C clutch snap-ring from the retainer/bulkhead (Fig. 108).

(5) Remove the 4C clutch pack from the retainer/bulkhead (Fig. 108).

DISASSEMBLY AND ASSEMBLY (Continued)

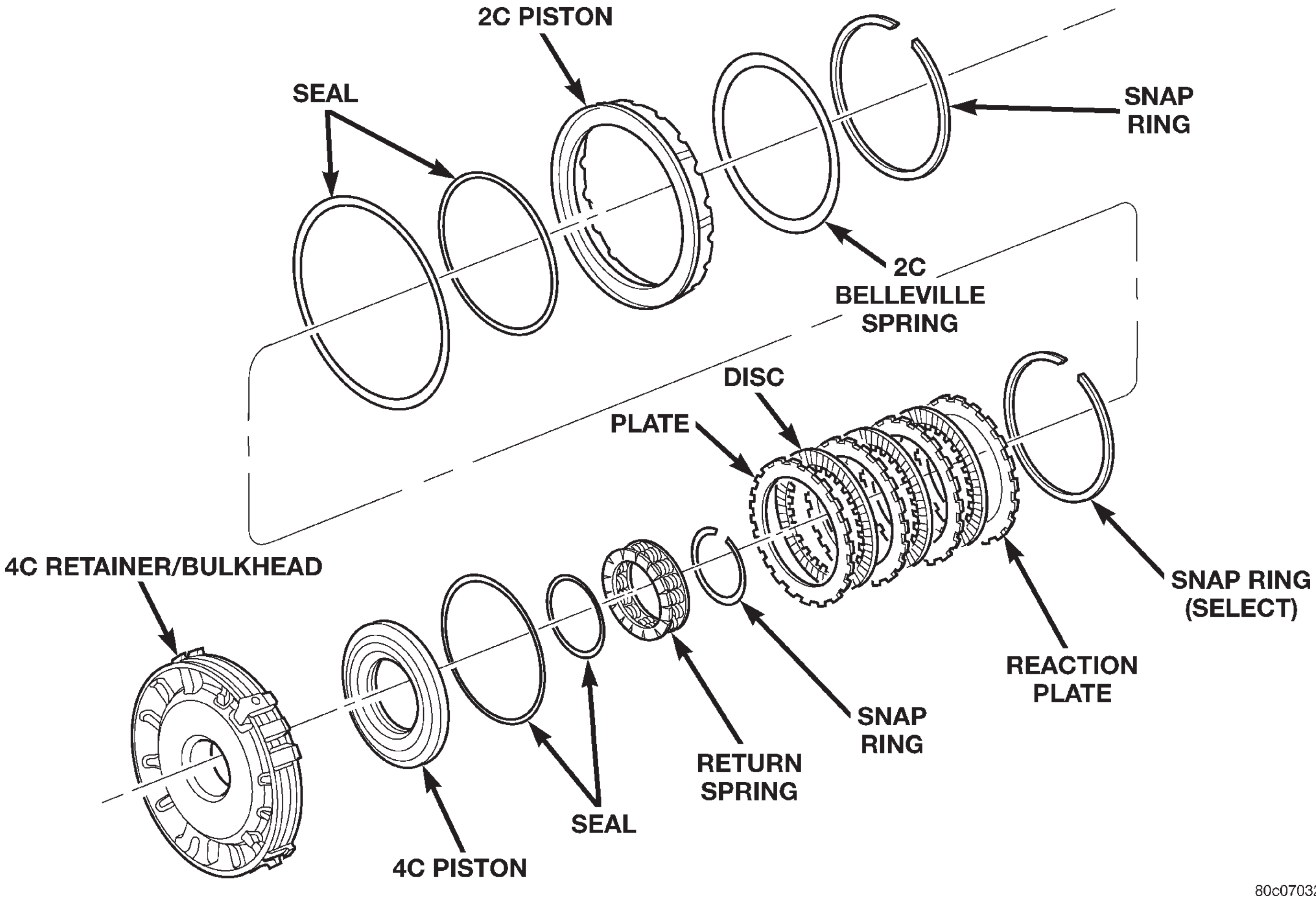


Fig. 108 4C Retainer/Bulkhead Components

(6) Using Spring Compressor 8250 and a suitable shop press, compress the 4C piston return spring and remove the snap-ring (Fig. 108).

(7) Remove the 4C piston return spring and piston from the retainer/bulkhead (Fig. 108). Use 20 psi of air pressure to remove the piston if necessary.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install new seals on the 2C and 4C pistons (Fig. 108).

(3) Lubricate all seals with Mopar® ATF+3, type 7176 prior to installation.

(4) Install the 4C piston into the 4C retainer/bulkhead (Fig. 108).

(5) Position the 4C piston return spring onto the 4C piston.

(6) Using Spring Compressor 8250 and a suitable shop press, compress the 4C piston return spring and install the snap-ring (Fig. 109).

(7) Assemble and install the 4C clutch pack into the retainer/bulkhead (Fig. 108).

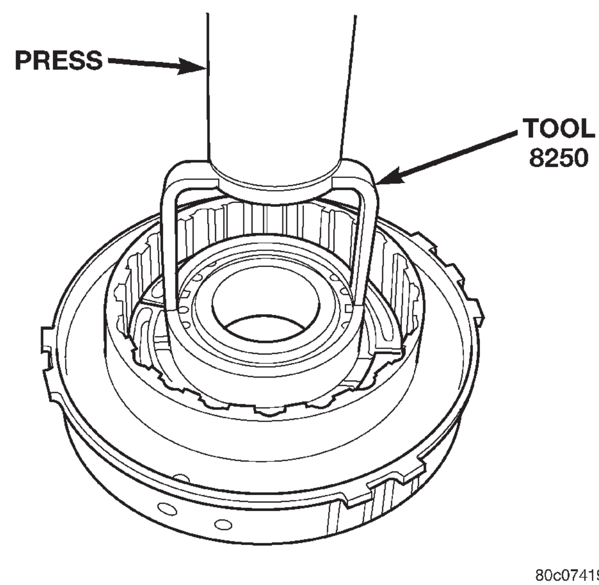


Fig. 109 Compress 4C Piston Return Spring Using Tool 8250

(8) Install the 4C reaction plate and snap-ring into the retainer/bulkhead (Fig. 108). The 4C reaction plate is non-directional.

(9) Measure the 4C clutch clearance. The correct clutch clearance is 0.81–1.35 mm (0.032–0.053 in.). The snap-ring is selectable. Install the chosen snap-ring and re-measure to verify the selection.

(10) Install the 2C piston into the retainer/bulkhead (Fig. 108).

(11) Position the 2C Belleville spring onto the 2C piston.

(12) Position the 2C Belleville spring snap-ring onto the 2C Belleville spring (Fig. 108).

(13) Using Spring Compressor 8249 and a suitable shop press (Fig. 110), compress the belleville spring until the snap-ring is engaged with the snap-ring groove in the retainer/bulkhead.

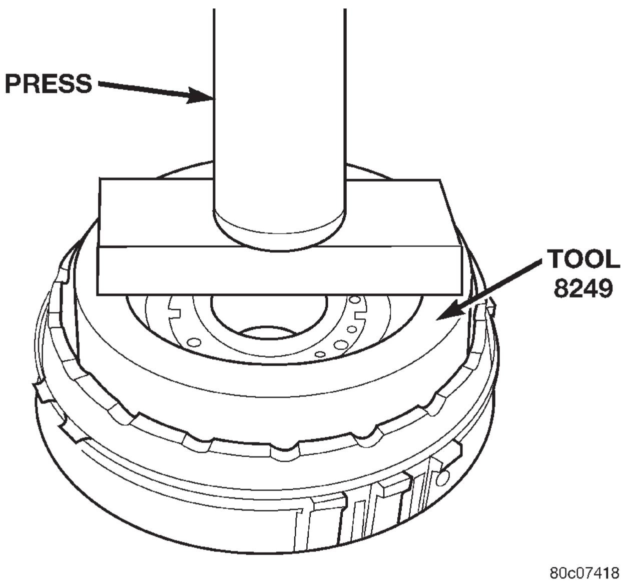


Fig. 110 Compress 2C Belleville Spring Using Tool 8249

PLANETARY GEAR SET

DISASSEMBLY

(1) Remove the snap-ring holding the input annulus into the input carrier (Fig. 111).

(2) Remove the input annulus from the input carrier (Fig. 111).

(3) Remove the number 9 bearing from the reverse planetary carrier. Note that this planetary carrier has four pinion gears.

(4) Remove the reverse planetary gear carrier (Fig. 111).

(5) Remove the number 10 bearing from the input sun gear (Fig. 111).

(6) Remove the input sun gear from the input carrier (Fig. 111).

(7) Remove the number 11 bearing from the input carrier (Fig. 111).

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install the number 11 bearing into the input planetary carrier with the flat side up and facing forward (Fig. 111).

(3) Install the input sun gear into the input carrier (Fig. 111).

(4) Install the number 10 bearing onto the rear of the reverse planetary carrier with the flat side toward the carrier (Fig. 111).

(5) Install the number 9 bearing onto the front of the reverse planetary carrier with the rounded side toward the carrier and the flat side facing upward (Fig. 111).

(6) Install the reverse planetary gear carrier into the input carrier (Fig. 111).

(7) Install the input annulus gear into the input carrier (Fig. 111).

(8) Install the snap-ring to hold the input annulus gear into the input carrier (Fig. 111).

DISASSEMBLY AND ASSEMBLY (Continued)

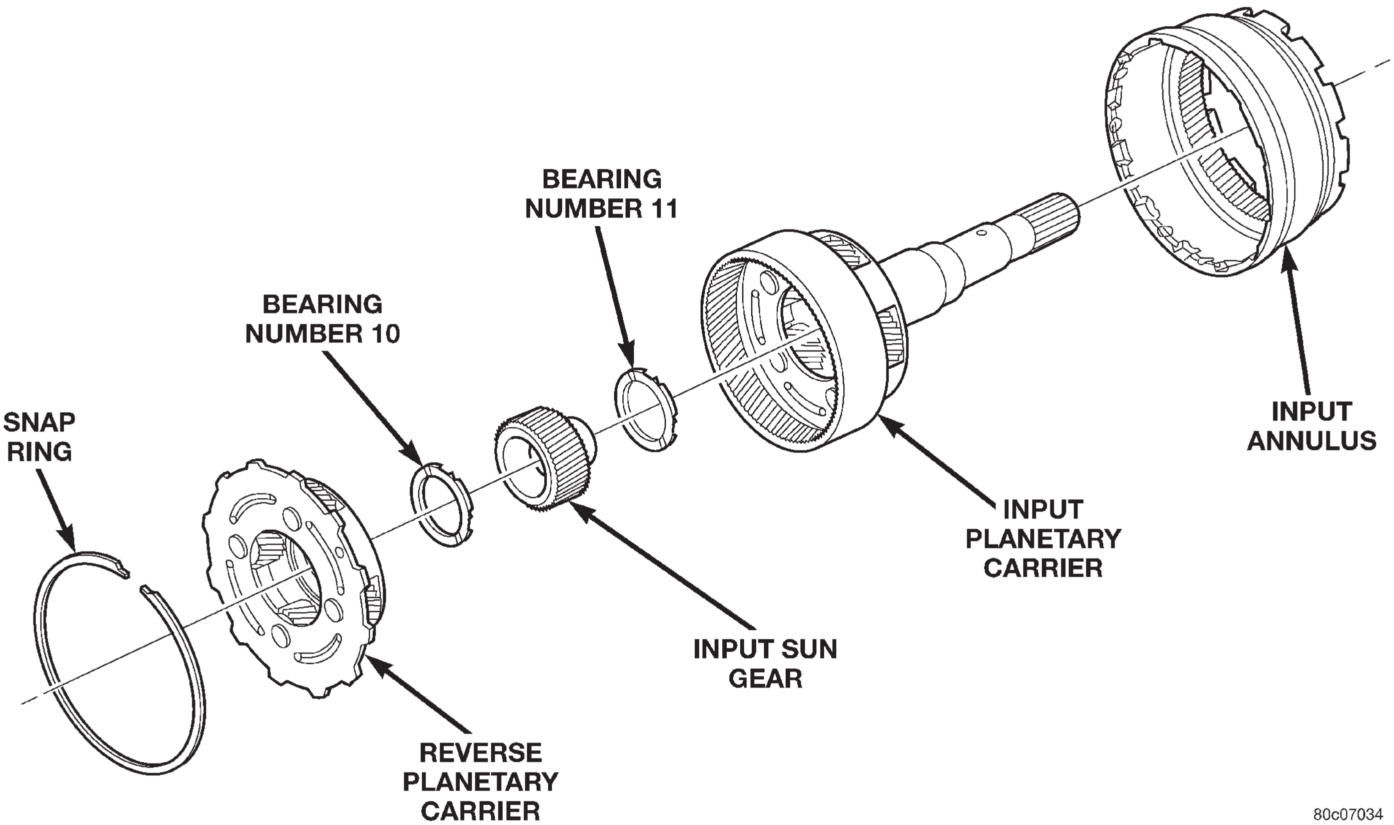


Fig. 111 Reverse/Input Planetary Carrier Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

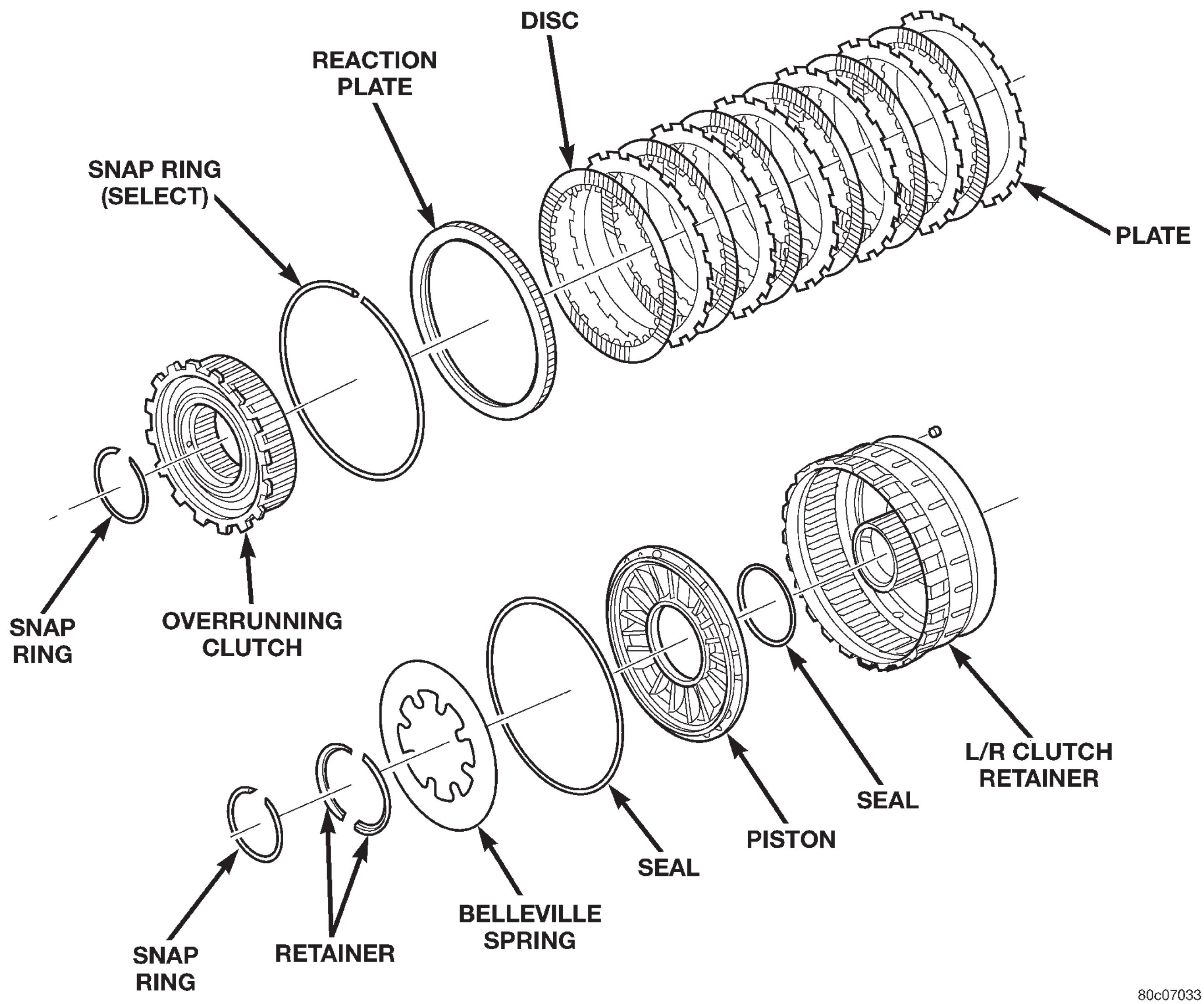


Fig. 112 Low/Reverse Clutch Assembly

LOW/REVERSE CLUTCH

DISASSEMBLY

(1) Remove the inner overrunning clutch snap-ring from the low/reverse clutch retainer (Fig. 112).

(2) Remove the outer low/reverse reaction plate flat snap-ring (Fig. 112).

(3) Remove the low/reverse clutch and the overrunning clutch from the low/reverse clutch retainer as an assembly (Fig. 112).

(4) Separate the low/reverse clutch from the overrunning clutch.

(5) Remove the overrunning clutch snap-ring (Fig. 113).

(6) Remove the spacer from the overrunning clutch (Fig. 113).

(7) Separate the inner and outer races of the overrunning clutch (Fig. 113).

(8) Remove the overrunning clutch lower snap-ring (Fig. 113).

(9) Using Spring Compressor 8285 and a suitable shop press (Fig. 114), compress the low/reverse piston Belleville spring and remove the split retaining ring holding the Belleville spring into the low/reverse clutch retainer.

(10) Remove the low/reverse clutch Belleville spring and piston from the low/reverse clutch retainer. Use 20 psi of air pressure to remove the piston if necessary.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Check the bleed orifice to ensure that it is not plugged or restricted.

DISASSEMBLY AND ASSEMBLY (Continued)

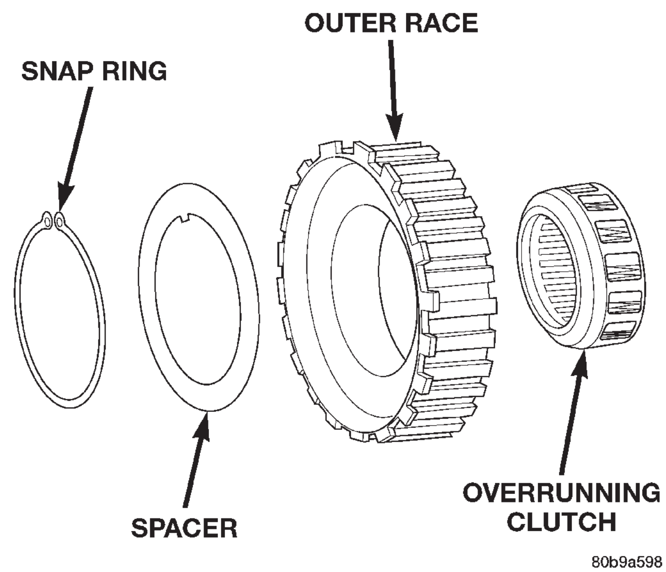


Fig. 113 Overrunning Clutch

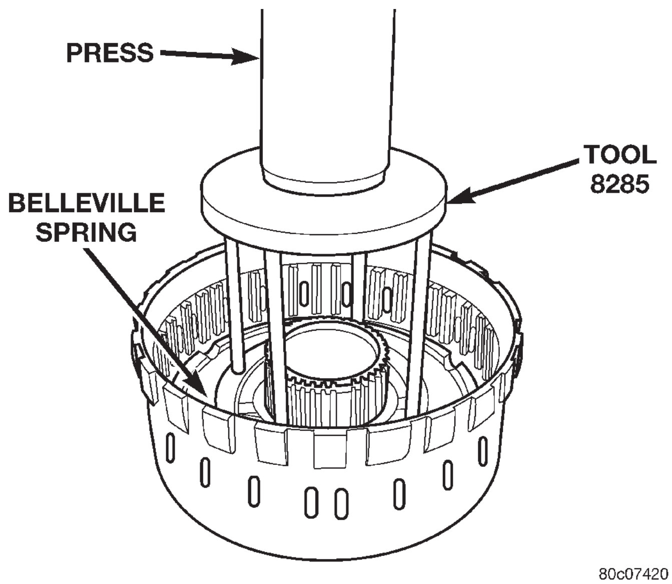


Fig. 114 Compress Low/Reverse Belleville Spring Using Tool 8285

(3) Install a new seal on the low/reverse piston. Lubricate the seal with Mopar® ATF+3, type 7176 prior to installation.

(4) Install the low/reverse piston into the low/reverse clutch retainer.

(5) Position the low/reverse piston Belleville spring on the low/reverse piston.

(6) Using Spring Compressor 8285 and a suitable shop press (Fig. 114), compress the low/reverse piston Belleville spring and install the split retaining ring to hold the Belleville spring into the low/reverse clutch retainer.

(7) Install the lower overrunning clutch snap-ring (Fig. 113).

(8) Assemble the inner and outer races of the overrunning clutch (Fig. 113).

(9) Position the overrunning clutch spacer on the overrunning clutch.

(10) Install the upper overrunning clutch snap-ring (Fig. 113).

(11) Assemble and install the low/reverse clutch pack into the low/reverse clutch retainer (Fig. 112).

(12) Install the low/reverse reaction plate into the low/reverse clutch retainer (Fig. 112). The reaction plate is directional and must be installed with the flat side down.

(13) Install the low/reverse clutch pack snap-ring (Fig. 112). The snap-ring is selectable and should be chosen to give the correct clutch pack clearance.

(14) Measure the low/reverse clutch pack clearance and adjust as necessary. The correct clutch clearance is 1.14–1.91 mm (0.045–0.05 in.).

(15) Install the overrunning clutch into the low/reverse clutch retainer making sure that the index splines are aligned with the retainer.

(16) Install the overrunning clutch inner snap-ring.

CLEANING AND INSPECTION

VALVE BODY

Clean the valve housings, valves, plugs, springs, and separator plates with a standard parts cleaning solution only. Do not use gasoline, kerosene, or any type of caustic solution.

Do not immerse any of the electrical components in cleaning solution. Clean the electrical components by wiping them off with dry shop towels only.

Dry all except the electrical parts with compressed air. Make sure all passages are clean and free from obstructions. **Do not use rags or shop towels to dry or wipe off valve body components. Lint from these materials can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straightedge to check surface flatness. Minor scratches may be removed with crocus cloth using only very light pressure.

CLEANING AND INSPECTION (Continued)

Minor distortion of a valve body mating surface may be corrected by smoothing the surface with a sheet of crocus cloth. Position the crocus cloth on a surface plate, sheet of plate glass or equally flat surface. If distortion is severe or any surfaces are heavily scored, the valve body will have to be replaced.

Inspect the valves and plugs (Fig. 115) for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

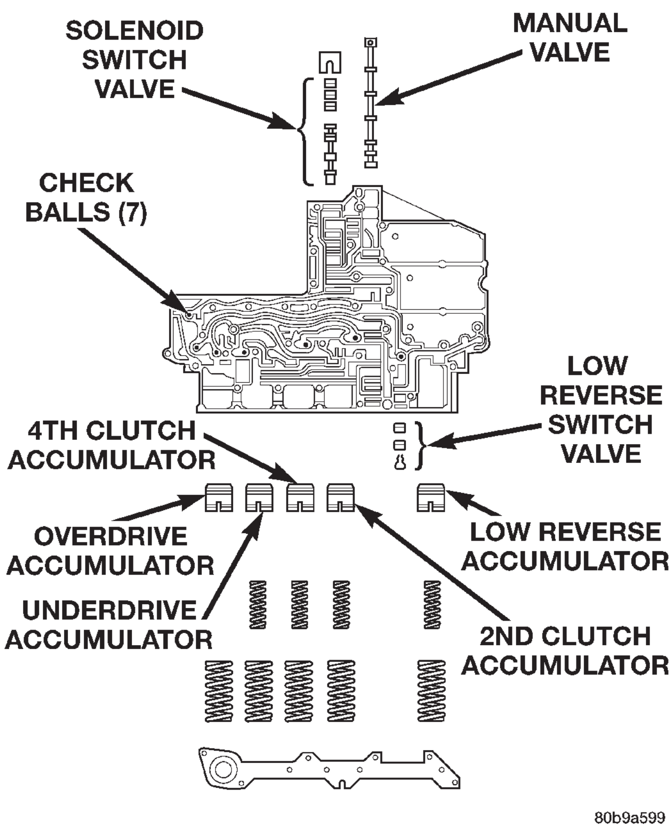


Fig. 115 Valve Body Components

Inspect all the valve and plug bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the valve body springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

Valve body bores do not change dimensionally with use. If the valve body functioned correctly when new, it will continue to operate properly after cleaning and inspection. It should not be necessary to replace a valve body assembly unless it is damaged in handling.

Inspect all the accumulator bores in the valve body. Use a penlight to view the bore interiors. Replace the valve body if any bores are distorted or scored. Inspect all of the accumulator springs. The springs must be free of distortion, warpage or broken coils.

Inspect all the fluid seals on the valve body (Fig. 116). Replace any seals that are cracked, distorted, or damaged in any way. These seals pass fluid pressure directly to the clutches. Any pressure leak at these points, may cause transmission performance problems.

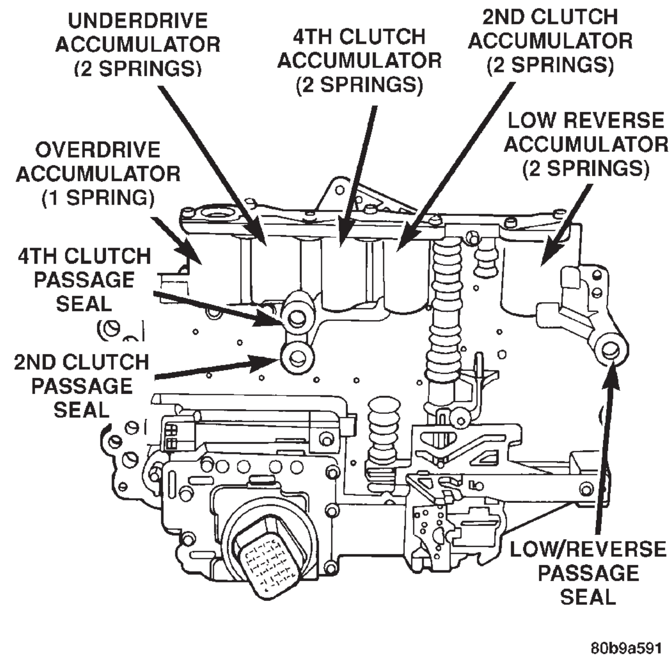


Fig. 116 Valve Body Seals

TRANSMISSION

GENERAL INFORMATION

Heli-Coil inserts can be used to repair damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive parts suppliers. Stainless steel inserts are recommended.

The use of crocus cloth is permissible where necessary, providing it is used carefully. When used on shafts, or valves, use extreme care to avoid rounding off sharp edges. Sharp edges are vital as they prevent foreign matter from getting between the valve and valve bore.

Do not reuse oil seals, gaskets, seal rings, or O-rings during overhaul. Replace these parts as a matter of course. Also do not reuse snap rings or E-clips that are bent or distorted. Replace these parts as well.

CLEANING AND INSPECTION (Continued)

Lubricate transmission parts with Mopar® ATF Plus 3, Type 7176, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used to hold parts in place during reassembly.

TRANSMISSION CASE CLEANING AND INSPECTION

Clean the case in a solvent tank. Flush the case bores and fluid passages thoroughly with solvent. Dry the case and all fluid passages with compressed air. Be sure all solvent is removed from the case and that all fluid passages are clear.

NOTE: Do not use shop towels or rags to dry the case (or any other transmission component) unless they are made from lint-free materials. Lint will stick to case surfaces and transmission components and circulate throughout the transmission after assembly. A sufficient quantity of lint can block fluid passages and interfere with valve body operation.

Inspect the case for cracks, porous spots, worn bores, or damaged threads. Damaged threads can be repaired with Helicoil thread inserts. However, the case will have to be replaced if it exhibits any type of damage or wear.

LOW/REVERSE CLUTCH ASSEMBLY

Clean the overrunning clutch assembly, clutch cam, and low-reverse clutch retainer. Dry them with compressed air after cleaning.

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse clutch retainer if the clutch race, roller surface or inside diameter is scored, worn or damaged.

ACCUMULATOR

Inspect the accumulator piston and seal rings. Replace the seal rings if worn or cut. Replace the piston if chipped or cracked.

Check condition of the accumulator inner and outer springs. Replace the springs if the coils are cracked, distorted or collapsed.

OIL PUMP AND REACTION SHAFT SUPPORT

Clean pump and support components with solvent and dry them with compressed air.

Check condition of the seal rings and thrust washer on the reaction shaft support. The seal rings do not need to be replaced unless cracked, broken, or severely worn.

Inspect the pump and support components. Replace the pump or support if the seal ring grooves or machined surfaces are worn, scored, pitted, or damaged. Replace the pump gears if pitted, worn chipped, or damaged.

Inspect the pump bushing. Then check the reaction shaft support bushing. Replace either bushing only if heavily worn, scored or damaged. It is not necessary to replace the bushings unless they are actually damaged.

Inspect the valves and plugs for scratches, burrs, nicks, or scores. Minor surface scratches on steel valves and plugs can be removed with crocus cloth but **do not round off the edges of the valve or plug lands.** Maintaining sharpness of these edges is vitally important. The edges prevent foreign matter from lodging between the valves and plugs and the bore.

Inspect all the valve and plug bores in the oil pump cover. Use a penlight to view the bore interiors. Replace the oil pump if any bores are distorted or scored. Inspect all of the valve springs. The springs must be free of distortion, warpage or broken coils.

Trial fit each valve and plug in its bore to check freedom of operation. When clean and dry, the valves and plugs should drop freely into the bores.

PLANETARY GEARTRAIN

Clean the planetary components in solvent and dry them with compressed air.

Check sun gear and driving shell condition. Replace the gear if damaged or if the bushings are scored or worn. The bushings are not serviceable. Replace the driving shell if worn, cracked or damaged.

Replace planetary gear sets if gears, pinion pins, or carrier are damaged in any way. Replace the annulus gears and supports if either component is worn or damaged.

Replace the output shaft if the machined surfaces are scored, pitted, or damaged in any way. Also replace the shaft if the splines are damaged, or exhibits cracks at any location.

ADJUSTMENTS

GEARSHIFT CABLE

Check adjustment by starting the engine in Park and Neutral. Adjustment is OK if the engine starts only in these positions. Adjustment is incorrect if the engine starts in one but not both positions. If the engine starts in any position other than Park or Neutral, or if the engine will not start at all, the park/neutral position switch may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into Park.

(2) Release cable adjuster lock (underneath the power brake booster) (Fig. 117) to unlock cable.

(3) Raise vehicle.

(4) Slide cable eyelet off transmission shift lever.

(5) Verify transmission shift lever is in Park detent by moving lever fully rearward. Last rearward detent is Park position.

(6) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(7) Slide cable eyelet onto transmission shift lever.

(8) Lower vehicle and check engine starting. Engine should start only in Park and Neutral.

(9) Lock shift cable by pressing cable adjuster clamp down until it snaps into place.

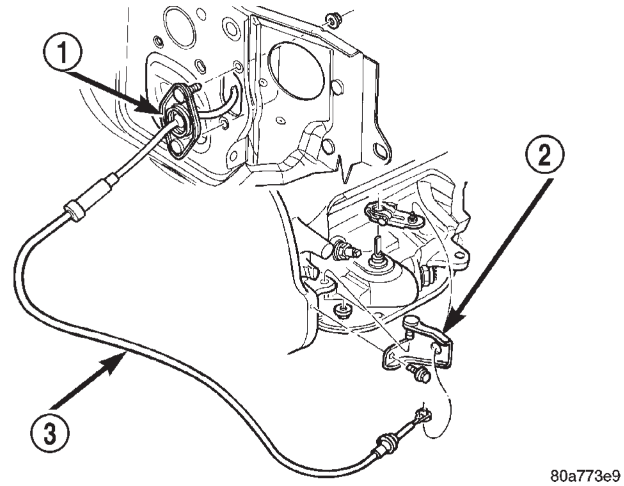


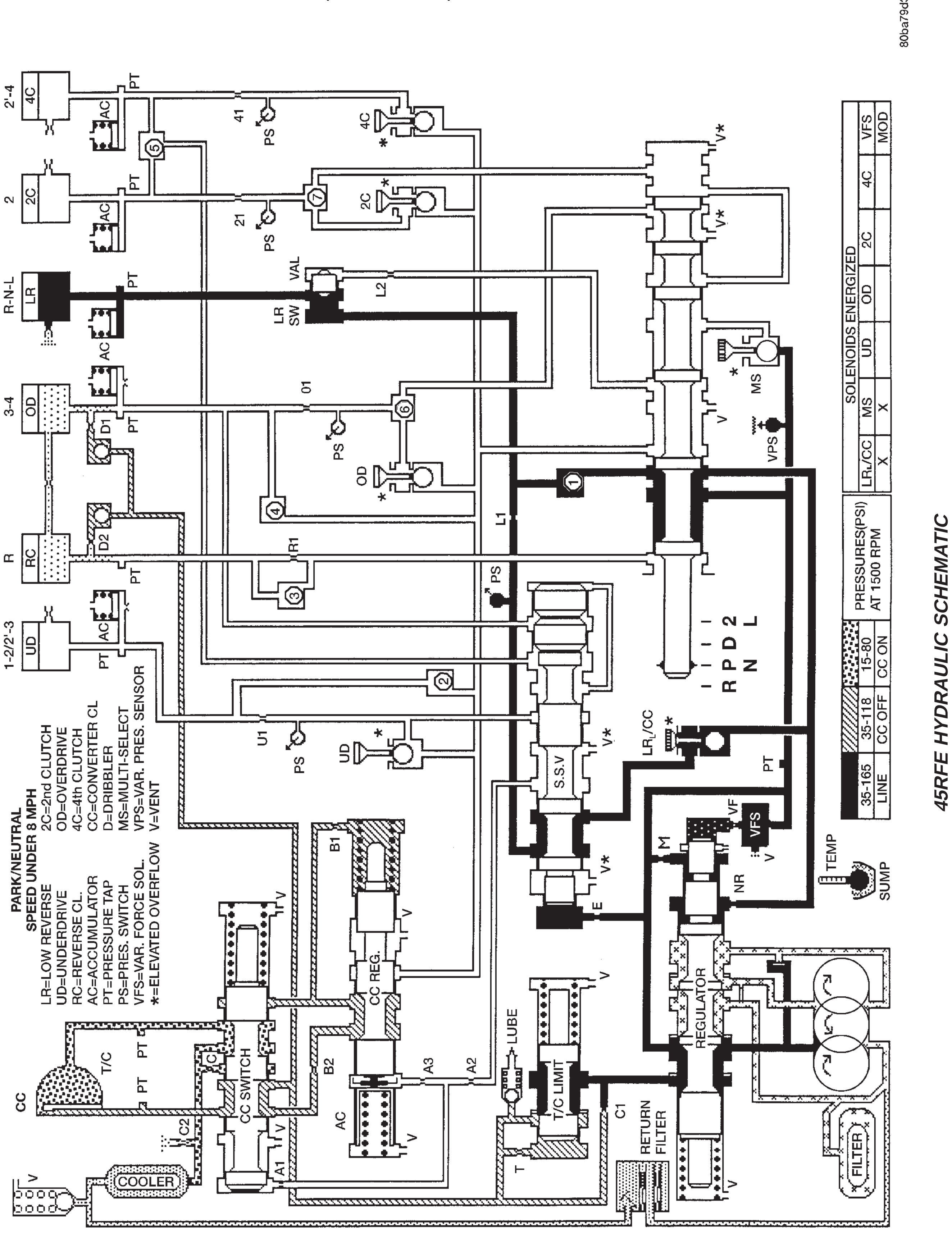
Fig. 117 Gearshift Cable Routing

1 – CABLE MOUNTING
2 – CABLE BRACKET AT TRANS.
3 – GEARSHIFT CABLE

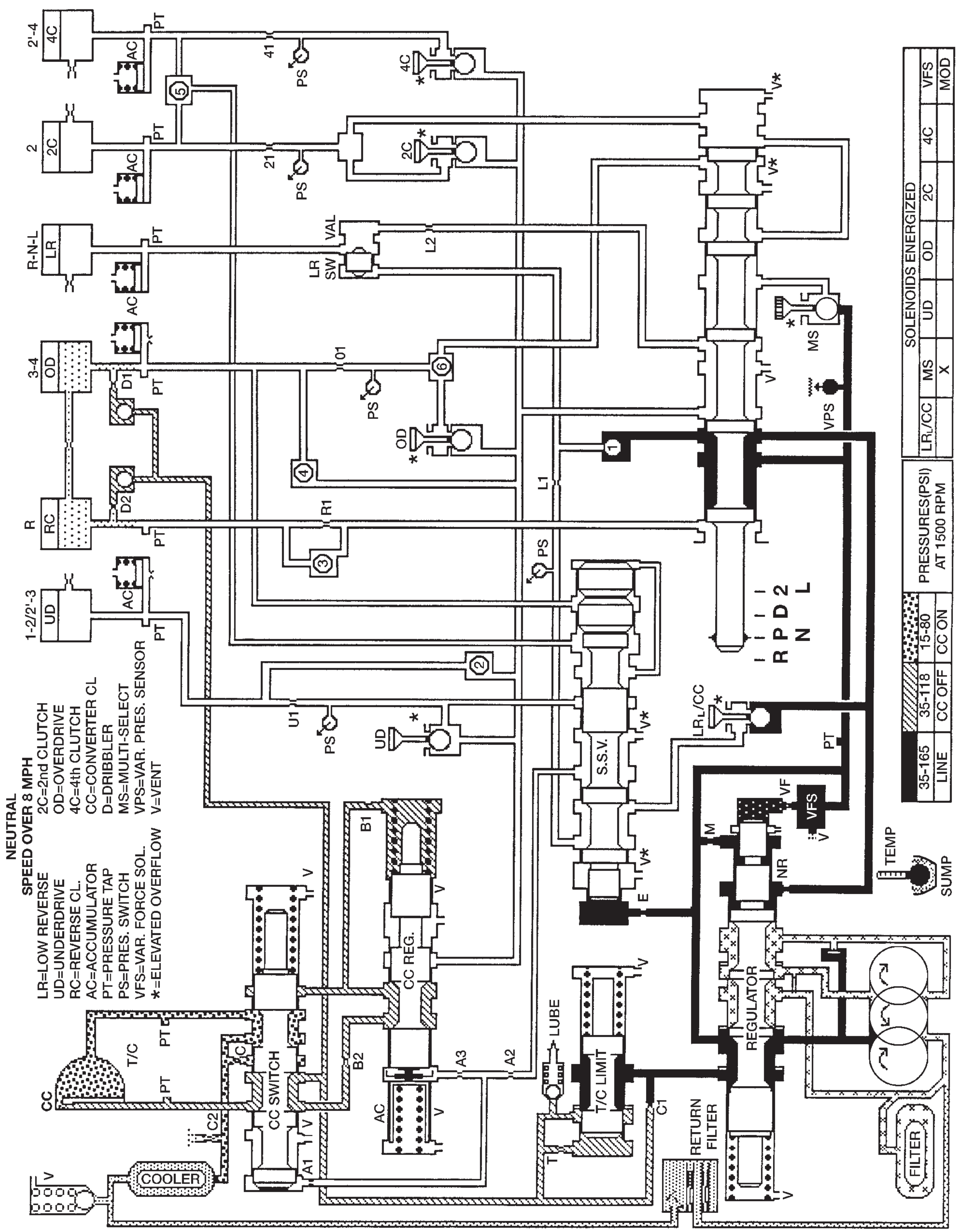
SCHEMATICS AND DIAGRAMS

HYDRAULIC SCHEMATICS

SCHEMATICS AND DIAGRAMS (Continued)

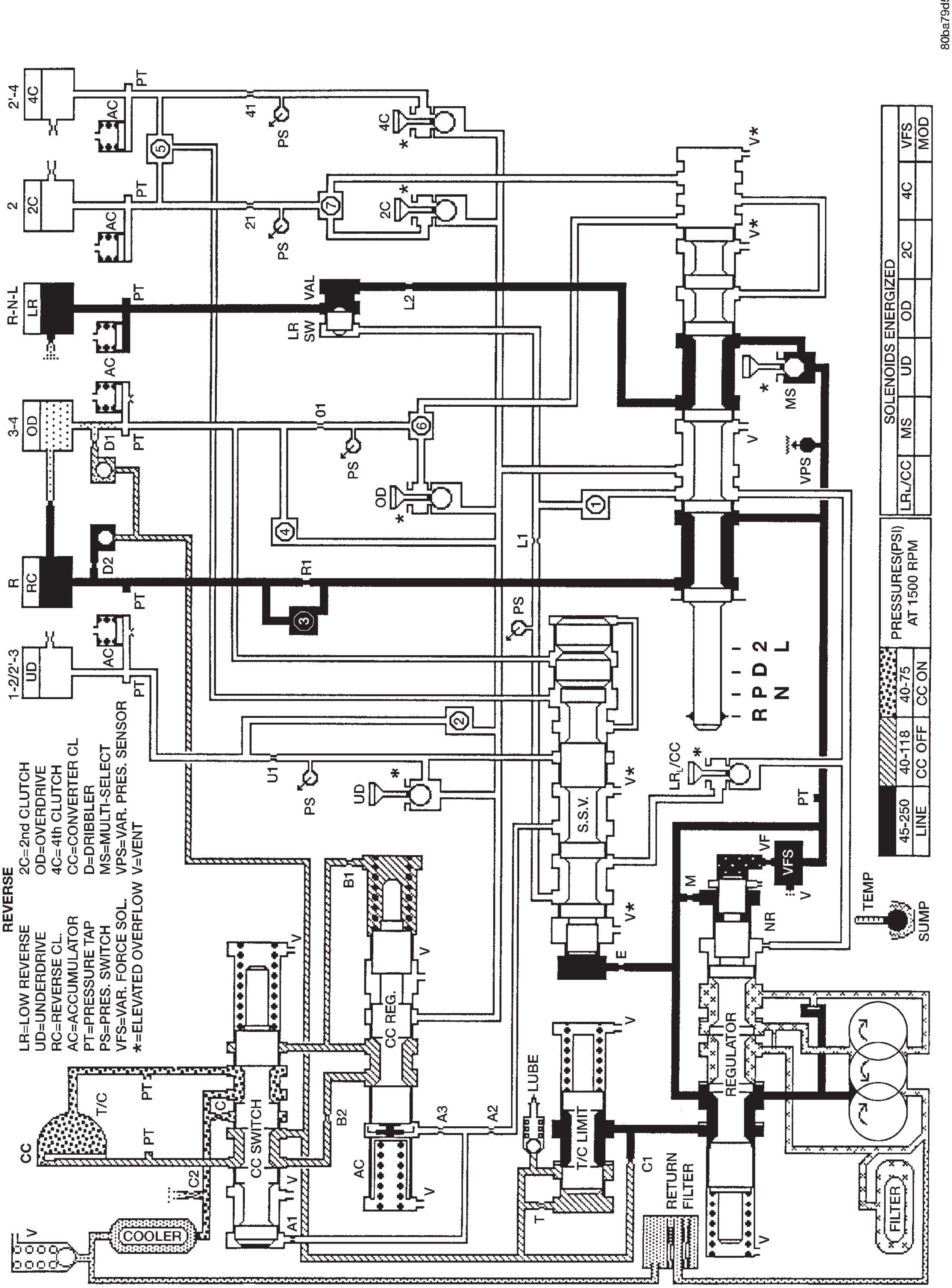


SCHEMATICS AND DIAGRAMS (Continued)



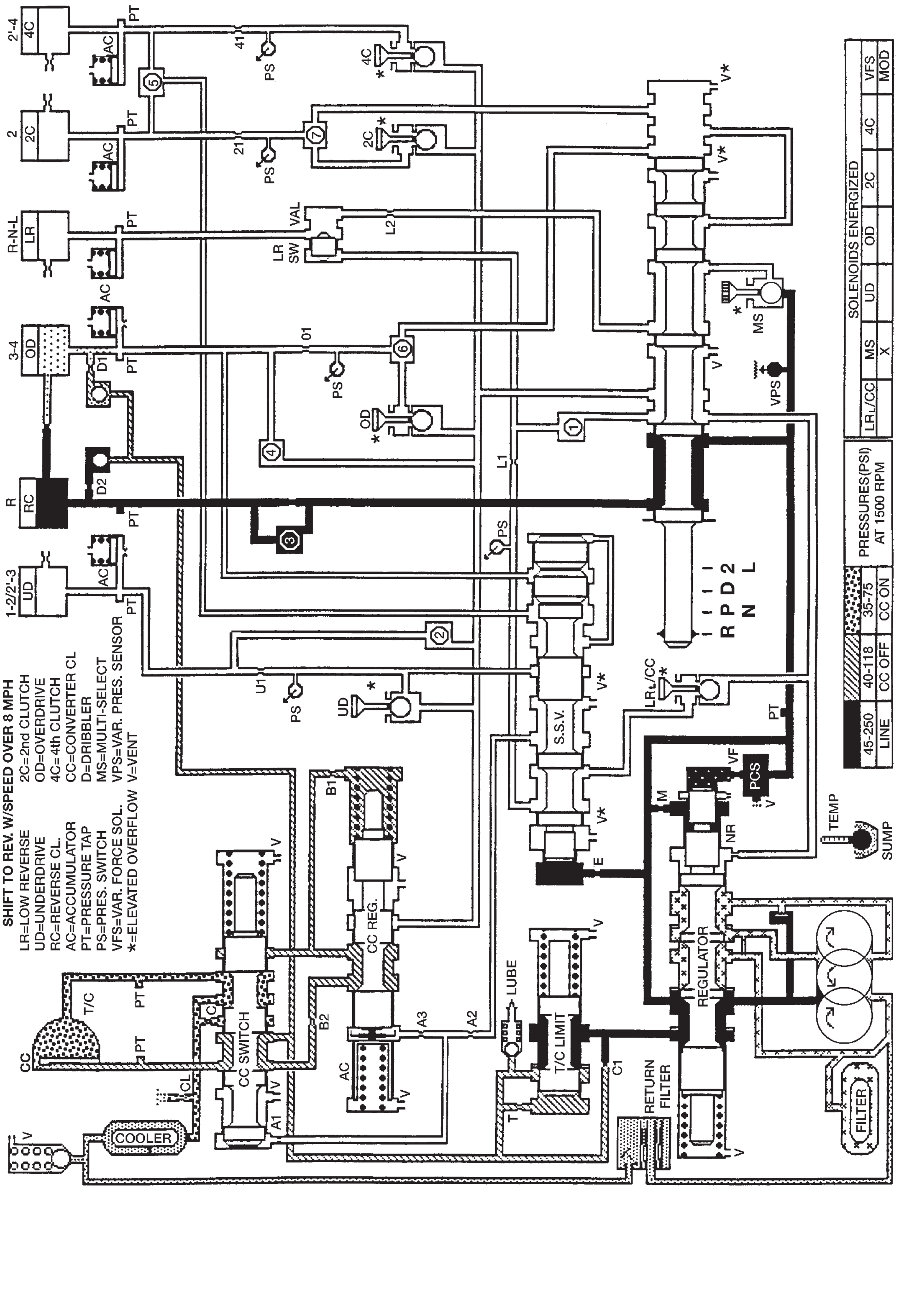
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



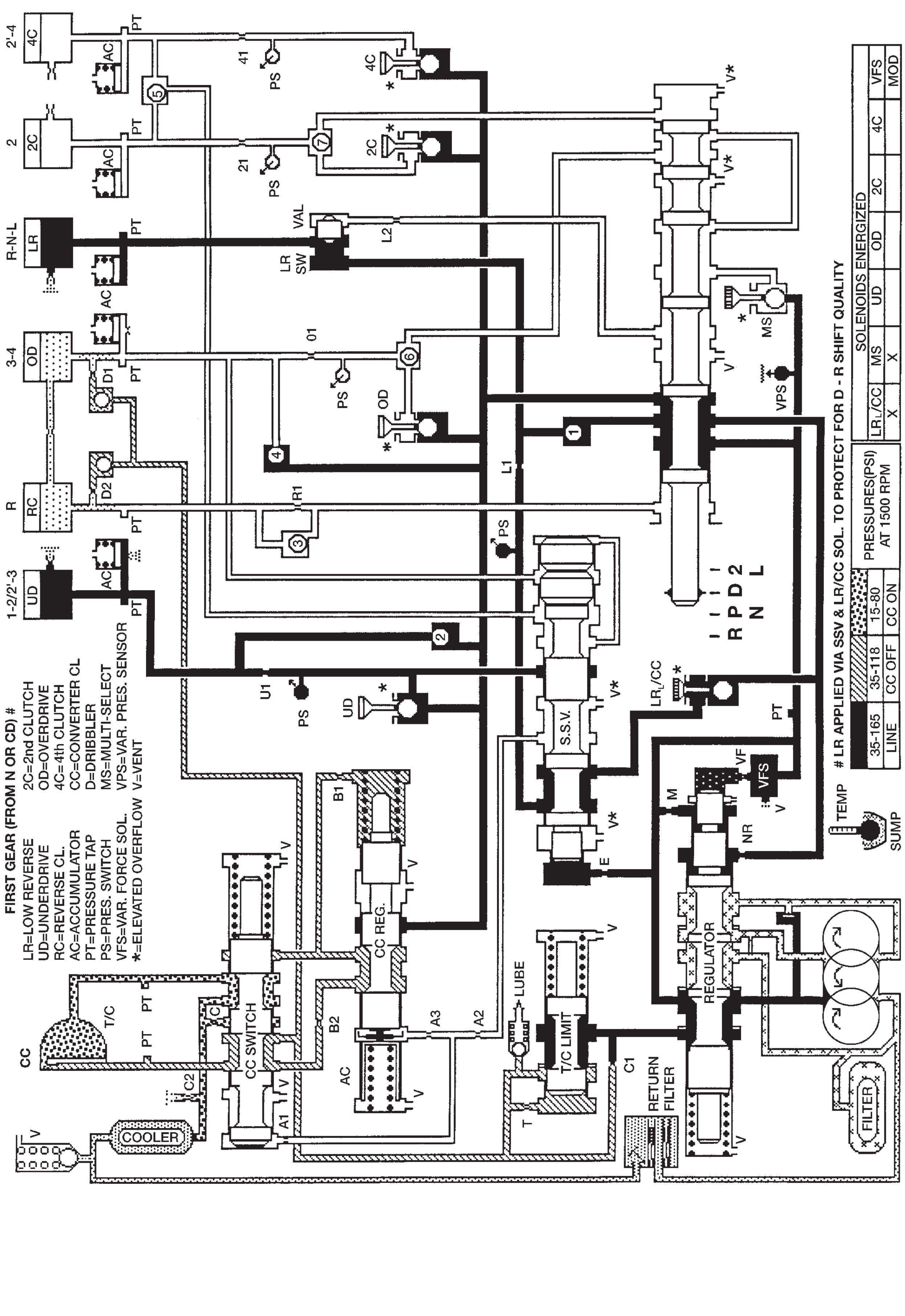
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



45RFE HYDRAULIC SCHEMATIC

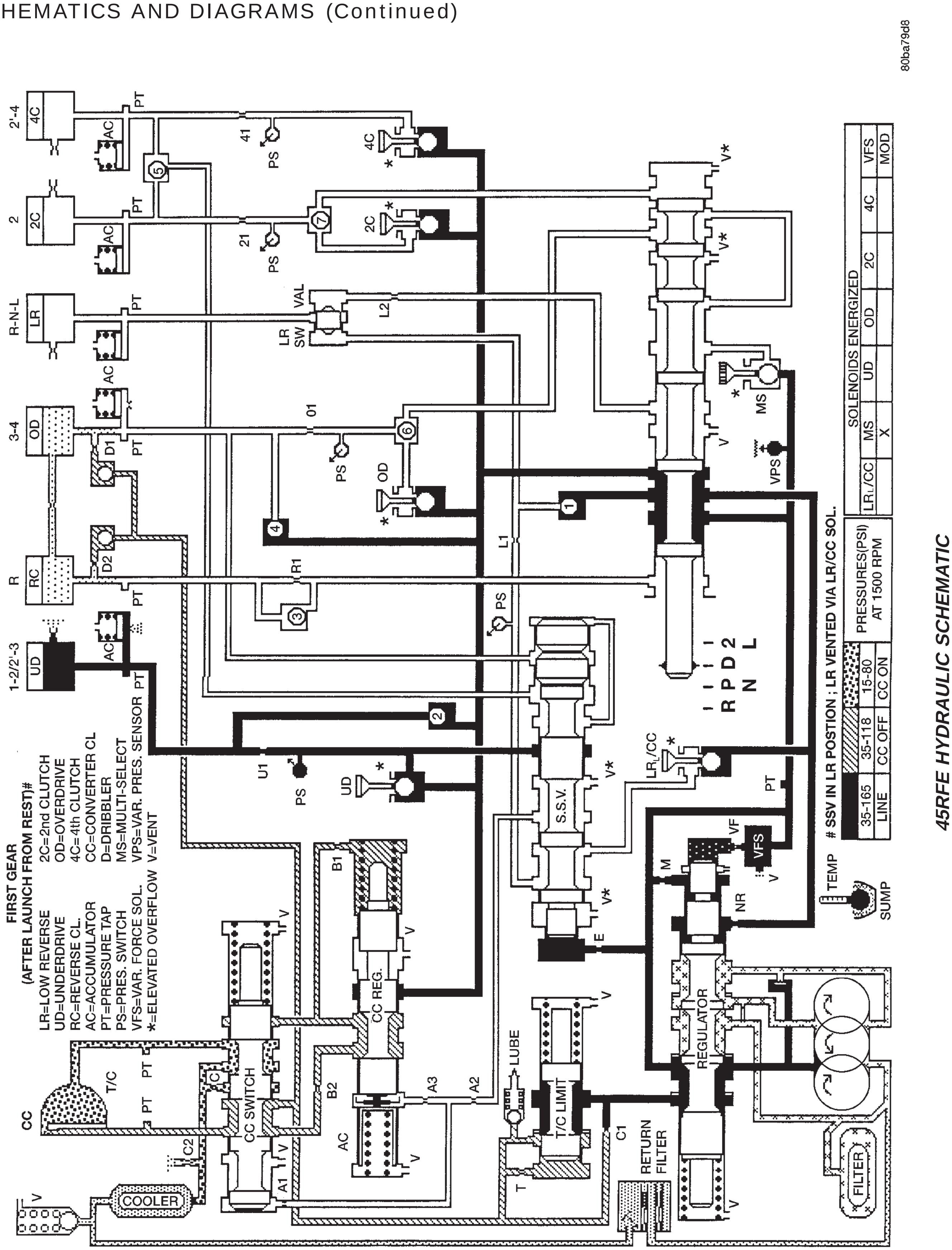
SCHEMATICS AND DIAGRAMS (Continued)



80ba79d7

45RFE HYDRAULIC SCHEMATIC

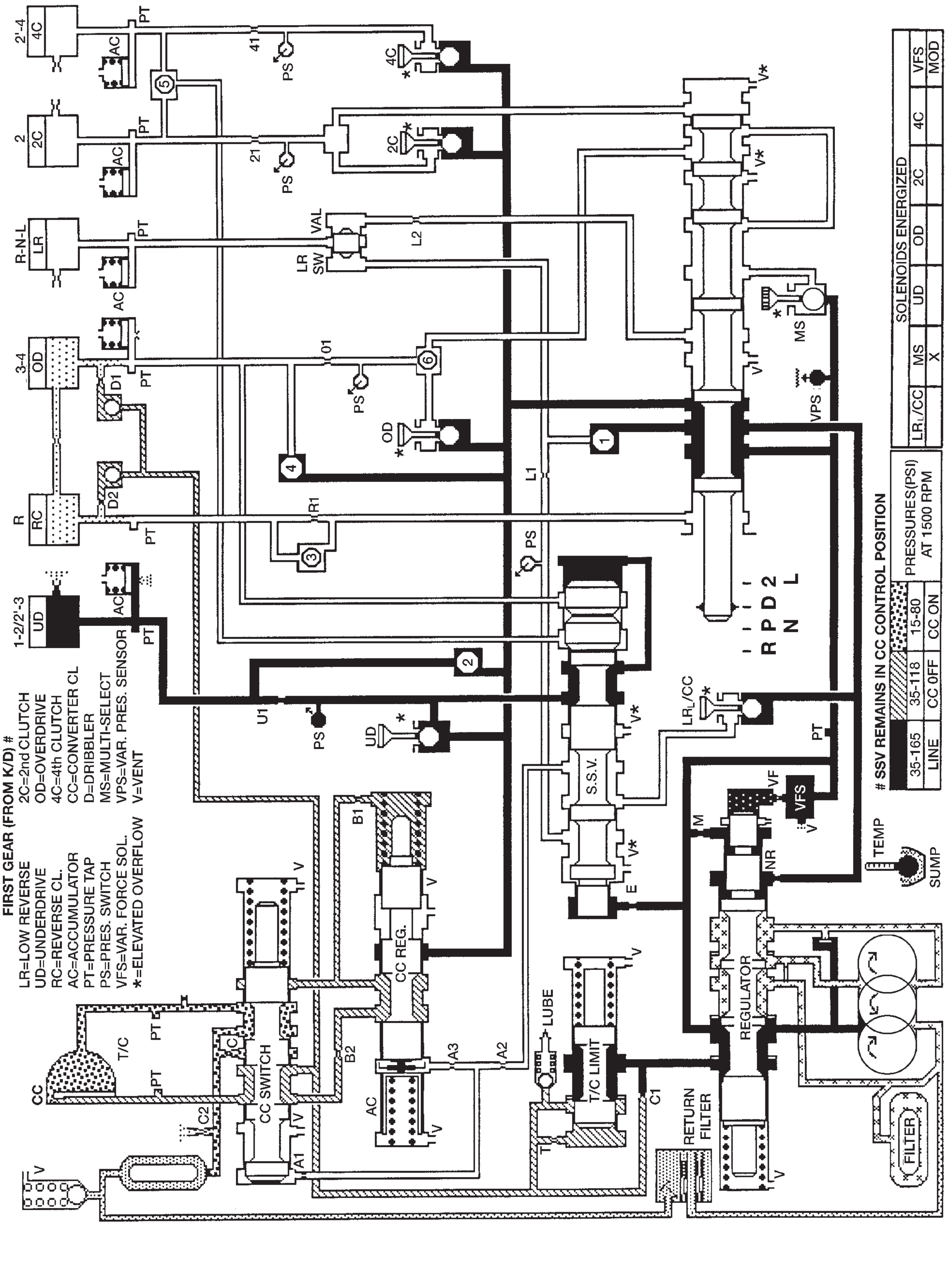
SCHEMATICS AND DIAGRAMS (Continued)



45RFE HYDRAULIC SCHEMATIC

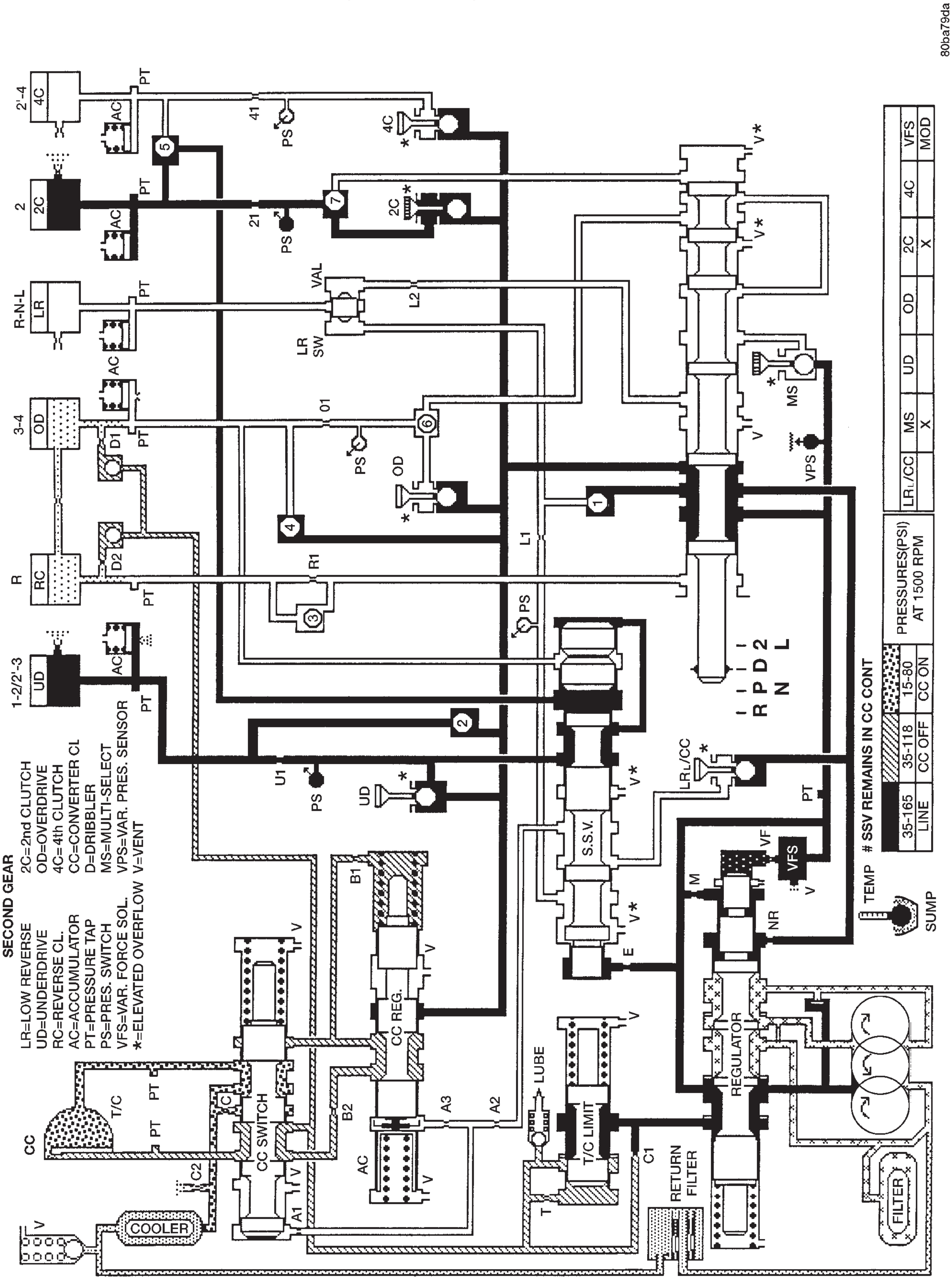
SCHEMATICS AND DIAGRAMS (Continued)

80ba79d9

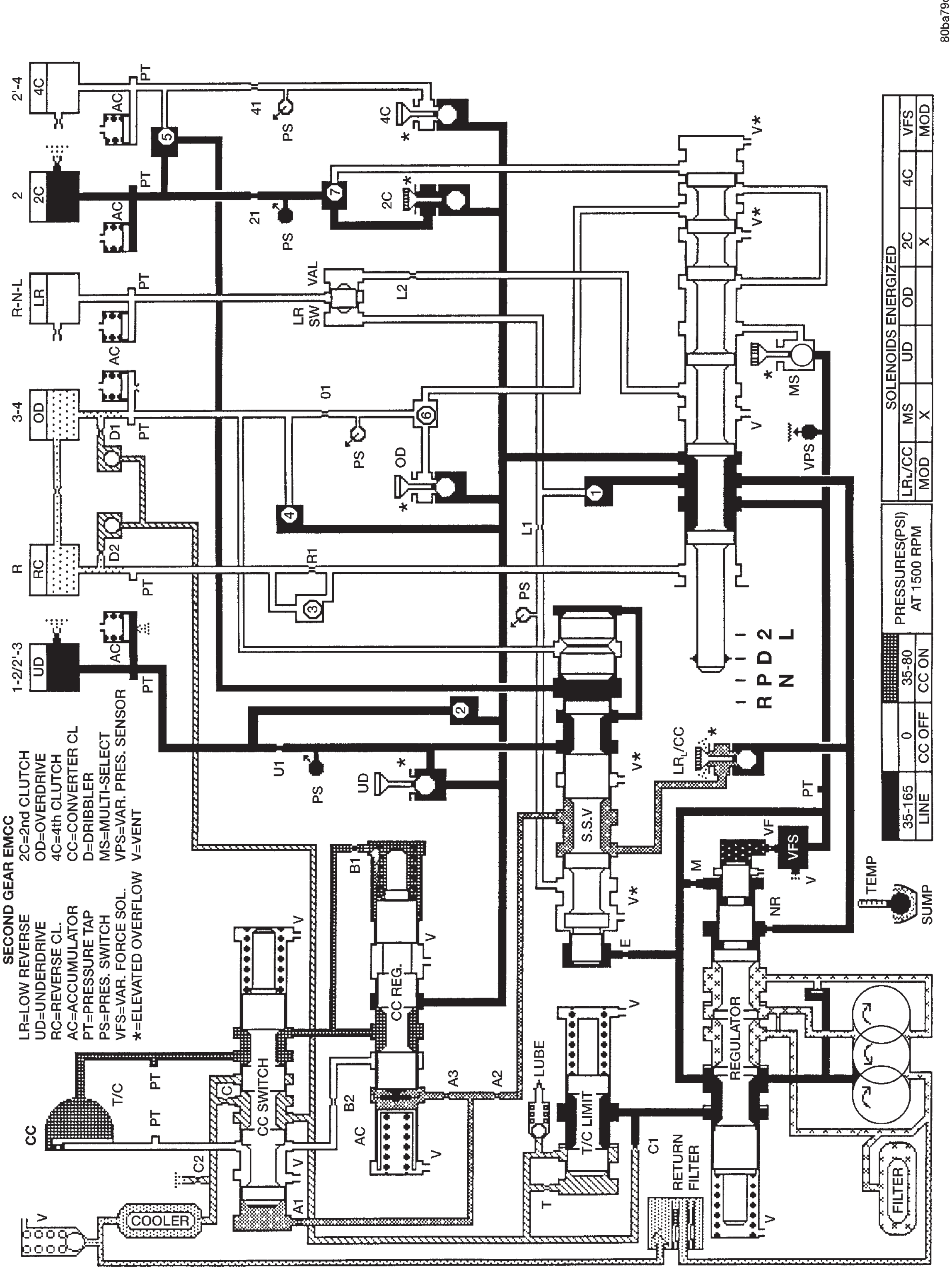


45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

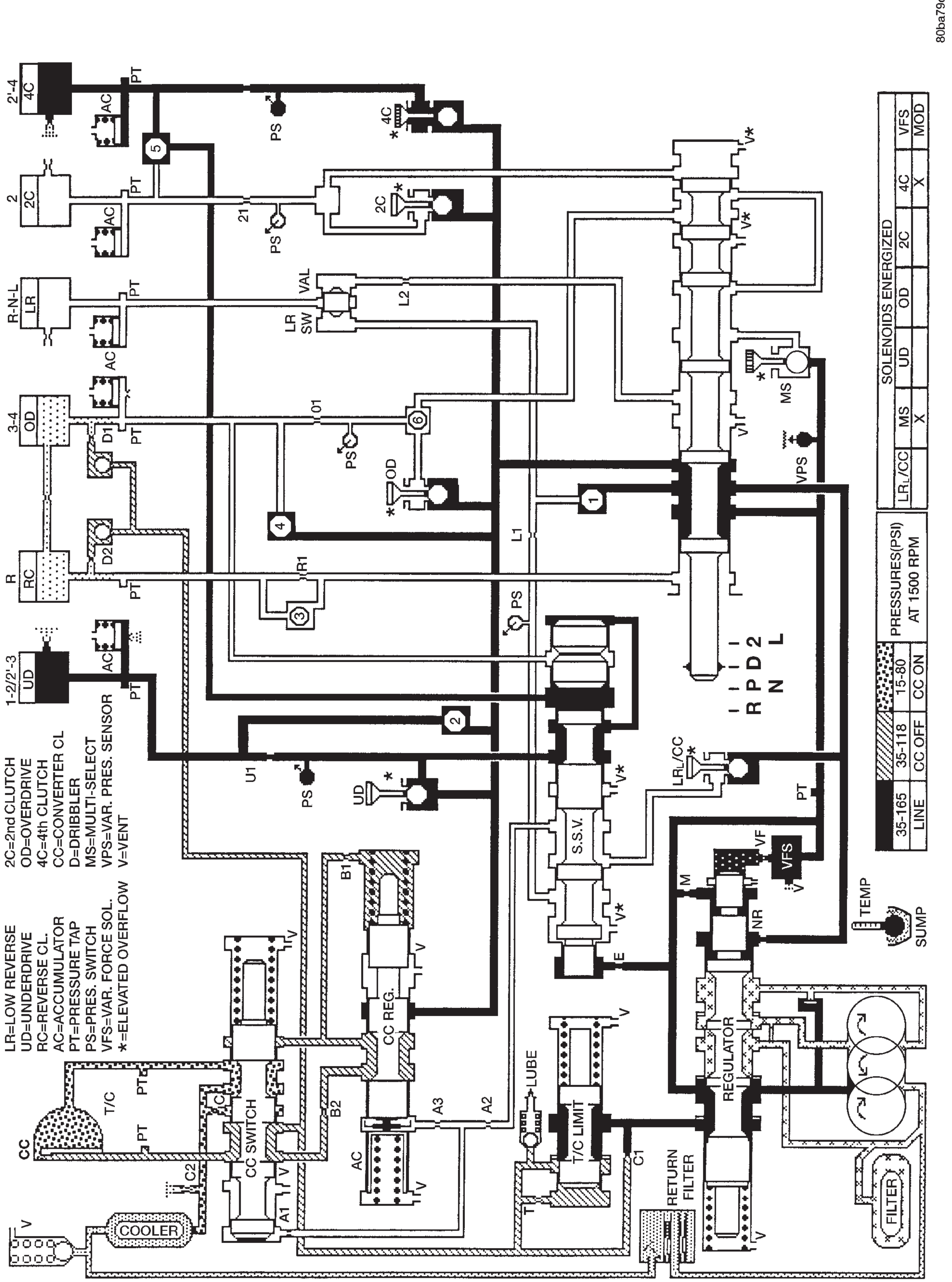


SCHEMATICS AND DIAGRAMS (Continued)



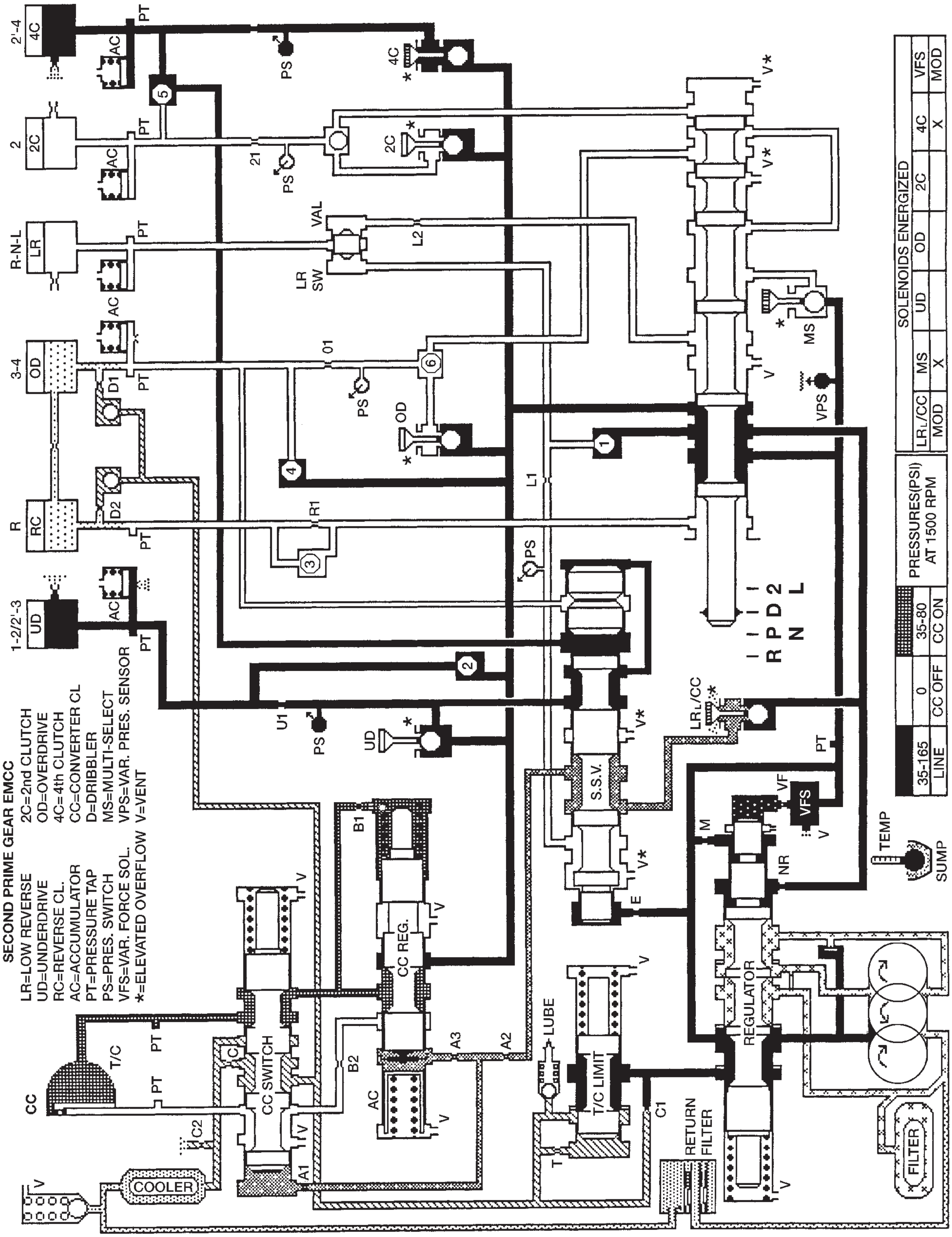
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



45RFE HYDRAULIC SCHEMATIC

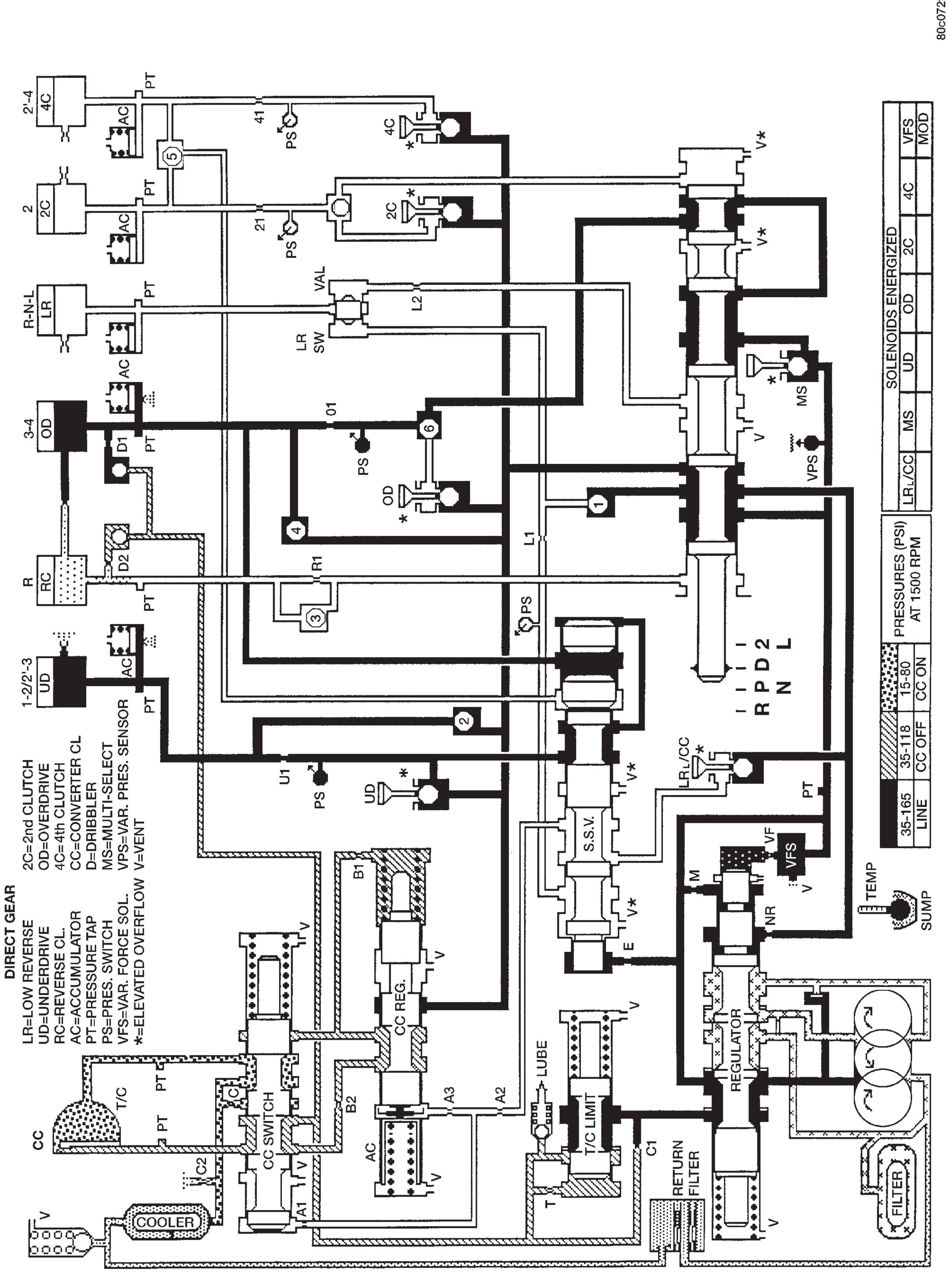
SCHEMATICS AND DIAGRAMS (Continued)



80ba79de

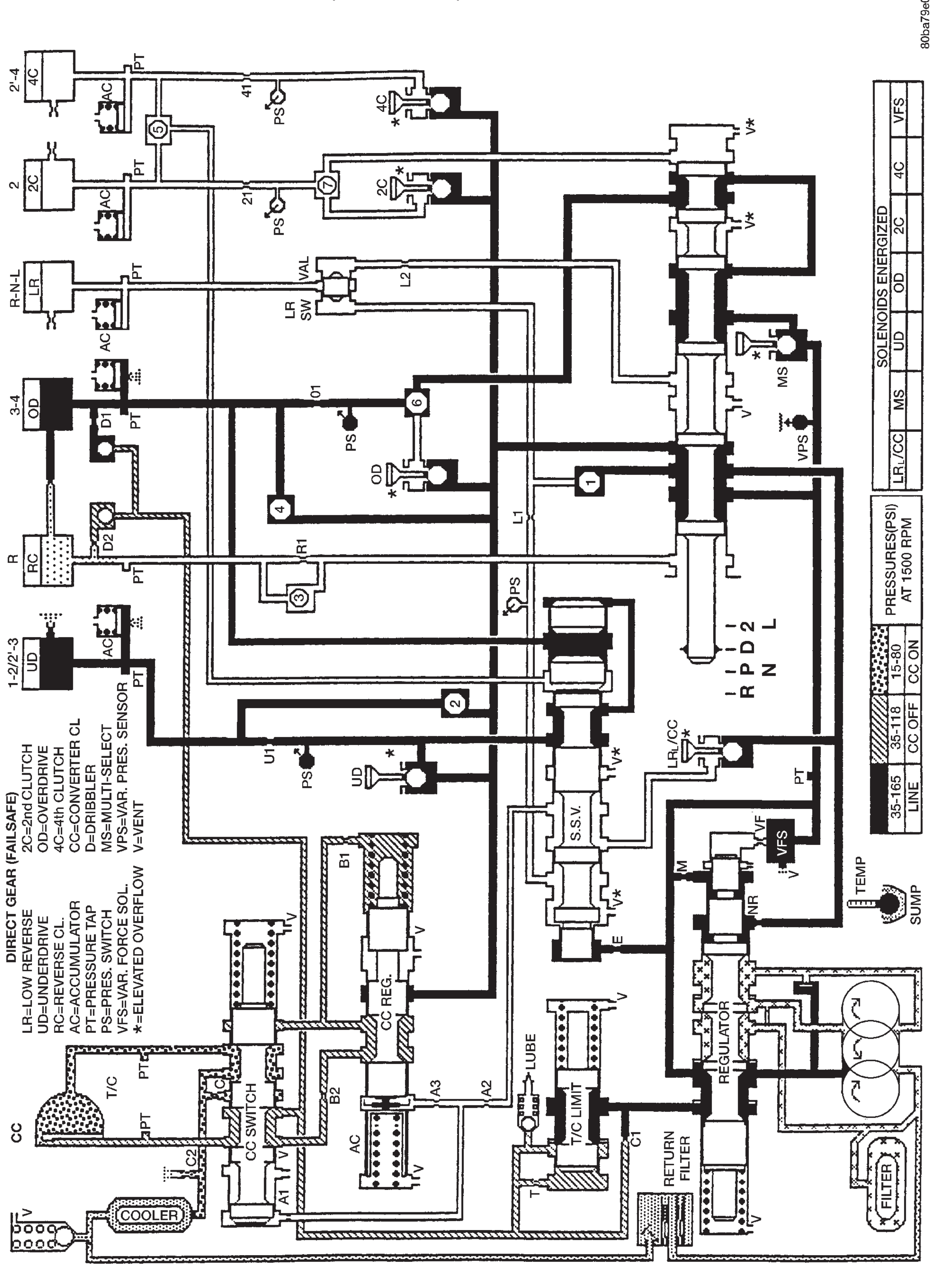
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



45RFE HYDRAULIC SCHEMATIC

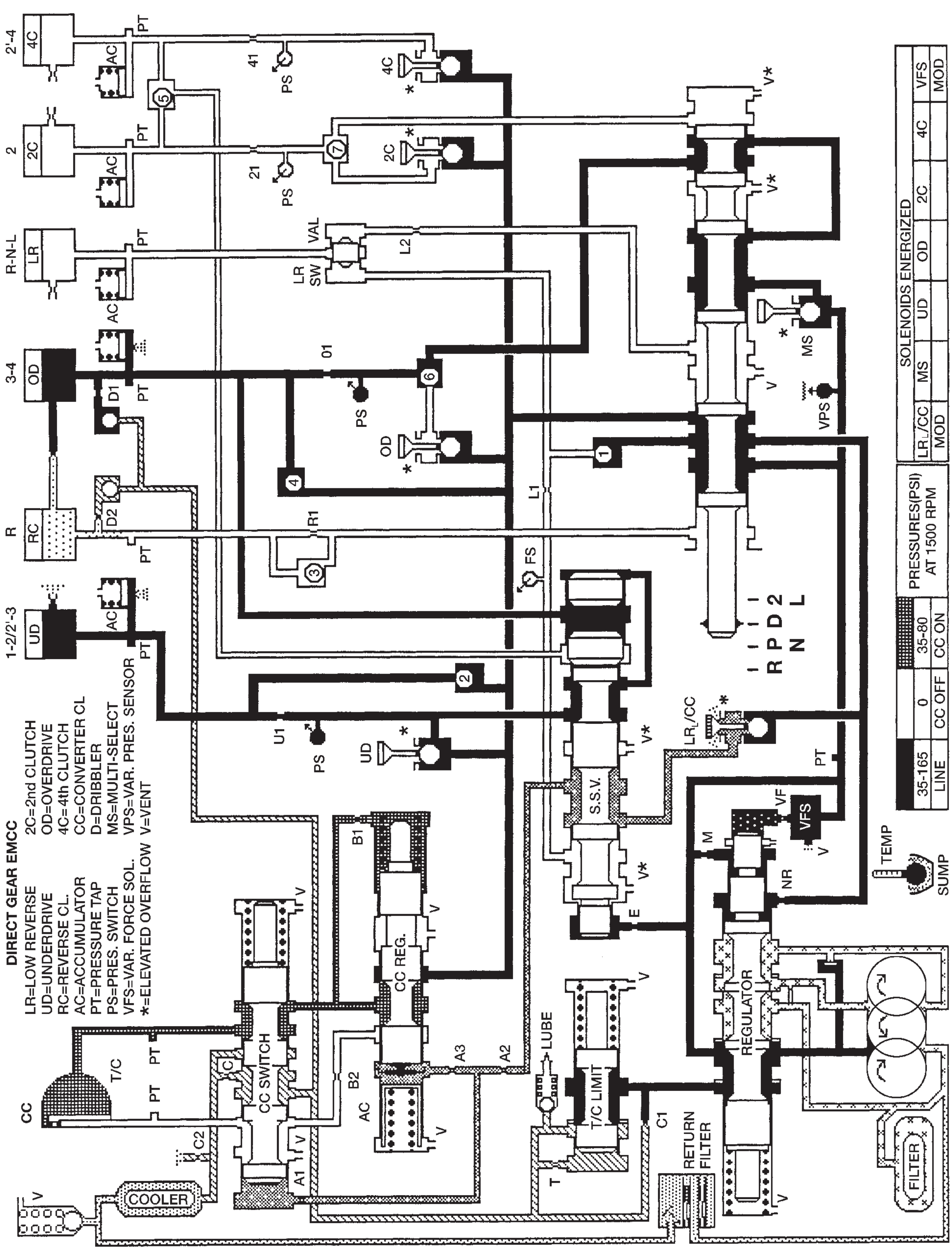
SCHEMATICS AND DIAGRAMS (Continued)



45RFE HYDRAULIC SCHEMATIC

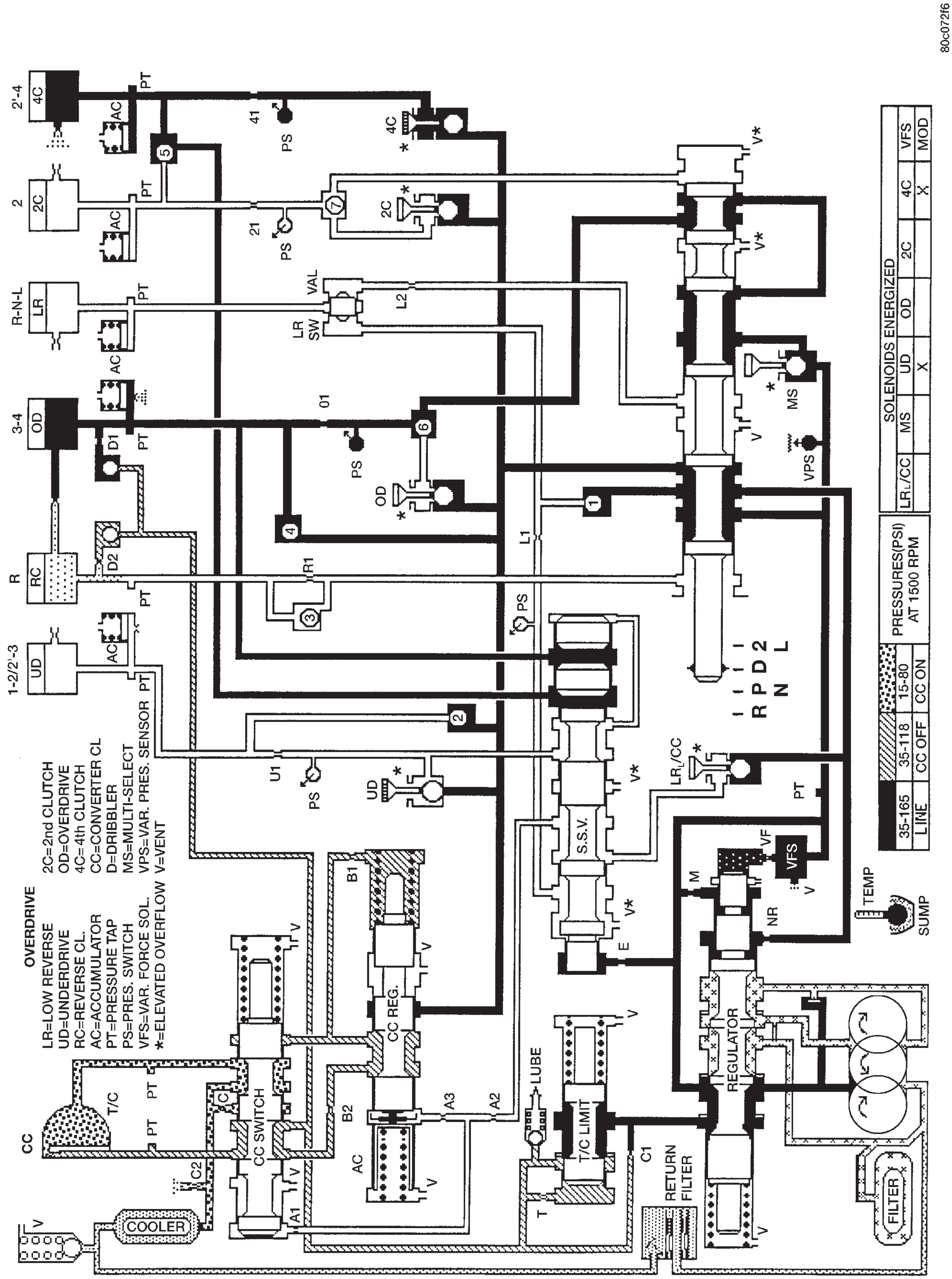
SCHEMATICS AND DIAGRAMS (Continued)

80c072f5



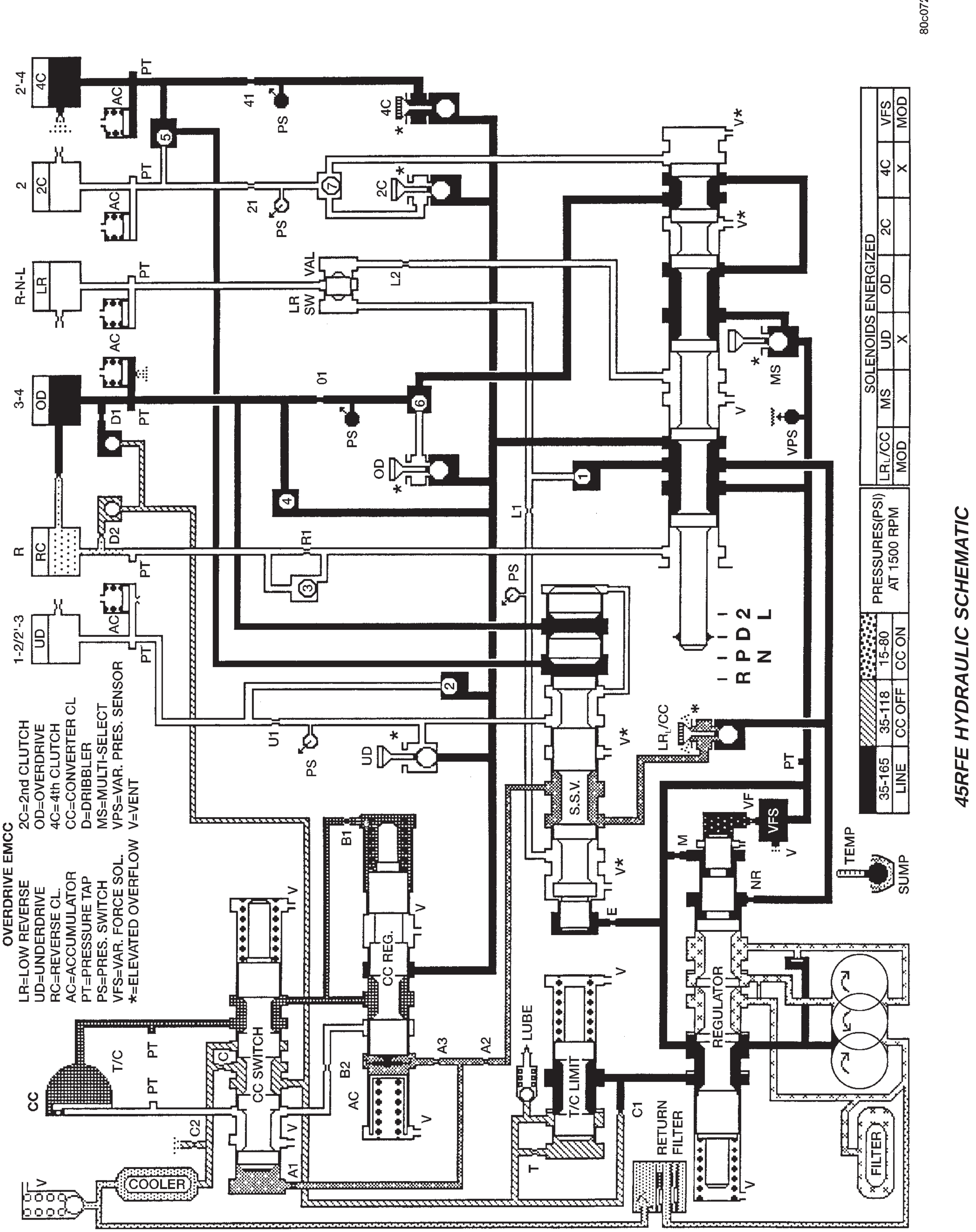
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



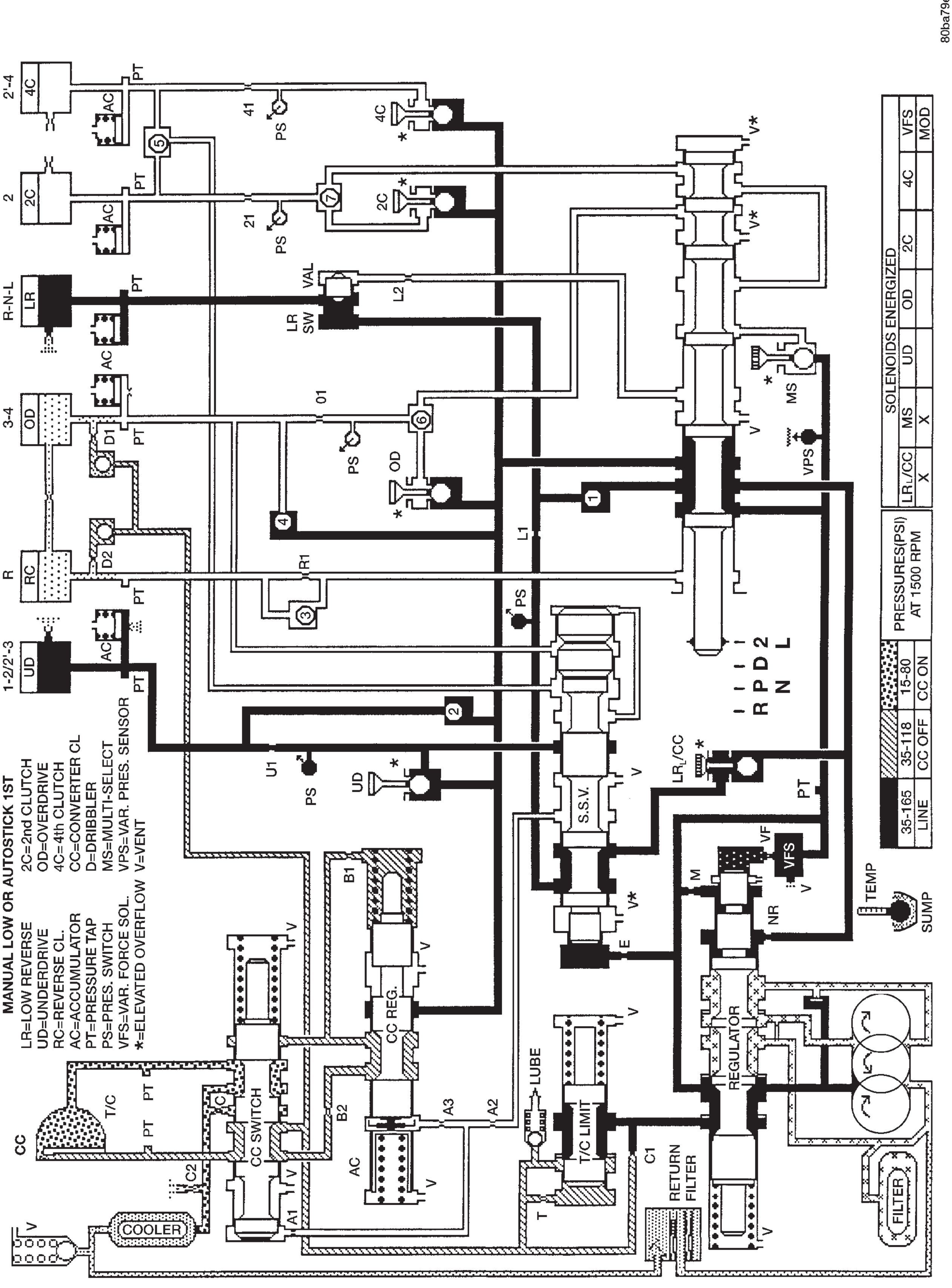
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



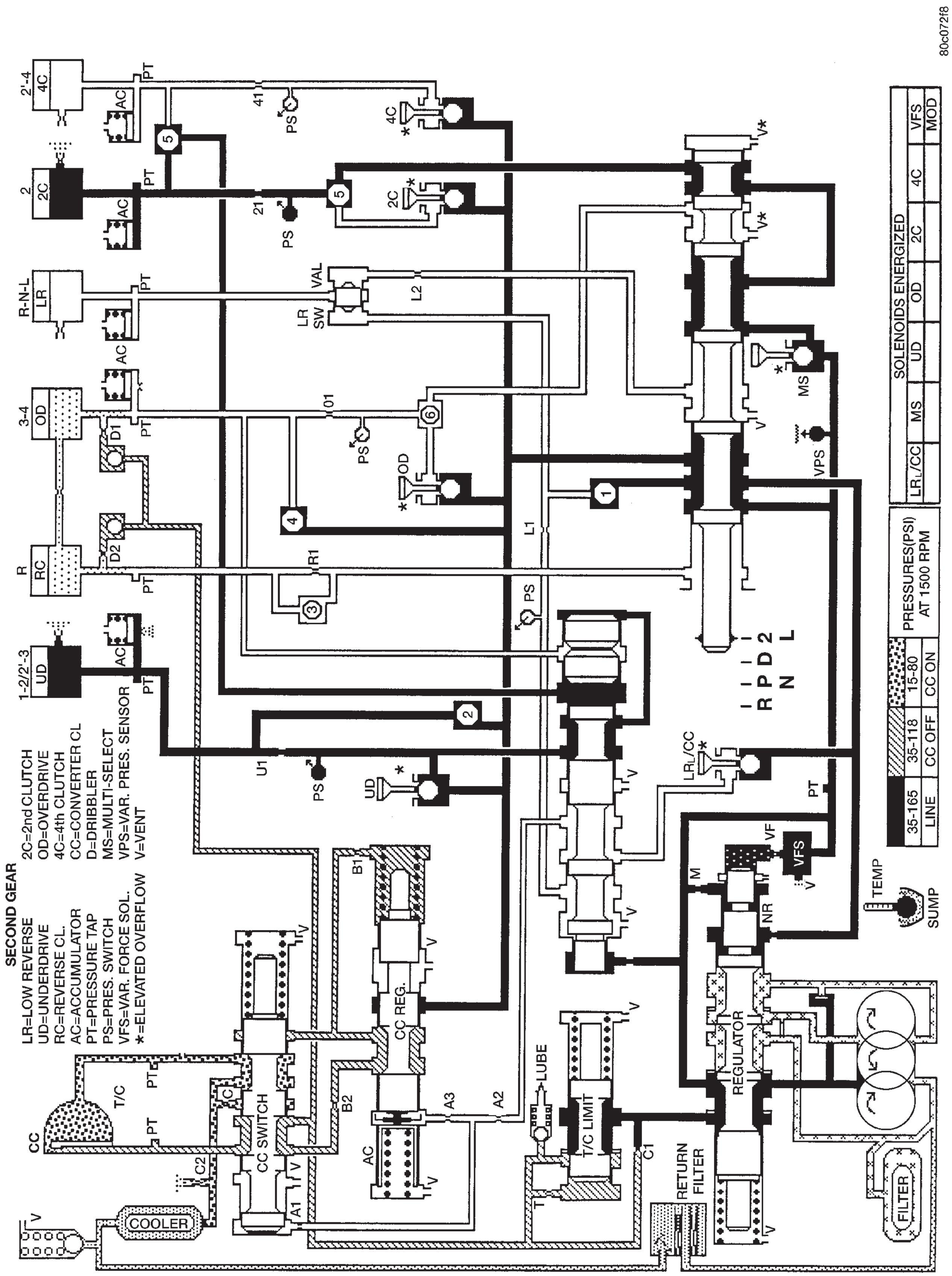
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



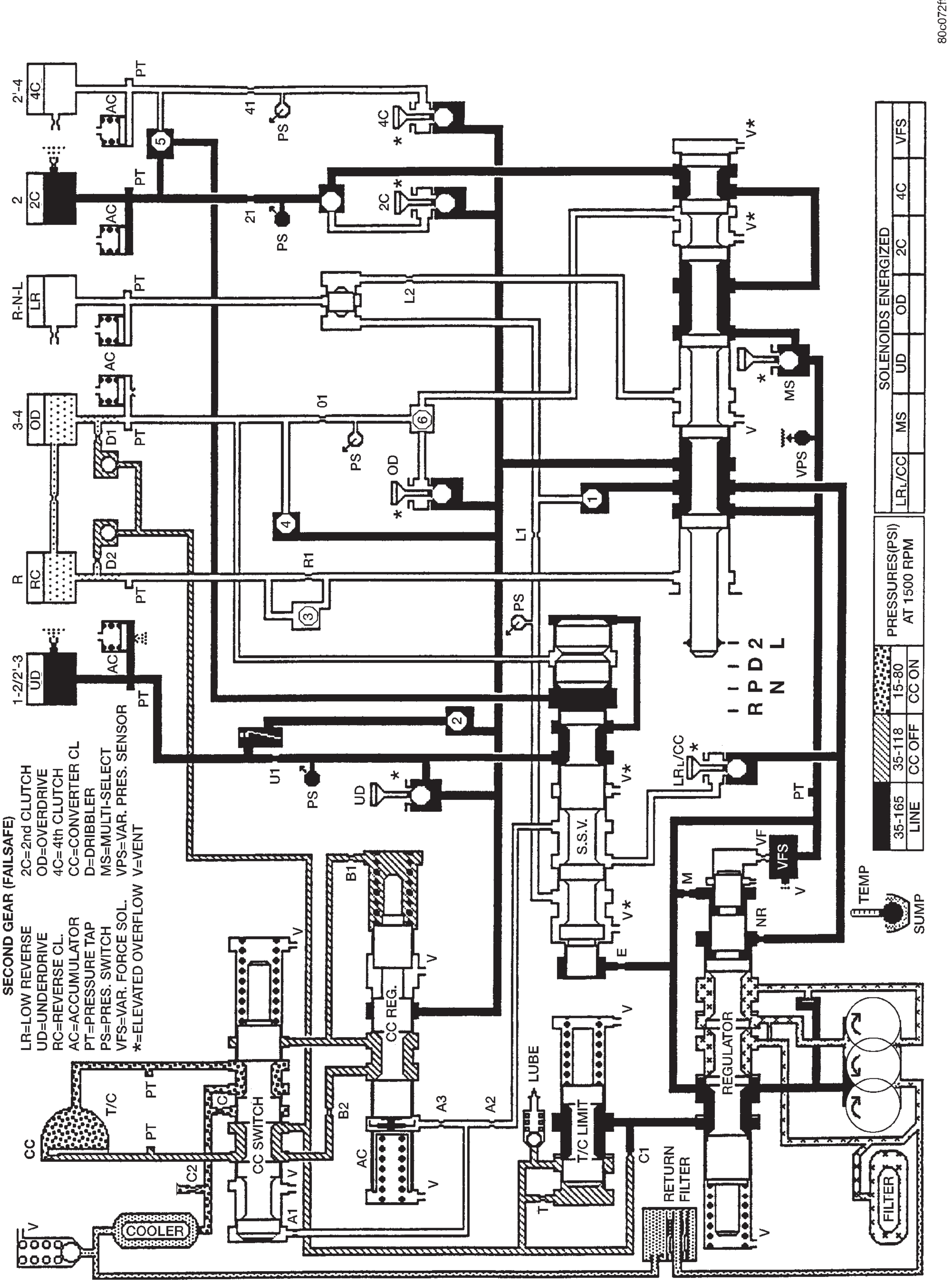
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



45RFE HYDRAULIC SCHEMATIC

SPECIFICATIONS

TRANSMISSION

GENERAL

Component	Metric	Inch
Output Shaft End Play	0.53-0.78 mm	0.021-0.031 in.
Input Shaft End Play	0.79-1.07 mm	0.031-0.042 in.
2C Clutch Pack Clearance	0.53-1.27 mm	0.021-0.050 in.
4C Clutch Pack Clearance	0.81-1.35 mm	0.032-0.053 in.
L/R Clutch Pack Clearance	1.14-1.91 mm	0.045-0.075 in.
OD Clutch Pack Clearance	1.016-1.65 mm	0.040-0.065 in.
UD Clutch Pack Clearance	0.76-1.160 mm	0.030-0.063 in.
Reverse Clutch Pack Clearance	0.81-1.24 mm	0.032-0.049 in.
Recommended fluid	Mopar® ATF Plus 3,type 7176	

GEAR RATIOS

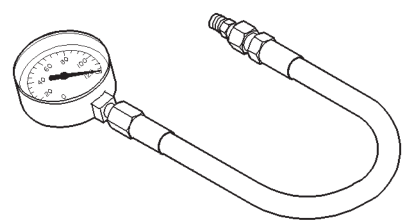
GEAR	RATIO
1ST	3.00:1
2ND	1.67:1
2ND PRIME	1.50:1
3RD	1.00:1
4TH	0.75:1
REVERSE	3.00:1

TORQUE

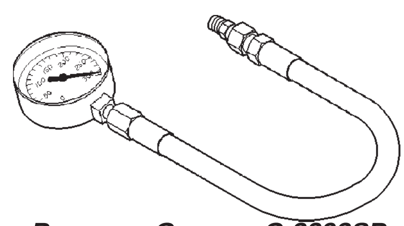
DESCRIPTION	TORQUE
Fitting, Cooler Line	17.5 N·m (155 in. lbs.)
Bolt, Torque Convertor	31 N·m (23 ft. lbs.)
Bolt, Driveplate	75 N·m (55 ft. lbs.)
Bolt/nut, Crossmember	68 N·m (50 ft. lbs.)
Bolt, Oil Pan	11.8 N·m (105 in. lbs.)
Screw, Primary Oil Filter	4.5 N·m (40 in. lbs.)
Filter, Cooler Return	14 N·m (125 in. lbs.)
Bolt, Oil Pump	28.2 N·m (250 in. lbs.)
Bolt, Oil Pump Body to Cover	4.5 N·m (40 in. lbs.)
Screw, Plate to Oil Pump Body	4.5 N·m (40 in. lbs.)
Plug, Pressure Test Port	5.1 N·m (45 in. lbs.)
Bolt, Reaction Shaft Support	11.8 N·m (105 in. lbs.)
Bolt, Valve Body	11.8 N·m (105 in. lbs.)
Screw, Valve Body to Transfer Plate	4.5 N·m (40 in. lbs.)
Screw, Solenoid Module to Transfer Plate	5.7 N·m (50 in. lbs.)
Screw, Accumulator Cover	4.5 N·m (40 in. lbs.)
Screw, Detent Spring	4.5 N·m (40 in. lbs.)
Bolt, Input Speed Sensor	11.8 N·m (105 in. lbs.)
Bolt, Output Speed Sensor	11.8 N·m (105 in. lbs.)
Bolt, Line Pressure Sensor	11.8 N·m (105 in. lbs.)
Bolt, Extension Housing	54 N·m (40 ft. lbs.)
Fitting, Vent	12 N·m (100 in. lbs.)
Screw, Manual Valve Cam Retaining	4.5 N·m (40 in. lbs.)
Bolt, Manual Lever	28.2 N·m (250 in. lbs.)

SPECIAL TOOLS

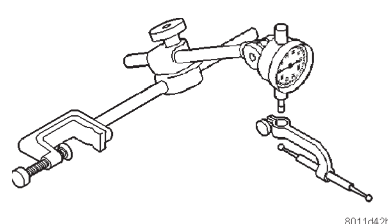
45RFE TRANSMISSION



Pressure Gauge—C-3292

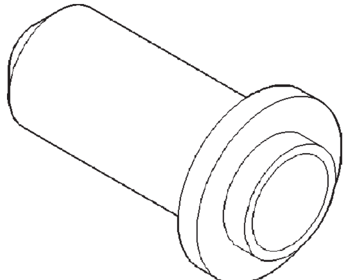


Pressure Gauge—C-3293SP

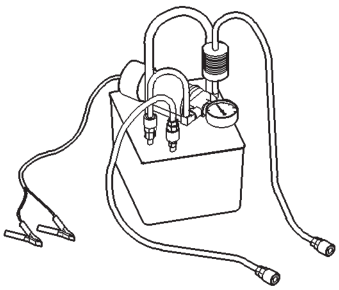


Dial Indicator—C-3339

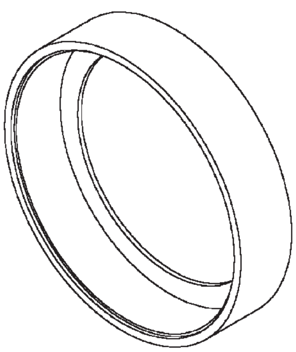
SPECIAL TOOLS (Continued)



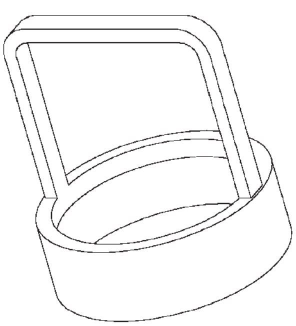
Seal Installer—C-3860–A



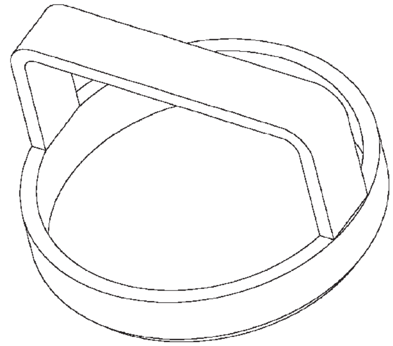
Flusher—6906



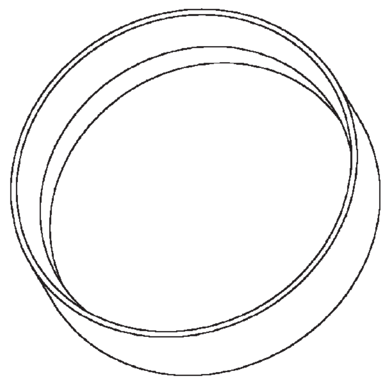
Spring Compressor—8249



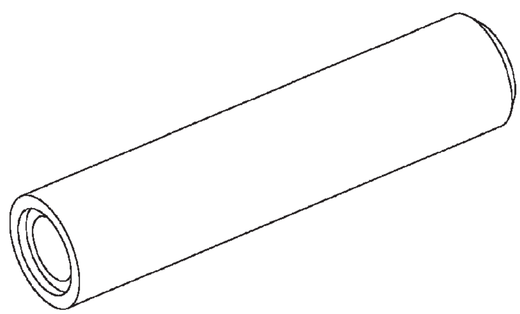
Spring Compressor—8250



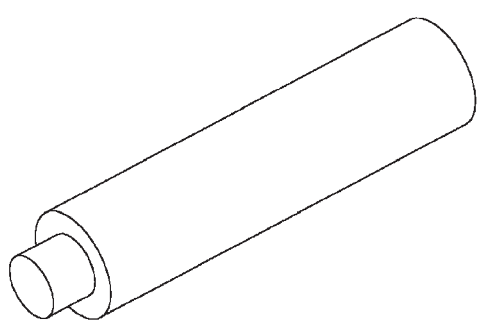
Spring Compressor—8251



Piston Installer—8252

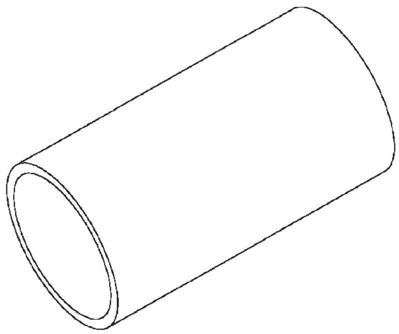


Seal Installer—8253

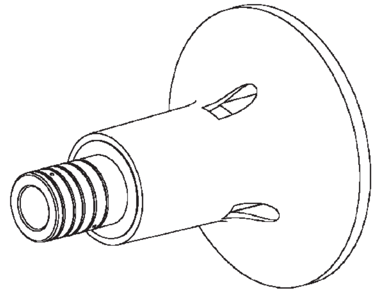


Seal Installer—8254

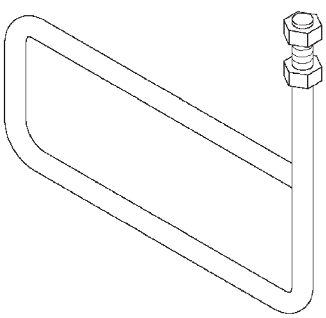
SPECIAL TOOLS (Continued)



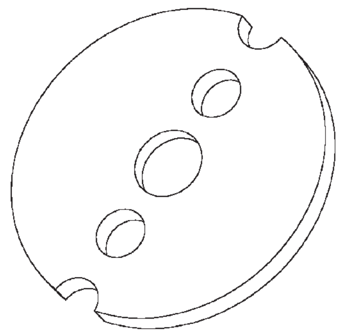
Installer—8255



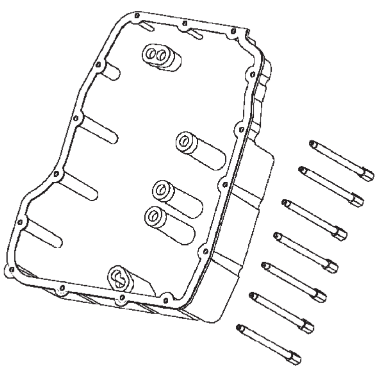
Input Clutch Pressure Fixture—8260



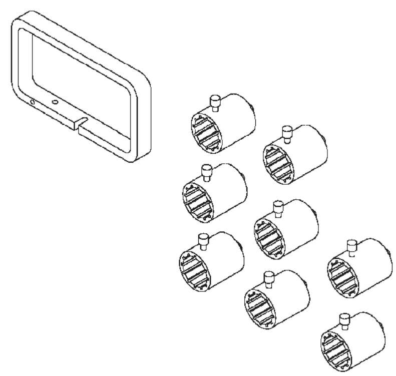
Support Stand—8257



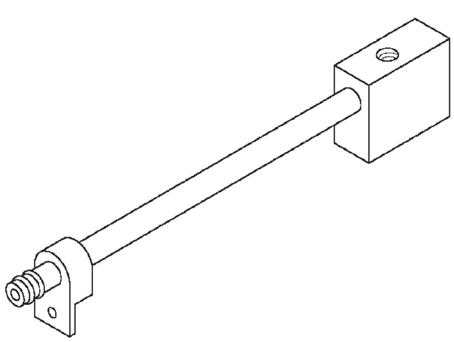
Alignment Plate—8261



Pressure Tap Adapter—8258

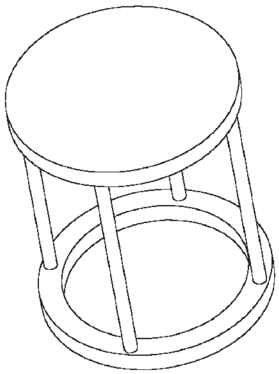


End Play Set—8266

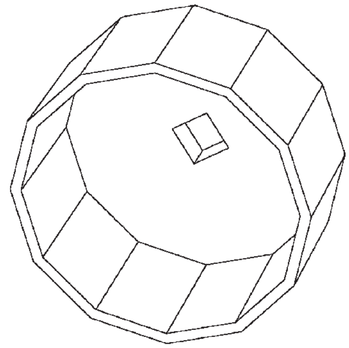


Line Pressure Adapter—8259

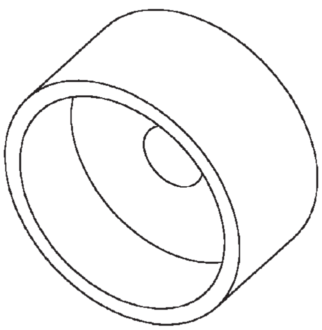
SPECIAL TOOLS (Continued)



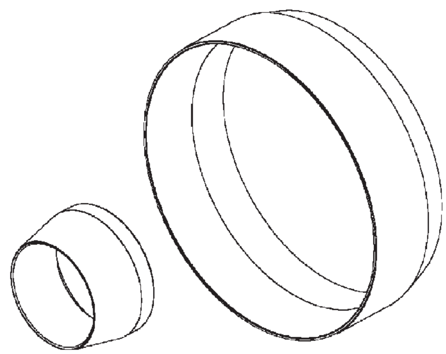
Spring Compressor—8285



Filter Wrench—8321



Bearing Installer—8320



Piston Installer—8504

NV231 TRANSFER CASE

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
NV231 TRANSFER CASE 506
LUBRICANT AND FILL LEVEL 507
DIAGNOSIS AND TESTING
NV231 DIAGNOSIS 507
REMOVAL AND INSTALLATION
TRANSFER CASE 508
TRANSFER CASE SHIFTER 509
FRONT OUTPUT SHAFT SEAL 509
REAR RETAINER BUSHING AND SEAL 509
DISASSEMBLY AND ASSEMBLY
NV231 TRANSFER CASE 511
CLEANING AND INSPECTION
NV231 TRANSFER CASE 527
ADJUSTMENTS
SHIFTER ADJUSTMENT 530
SPECIFICATIONS
TORQUE 531
SPECIAL TOOLS
NV231 531

DESCRIPTION AND OPERATION

NV231 TRANSFER CASE

DESCRIPTION

The NV231 is a part-time transfer case with a low range reduction gear system. The NV231 has three operating ranges plus a Neutral position. A low range system provides a reduction ratio for increased low speed torque capability.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.

OPERATING RANGES

Transfer case operating ranges are:
- 2WD (2-wheel drive)
- 4HI LOCK (4-wheel drive)
- 4LO LOCK (4-wheel drive low range

The 2WD range is for use on any road surface at any time.

The 4HI LOCK and 4LO LOCK ranges are for off road use only. They are not for use on hard surface roads. The only exception being when the road surface is wet or slippery or covered by ice and snow.

The low range reduction gear system is operative in 4LO LOCK range only. This range is for extra pulling power in off road situations. Low range reduction ratio is 2.72:1.

SHIFT MECHANISM

Operating ranges are selected with a body mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod. A straight line shift pattern is used. Range positions are marked on the shifter bezel cover plate.

IDENTIFICATION

A circular ID tag is attached to the rear case of each transfer case (Fig. 1). The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.

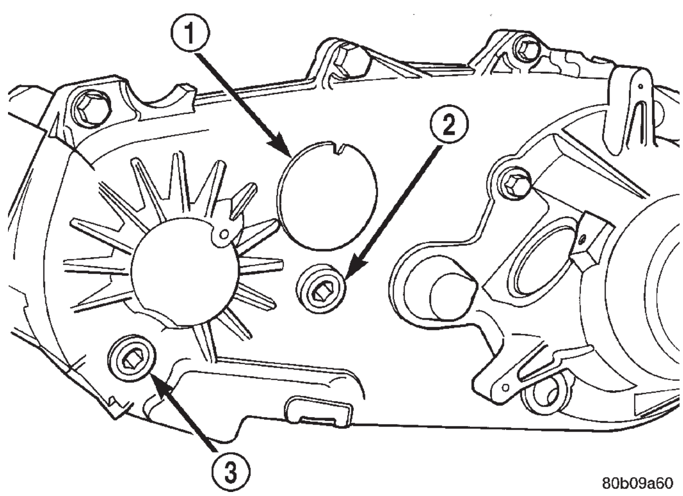


Fig. 1 Fill/Drain Plug And I.D. Tag Locations

1 – I.D. TAG
2 – FILL PLUG
3 – DRAIN PLUG

OPERATION

The input gear is splined to the transmission output shaft. The input gear drives the mainshaft through the planetary assembly and range hub. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and

DESCRIPTION AND OPERATION (Continued)

hub. The sleeve and hub are not equipped with a synchronizer mechanism for shifting.

LUBRICANT AND FILL LEVEL

DESCRIPTION

Recommended lubricant for the NV231 transfer case is Mopar® Dexron III, or ATF+3, type 7176. Approximate lubricant fill capacity is 1.2 liters (2.5 pints).

The fill and drain plugs are both in the rear case (Fig. 2). Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.

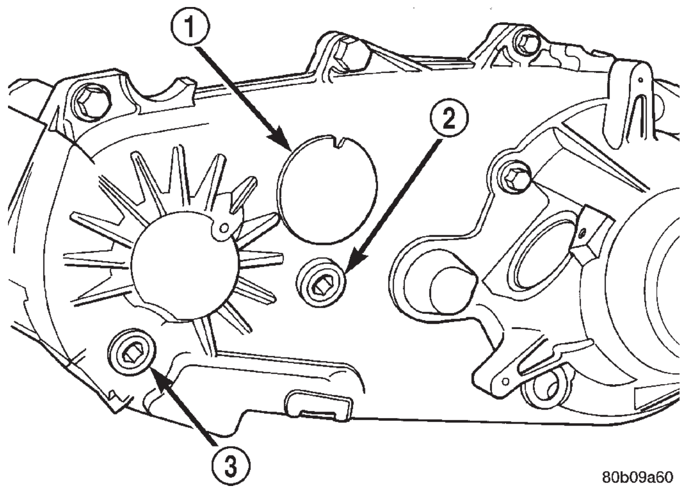


Fig. 2 Fill/Drain Plug Locations

1 – I.D. TAG
2 – FILL PLUG
3 – DRAIN PLUG

DIAGNOSIS AND TESTING

NV231 DIAGNOSIS

DIAGNOSIS CHART

Condition	Possible Cause	Correction
Transfer case difficult to shift or will not shift into desired range.	1) Vehicle speed to great to permit shifting.	1) Slow vehicle and shift into desired range.
	2) If vehicle was operated for an extended period in 4HI LOCK mode on dry surface, driveline torque load may cause difficulty.	2) Stop vehicle and shift transfer case to Neutral position. Transfer case can then be shifted to the desired mode.
	3) Transfer case shift linkage binding.	3) Repair or replace linkage as necessary.
	4) Insufficient or incorrect lubricant.	4) Drain and refill transfer case with the correct quantity of Mopar® DexronIII or ATF+3, type 7176, Automatic transmission fluid.
	5) Internal transfer case components binding, worn, or damaged.	5) Repair or replace components as necessary.
Transfer case noisy in all drive modes.	1) Insufficient or incorrect lubricant.	1) Drain and refill transfer case with the correct quantity of Mopar® DexronIII or ATF+3, type 7176, Automatic transmission fluid.lubricant.

DIAGNOSIS AND TESTING (Continued)

Condition	Possible Cause	Correction
Transfer case noisy while in, or jumps out of, 4LO LOCK mode.	1) Transfer case not completely engaged in 4LO LOCK position.	1) With the transmission in neutral, or clutch depressed on vehicles equiped with a manual transmission, shift transfer case to the Neutral position, and then back into the 4LO LOCK position.
	2) Transfer case shift linkage out of adjustment.	2) Adjust linkage as necessary.
	3) Transfer case shift linkage loose or binding.	3) Repair, replace, or tighten linkage components as necessary.
	4) Range fork damaged, inserts worn, or fork is binding on the shift rail.	4) Repair or replace components as necessary.
	5) Low range gear worn or damaged.	5) Repair or replace components as necessary.
Lubricant leaking from transfer case seals or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Transfer case vent closed or restricted.	2) Clean or replace vent as necessary.
	3) Transfer case seals damaged or installed incorrectly.	3) Replace suspect seal.
Abnormal tire wear.	1) Extended operation in 4HI LOCKmode on dry surfaces,	1) Operate vehicle in 2H mode on dry surfaces.

REMOVAL AND INSTALLATION

TRANSFER CASE

REMOVAL

(1) Shift transfer case into 2WD.
(2) Raise vehicle.
(3) Drain transfer case lubricant.
(4) Mark front and rear propeller shafts for alignment reference.
(5) Support transmission with jack stand.
(6) Remove rear crossmember and skid plate, if equipped.
(7) Disconnect front and rear propeller shafts at transfer case.
(8) Disconnect transfer case linkage rod from range lever.
(9) Disconnect transfer case vent hose (Fig. 3) and indicator switch harness, if necessary.
(10) Support transfer case with transmission jack.
(11) Secure transfer case to jack with chains.
(12) Remove nuts attaching transfer case to transmission.
(13) Pull transfer case and jack rearward to disengage transfer case.
(14) Remove transfer case from under vehicle.

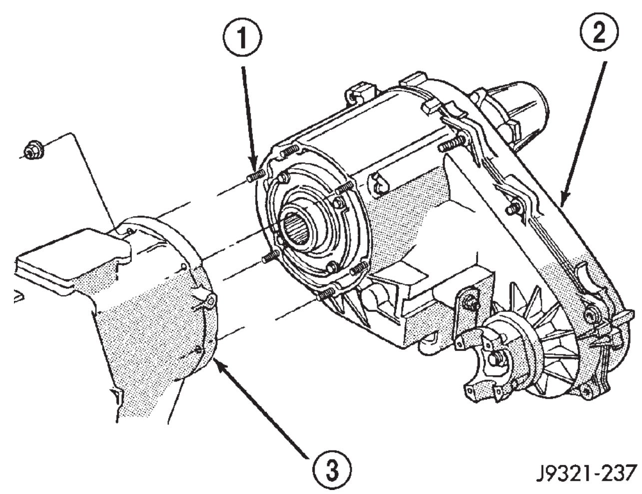


Fig. 3 Transfer Case Mounting–Typical

1 – MOUNTING STUDS
2 – TRANSFER CASE
3 – TRANSMISSION

INSTALLATION

(1) Mount transfer case on a transmission jack.
(2) Secure transfer case to jack with chains.
(3) Position transfer case under vehicle.
(4) Align transfer case and transmission shafts and install transfer case on transmission.

REMOVAL AND INSTALLATION (Continued)

(5) Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque (Fig. 3).

(6) Connect vent hose.

(7) Connect indicator switch harness to transfer case switch, if necessary. Secure wire harness to clips on transfer case.

(8) Align and connect the propeller shafts.

(9) Fill transfer case with correct fluid. Refer to Lubricant And Fill Level section for proper fluid and capacity.

(10) Install rear crossmember and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.

(11) Remove transmission jack and support stand.

(12) Connect shift rod to transfer case range lever.

(13) Verify the adjustment of the transfer case shift linkage.

(14) Lower vehicle and verify transfer case shift operation.

TRANSFER CASE SHIFTER

REMOVAL

(1) Shift transfer case and shifter into the 2WD position.

(2) Raise and support vehicle.

(3) Loosen adjusting trunnion lock bolt and slide shift rod out of trunnion (Fig. 4). If rod lacks enough travel to come out of trunnion, push trunnion out of the shifter arm.

(4) Lower the vehicle.

(5) Remove transfer case shifter knob cap.

(6) Remove nut holding shifter knob to shift lever.

(7) Remove shifter knob.

(8) Remove the shifter bezel.

(9) Remove the shift lever.

(10) Remove bolts holding shifter to vehicle floor pan.

(11) Separate shifter from the vehicle.

INSTALLATION

(1) If a new shifter is not being installed, secure an appropriately sized pin through the adjustment channel and hole, located in the base of the shifter body.

(2) Position shifter on the vehicle floor pan.

(3) Install the bolts to hold the shifter to the floor pan. Tighten the bolts to 12.4 N·m (110 in.lbs.).

(4) Install the shift lever to the shifter. Tighten the shift lever bolt to 28.3 N·m (250 in.lbs.).

(5) Install the shifter bezel.

(6) Install shift knob on shift lever.

(7) Install nut to hold shifter knob to shift lever.

(8) Install shifter knob cap.

(9) Raise the vehicle.

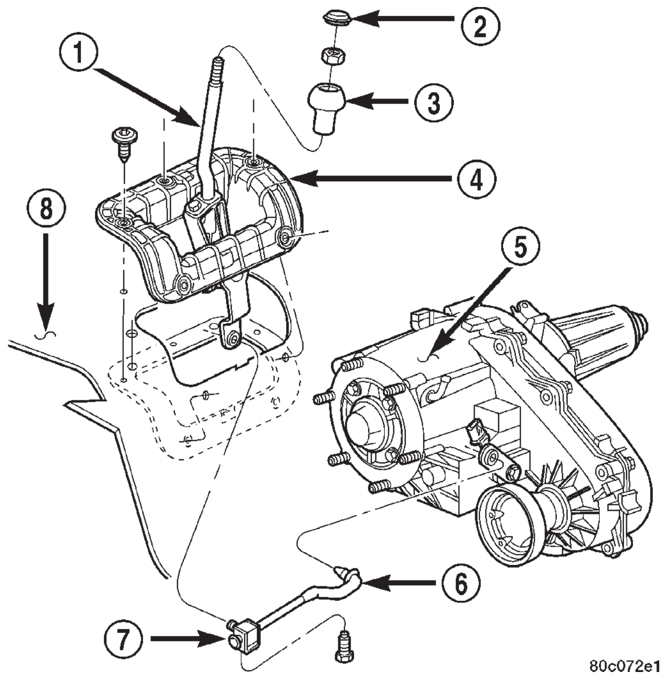


Fig. 4 Shifter

(10) Install the shift rod to the trunnion, if necessary.

(11) Tighten trunnion lock bolt 10 N·m (90 in.lbs).

(12) Remove the locating pin from the adjustment channel and hole in the base of the shifter.

(13) Lower vehicle.

(14) Verify transfer case operation.

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle.

(2) Remove front propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedure.

(3) Remove front output shaft yoke.

(4) Remove seal from front case with pry tool (Fig. 5).

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 8143 as follows:

(a) Place new seal on tool. Garter spring on seal goes toward interior of case.

(b) Start seal in bore with light taps from hammer (Fig. 6). Once seal is started, continue tapping seal into bore until installer tool seats against case.

REAR RETAINER BUSHING AND SEAL

REMOVAL

(1) Raise vehicle.

(2) Remove rear propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedure.

REMOVAL AND INSTALLATION (Continued)

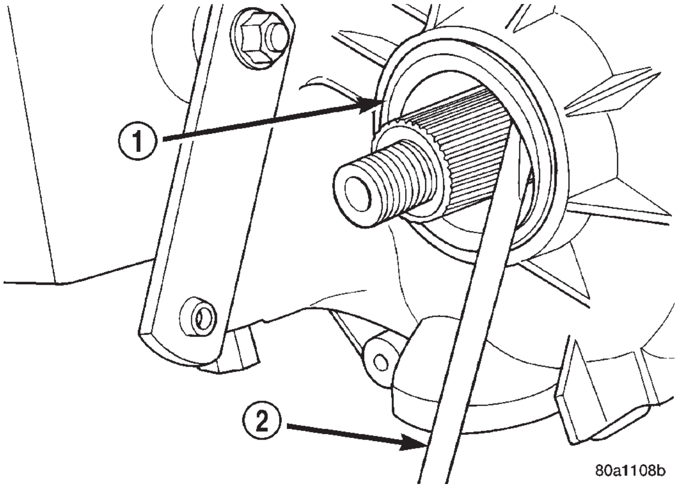


Fig. 5 Remove Front Output Shaft Seal

1 – OUTPUT SHAFT SEAL
2 – PRYBAR

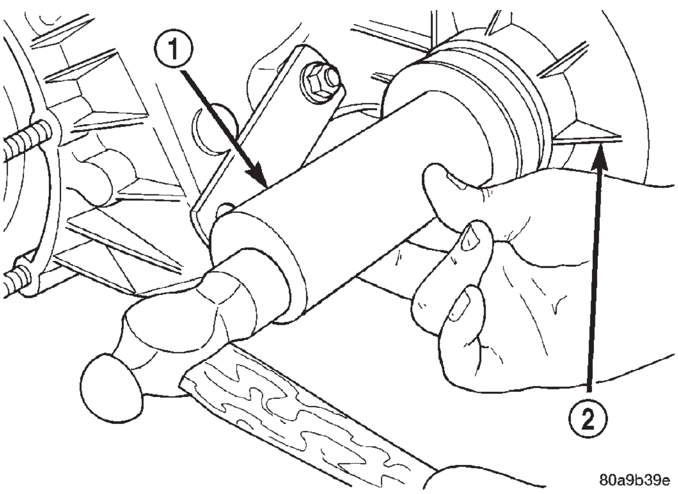


Fig. 6 Front Output Seal Installation

1 – INSTALLER 8143
2 – TRANSFER CASE

(3) Using a suitable pry tool or slide-hammer mounted screw, remove the rear retainer seal.

(4) Using Remover 6957, remove bushing from rear retainer (Fig. 7).

INSTALLATION

(1) Clean fluid residue from sealing surface and inspect for defects.

(2) Position replacement bushing in rear retainer with fluid port in bushing aligned with slot in retainer.

(3) Using Installer 8160, drive bushing into retainer until installer seats against case (Fig. 8).

(4) Using Installer C-3995-A, install seal in rear retainer (Fig. 9).

(5) Install propeller shaft.

(6) Verify proper fluid level.

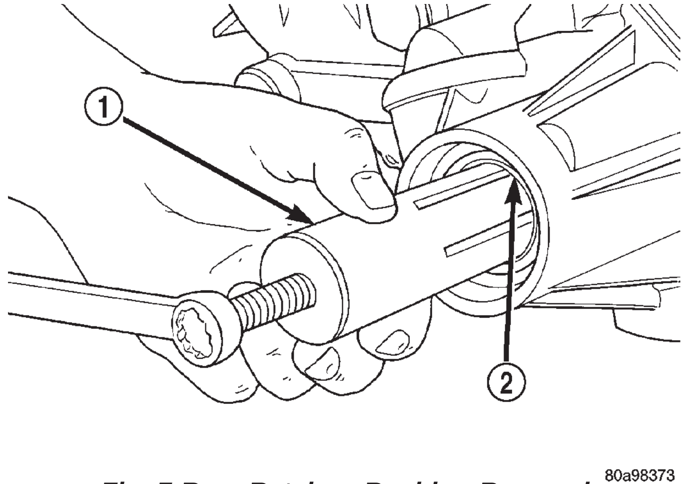


Fig. 7 Rear Retainer Bushing Removal

1 – REMOVER 6957
2 – REAR RETAINER BUSHING

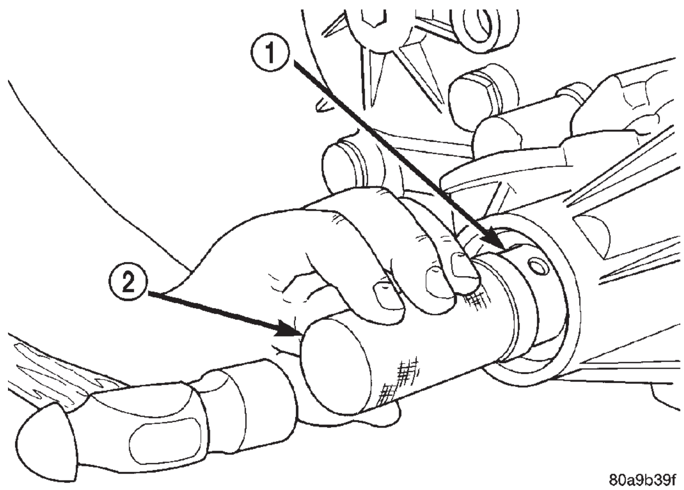


Fig. 8 Rear Retainer Bushing Install

1 – REAR RETAINER BUSHING
2 – INSTALLER 8160

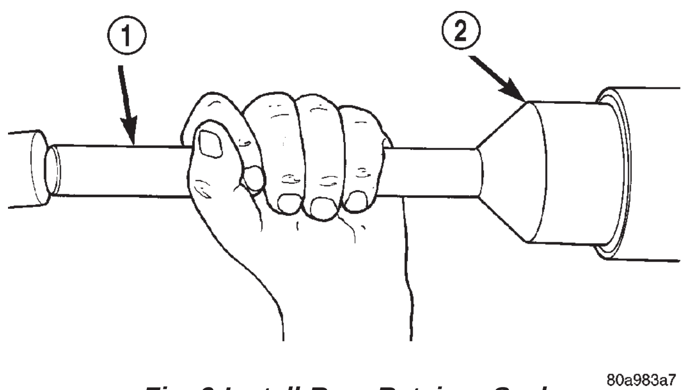


Fig. 9 Install Rear Retainer Seal

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3995-A

(7) Lower vehicle.

DISASSEMBLY AND ASSEMBLY

NV231 TRANSFER CASE

DISASSEMBLY

Position transfer case on shallow drain pan. Remove drain plug and drain lubricant remaining in case.

REAR RETAINER AND OIL PUMP REMOVAL

(1) Remove extension housing bolts.

(2) Tap extension housing with plastic or rawhide mallet to loosen sealer (Fig. 10).

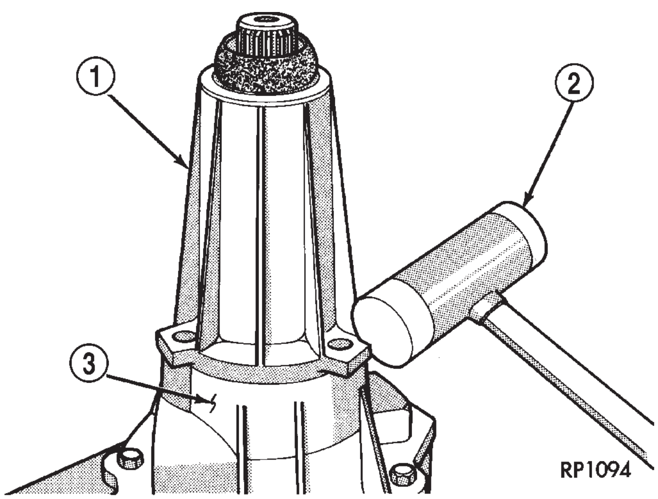


Fig. 10 Remove Extension Housing

1 – EXTENSION HOUSING
2 – PLASTIC HAMMER
3 – REAR RETAINER

(3) Separate extension housing from rear retainer.

(4) Remove rear bearing snap-ring (Fig. 11).

(5) Remove bolts holding rear retainer to rear case half.

(6) Loosen rear retainer with pry tool to break sealer bead. Pry only against retainer boss as shown (Fig. 12).

(7) Disengage oil pickup tube from oil pump and remove oil pump assembly (Fig. 13).

(8) Remove pick-up tube o-ring from oil pump (Fig. 14), if necessary. Do not disassemble the oil pump, it is not serviceable.

YOKE AND RANGE LEVER REMOVAL

(1) Remove transfer case indicator switch.

(2) Remove front yoke nut as follows:

(a) Move range lever to 4L position.

(b) Then remove nut with socket and impact wrench (Fig. 15).

(3) Remove yoke. If yoke is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller (Fig. 16). Be sure puller tool is positioned on yoke and not on slinger as slinger will be damaged.

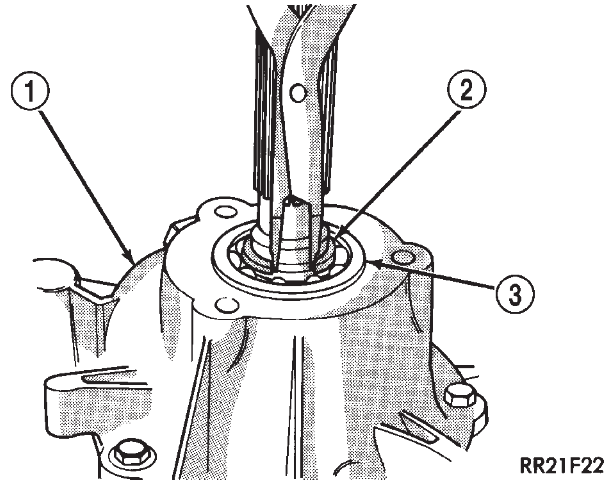


Fig. 11 Remove Rear Bearing Snap-ring

1 – REAR RETAINER
2 – SNAP RING
3 – REAR BEARING

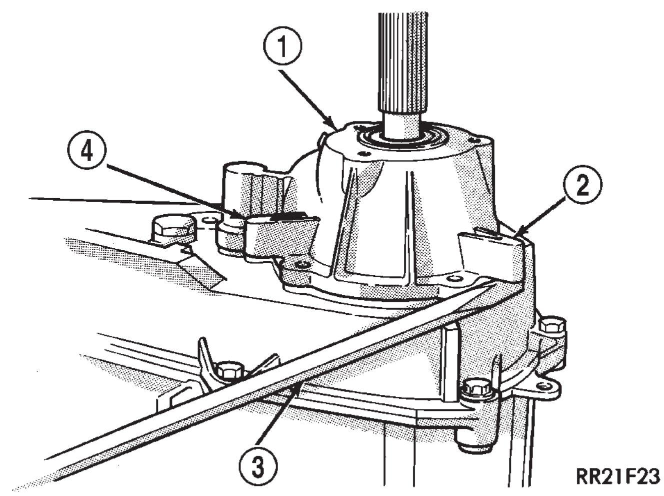


Fig. 12 Loosening Rear Retainer

1 – REAR RETAINER
2 – TAB (2)
3 – SCREWDRIVER
4 – TAB

(4) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(5) Remove nut and washer that attach range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft (Fig. 17).

FRONT OUTPUT SHAFT AND DRIVE CHAIN REMOVAL

(1) Support transfer case so rear case is facing upward.

DISASSEMBLY AND ASSEMBLY (Continued)

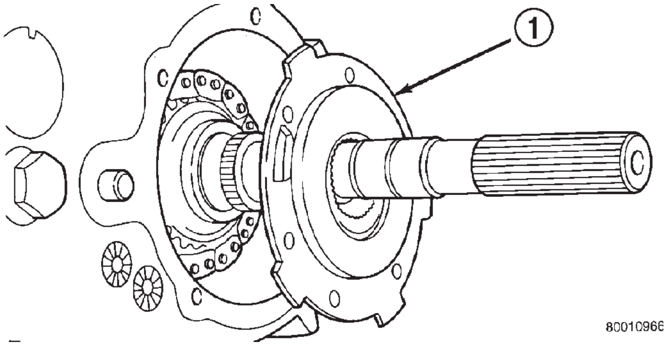


Fig. 13 Oil Pump Removal

1 – OIL PUMP

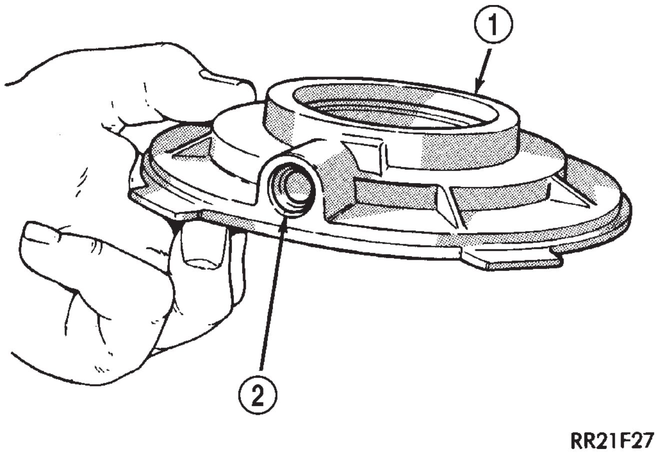


Fig. 14 Pick-up Tube O-ring Location

1 – OIL PUMP
2 – O-RING

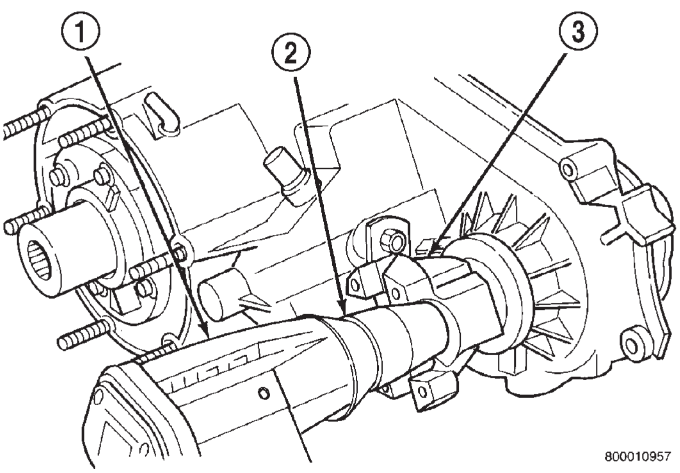


Fig. 15 Yoke Nut Removal

1 – IMPACT WRENCH
2 – SOCKET
3 – YOKE

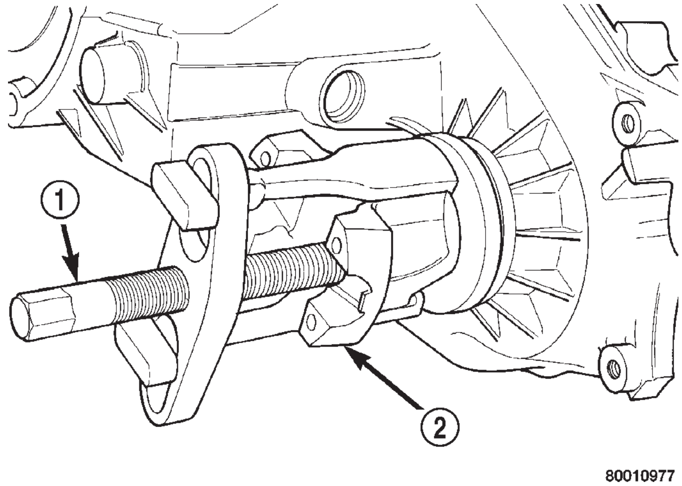


Fig. 16 Yoke Removal

1 – PULLER TOOL
2 – YOKE

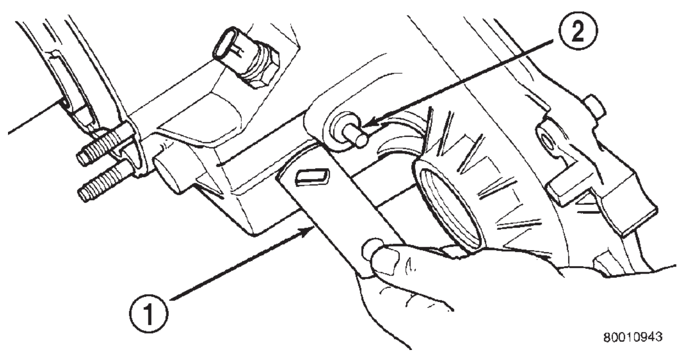


Fig. 17 Range Lever Removal

1 – RANGE LEVER
2 – SECTOR SHAFT

(2) Remove bolts holding front case to rear case. The case alignment bolts require flat washers (Fig. 18).

(3) Loosen rear case with flat blade screwdriver to break sealer bead. Insert pry tool blade only into notches provided at each end of case (Fig. 19).

(4) Remove rear case from front case.

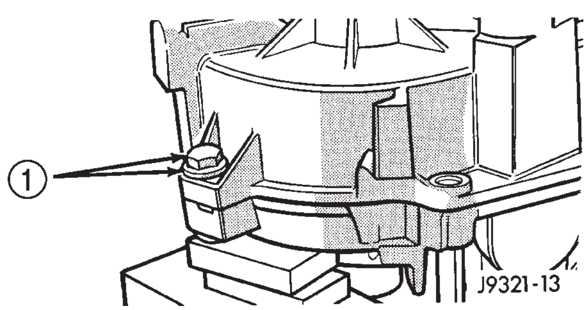


Fig. 18 Rear Case Alignment Bolt Locations

1 – ALIGNMENT BOLT AND WASHER (AT EACH END OF CASE)

DISASSEMBLY AND ASSEMBLY (Continued)

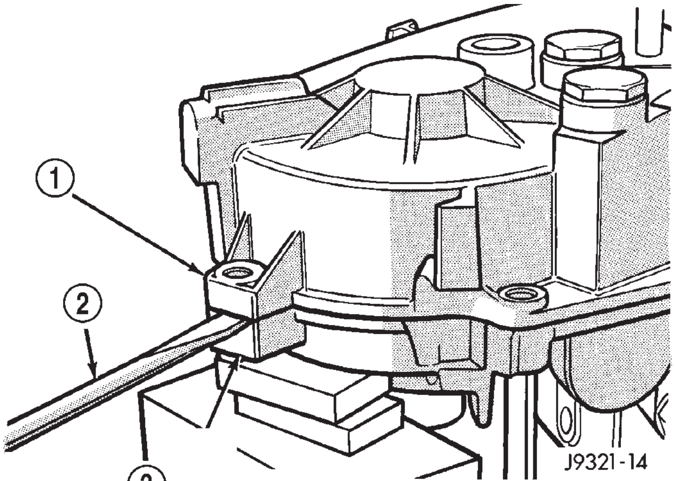


Fig. 19 Loosening Rear Case

1 – REAR CASE
2 – PRY TOOL (IN CASE SLOT)
3 – FRONT CASE

(5) Remove oil pickup tube from rear case (Fig. 20).

(6) Remove mode fork spring (Fig. 21).

(7) Pull front output shaft upward and out of front output shaft bearing (Fig. 22).

(8) Remove front output shaft and chain.

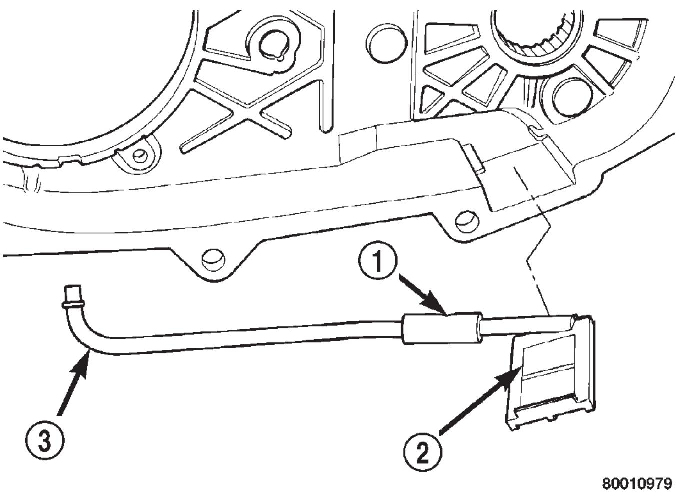


Fig. 20 Oil Pickup Tube Removal

1 – CONNECTING HOSE
2 – PICKUP SCREEN
3 – PICKUP TUBE

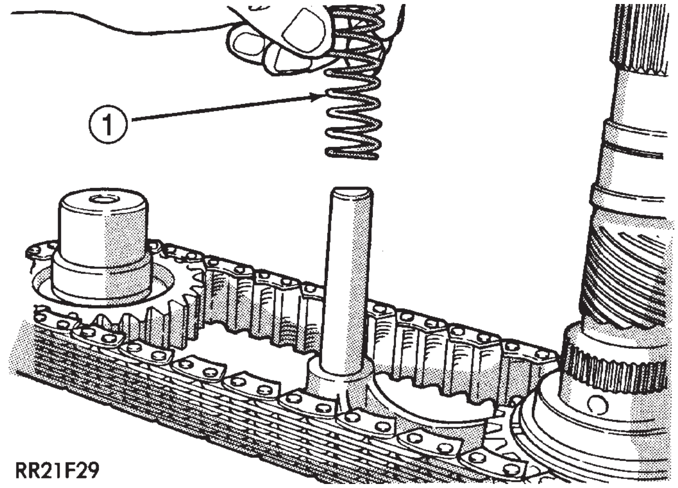


Fig. 21 Mode Fork Spring Removal

1 – MODE SPRING

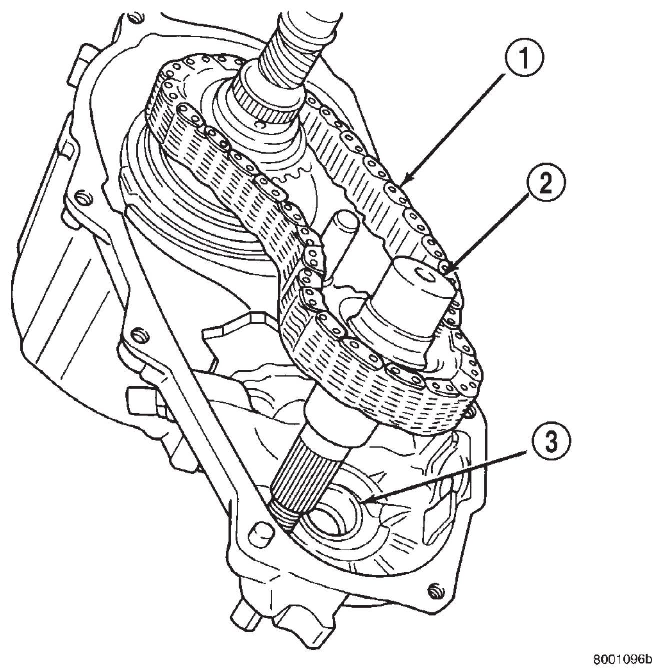


Fig. 22 Remove Front Output Shaft And Chain

1 – DRIVE CHAIN
2 – FRONT OUTPUT SHAFT
3 – SHAFT FRONT BEARING

DISASSEMBLY AND ASSEMBLY (Continued)

SHIFT FORKS AND MAINSHAFT REMOVAL

(1) Remove detent plug, O-ring, detent spring and detent plunger (Fig. 23).

(2) Remove mainshaft from mode sleeve and input gear pilot bearing.

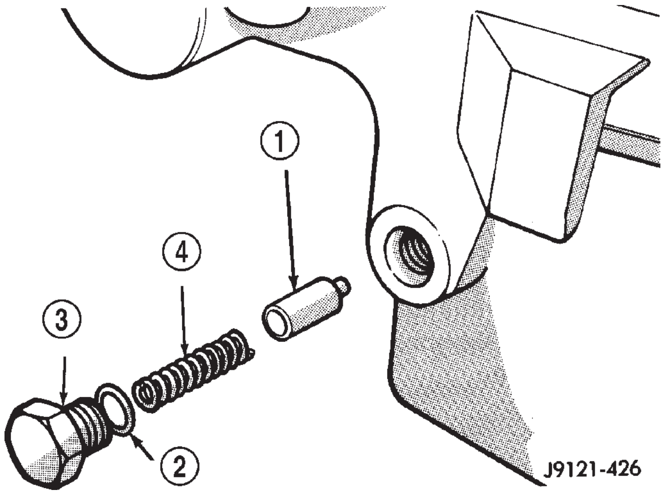


Fig. 23 Detent Plug, Spring And Plunger Removal

1 – PLUNGER
2 – O-RING
3 – PLUG
4 – SPRING

(3) Remove mode fork and sleeve as an assembly (Fig. 24). Note position of sleeve for assembly reference. The short side of the sleeve faces upward.

(4) Remove range fork and hub as an assembly (Fig. 25). Note fork position for installation reference.

(5) Remove shift sector from front case (Fig. 26).

(6) Remove shift sector bushing and O-ring (Fig. 27).

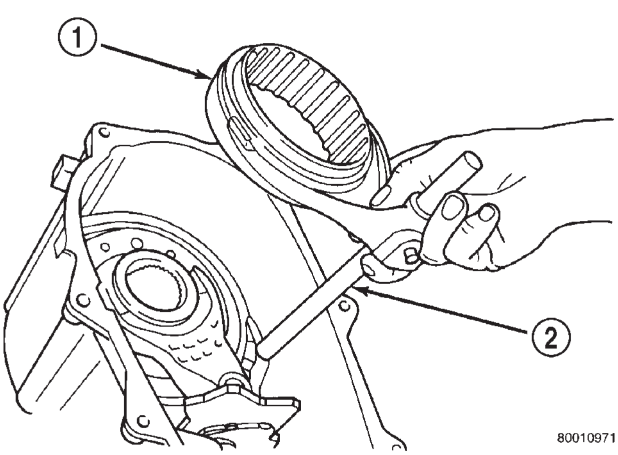


Fig. 24 Mode Fork And Sleeve Removal

1 – MODE SLEEVE
2 – MODE FORK AND RAIL

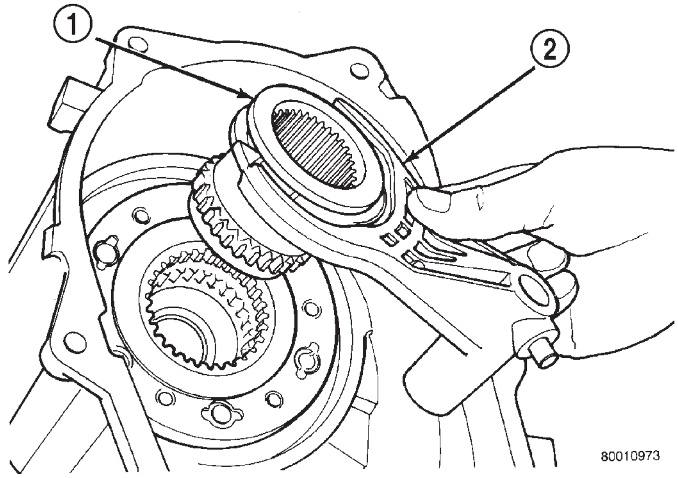


Fig. 25 Range Fork And Hub Removal

1 – RANGE HUB
2 – RANGE FORK

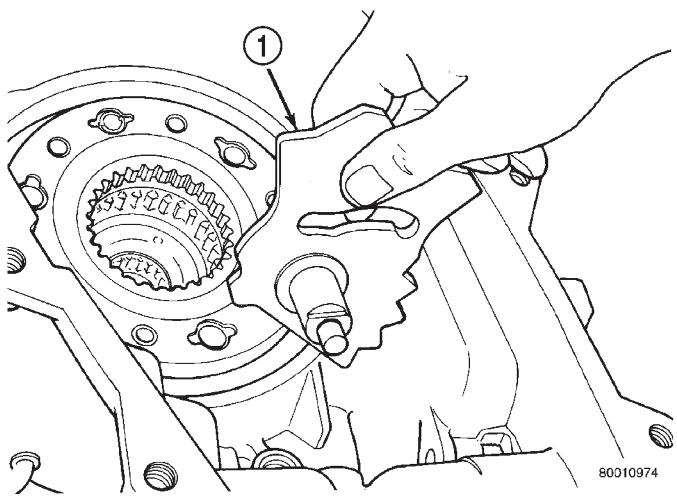


Fig. 26 Shift Sector Removal

1 – SHIFT SECTOR

MAINSHAFT DISASSEMBLY

(1) Remove mode hub retaining ring with heavy duty snap-ring pliers (Fig. 28).

(2) Slide mode hub off mainshaft (Fig. 29).

(3) Slide drive sprocket off mainshaft (Fig. 30).

DISASSEMBLY AND ASSEMBLY (Continued)

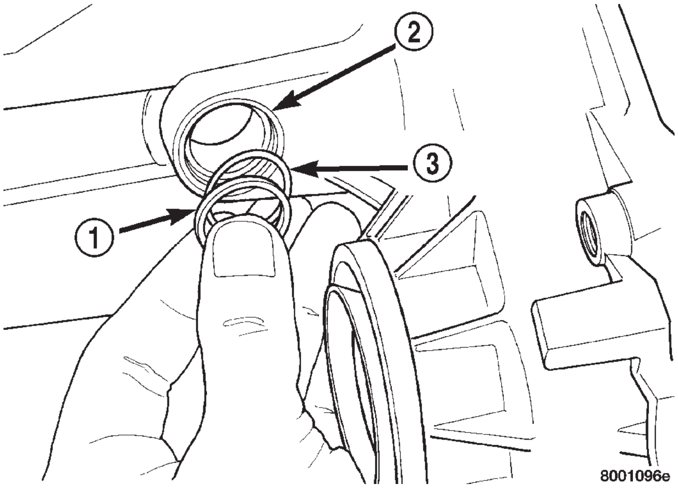


Fig. 27 Sector Bushing And O-Ring Removal

1 – SEAL RETAINER
2 – SECTOR SHAFT BORE
3 – O-RING SEAL

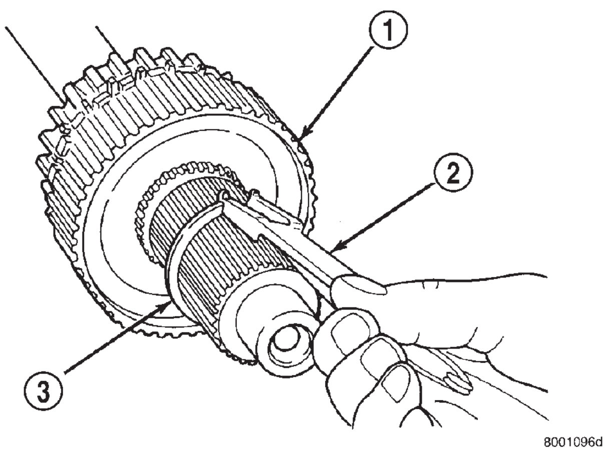


Fig. 28 Mode Hub Retaining Ring Removal

1 – MODE HUB
2 – SNAP RING PLIERS (HEAVY DUTY)
3 – MODE HUB RETAINING RING

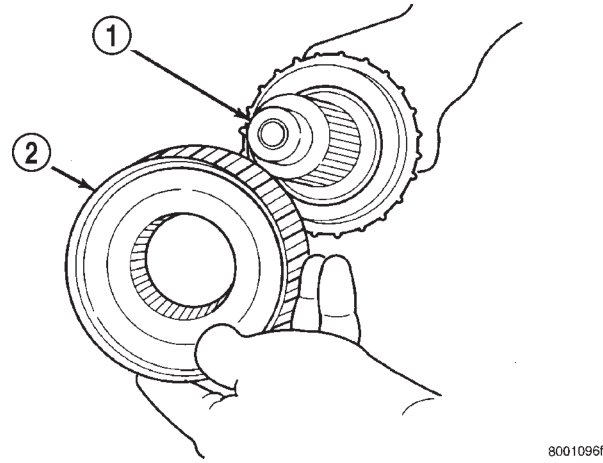


Fig. 29 Mode Hub Removal

1 – MAINSHAFT
2 – MODE HUB

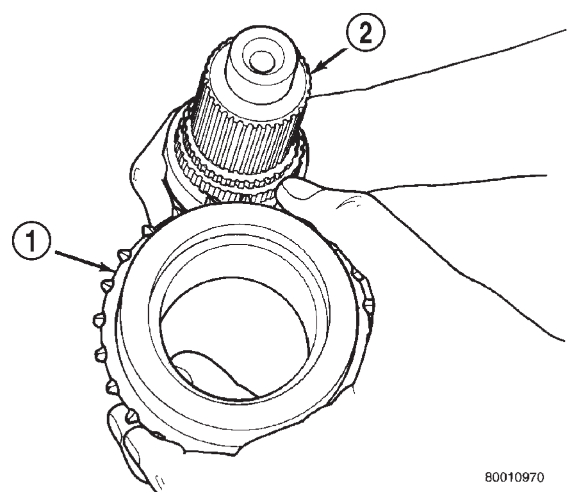


Fig. 30 Drive Sprocket Removal

1 – DRIVE SPROCKET
2 – MAINSHAFT

DISASSEMBLY AND ASSEMBLY (Continued)

INPUT GEAR AND LOW RANGE GEAR REMOVAL

(1) Remove front bearing retainer attaching bolts (Fig. 31).

(2) Remove front bearing retainer. Pry retainer loose with pry tool positioned in slots at each end of retainer (Fig. 32).

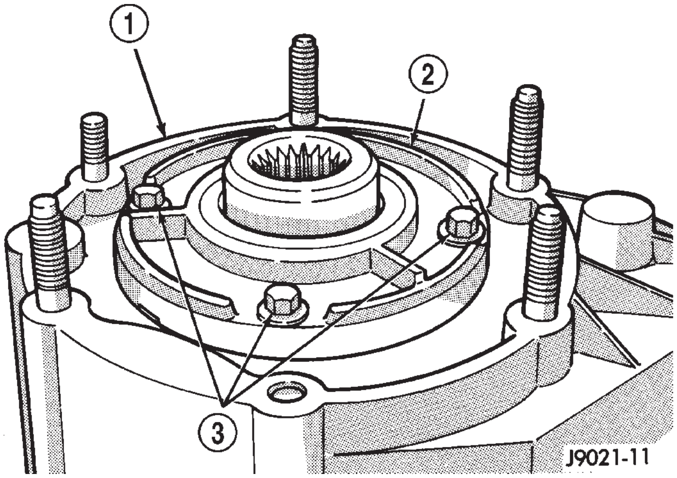


Fig. 31 Front Bearing Retainer Bolts

1 – FRONT CASE
2 – FRONT BEARING RETAINER
3 – RETAINER BOLTS

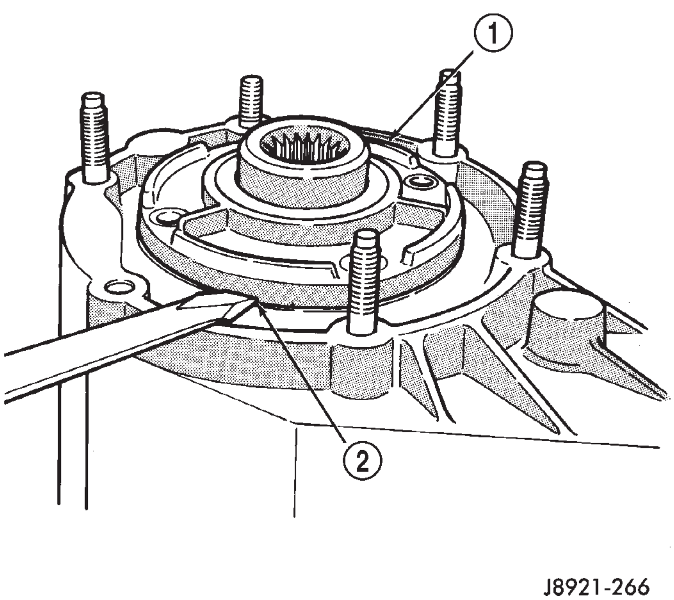


Fig. 32 Front Bearing Retainer Removal

1 – FRONT BEARING RETAINER
2 – RETAINER SLOT

(3) Remove front bearing retainer seal. Tap seal out with drift and hammer.

(4) Remove input gear retaining ring with heavy duty snap ring pliers (Fig. 33)

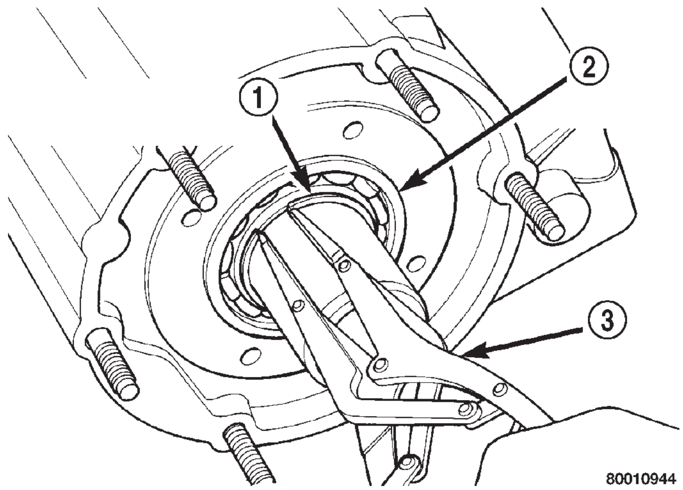


Fig. 33 Removing Input Gear Retaining ring

1 – INPUT GEAR BEARING RETAINING RING
2 – INPUT GEAR BEARING
3 – SNAP RING PLIERS

(5) Place front case in horizontal position. Then remove input gear and low range gear as an assembly (Fig. 34). Tap gear out of bearing with plastic mallet if necessary.

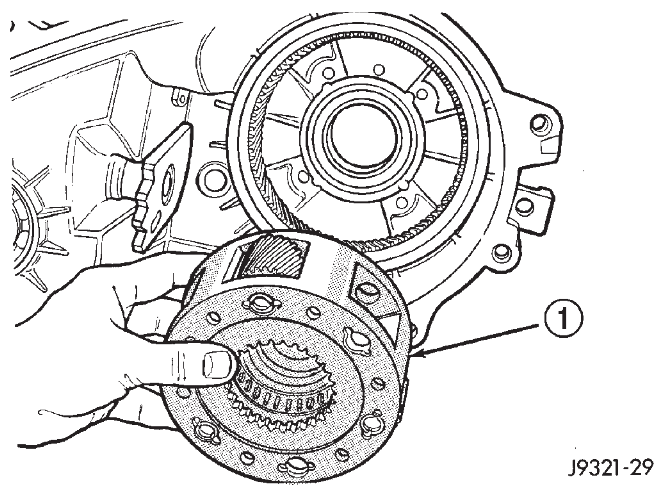


Fig. 34 Input Gear And Planetary Carrier Removal

1 – INPUT AND LOW RANGE GEAR ASSEMBLY

DISASSEMBLY AND ASSEMBLY (Continued)

INPUT AND LOW RANGE GEAR DISASSEMBLY

(1) Remove snap-ring that retains input gear in low range gear (Fig. 35).

(2) Remove retainer (Fig. 36).

(3) Remove front tabbed thrust washer (Fig. 37).

(4) Remove input gear (Fig. 38).

(5) Remove rear tabbed thrust washer from low range gear (Fig. 39).

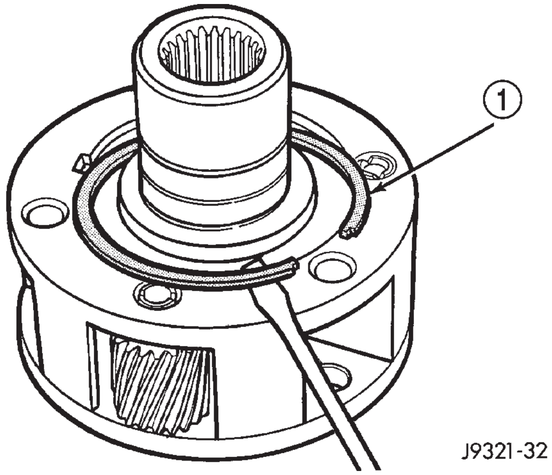


Fig. 35 Input Gear Snap-Ring Removal

1 – INPUT GEAR SNAP RING

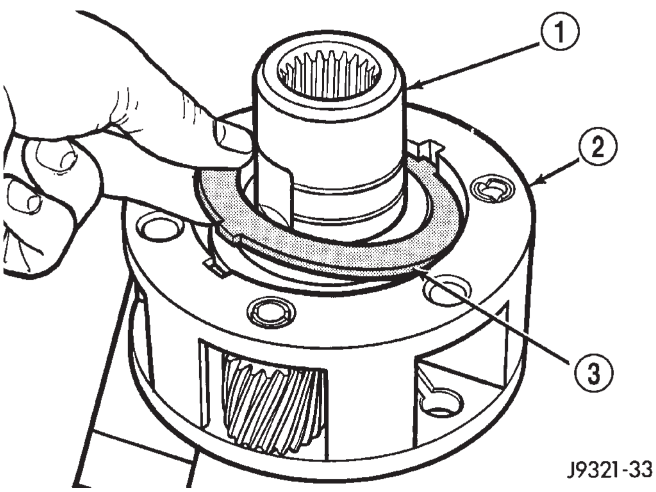


Fig. 36 Input Gear Retainer Removal

1 – INPUT GEAR
2 – LOW RANGE GEAR
3 – RETAINER

ASSEMBLY

Lubricate transfer case components with Mopar® Dexron II automatic transmission fluid or petroleum jelly (where indicated) during assembly.

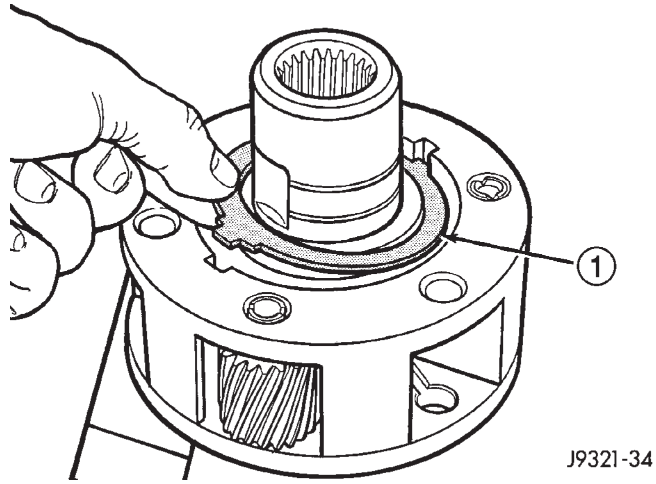


Fig. 37 Front Tabbed Thrust Washer Removal

1 – FRONT TABBED THRUST WASHER

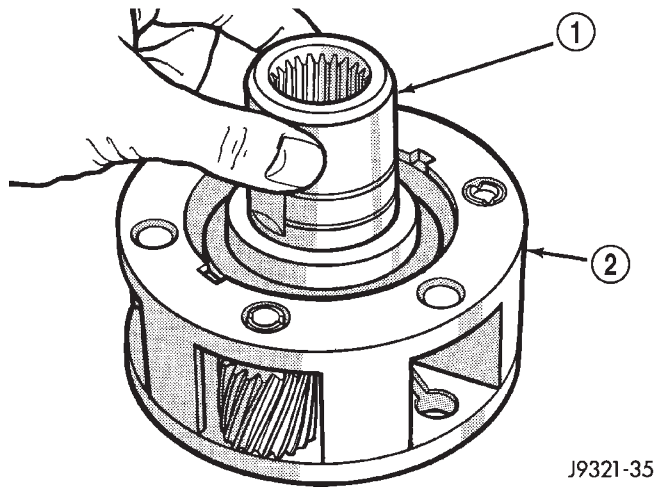


Fig. 38 Input Gear Removal

1 – INPUT GEAR
2 – LOW RANGE GEAR

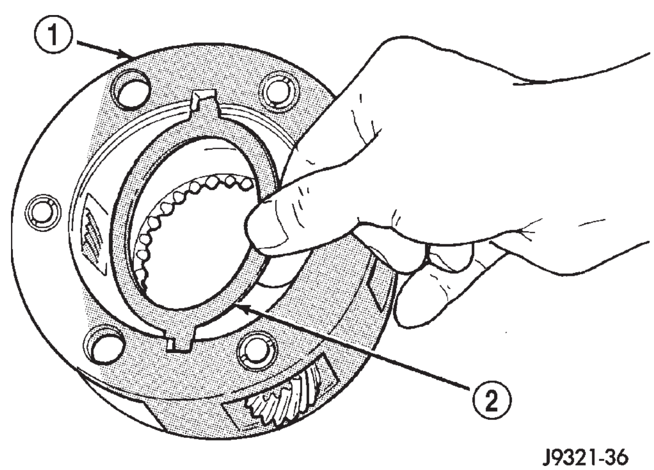


Fig. 39 Rear Tabbed Thrust Washer Removal

1 – LOW RANGE GEAR
2 – REAR TABBED THRUST WASHER

DISASSEMBLY AND ASSEMBLY (Continued)

BEARING AND SEAL INSTALLATION

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

(1) Remove seal from case with pry tool (Fig. 40).

(2) Remove bearing retaining ring with screwdriver (Fig. 41).

(3) Remove bearing with Tool Handle C-4171 and Tool 5065 (Fig. 42).

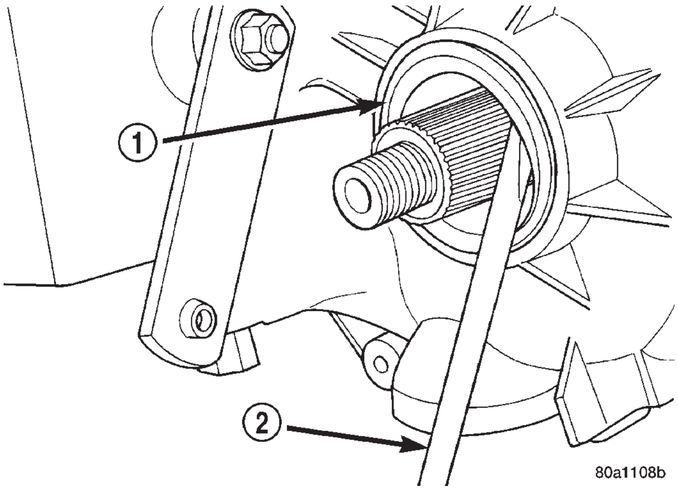


Fig. 40 Front Output Seal Removal

1 – OUTPUT SHAFT SEAL
2 – PRYBAR

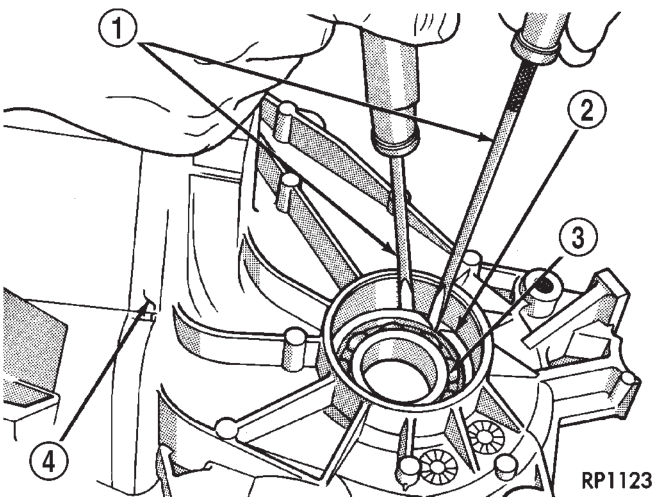


Fig. 41 Front Output Shaft Bearing Retaining Ring Removal

1 – SCREWDRIVERS
2 – SNAP RING
3 – FRONT OUTPUT SHAFT BEARING
4 – FRONT CASE

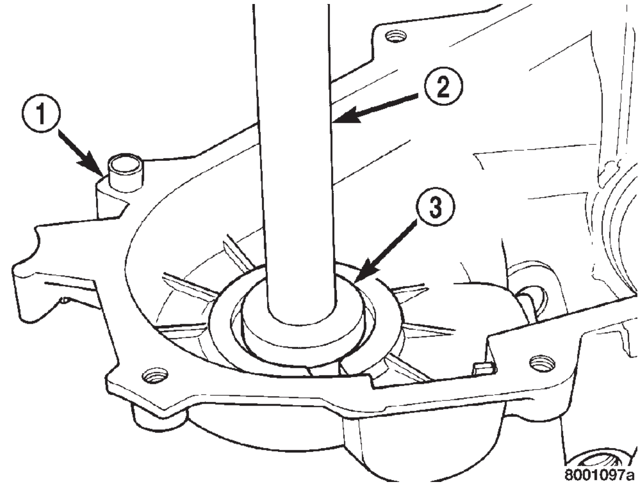


Fig. 42 Front Output Shaft Bearing Removal

1 – FRONT CASE
2 – SPECIAL TOOL C-4171
3 – SPECIAL TOOL 5065

(4) Install front output shaft front bearing in case with Tool Handle C-4171 and Installer 5064 (Fig. 43).

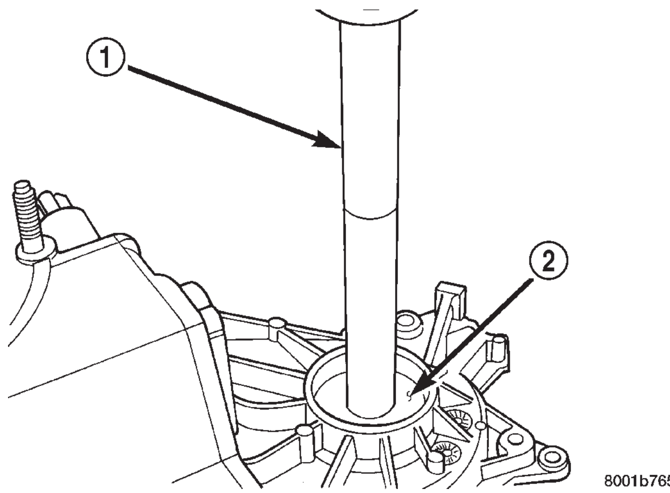


Fig. 43 Front Output Shaft Bearing Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL 5064

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Install output shaft front bearing retaining ring (Fig. 44). Start ring into place by hand. Then use small screwdriver to work ring into case groove. Be sure ring is fully seated before proceeding.

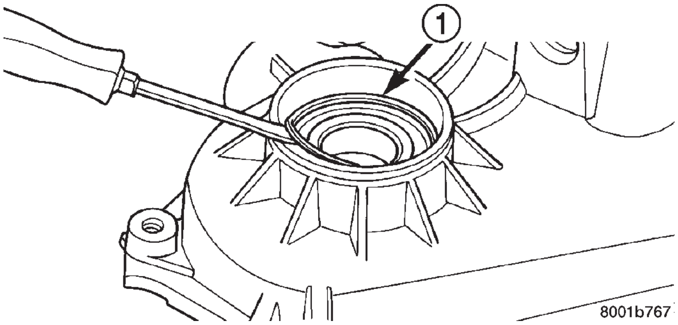


Fig. 44 Installing Output Shaft Front Bearing Retaining Ring

1 – WORK RETAINING RING INTO BORE GROOVE WITH SMALL SCREWDRIVER

(6) Install new front output seal in front case with Installer Tool 8143 as follows:

(a) Place new seal on tool. **Garter spring on seal goes toward interior of case.**

(b) Start seal in bore with light taps from hammer (Fig. 45). Once seal is started, continue tapping seal into bore until installer tool bottoms against case.

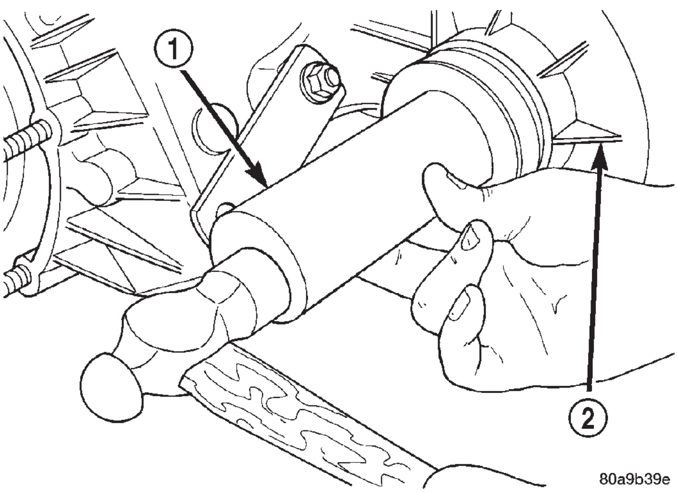


Fig. 45 Front Output Seal Installation

1 – INSTALLER 8143
2 – TRANSFER CASE

(7) Remove the output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 46).

(8) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 47). The bearing bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (Fig. 48).

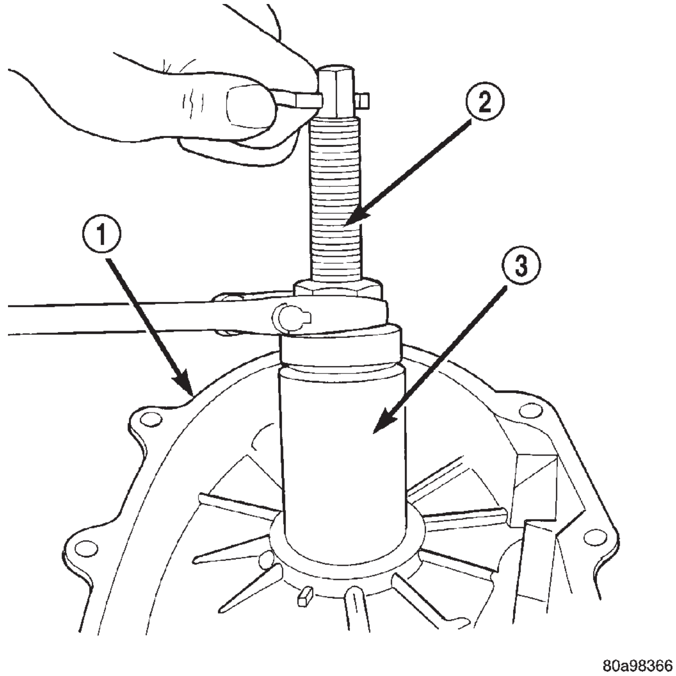


Fig. 46 Output Shaft Rear Bearing Removal

1 – REAR CASE
2 – SPECIAL TOOL L-4454–1 AND L-4454–3
3 – SPECIAL TOOL 8148

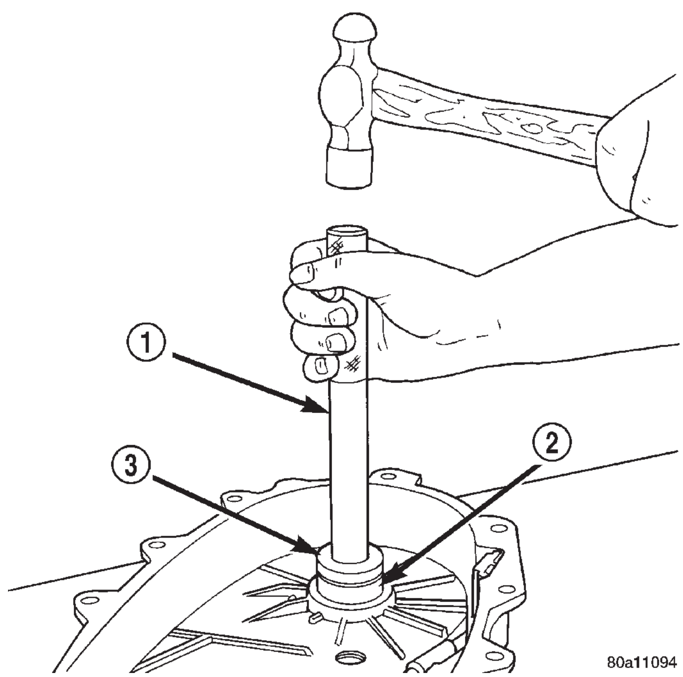


Fig. 47 Output Shaft Rear Bearing Installation

1 – HANDLE C-4171
2 – OUTPUT SHAFT INNER BEARING
3 – INSTALLER 5066

DISASSEMBLY AND ASSEMBLY (Continued)

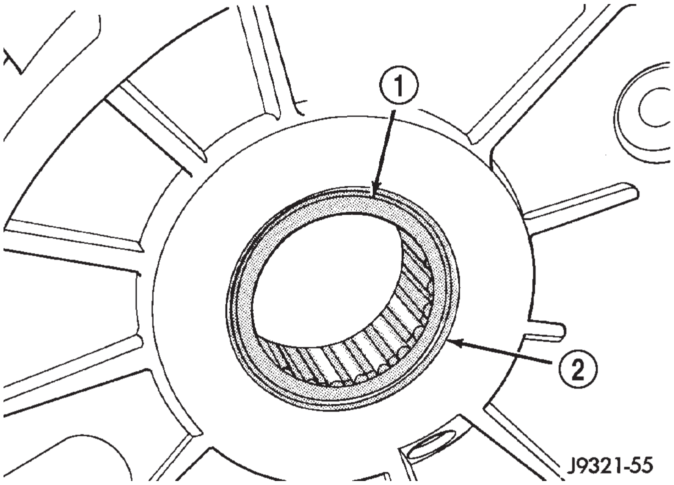


Fig. 48 Output Shaft Rear Bearing Installation Depth

1 – BEARING (SEATED) AT LOWER EDGE OF CHAMFER
2 – CHAMFER

(9) Using Remover C-4210 and Handle C-4171, drive input shaft bearing from inside the annulus gear opening in the case. (Fig. 49).

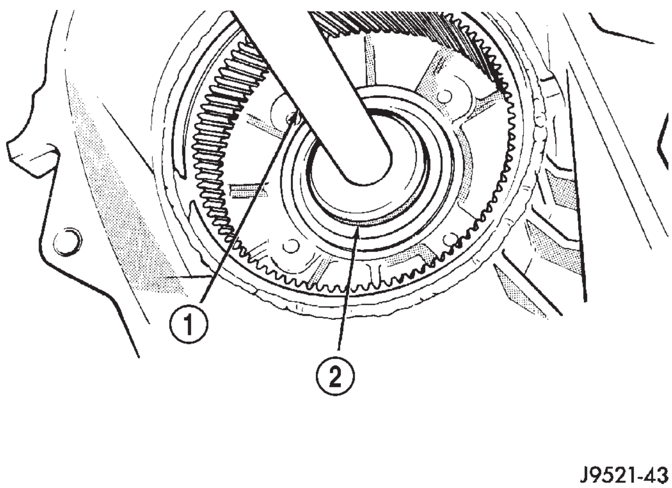


Fig. 49 Input Shaft Bearing Removal

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-4210

(10) Install locating ring on new bearing.

(11) Position case so forward end is facing upward.

(12) Using Remover C-4210 and Handle C-4171, drive input shaft bearing into case. The bearing locating ring must be fully seated against case surface (Fig. 50).

(13) Remove input gear pilot bearing by inserting a suitably sized drift into the splined end of the input gear and driving the bearing out with the drift and a hammer (Fig. 51).

(14) Install new pilot bearing with Installer 5065 and Handle C-4171 (Fig. 52).

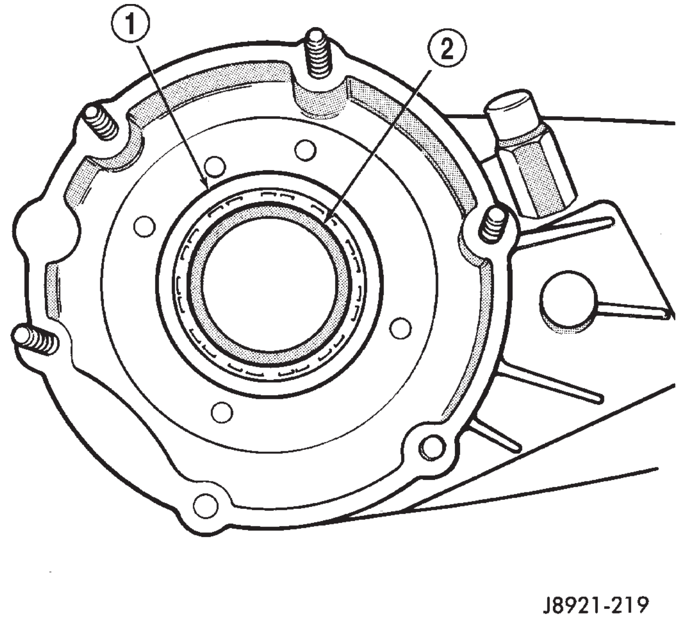


Fig. 50 Seating Input Shaft Bearing

1 – SNAP RING
2 – INPUT SHAFT BEARING

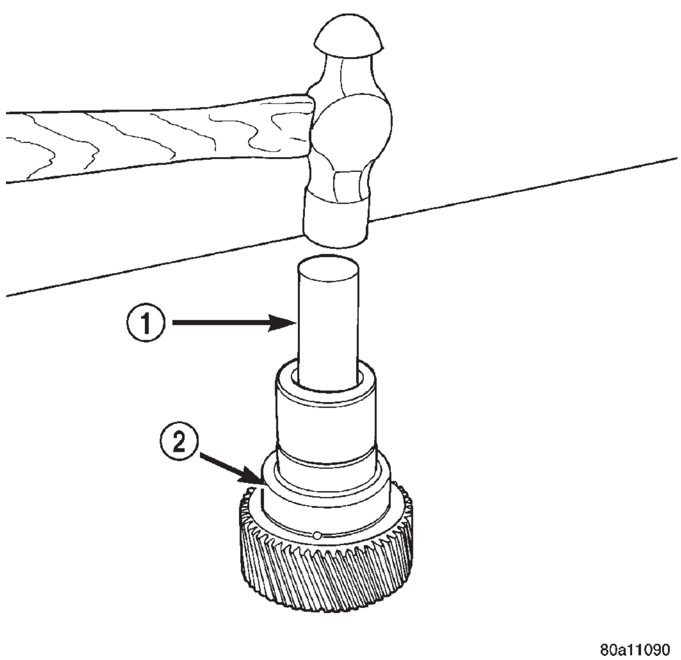


Fig. 51 Remove Input Gear Pilot Bearing

1 – DRIFT
2 – INPUT GEAR

(15) Remove front bearing retainer seal with suitable pry tool.

(16) Install new front bearing retainer with Installer 7884 (Fig. 53).

(17) Remove seal from oil pump housing with a suitable pry tool

DISASSEMBLY AND ASSEMBLY (Continued)

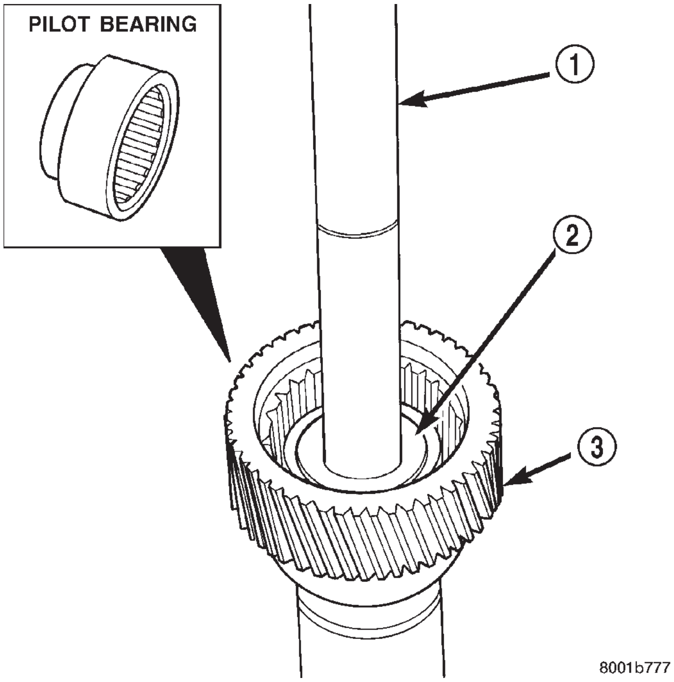


Fig. 52 Install Input Gear Pilot Bearing

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL 5065
3 – INPUT GEAR

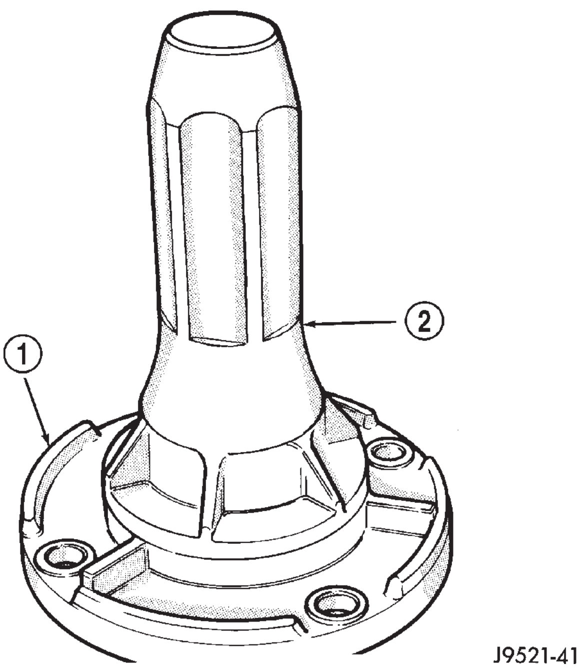


Fig. 53 Install Front Bearing Retainer Seal

1 – FRONT BEARING RETAINER
2 – SPECIAL TOOL 7884

(18) Install new seal in oil pump housing with Installer 7888 (Fig. 54).

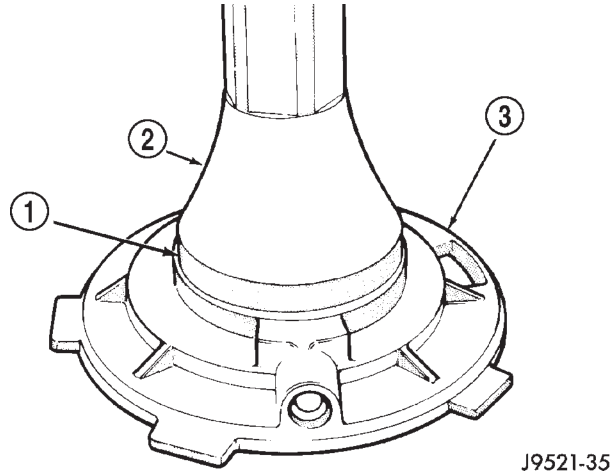


Fig. 54 Oil Pump Seal Installation

1 – HOUSING SEAL
2 – SPECIAL TOOL 7888
3 – OIL PUMP FEED HOUSING

(19) Remove rear retainer bearing with Installer 8128 and Handle C-4171.

(20) Install rear bearing in retainer with Handle C-4171 and Installer 5064 (Fig. 55).

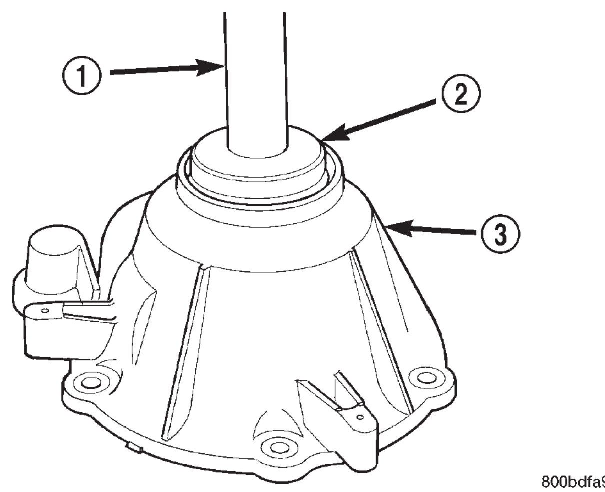


Fig. 55 Installing Rear Bearing In Retainer

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL 5064
3 – REAR RETAINER

INPUT AND LOW RANGE GEAR ASSEMBLY

(1) Lubricate gears and thrust washers (Fig. 56) with recommended transmission fluid.

(2) Install first thrust washer in low range gear (Fig. 56). Be sure washer tabs are properly aligned in gear notches.

(3) Install input gear in low range gear. Be sure input gear is fully seated.

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Install remaining thrust washer in low range gear and on top of input gear. Be sure washer tabs are properly aligned in gear notches.

(5) Install retainer on input gear and install snap-ring.

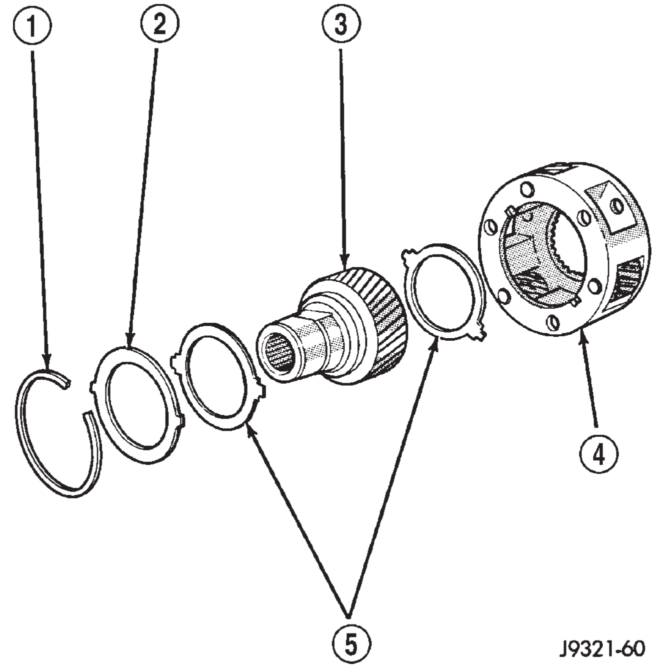


Fig. 56 Input/Low Range Gear Components

1 – SNAP RING
2 – RETAINER PLATE
3 – INPUT GEAR
4 – LOW RANGE GEAR
5 – THRUST WASHERS

INPUT GEAR AND LOW RANGE GEAR INSTALLATION

(1) Align and install low range/input gear assembly in front case (Fig. 57). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

(2) Install snap-ring to hold input/low range gear into front bearing (Fig. 58).

(3) Clean gasket sealer residue from retainer and inspect retainer for cracks or other damage.

(4) Apply a 3 mm (1/8 in.) bead of Mopar® gasket maker or silicone adhesive to sealing surface of retainer.

(5) Align cavity in seal retainer with fluid return hole in front of case.

CAUTION: Do not block fluid return cavity on sealing surface of retainer when applying Mopar® gasket maker or silicone adhesive sealer. Seal failure and fluid leak can result.

(6) Install bolts to hold retainer to transfer case (Fig. 59). Tighten to 21 N·m (16 ft. lbs.) of torque.

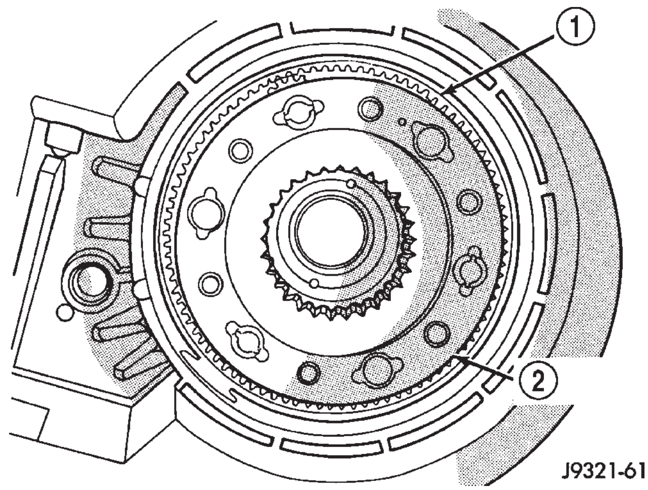


Fig. 57 Input/Low Range Gear Installation

1 – ANNULUS GEAR
2 – INPUT/LOW RANGE GEAR

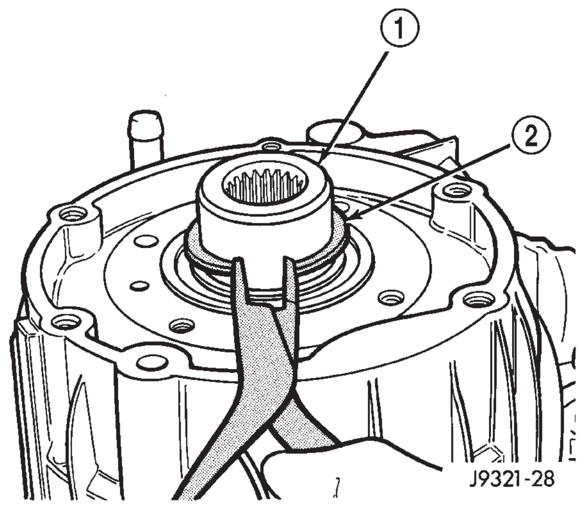


Fig. 58 Install Snap-Ring

1 – INPUT GEAR
2 – SNAP RING

MAINSHAFT ASSEMBLY

(1) Lubricate mainshaft splines with recommended transmission fluid.

(2) Slide drive sprocket onto mainshaft.

(3) Slide mode hub onto mainshaft.

(4) Install mode hub retaining ring. Verify that the retaining ring is fully seated in mainshaft groove.

SHIFT FORKS AND MAINSHAFT INSTALLATION

(1) Install new sector shaft O-ring and bushing (Fig. 60).

(2) Install shift sector in case (Fig. 61). Lubricate sector shaft with transmission fluid before installation.

DISASSEMBLY AND ASSEMBLY (Continued)

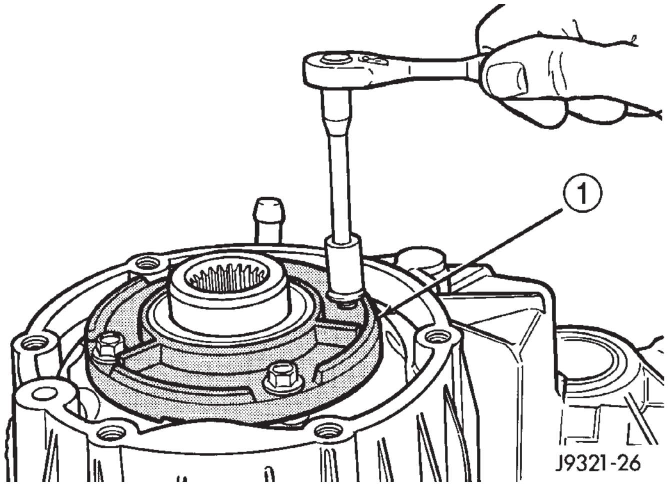


Fig. 59 Install Front Bearing Retainer

1 – FRONT BEARING RETAINER

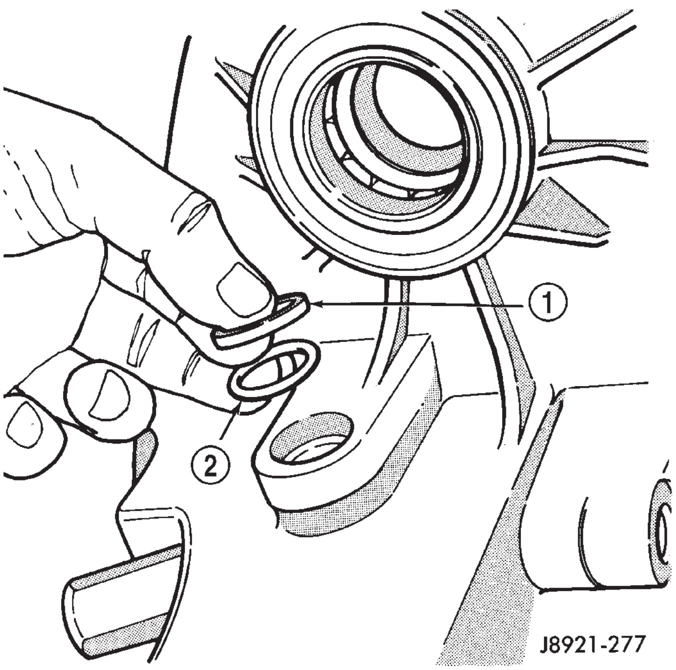


Fig. 60 Sector O-Ring And Bushing Installation

1 – SECTOR BUSHING
2 – O-RING

(3) Install range lever, washer, and nut on sector shaft (Fig. 62). Tighten range lever nut to 27–34 N.m (20–25 ft. lbs.) torque.

(4) Assemble and install range fork and hub (Fig. 63). Be sure hub is properly seated in low range gear and engaged to the input gear.

(5) Align and insert range fork pin in shift sector slot.

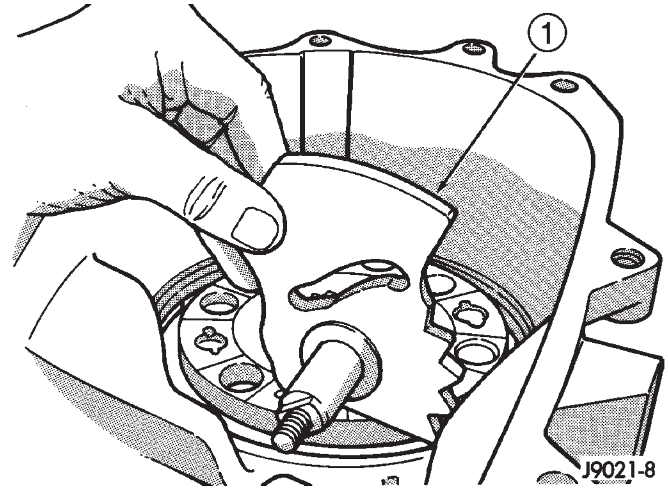


Fig. 61 Shift Sector Installation

1 – SHIFT SECTOR

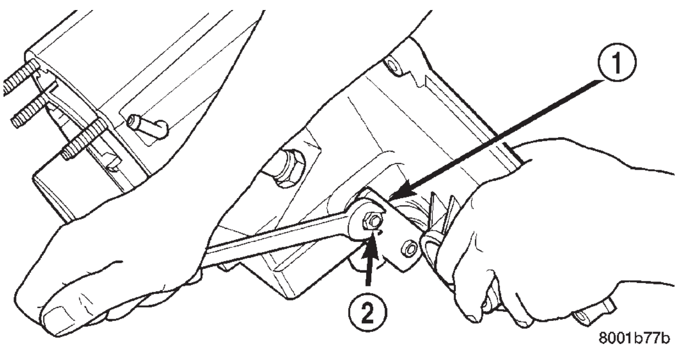


Fig. 62 Range Lever Installation

1 – RANGE LEVER
2 – LEVER NUT

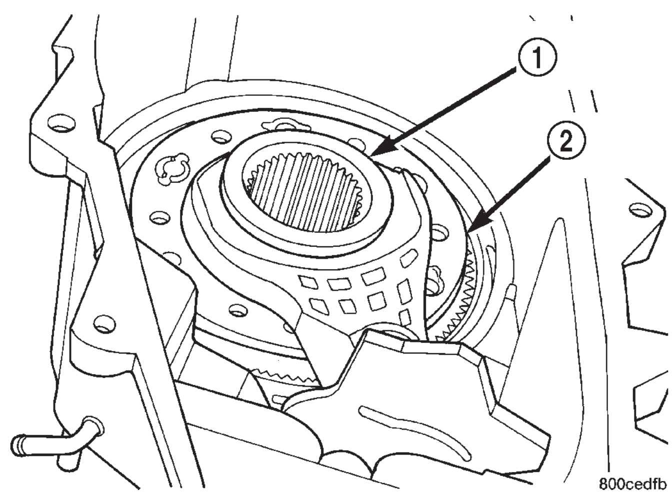


Fig. 63 Install Range Fork And Hub Assembly

1 – RANGE HUB
2 – RANGE FORK

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Install assembled mainshaft (Fig. 64). Be sure shaft is seated in pilot bearing and input gear.

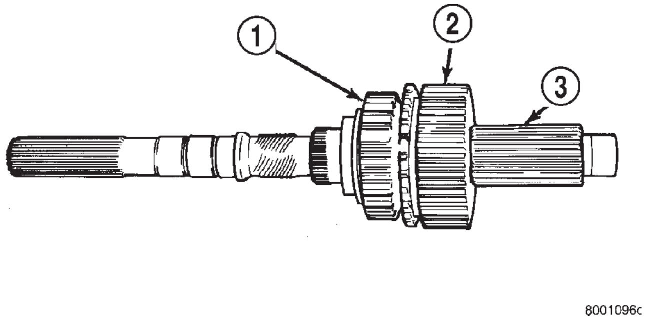


Fig. 64 Mainshaft Assembly Installation

1 – DRIVE SPROCKET
2 – MODE HUB
3 – MAINSHAFT

(7) Install new pads on mode fork if necessary.

(8) Insert mode sleeve in mode fork mode fork. Be sure long side of sleeve is toward long end of shift rail (Fig. 65).

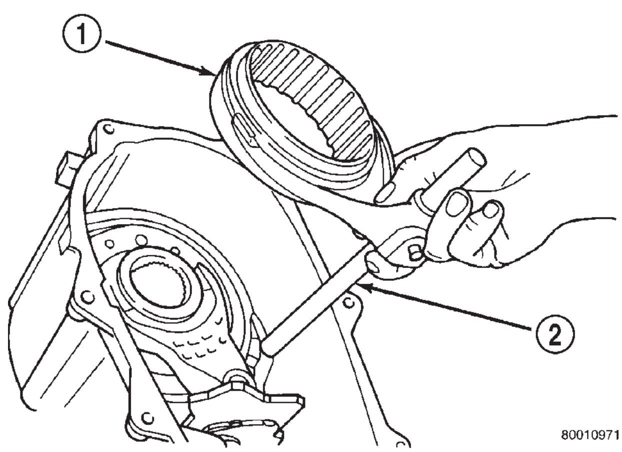


Fig. 65 Assembling Mode Fork And Sleeve

1 – MODE SLEEVE
2 – MODE FORK AND RAIL

(9) Install assembled mode fork and sleeve (Fig. 66). Be sure fork rail goes through range fork and into case bore. Also be sure sleeve is aligned and seated on mainshaft hub.

(10) Rotate sector to Neutral position.

(11) Install new O-ring on detent plug (Fig. 67).

(12) Lubricate detent plunger with transmission fluid or light coat of petroleum jelly.

(13) Install detent plunger, spring and plug (Fig. 67).

(14) Verify that plunger is properly engaged in sector.

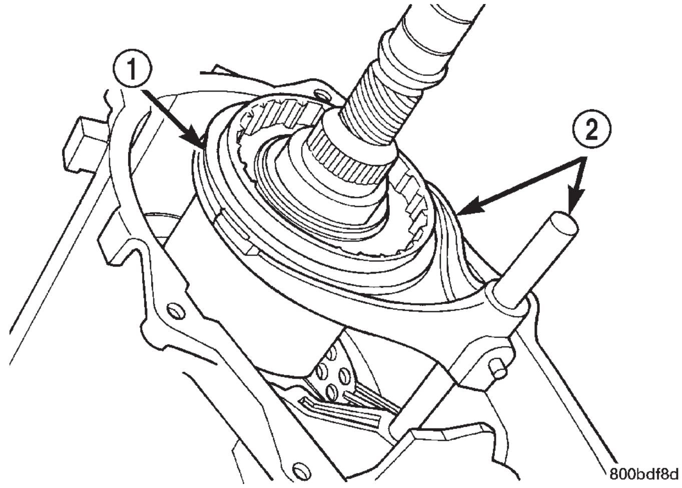


Fig. 66 Mode Fork And Sleeve Installation

1 – MODE SLEEVE
2 – MODE FORK AND RAIL

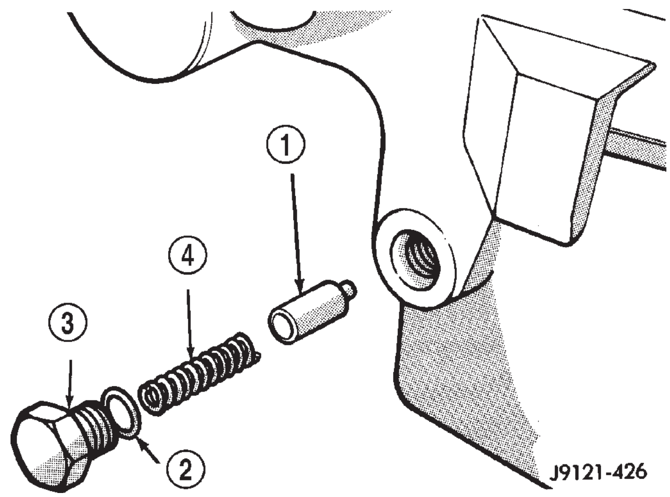


Fig. 67 Shift Detent Components

1 – PLUNGER
2 – O-RING
3 – PLUG
4 – SPRING

FRONT OUTPUT SHAFT AND DRIVE CHAIN INSTALLATION

(1) Lubricate front output shaft-sprocket assembly, drive chain and drive sprocket with transmission fluid.

(2) Assemble drive chain and front output shaft (Fig. 68).

(3) Start chain on mainshaft drive sprocket.

(4) Guide front shaft into bearing and drive sprocket onto mainshaft drive gear (Fig. 68).

(5) Install mode spring on upper end of mode fork shift rail (Fig. 69).

DISASSEMBLY AND ASSEMBLY (Continued)

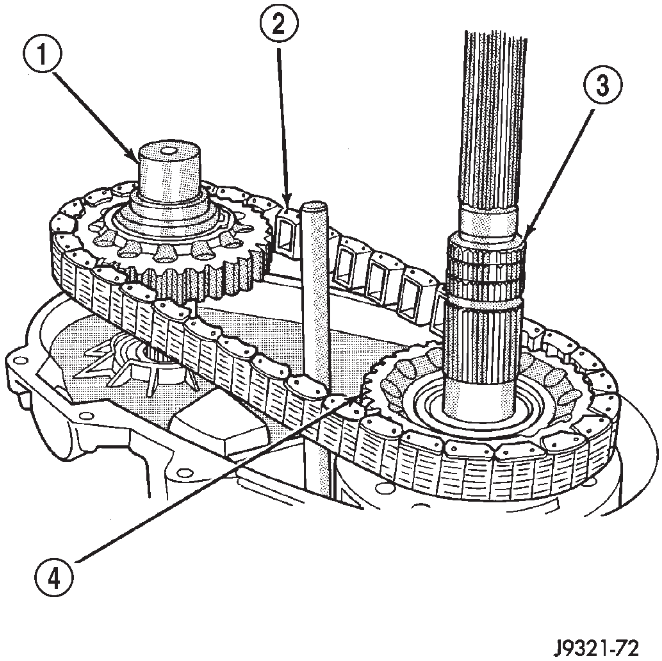


Fig. 68 Installing Drive Chain And Front Output Shaft

1 – FRONT OUTPUT SHAFT
2 – DRIVE CHAIN
3 – MAINSHAFT
4 – DRIVE SPROCKET

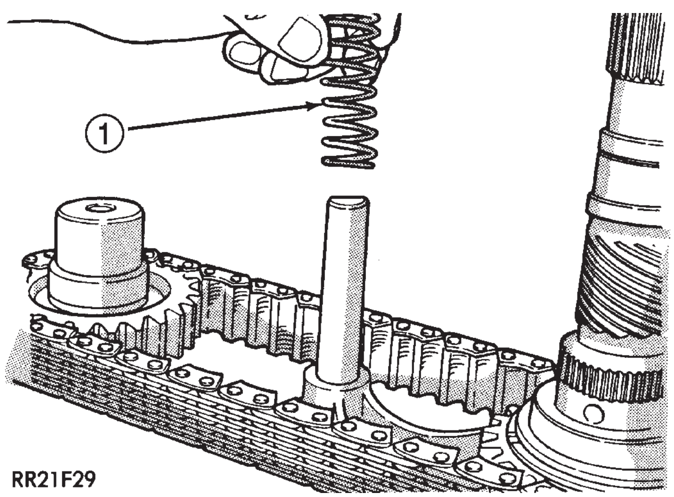


Fig. 69 Install Mode Fork Spring

1 – MODE SPRING

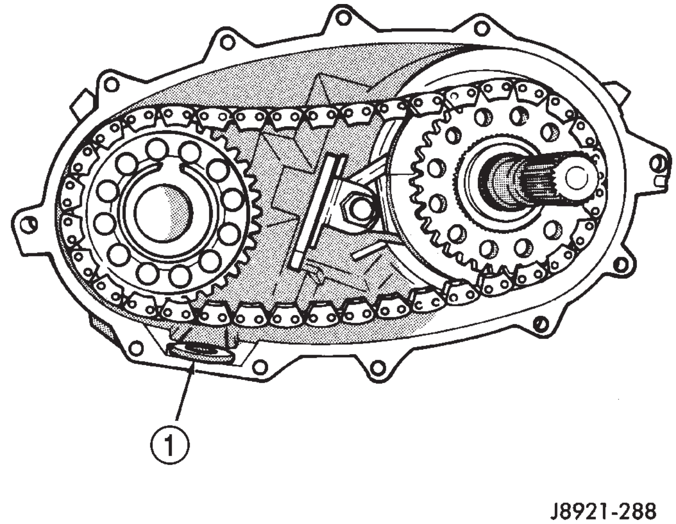


Fig. 70 Installing Case Magnet

1 – MAGNET

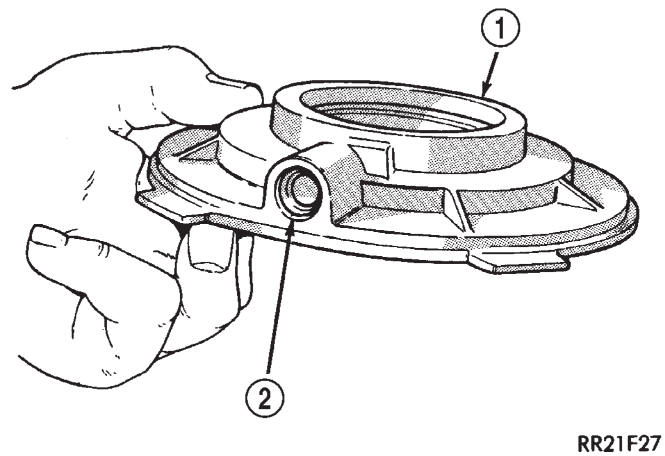


Fig. 71 Pickup Tube O-Ring Position

1 – OIL PUMP
2 – O-RING

OIL PUMP AND REAR CASE ASSEMBLY/INSTALLATION

(1) Install magnet in front case pocket (Fig. 70).

(2) Assemble oil pickup screen, connecting hose, and tube.

(3) Install new pickup tube O-ring in oil pump (Fig. 71).

(4) Insert oil pickup tube in oil pump inlet.

(5) Position assembled oil pump and pickup tube in rear case. Be sure pickup screen is securely seated in case slot. Also be sure oil pump locating tabs are outside rear case (Fig. 72).

(6) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting flange of front case. Work sealer bead around bolt holes.

(7) Lift rear case and oil pump and carefully position assembly on front case. Be sure case dowels are aligned and that mode fork rail extends through rear case before seating rear case on front case.

(8) Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (Fig. 73).

(9) Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.

DISASSEMBLY AND ASSEMBLY (Continued)

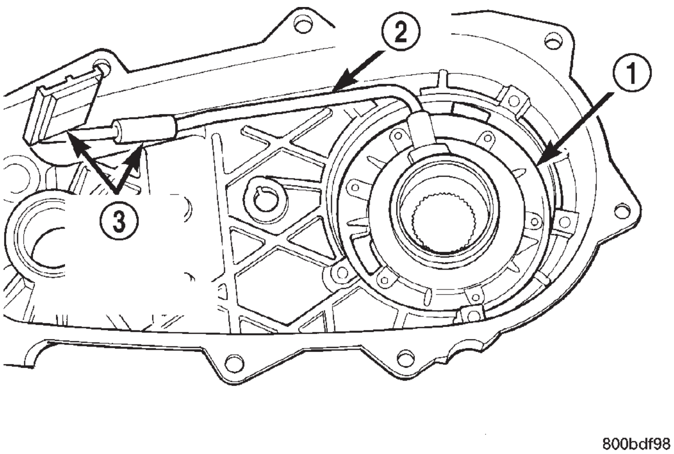


Fig. 72 Oil Pump And Pickup Tube Installation

1 – OIL PUMP
2 – PICKUP TUBE
3 – PICKUP SCREEN AND CONNECTOR

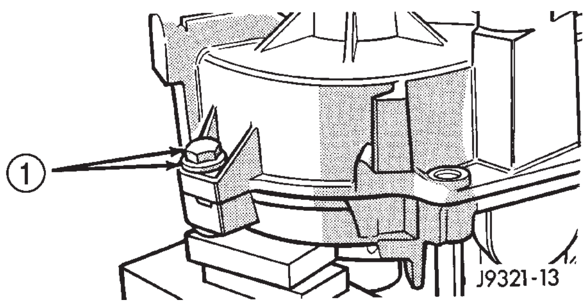


Fig. 73 Alignment Bolt Location

1 – ALIGNMENT BOLT AND WASHER (AT EACH END OF CASE)

YOKE AND RANGE LEVER INSTALLATION

(1) Install indicator switch in front case. Tighten switch to 20–34 N·m (15–25 ft. lbs.) torque.

(2) Install range lever, washer and locknut on sector shaft (Fig. 74). Tighten locknut to 27-34 N·m (20-25 ft. lbs.) torque.

(3) Install new seal washer on front output shaft (Fig. 76).

(4) Lubricate yoke hub with transmission fluid and install yoke on front shaft.

(5) Install new seal washer on front shaft.

(6) Install yoke and new yoke nut on front output shaft (Fig. 75).

(7) Tighten yoke nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool C-3281, or similar tool to hold yoke while tightening yoke nut.

REAR RETAINER ASSEMBLY AND INSTALLATION

(1) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting surface of rear retainer. Allow sealer to set-up slightly before proceeding.

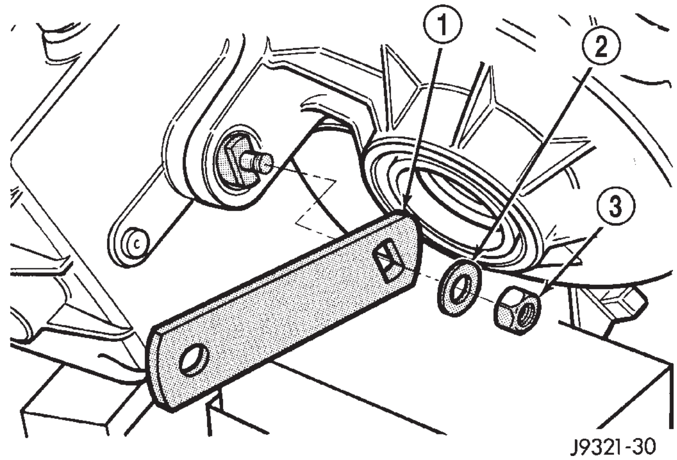


Fig. 74 Range Lever Installation

1 – RANGE LEVER
2 – WASHER
3 – LOCKNUT

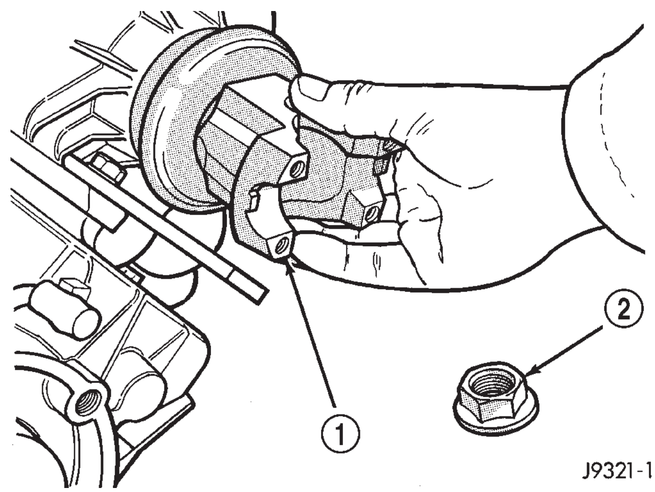


Fig. 75 Output Shaft Yoke Installation

1 – OUTPUT SHAFT YOKE
2 – YOKE NUT

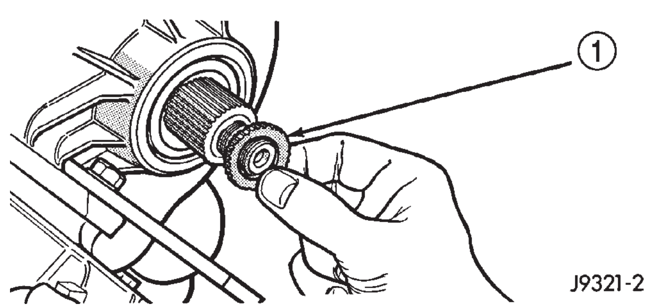


Fig. 76 Yoke Seal Washer Installation

1 – YOKE SEAL WASHER

(2) Install rear retainer on rear case. Tighten retainer bolts to 35–46 N·m (26–34 ft. lbs).

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Install new output shaft bearing snap-ring (Fig. 77). Lift mainshaft slightly to seat snap-ring in shaft groove, if necessary.

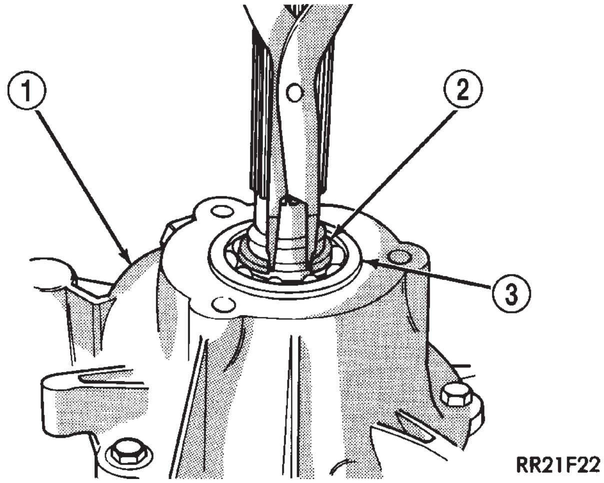


Fig. 77 Install Output Bearing Snap-ring

1 – REAR RETAINER
2 – SNAP RING
3 – REAR BEARING

(4) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting surface ofextension housing. Allow sealer to set-up slightly before proceeding.

(5) Install extension housing on rear retainer.

(6) Install extension housing bolts and tighten to 35–46 N·m (26–34 ft. lbs.).

CLEANING AND INSPECTION

NV231 TRANSFER CASE

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and 3M all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

The oil pickup screen can be cleaned with solvent. Shake excess solvent from the screen after cleaning and allow it to air dry. Do not use compressed air.

MAINSHAFT/SPROCKET/HUB INSPECTION

Inspect the splines on the hub and shaft and the teeth on the sprocket (Fig. 78). Minor nicks and scratches can be smoothed with an oilstone. However, replace any part that is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320–400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER

Check the teeth on the gear (Fig. 79). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300–400 grit emery cloth if necessary.

Examine the carrier body and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the lock ring and both thrust washers for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

CLEANING AND INSPECTION (Continued)

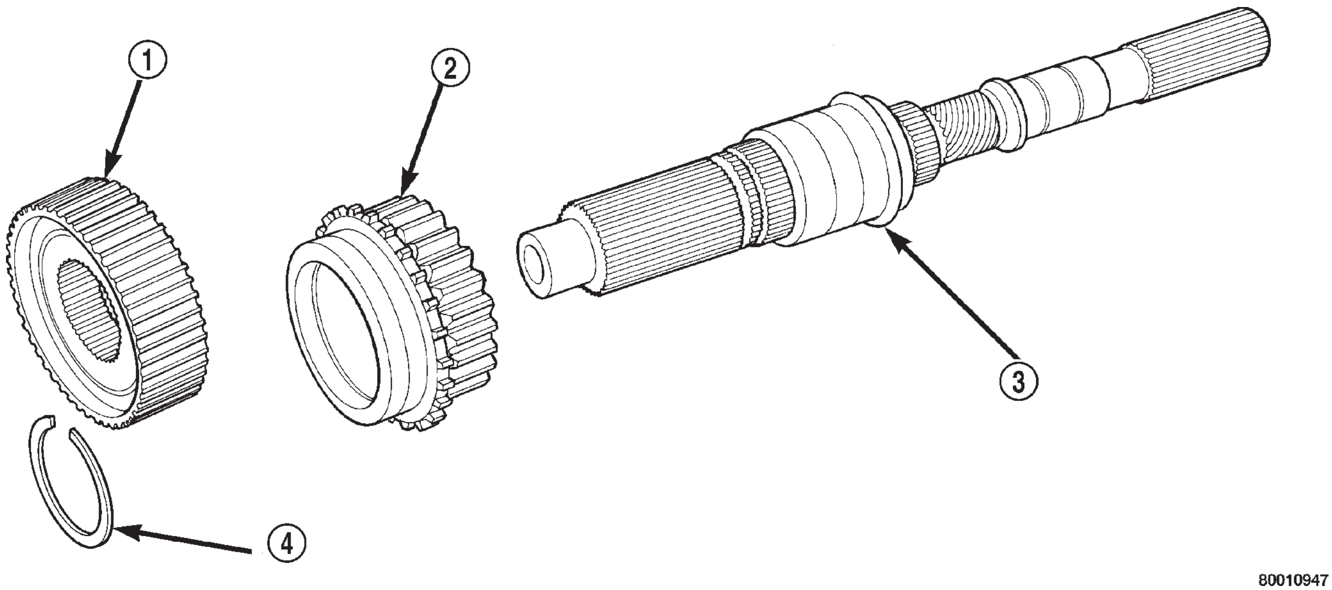


Fig. 78 Mainshaft, Mode Hub, And Drive Sprocket

1 – MODE HUB
2 – DRIVE SPROCKET
3 – MAINSHAFT
4 – MODE HUB RETAINING RING

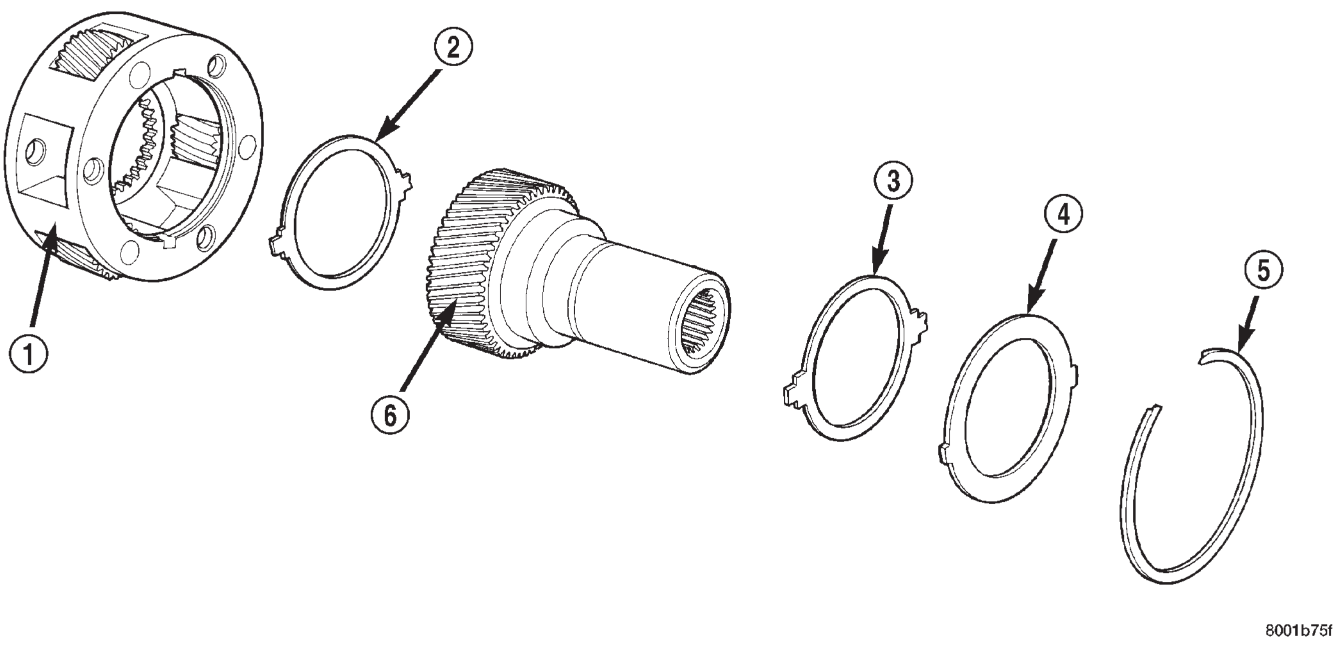


Fig. 79 Input Gear And Carrier Components

1 – PLANETARY CARRIER
2 – REAR THRUST WASHER
3 – FRONT THRUST WASHER
4 – CARRIER LOCK RING
5 – CARRIER LOCK RETAINING RING
6 – INPUT GEAR

CLEANING AND INSPECTION (Continued)

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (Fig. 80). Minor nicks on the shift rail can be smoothed with 320–400 grit emery cloth.

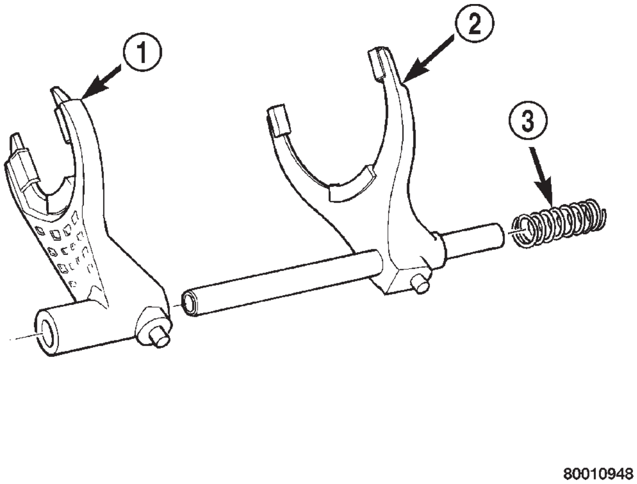


Fig. 80 Shift forks

1 – RANGE FORK
2 – MODE FORK AND RAIL
3 – MODE SPRING

Inspect the shift fork wear pads (Fig. 81). The mode fork pads are serviceable and can be replaced if necessary. The range fork pads are not serviceable. The fork must be replaced as an assembly if the pads are worn or damaged.

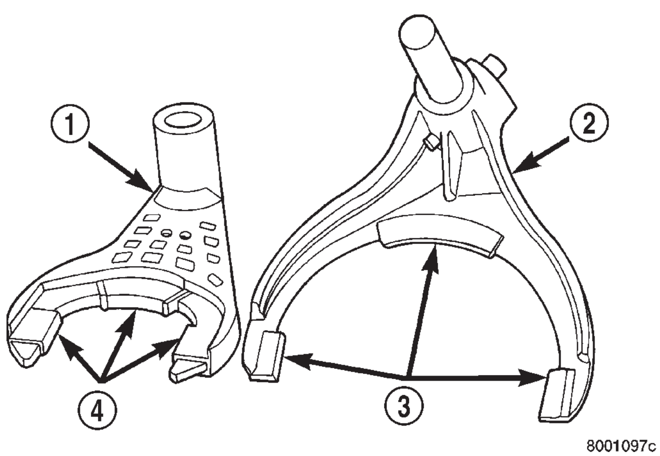


Fig. 81 Shift Fork And Wear Pad Locations

1 – RANGE FORK
2 – MODE FORK
3 – WEAR PADS (SERVICEABLE)
4 – WEAR PADS (NON-SERVICEABLE)

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

REAR RETAINER AND EXTENSION HOUSING

Inspect the retainer components. Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and 3M all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

Inspect the retaining rings and washers. Replace any part if distorted, bent, or broken. Reuse is not recommended.

Inspect the extension housing seal and bushing. Replace both components if either shaoe any sign of wear or damage.

FRONT OUTPUT SHAFT/YOKE/DRIVE CHAIN

Check condition of the seal contact surfaces of the yoke slinger (Fig. 82). This surface must be clean and smooth to ensure proper seal life. Replace the yoke nut and seal washer as neither part should be reused.

Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320–400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

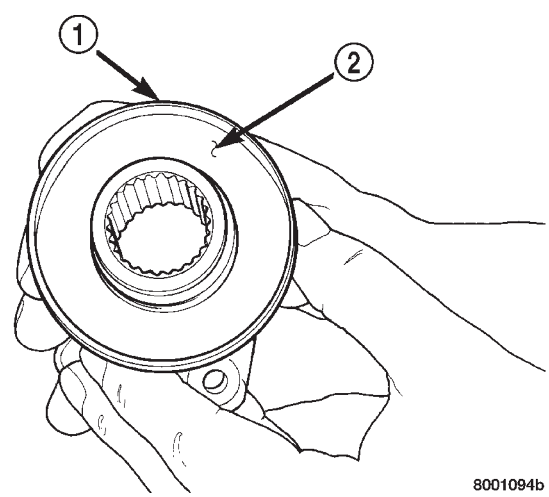


Fig. 82 Seal Contact Surface Of Yoke Slinger

1 – FRONT SLINGER (PART OF YOKE)
2 – SEAL CONTACT SURFACE MUST BE CLEAN AND SMOOTH

CLEANING AND INSPECTION (Continued)

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (Fig. 83)

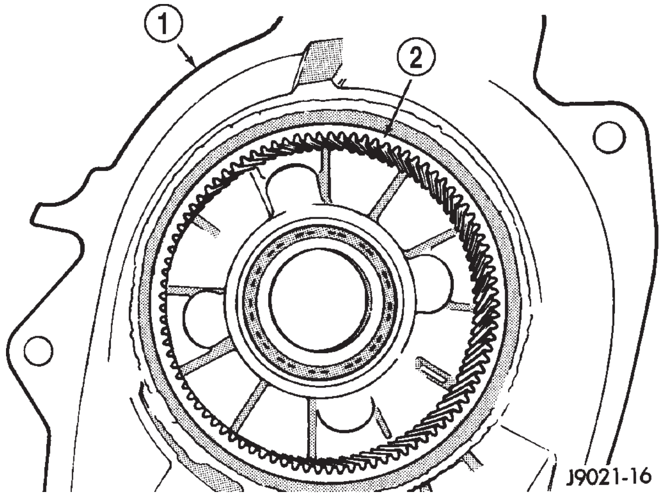


Fig. 83 Low Range Annulus Gear

1 – FRONT CASE
2 – LOW RANGE ANNULUS GEAR

FRONT-REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Clean the sealing surfaces with a scraper and 3M all purpose cleaner. This will ensure proper sealer adhesion at assembly. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil stainless steel inserts if required.

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

ADJUSTMENTS

SHIFTER ADJUSTMENT

(1) Shift transfer case into the 2WD position.

(2) Raise vehicle.

(3) Loosen the trunnion lock bolt (Fig. 84).

(4) Make sure the shift rod slides freely in the adjusting swivel. Lube rod and swivel if necessary.

(5) Verify that transfer case range lever is in 2WD detent. The 2WD detent is the second detent position from the full forward position.

(6) Align the adjustment locating hole in the lower shift lever to the adjustment channel in the shifter body (Fig. 85).

(7) Insert an appropriately sized pin through the adjustment hole and channel.

(8) Tighten the trunnion lock bolt to 10 N·m (90 in. lbs.) torque.

(9) Lower vehicle just enough to enter vehicle. Be sure all wheels are off shop floor. Then start engine, shift transmission into gear, and shift transfer case through all ranges to verify correct adjustment.

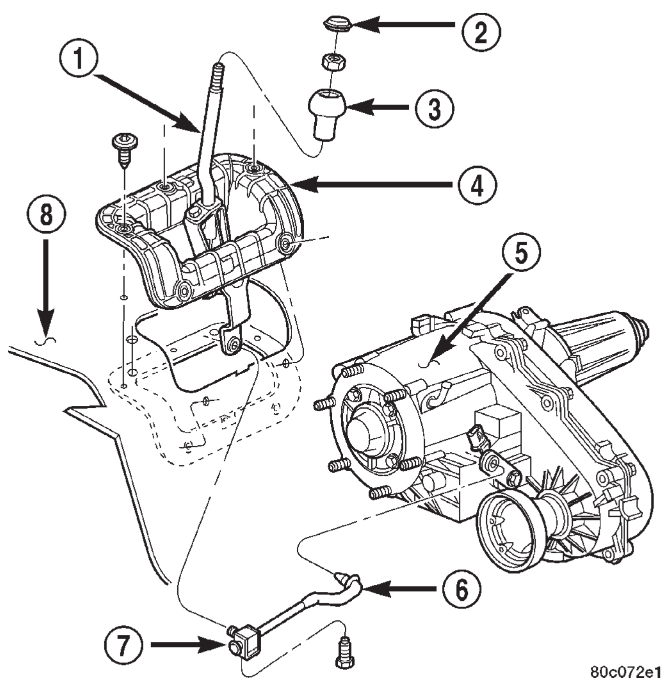


Fig. 84 Transfer Case Shift Linkage

ADJUSTMENTS (Continued)

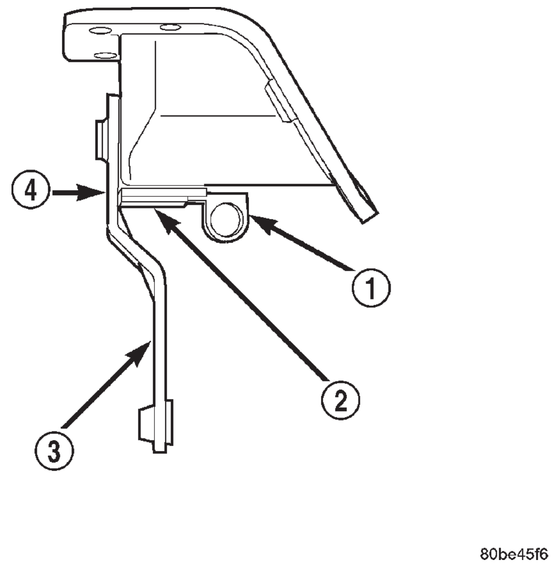


Fig. 85 Shifter Adjustment Channel and Hole

1 – LOCATING PIN
2 – ADJUSTMENT CHANNEL
3 – LOWER SHIFTER LEVER
4 – LOCATING HOLE

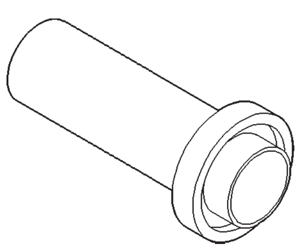
SPECIFICATIONS

TORQUE

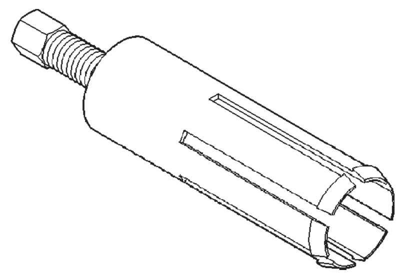
DESCRIPTION	TORQUE
Plug, Detent	16–24 N·m (12–18 ft. lbs.)
Plug, Drain/Fill	20–34 N·m (15–25 ft. lbs.)
Bolt, Front Brg. Retainer	21 N·m (16 ft. lbs.)
Bolt, Front Brg. Retainer	21 N·m (16 ft. lbs.)
Bolt, Case Half	27–34 N·m (20–25 ft. lbs.)
Nut, Front Yoke	122–176 N·m (90–130 ft. lbs.)
Nut, Range Lever	27–34 N·m (20–25 ft. lbs.)
Bolt, Rear Retainer	35–46 N·m (26–34 ft. lbs.)
Nuts, Mounting	30–41 N·m (20–30 ft. lbs.)
Switch, Indicator	20–34 N·m (15–25 ft. lbs.)
Nut, Shifter Knob .	11.3–13.6 N·m) 100–120 in.lbs.)
Bolt, Shift Lever . .	22.6–33.9 N·m (200–300 in.lbs.)

SPECIAL TOOLS

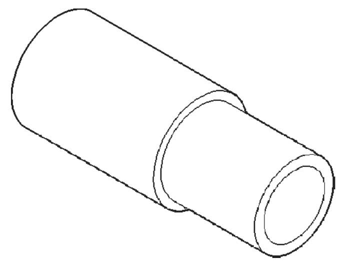
NV231



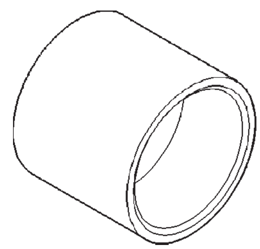
Installer, Seal—8143



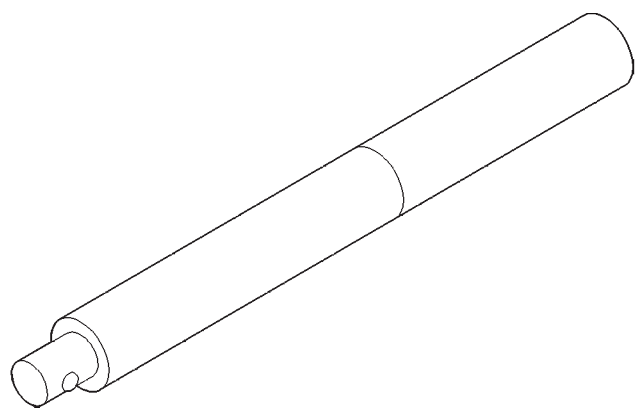
Remover, Bushing—6957



Installer, Bushing—8160

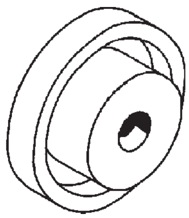


Installer, Seal—C-3995-A

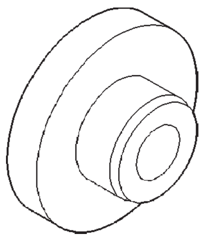


Handle, Universal—C-4171

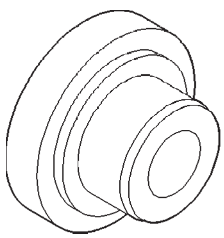
SPECIAL TOOLS (Continued)



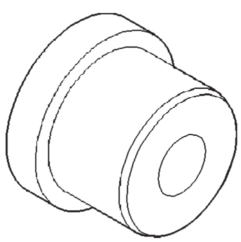
Installer, Seal—C-4210



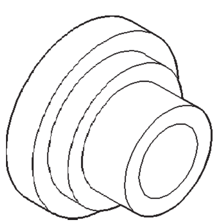
Installer, Bearing—5064



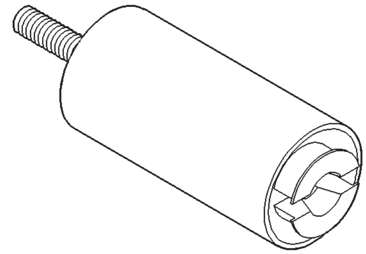
Installer, Bearing—5065



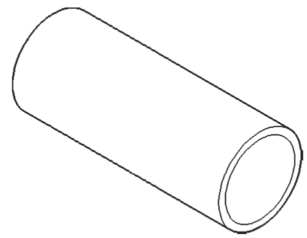
Installer, Bushing—5066



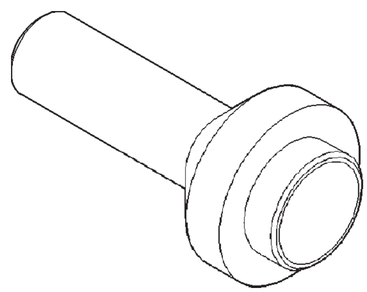
Installer, Bearing—8128



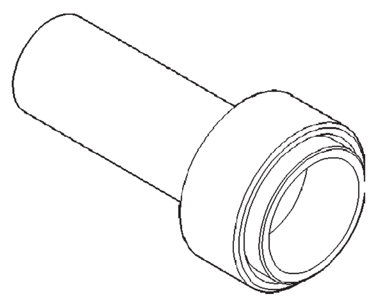
Remover—L-4454



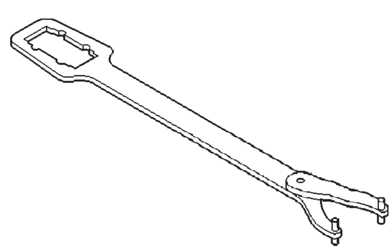
Cup—8148



Installer, Seal—7884



Installer, Pump Housing Seal—7888



Holder, Yoke—C-3281

NV242 TRANSFER CASE

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
NV242 TRANSFER CASE 533
LUBRICANT AND FILL LEVEL 534
DIAGNOSIS AND TESTING
NV242 DIAGNOSIS 534
REMOVAL AND INSTALLATION
TRANSFER CASE 535
TRANSFER CASE SHIFTER 535
FRONT OUTPUT SHAFT SEAL 536
REAR RETAINER BUSHING AND SEAL 536

page

DISASSEMBLY AND ASSEMBLY
NV242 TRANSFER CASE 538
CLEANING AND INSPECTION
NV242 TRANSFER CASE 558
ADJUSTMENTS
SHIFTER ADJUSTMENT 560
SPECIFICATIONS
TORQUE 561
SPECIAL TOOLS
NV242 561

DESCRIPTION AND OPERATION

NV242 TRANSFER CASE

DESCRIPTION

The NV242 is a full and part-time transfer case (Fig. 1) with no two wheel drive operation.

A differential in the transfer case is used to control torque transfer to the front and rear axles. A low range gear provides increased low speed torque capability for off road operation. The low range provides a 2.72:1 reduction ratio.

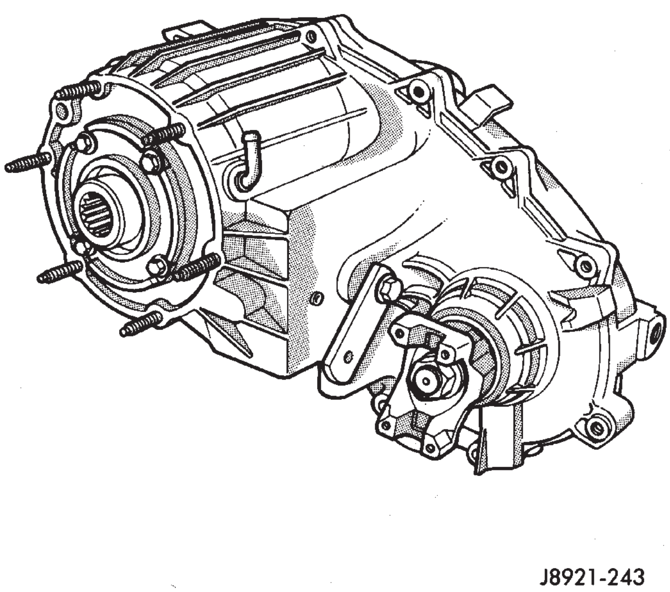


Fig. 1 NV242 Transfer Case

The input gear is splined to the transmission output shaft. It drives the mainshaft through the planetary gear and range hub. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchro mechanism for shifting.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.

TRANSFER CASE IDENTIFICATION

A circular ID tag is attached to the rear case of each transfer case (Fig. 2). The ID tag provides the transfer case model number, assembly number, serial number, and low range ratio.

The transfer case serial number also represents the date of build.

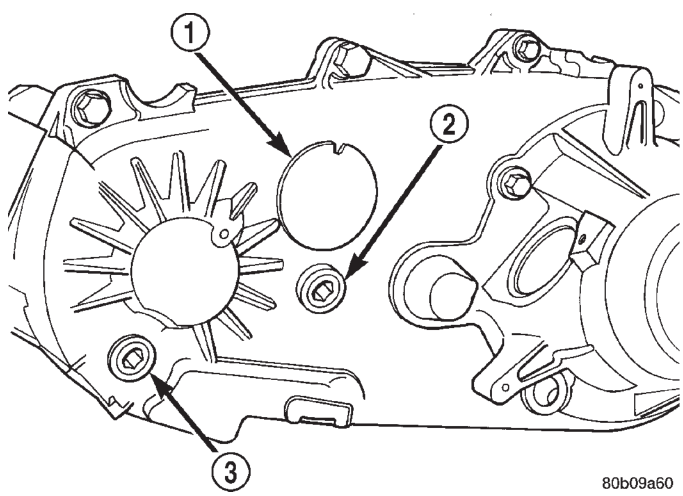


Fig. 2 Fill/Drain Plug And I.D. Tag Locations

1 – I.D. TAG
2 – FILL PLUG
3 – DRAIN PLUG

DESCRIPTION AND OPERATION (Continued)

OPERATING RANGES

NV242 operating ranges are 4HI LOCK (part-time), 4HI LOCK (full time), and 4LO LOCK.

The 4WD modes can be used at any time and on any road surface.

The 4HI LOCK (part-time) and 4LO LOCK ranges are for off road use only. The only time these ranges can be used on hard surface roads, is when the surface is covered with snow and ice.

SHIFT MECHANISM

Operating ranges are selected with a body mounted shift lever. The shift lever is connected to the transfer case range lever by an adjustable linkage rod. A straight line shift pattern is used. Range positions are marked on the shifter bezel cover plate, or on the shift knob.

LUBRICANT AND FILL LEVEL

DESCRIPTION

Recommended lubricant for the NV242 transfer case is Mopar® Dexron III, or ATF+3, type 7176. Approximate lubricant fill capacity is 1.35 liters (2.85 pints).

The fill and drain plugs are both in the rear case (Fig. 3). Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.

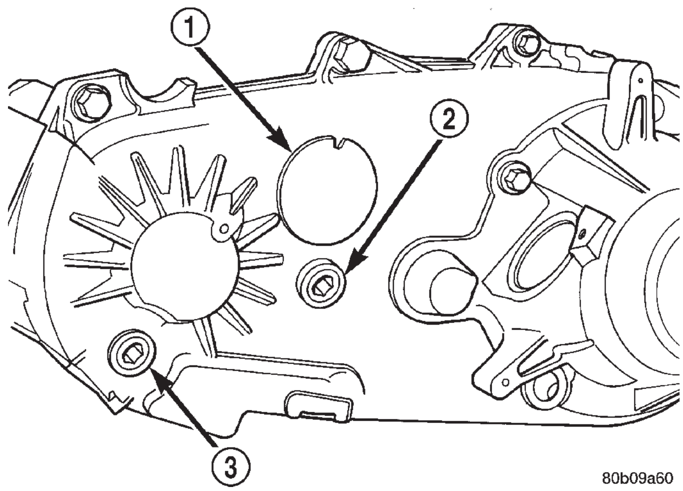


Fig. 3 Fill/Drain Plug Locations

1 – I.D. TAG
2 – FILL PLUG
3 – DRAIN PLUG

DIAGNOSIS AND TESTING

NV242 DIAGNOSIS

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Transfer case difficult to shift or will not shift into desired range.	1) Transfer case shift linkage binding.	1) Repair or replace linkage as necessary.
	2) Insufficient or incorrect lubricant.	2) Drain and refill transfer case with the correct quantity of Mopar® DexronIII or ATF+3, type 7176, Automatic transmission fluid.
	3) Internal transfer case components binding, worn, or damaged.	3) Repair or replace components as necessary.
Transfer case noisy in all drive modes.	1) Insufficient or incorrect lubricant.	1) Drain and refill transfer case with the correct quantity of Mopar® DexronIII or ATF+3, type 7176, Automatic transmission fluid.
Lubricant leaking from transfer case seals or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Transfer case vent closed or restricted.	2) Clean or replace vent as necessary.
	3) Transfer case seals damaged or installed incorrectly.	3) Replace suspect seal.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSE	CORRECTION
Transfer case will not shift through 4HI LOCK (part time) range (light remains on)	1) Incomplete shift due to drivetrain torque load.	1) Momentarily release the accelerator pedal to complete the shift.
	2) Incorrect tire pressure.	2) Correct tire pressure as necessary.
	3) Excessive Tire wear.	3) Correct tire condition as necessary.
	4) Excessive vehicle loading.	4) Correct as necessary.

REMOVAL AND INSTALLATION

TRANSFER CASE

REMOVAL

(1) Shift transfer case into 4WD.
(2) Raise vehicle.
(3) Drain transfer case lubricant.
(4) Mark front and rear propeller shafts for alignment reference.
(5) Support transmission with jack stand.
(6) Remove skid plate, if equipped.
(7) Disconnect front and rear propeller shafts at transfer case.
(8) Disconnect transfer case linkage rod from range lever.
(9) Disconnect transfer case vent hose (Fig. 4) and indicator switch harness, if necessary.
(10) Support transfer case with transmission jack.
(11) Secure transfer case to jack with chains.
(12) Remove nuts attaching transfer case to transmission.
(13) Pull transfer case and jack rearward to disengage transfer case.
(14) Remove transfer case from under vehicle.

INSTALLATION

(1) Mount transfer case on a transmission jack.
(2) Secure transfer case to jack with chains.
(3) Position transfer case under vehicle.
(4) Align transfer case and transmission shafts and install transfer case on transmission.
(5) Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque (Fig. 4).
(6) Connect vent hose.
(7) Connect indicator switch harness to transfer case switch, if necessary. Secure wire harness to clips on transfer case.
(8) Align and connect the propeller shafts.
(9) Fill transfer case with correct fluid. Refer to Lubricant And Fill Level section for proper fluid and capacity.

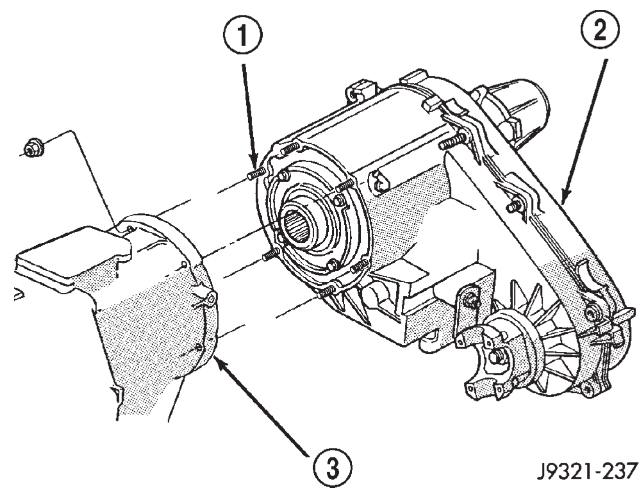


Fig. 4 Transfer Case Mounting–Typical
1 – MOUNTING STUDS
2 – TRANSFER CASE
3 – TRANSMISSION

(10) Install rear crossmember and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.
(11) Remove transmission jack and support stand.
(12) Connect shift rod to transfer case range lever.
(13) Verify the adjustment of the transfer case shift linkage.
(14) Lower vehicle and verify transfer case shift operation.

TRANSFER CASE SHIFTER

REMOVAL

(1) Shift transfer case and shifter into the 42WD position.
(2) Raise and support vehicle.
(3) Loosen adjusting trunnion lock bolt and slide shift rod out of trunnion (Fig. 5). If rod lacks enough travel to come out of trunnion, push trunnion out of the shifter arm.
(4) Lower the vehicle.
(5) Remove transfer case shifter knob cap.
(6) Remove nut holding shifter knob to shift lever.

(7) Remove shifter knob.
(8) Remove the shifter bezel.
(9) Remove the shift lever.
(10) Remove bolts holding shifter to vehicle floor pan.
(11) Separate shifter from the vehicle.

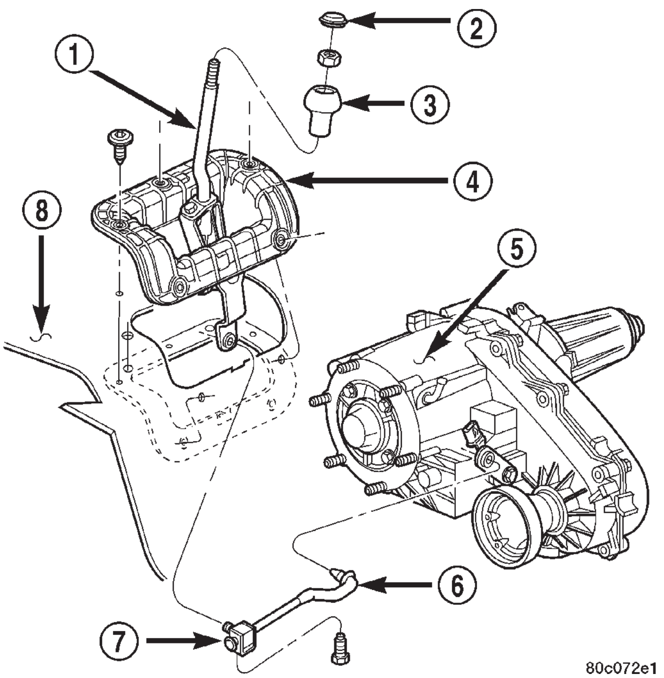


Fig. 5 Shifter

INSTALLATION

(1) If a new shifter is not being installed, secure an appropriately sized pin through the adjustment channel and hole, located in the base of the shifter body.
(2) Position shifter on the vehicle floor pan.
(3) Install the bolts to hold the shifter to the floor pan. Tighten the bolts to 12.4 N·m (110 in.lbs.).
(4) Install the shift lever to the shifter. Tighten the shift lever bolt to 28.3 N·m (250 in.lbs.).
(5) Install the shifter bezel.
(6) Install shift knob on shift lever.
(7) Install nut to hold shifter knob to shift lever.
(8) Install shifter knob cap.
(9) Raise the vehicle.
(10) Install the shift rod to the trunnion, if necessary.
(11) Tighten trunnion lock bolt 10 N·m (90 in.lbs).
(12) Remove the locating pin from the adjustment channel and hole in the base of the shifter.
(13) Lower vehicle.
(14) Verify transfer case operation.

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle.
(2) Remove front propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedure.
(3) Remove front output shaft yoke.
(4) Remove seal from front case with pry tool (Fig. 6).

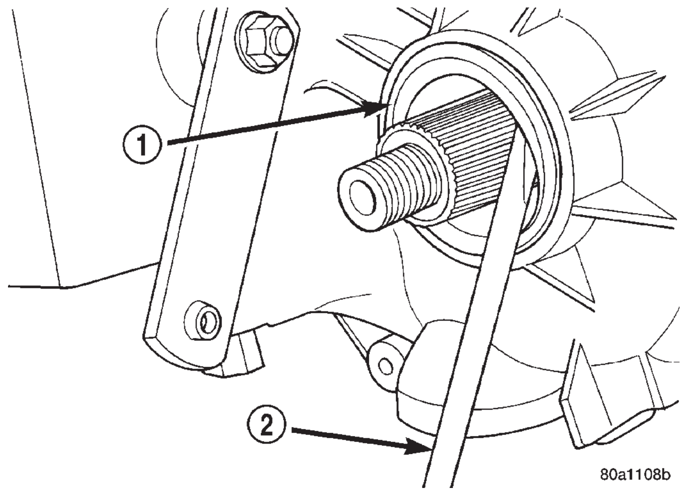


Fig. 6 Remove Front Output Shaft Seal

1 – OUTPUT SHAFT SEAL
2 – PRYBAR

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 6952-A as follows:
(a) Place new seal on tool. Garter spring on seal goes toward interior of case.
(b) Start seal in bore with light taps from hammer (Fig. 7). Once seal is started, continue tapping seal into bore until installer tool seats against case.

REAR RETAINER BUSHING AND SEAL

REMOVAL

(1) Raise vehicle.
(2) Remove rear propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedure.
(3) Using a suitable pry tool or slide-hammer mounted screw, remove the rear retainer seal.
(4) Using Remover 6957, remove bushing from rear retainer (Fig. 8).

INSTALLATION

(1) Clean fluid residue from sealing surface and inspect for defects.
(2) Position replacement bushing in rear retainer with fluid port in bushing aligned with slot in retainer.

REMOVAL AND INSTALLATION (Continued)

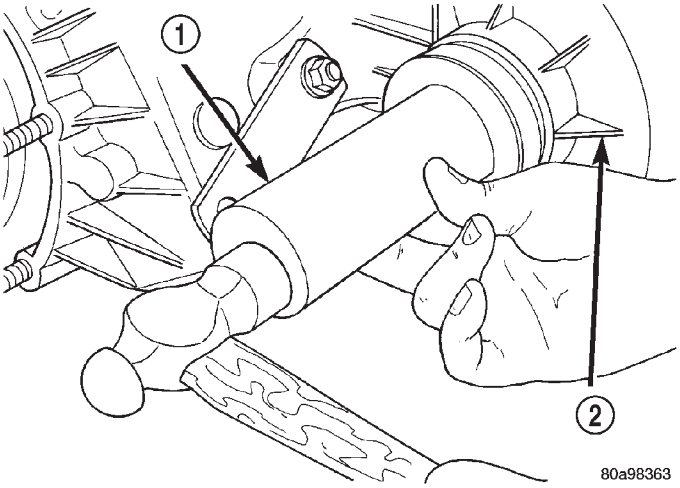


Fig. 7 Front Output Seal Installation

1 – INSTALLER 6952–A
2 – TRANSFER CASE

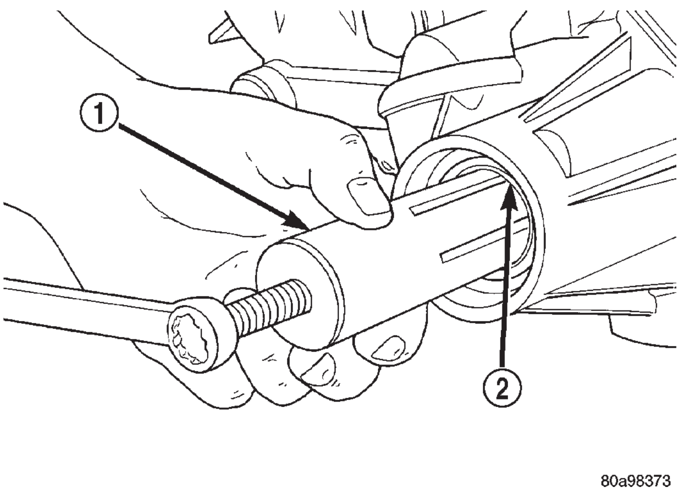


Fig. 8 Rear Retainer Bushing Removal

1 – REMOVER 6957
2 – REAR RETAINER BUSHING

(3) Using Installer 8160, drive bushing into retainer until installer seats against case (Fig. 9).

(4) Using Installer C-3995-A, install seal in rear retainer (Fig. 10).

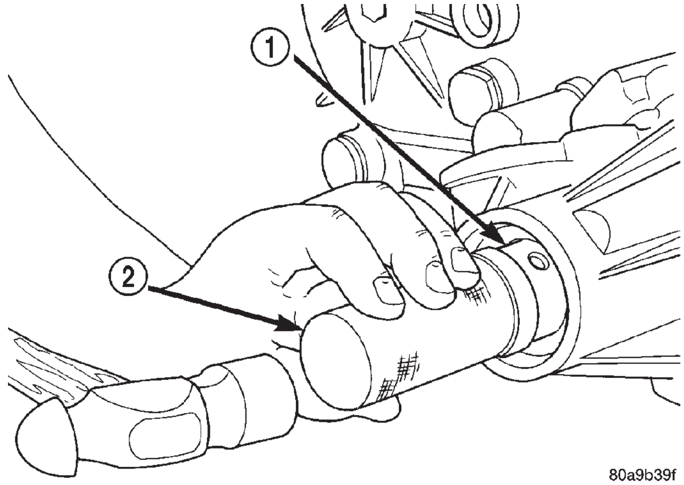


Fig. 9 Rear Retainer Bushing Install

1 – REAR RETAINER BUSHING
2 – INSTALLER 8160

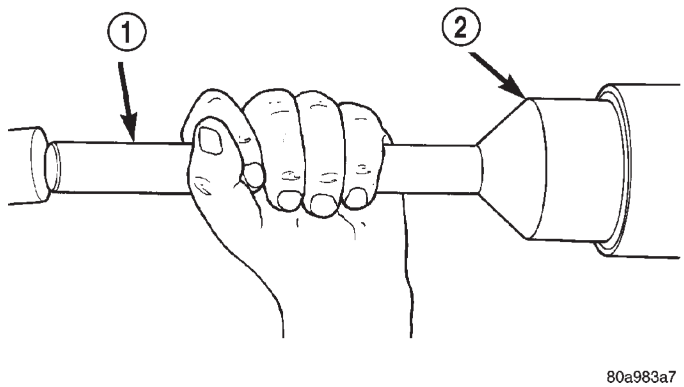


Fig. 10 Install Rear Retainer Seal

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-3995-A

(5) Install propeller shaft.
(6) Verify proper fluid level.
(7) Lower vehicle.

DISASSEMBLY AND ASSEMBLY

NV242 TRANSFER CASE

DISASSEMBLY

REAR RETAINER

(1) Remove extension housing bolts.

(2) Tap extension housing with plastic or rawhide mallet to loosen sealer (Fig. 11).

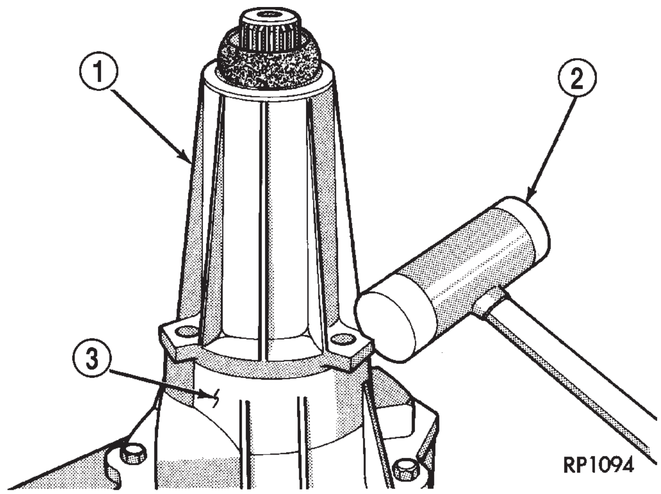


Fig. 11 Remove Extension Housing

1 – EXTENSION HOUSING
2 – PLASTIC HAMMER
3 – REAR RETAINER

(3) Separate extension housing from rear retainer.

(4) Remove rear bearing snap-ring (Fig. 12).

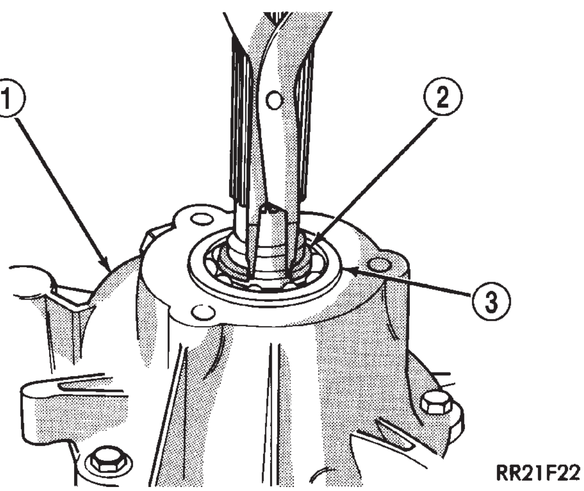


Fig. 12 Remove Rear Bearing Snap-ring

1 – REAR RETAINER
2 – SNAP RING
3 – REAR BEARING

(5) Remove bolts holding rear retainer to rear case half.

(6) Loosen rear retainer with pry tool to break sealer bead. Pry only against retainer boss as shown (Fig. 13).

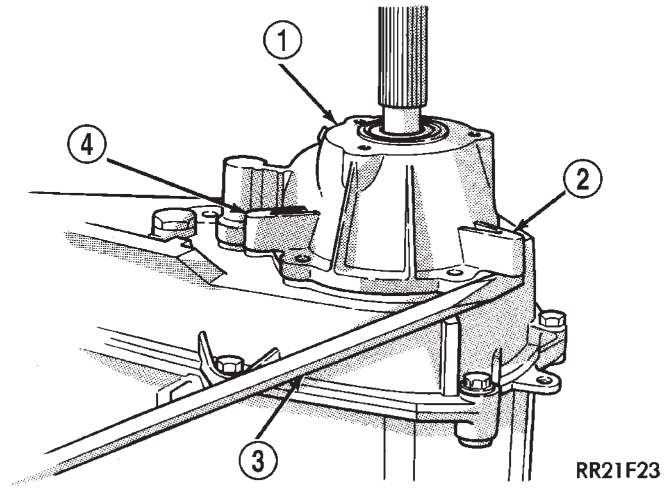


Fig. 13 Loosening Rear Retainer

1 – REAR RETAINER
2 – TAB (2)
3 – SCREWDRIVER
4 – TAB

(7) Remove rear bearing O.D. retaining ring with snap ring pliers. Then tilt pump and slide it off output shaft (Fig. 14)

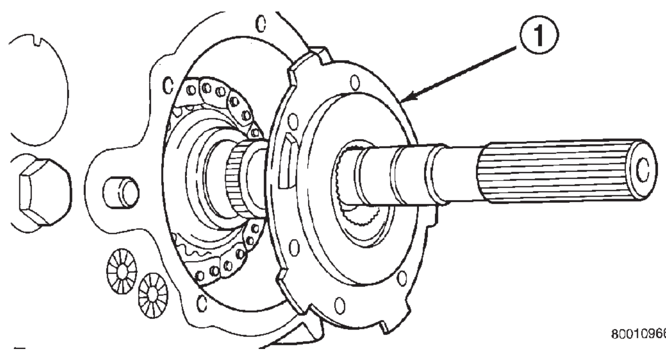


Fig. 14 Oil Pump Removal

1 – OIL PUMP

(8) Remove pickup tube O-ring from pump (Fig. 15) but do not disassemble pump; it is not a repairable part.

(9) Remove seal from oil pump with pry tool.

(10) Remove bolts attaching rear case to front case (Fig. 16). Note position of the two black finish bolts at each end of the case. These bolts go through the case dowels and require a washer under the bolt head.

DISASSEMBLY AND ASSEMBLY (Continued)

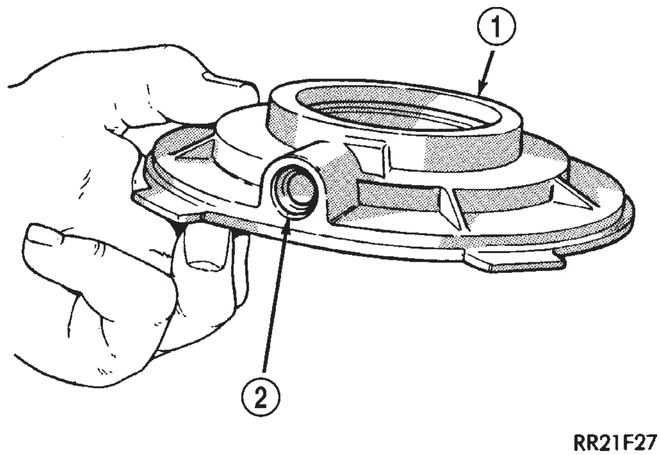


Fig. 15 Pickup Tube O-Ring Location

1 – OIL PUMP
2 – O-RING

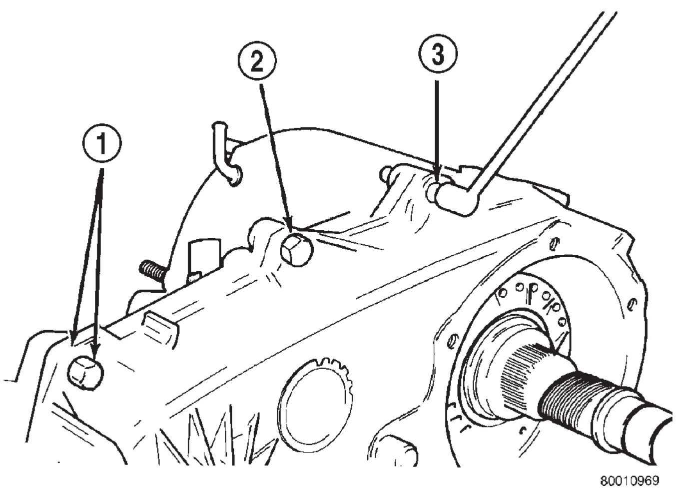


Fig. 16 Spline And Dowel Bolt Locations

1 – DOWEL BOLT AND WASHER (2)
2 – CASE BOLT (5)
3 – SPLINE HEAD BOLT (1)

(11) Remove rear case from front case (Fig. 17). Insert screwdrivers into slots cast into each end of case. Then pry upward to break sealer bead and remove rear case.

CAUTION: Do not pry on the sealing surface of either case half as the surfaces will become damaged.

(12) Remove oil pickup tube and screen from rear case (Fig. 18).

YOKE AND RANGE LEVER

(1) Remove front yoke nut:

(a) Move range lever to 4L position.

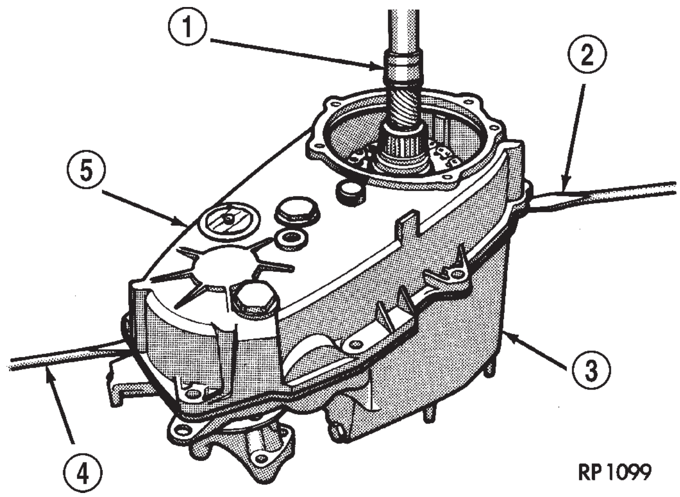


Fig. 17 Loosening/Removing Rear case

1 – MAINSHAFT
2 – SCREWDRIVER
3 – FRONT CASE
4 – SCREWDRIVER
5 – REAR CASE

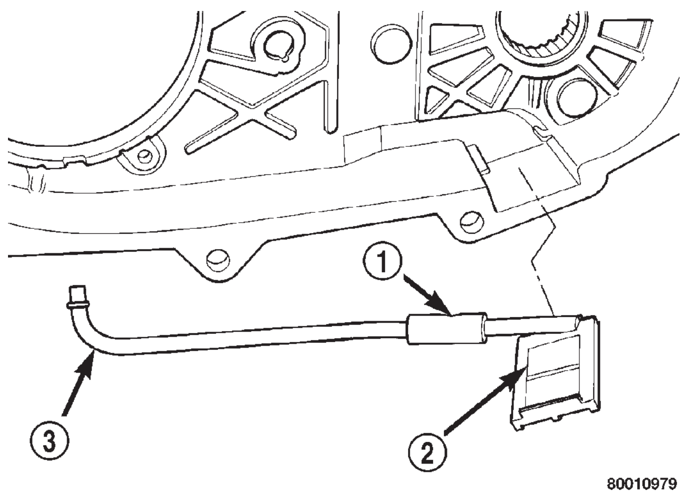


Fig. 18 Oil Pickup Screen, Hose And Tube Removal

1 – CONNECTING HOSE
2 – PICKUP SCREEN
3 – PICKUP TUBE

(b) Remove nut with socket and impact wrench (Fig. 19).

(2) Remove yoke. If yoke is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller (Fig. 20). Be sure puller tool is positioned on yoke and not on slinger as slinger will be damaged.

(3) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(4) Remove nut and washer that attach range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft (Fig. 21).

DISASSEMBLY AND ASSEMBLY (Continued)

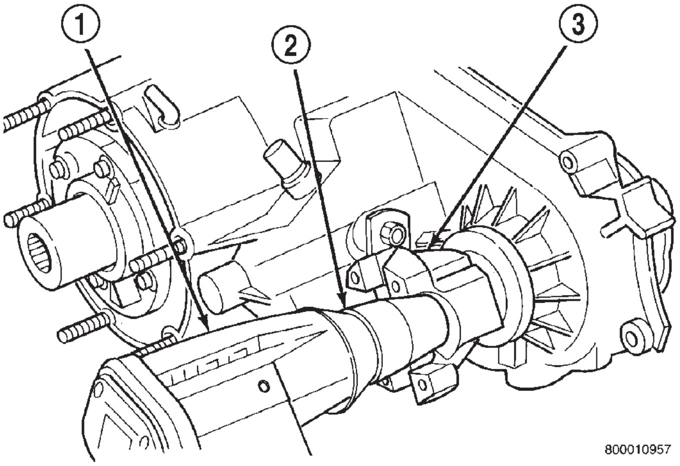


Fig. 19 Yoke Nut Removal

1 – IMPACT WRENCH
2 – SOCKET
3 – YOKE

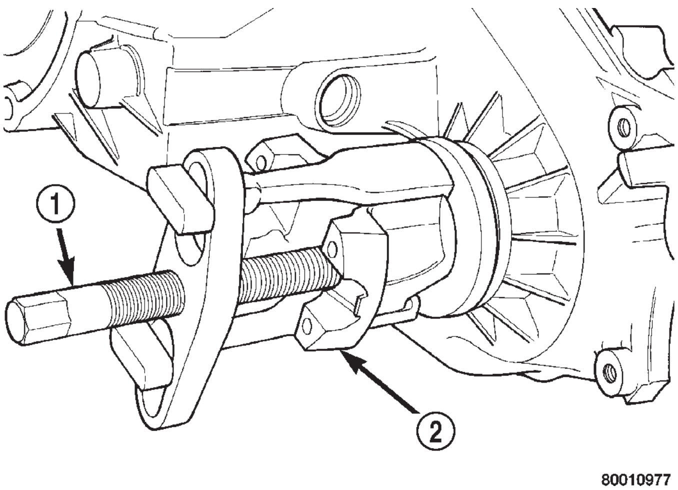


Fig. 20 Yoke Removal

1 – PULLER TOOL
2 – YOKE

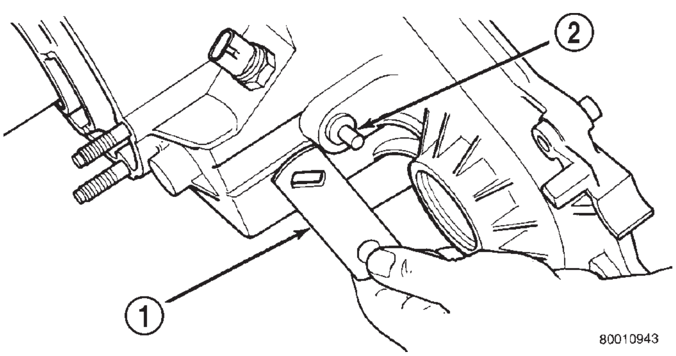


Fig. 21 Range Lever Removal

1 – RANGE LEVER
2 – SECTOR SHAFT

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Remove drive sprocket snap-ring (Fig. 22).

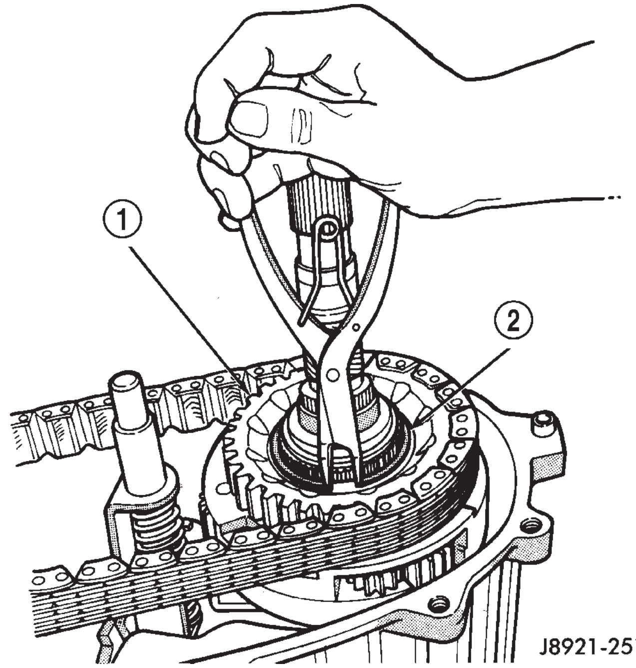


Fig. 22 Drive Sprocket Snap-Ring Removal

1 – DRIVE SPROCKET
2 – DRIVE SPROCKET SNAP RING

(2) Remove drive sprocket and chain (Fig. 23).
(3) Remove front output shaft (Fig. 24).

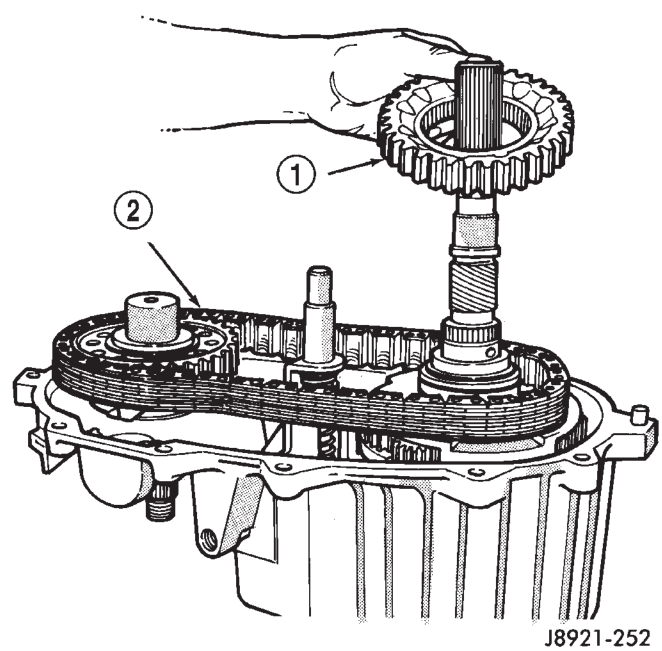


Fig. 23 Drive Sprocket And Chain Removal

1 – DRIVE SPROCKET
2 – DRIVE CHAIN

DISASSEMBLY AND ASSEMBLY (Continued)

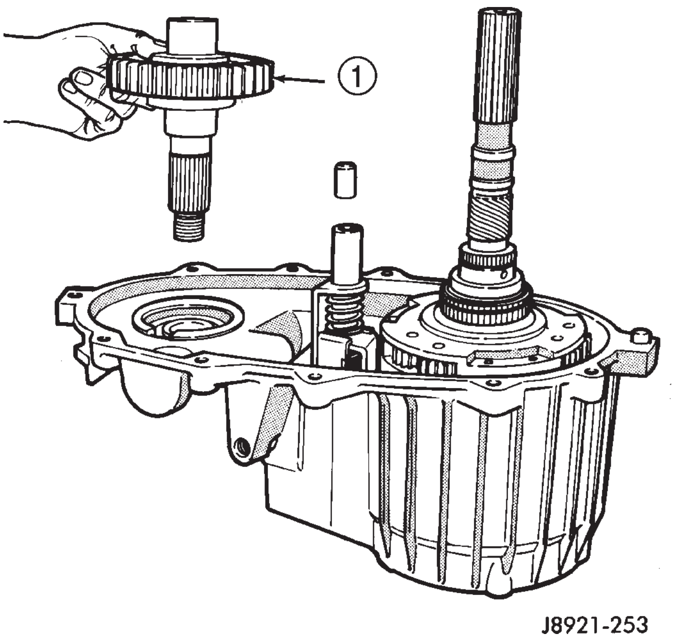


Fig. 24 Removing Front Output Shaft

1 – FRONT OUTPUT SHAFT

SHIFT FORKS AND MAINSHAFT

(1) Remove shift detent plug, spring and pin (Fig. 25).

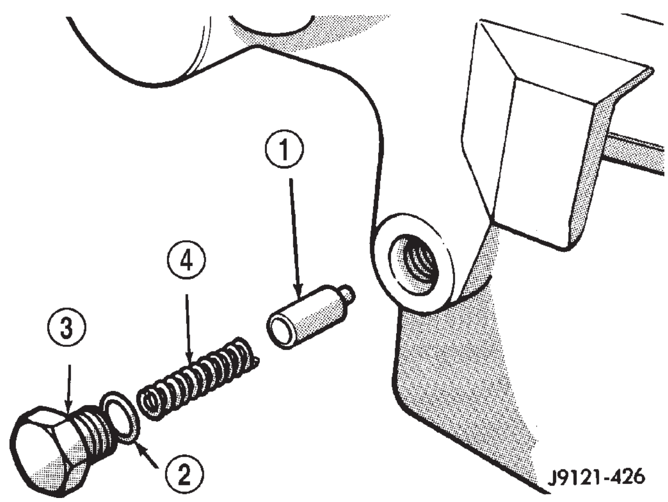


Fig. 25 Detent Component Removal

1 – PLUNGER
2 – O-RING
3 – PLUG
4 – SPRING

(2) Remove seal plug from low range fork lockpin access hole. Then move shift sector to align low range fork lockpin with access hole.

(3) Remove range fork lockpin with size number one easy-out tool as follows:

(a) Insert easy-out tool through access hole in side of transfer case and into lock-pin.

(b) Tap easy-out tool into lock-pin with hammer until tool is securely engaged into the lock-pin.

(c) Install a t-handle, such as from a tap and die set, onto the easy-out tool.

(d) Securely tighten the t-handle onto the tool.

(e) In one motion, pull upward and turn the t-handle counter-clockwise to remove the lock-pin.

(4) Remove shift rail by pulling it straight up and out of fork (Fig. 26).

(5) Remove mode fork and mainshaft as assembly (Fig. 27).

(6) Remove mode shift sleeve and mode fork assembly from mainshaft (Fig. 28). Note position of mode sleeve in fork and remove sleeve.

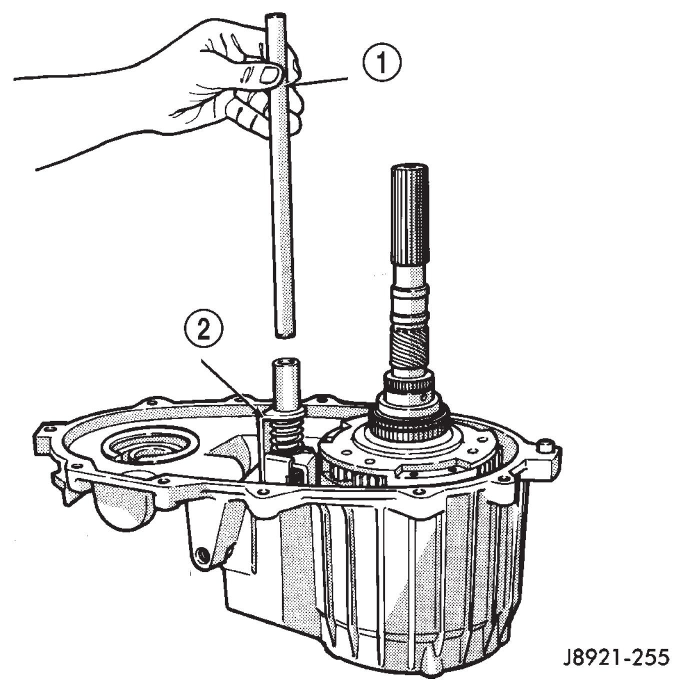


Fig. 26 Shift Rail Removal

1 – SHIFT RAIL
2 – MODE FORK

DISASSEMBLY AND ASSEMBLY (Continued)

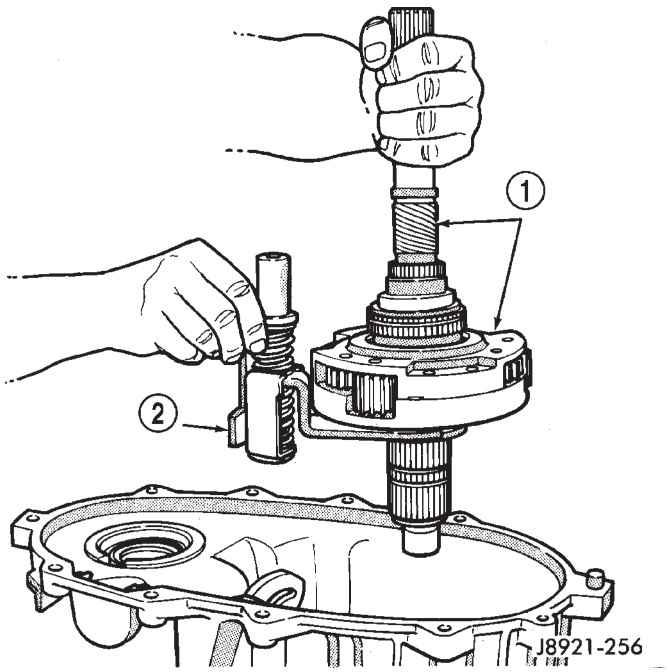


Fig. 27 Mode Fork And Mainshaft Removal

1 – MAINSHAFT ASSEMBLY
2 – MODE FORK

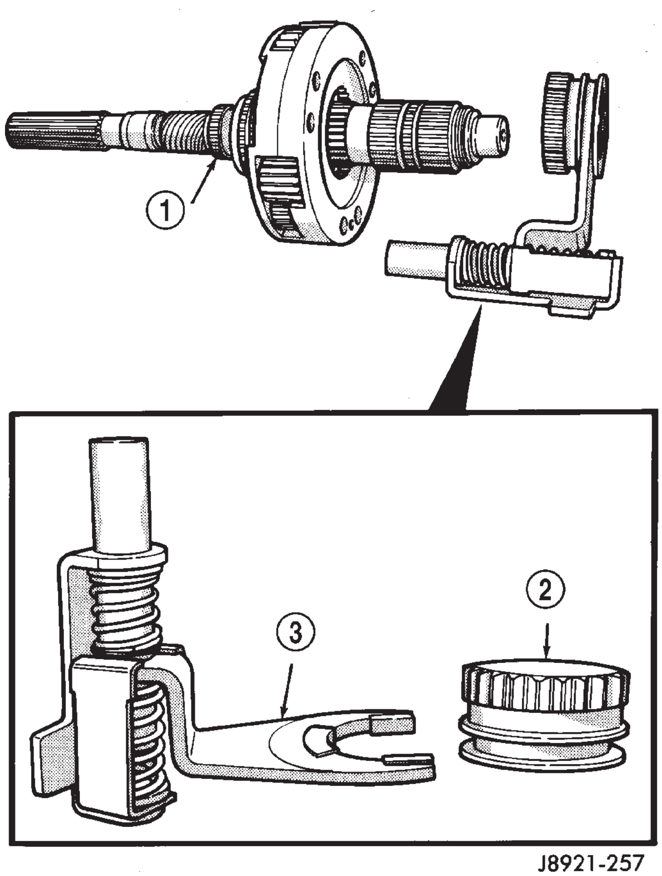


Fig. 28 Mode Fork And Sleeve Removal

1 – MAINSHAFT
2 – SLEEVE
3 – MODE FORK ASSEMBLY

(7) Remove intermediate clutch shaft snap-ring (Fig. 29).

(8) Remove clutch shaft thrust ring (Fig. 30).

(9) Remove intermediate clutch shaft (Fig. 31).

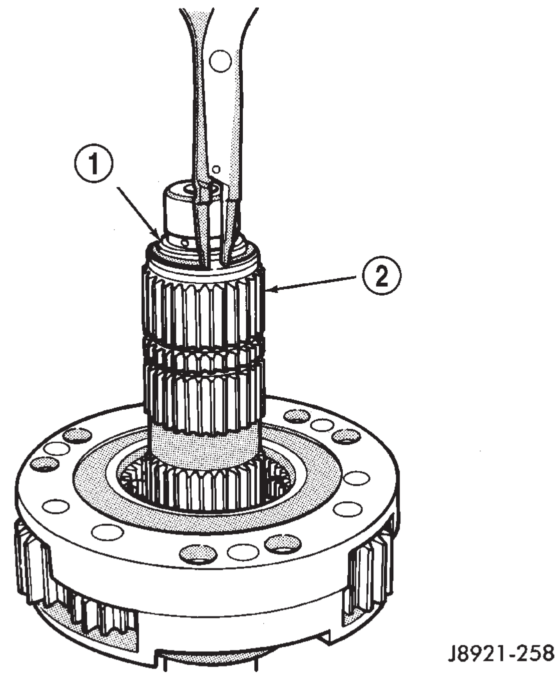


Fig. 29 Intermediate Clutch Shaft Snap-Ring Removal

1 – SNAP RING
2 – INTERMEDIATE CLUTCH SHAFT

Fig. 30 Clutch Shaft Thrust Ring Removal

1 – CLUTCH SHAFT THRUST RING

DISASSEMBLY AND ASSEMBLY (Continued)

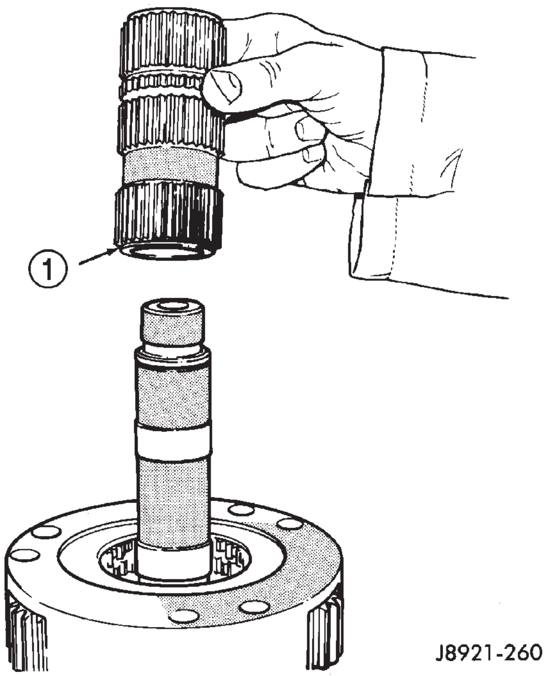


Fig. 31 Intermediate Clutch Shaft Removal

1 – INTERMEDIATE CLUTCH SHAFT

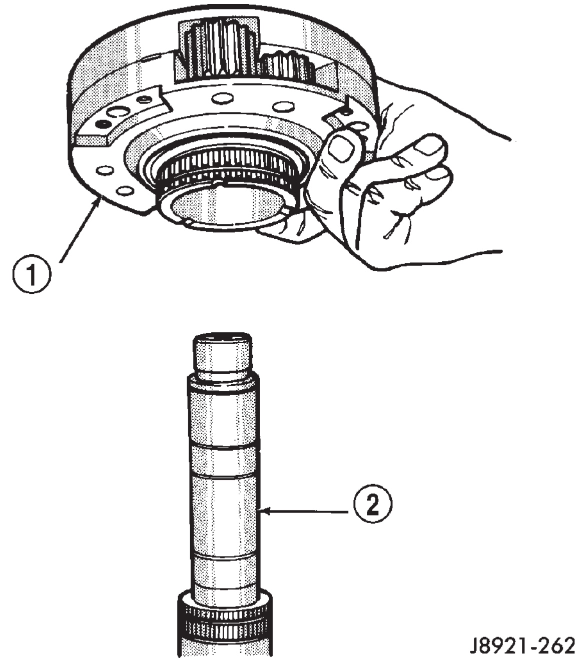


Fig. 33 Differential Removal

1 – DIFFERENTIAL
2 – MAINSHAFT

(10) Remove differential snap-ring (Fig. 32).

(11) Remove differential (Fig. 33).

(12) Remove differential needle bearings and both needle bearing thrust washers from mainshaft.

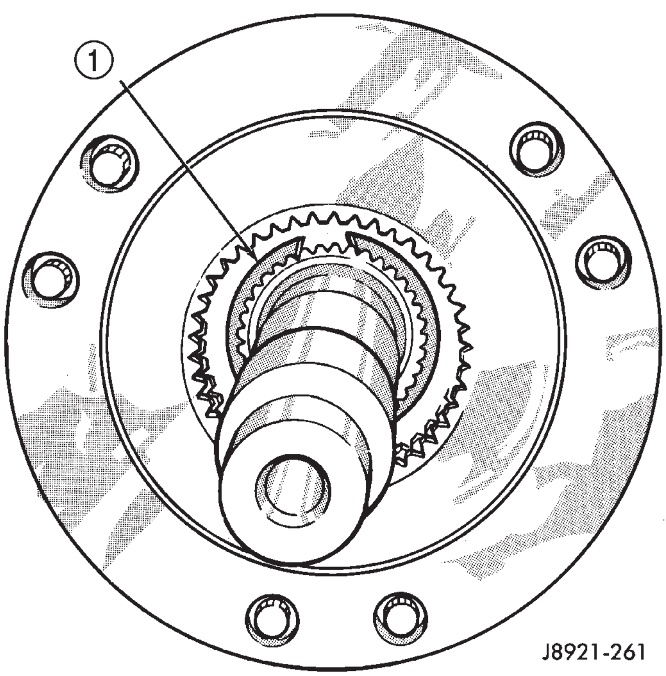


Fig. 32 Differential Snap-Ring Removal

1 – DIFFERENTIAL SNAP RING

(13) Slide low range fork pin out of shift sector slot (Fig. 34).

(14) Remove low range fork and hub (Fig. 35).

(15) Remove shift sector (Fig. 36).

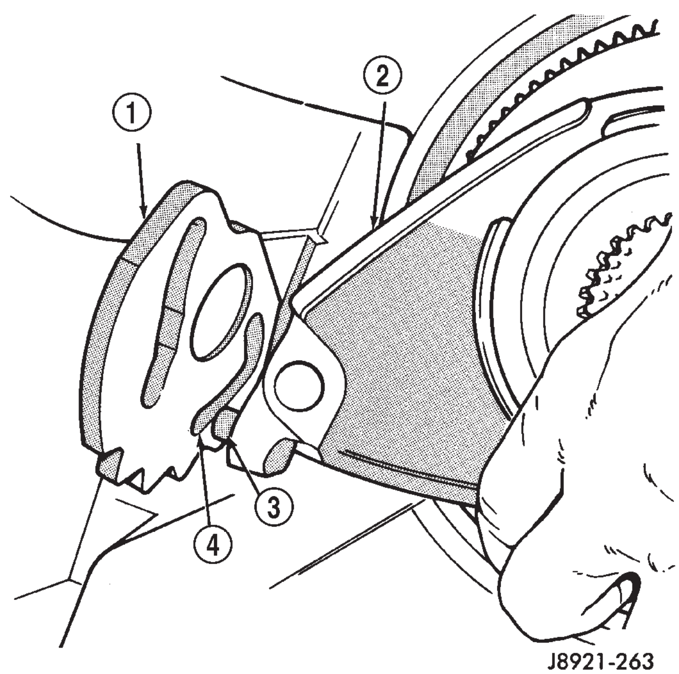


Fig. 34 Disengaging Low Range Fork

1 – SHIFT SECTOR
2 – LOW RANGE FORK
3 – PIN
4 – SLOT

DISASSEMBLY AND ASSEMBLY (Continued)

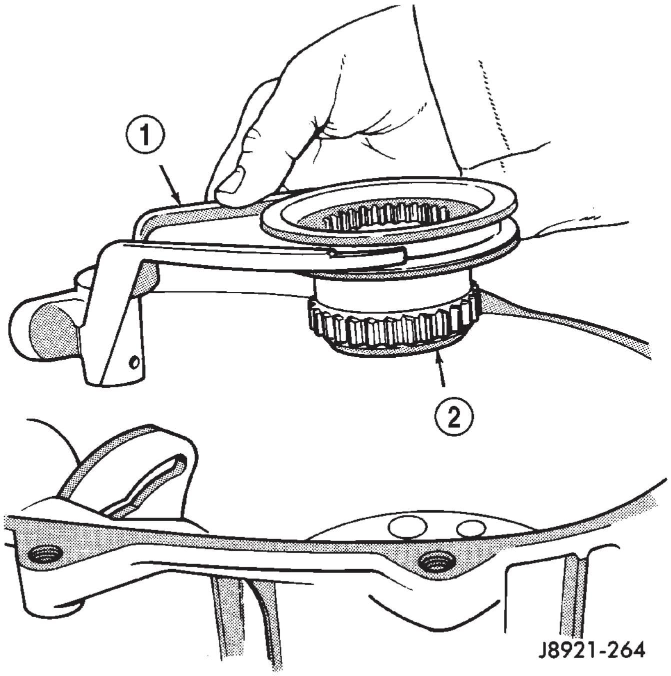


Fig. 35 Low Range Fork And Hub Removal

1 – LOW RANGE FORK
2 – FORK HUB

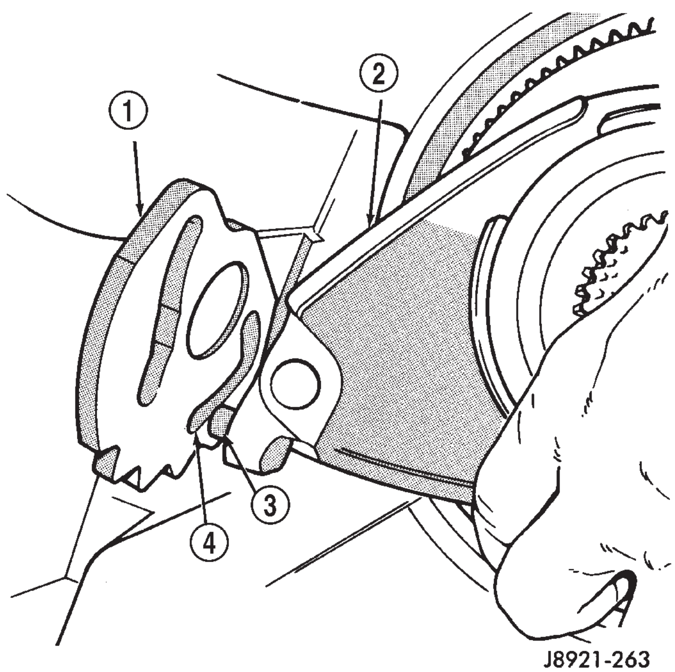


Fig. 36 Shift Sector Position

1 – SHIFT SECTOR
2 – LOW RANGE FORK
3 – PIN
4 – SLOT

(16) Remove shift sector bushing and O-ring (Fig. 37).

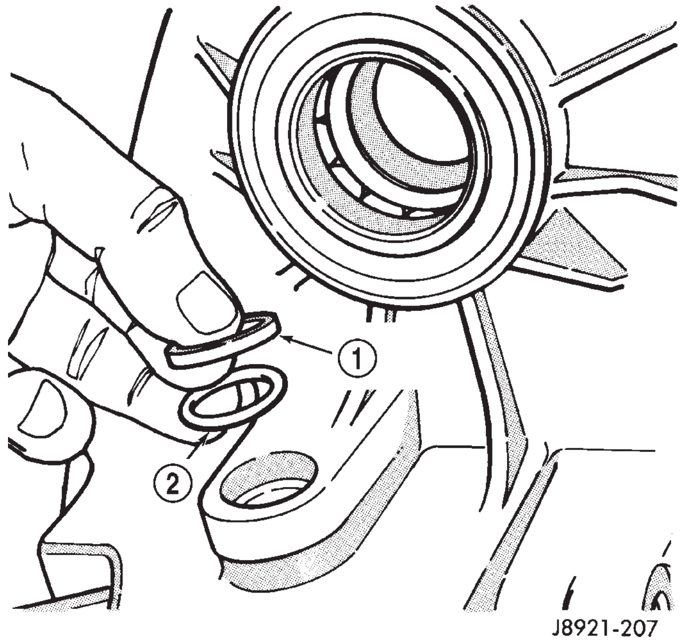


Fig. 37 Sector Bushing And O-Ring Removal

1 – SHIFT SECTOR BUSHING
2 – O-RING

INPUT GEAR/LOW RANGE ASSEMBLY

(1) Remove front bearing retainer bolts.

(2) Remove front bearing retainer. Carefully pry retainer loose with screwdriver (Fig. 38). Position screwdriver in slots cast into retainer.

(3) Remove input gear snap-ring (Fig. 39).

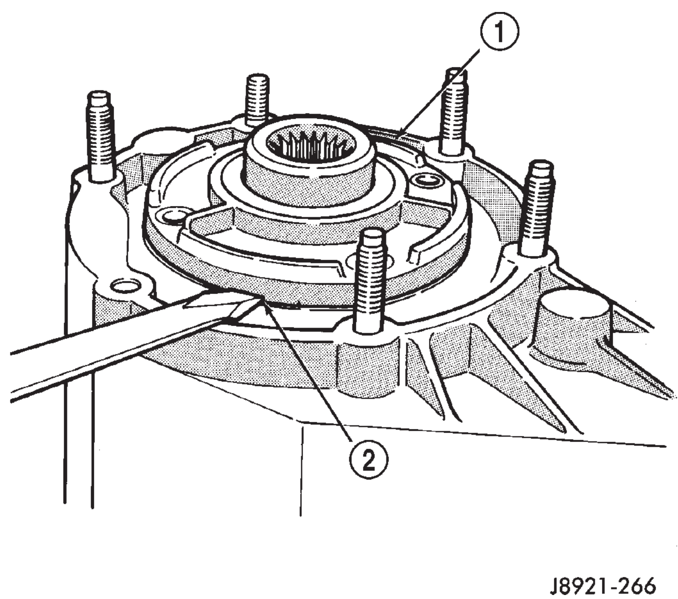


Fig. 38 Front Bearing Retainer Removal

1 – FRONT BEARING RETAINER
2 – RETAINER SLOT

DISASSEMBLY AND ASSEMBLY (Continued)

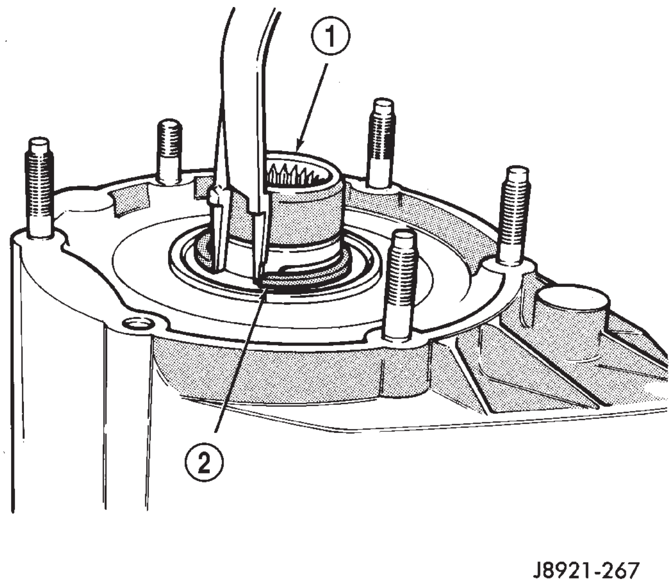


Fig. 39 Input Gear Snap-Ring Removal

1 – INPUT GEAR
2 – SNAP RING

(4) Remove input/low range gear assembly from bearing with Tool Handle C-4171 and Tool 7829A (Fig. 40).

(5) Remove low range gear snap-ring (Fig. 41).

(6) Remove input gear retainer, thrust washers and input gear from low range gear (Fig. 42).

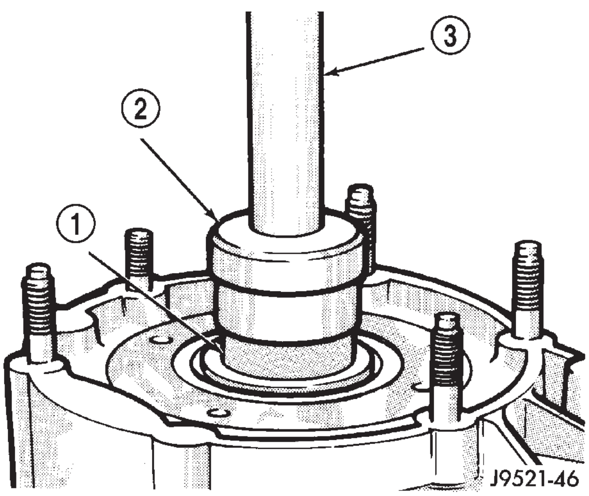


Fig. 40 Input And Low Range Gear Assembly Removal

1 – INPUT-LOW RANGE GEARS
2 – SPECIAL TOOL 7829A
3 – SPECIAL TOOL C-4171

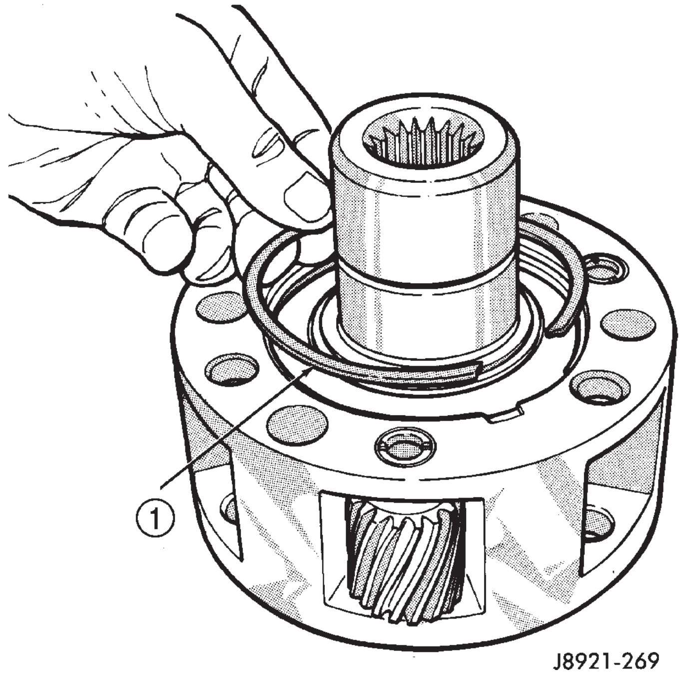


Fig. 41 Low Range Gear Snap-Ring Removal/ Installation

1 – LOW RANGE GEAR SNAP RING

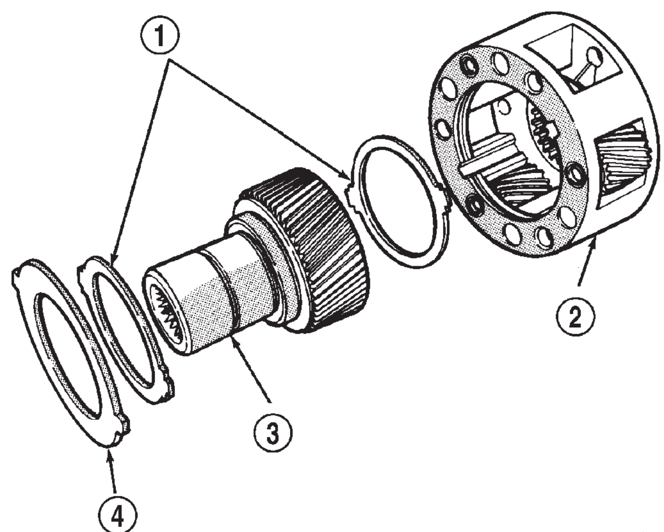


Fig. 42 Low Range Gear Disassembly

1 – THRUST WASHERS
2 – LOW RANGE GEAR
3 – INPUT GEAR
4 – RETAINER

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Inspect low range annulus gear (Fig. 43). **Gear is not a serviceable component. If damaged, replace gear and front case as assembly.**

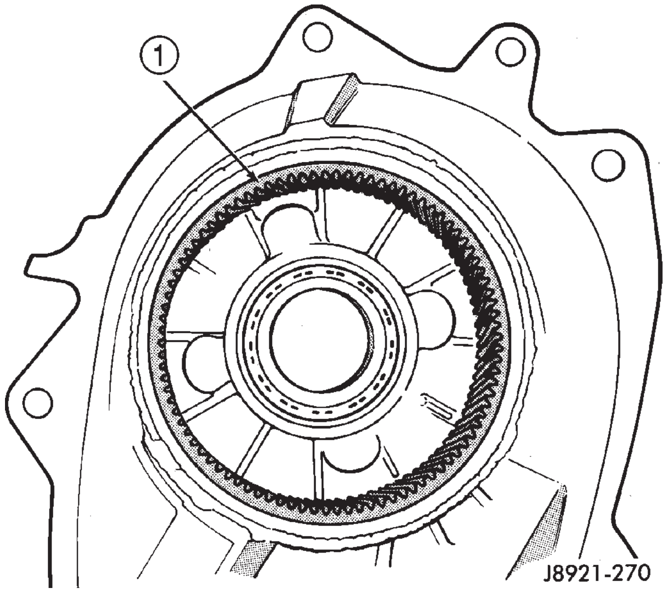


Fig. 43 Inspecting Low Range Annulus Gear

1 – LOW RANGE ANNULUS GEAR

(8) Remove oil seals from following components:
- front bearing retainer.
- rear retainer.
- oil pump.
- case halves.

DIFFERENTIAL

(1) Mark differential case halves for reference.
(2) Remove differential case bolts.
(3) Invert differential on workbench.
(4) Separate top case from bottom case. Use slots in case halves to pry them apart (Fig. 44).
(5) Remove thrust washers and planet gears from case pins (Fig. 45).
(6) Remove mainshaft and sprocket gears from bottom case (Fig. 46). Note gear position for reference before separating them.

ASSEMBLY

Lubricate transfer case components with automatic transmission fluid or petroleum jelly (where indicated) during assembly.

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

BEARING AND SEAL

(1) Remove snap-ring that retains front output shaft front bearing in case (Fig. 47). Then remove

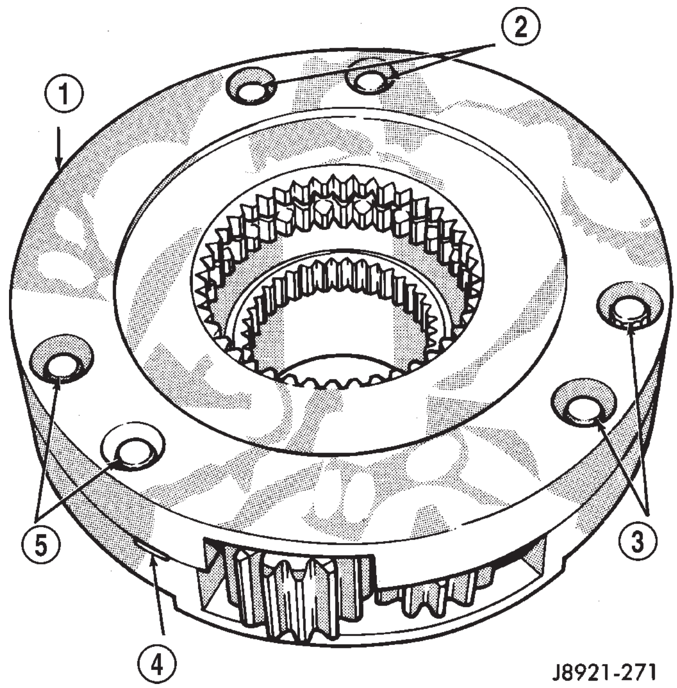


Fig. 44 Separating Differential Case Halves

1 – TOP CASE
2 – CASE BOLTS
3 – CASE BOLTS
4 – CASE SLOTS
5 – CASE BOLTS

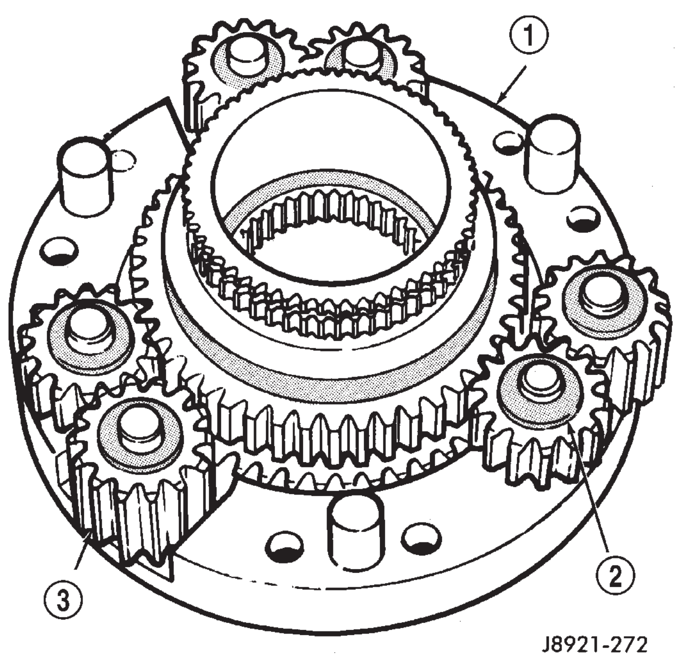


Fig. 45 Planet Gears And Thrust Washer Removal

1 – BOTTOM CASE
2 – THRUST WASHERS (12)
3 – PLANET GEARS (6)

DISASSEMBLY AND ASSEMBLY (Continued)

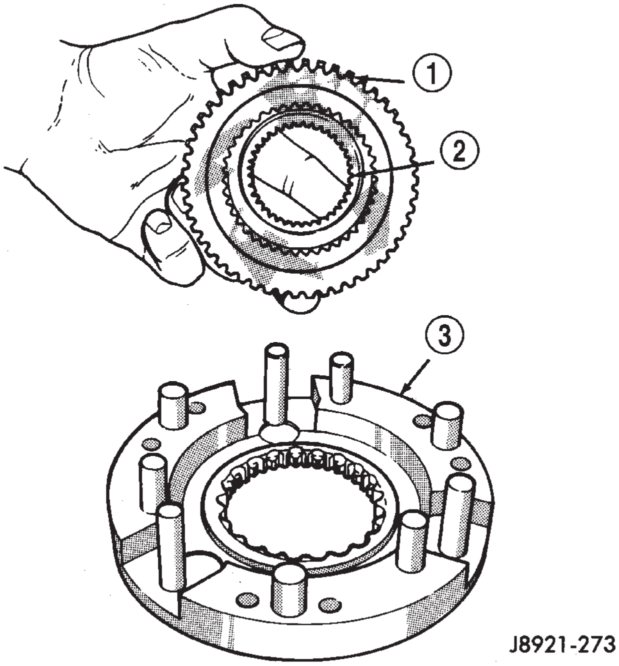


Fig. 46 Mainshaft And Sprocket Gear Removal

1 – MAINSHAFT GEAR
2 – SPROCKET GEAR
3 – BOTTOM CASE

bearing. Use hammer handle, or hammer and brass punch to tap bearing out of case.

(2) Install new front output shaft front bearing with Tool Handle C-4171 and Installer 8033A with the tapered cone upward (Fig. 48).

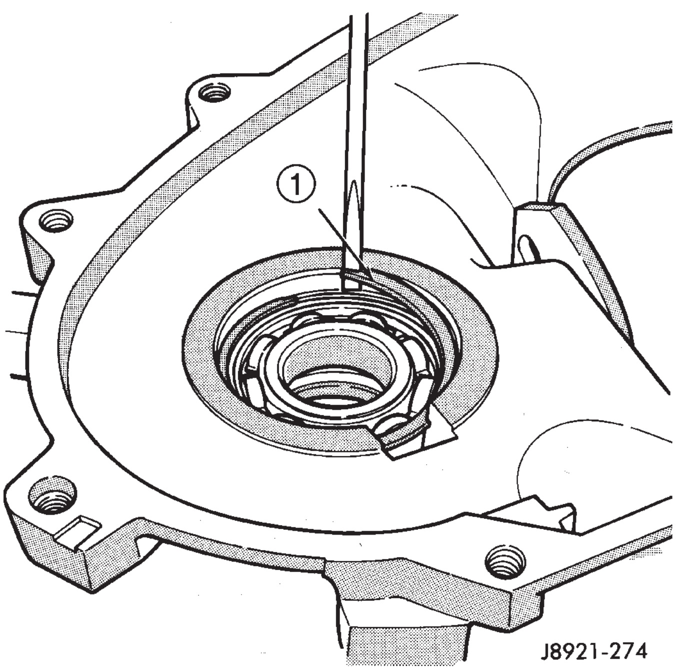


Fig. 47 Front Output Shaft Front Bearing Snap-Ring Removal

1 – FRONT BEARING SNAP RING

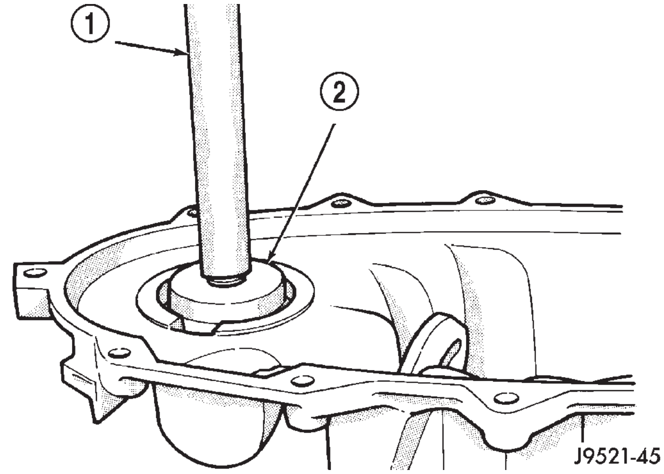


Fig. 48 Front Output Shaft Front Bearing Installation

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL 8033A

(3) Install front bearing snap-ring (Fig. 47).

(4) Remove front output shaft seal using an appropriate pry tool (Fig. 49) or slide-hammer mounted screw.

(5) Install new front output shaft oil seal with Installer 6952-A (Fig. 50).

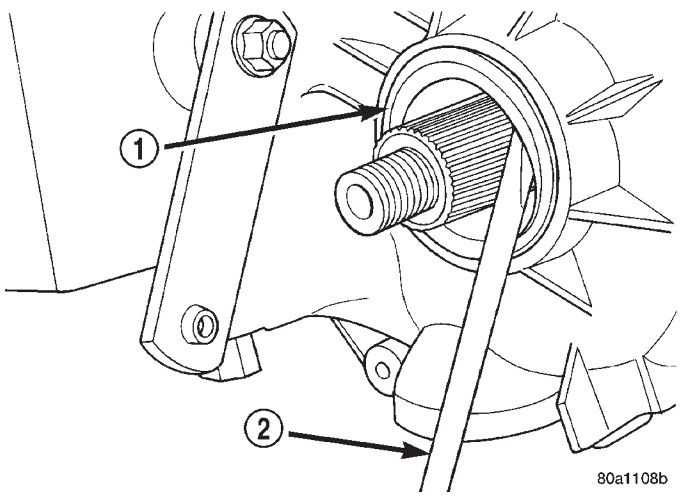


Fig. 49 Remove Front Output Shaft Seal

1 – OUTPUT SHAFT SEAL
2 – PRYBAR

DISASSEMBLY AND ASSEMBLY (Continued)

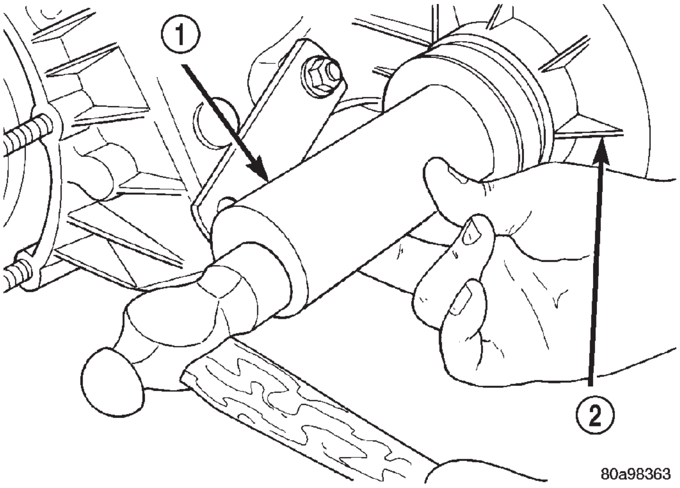


Fig. 50 Install Front Output Shaft Seal

1 – INSTALLER 6952–A
2 – TRANSFER CASE

(6) Remove input gear bearing with Tool Handle C-4171 and Remover C-4210 (Fig. 51).

(7) Install snap-ring on new input gear bearing.

(8) Install new input gear bearing with Tool Handle C-4171 and Remover C-4210. Install bearing far enough to seat snap-ring against case (Fig. 52).

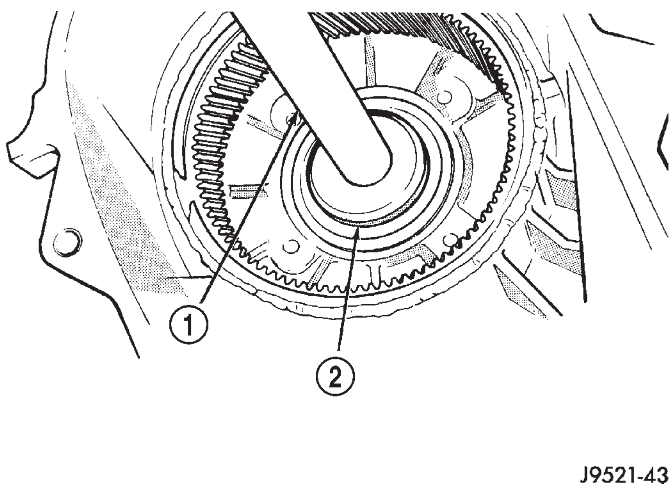


Fig. 51 Input Gear Bearing Removal

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL C-4210

(9) Remove the input gear pilot bearing by inserting a suitably sized drift into the splined end of the input gear and driving the bearing out with the drift and a hammer (Fig. 53).

(10) Install new pilot bearing with Installer 8128 and Handle C-4171 (Fig. 54).

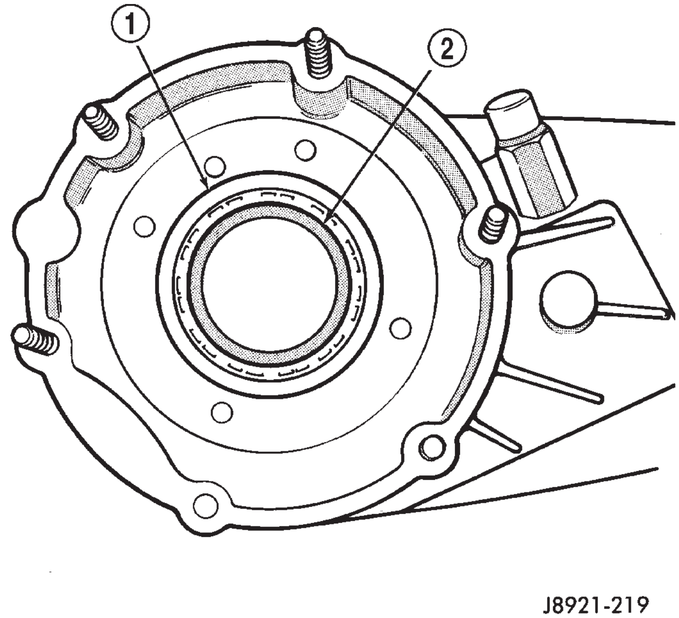


Fig. 52 Seating Input Gear Bearing

1 – SNAP RING
2 – INPUT SHAFT BEARING

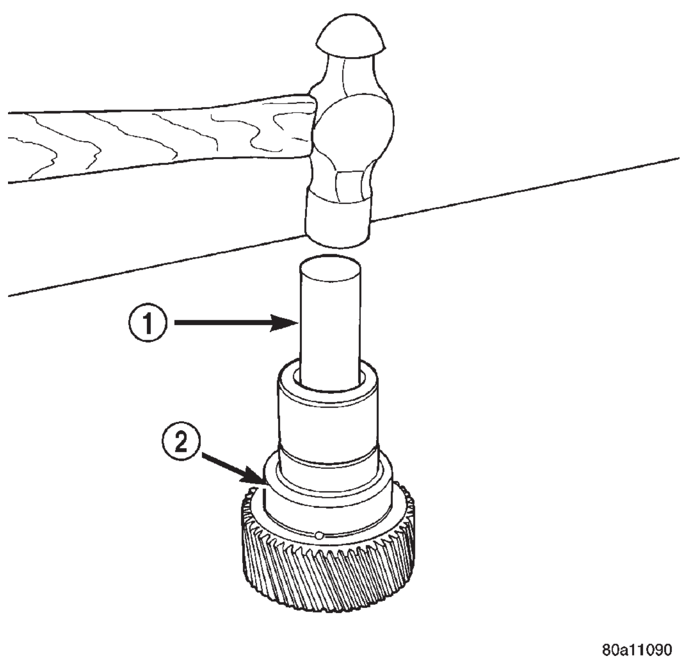


Fig. 53 Remove Input Gear Pilot Bearing

1 – DRIFT
2 – INPUT GEAR

DISASSEMBLY AND ASSEMBLY (Continued)

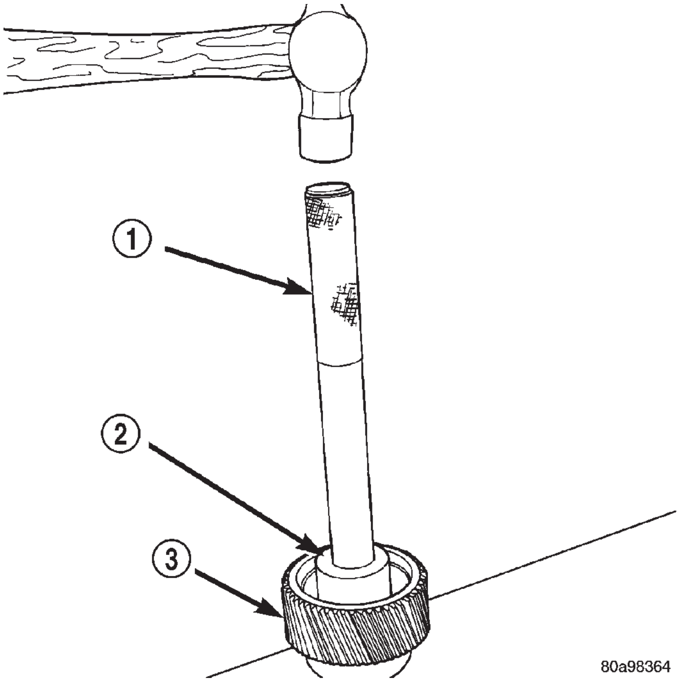


Fig. 54 Install Input Gear Pilot Bearing

1 – HANDLE C-4171
2 – INSTALLER 8128
3 – INPUT GEAR

(11) Install new seal in front bearing retainer with Installer 7884 (Fig. 55).

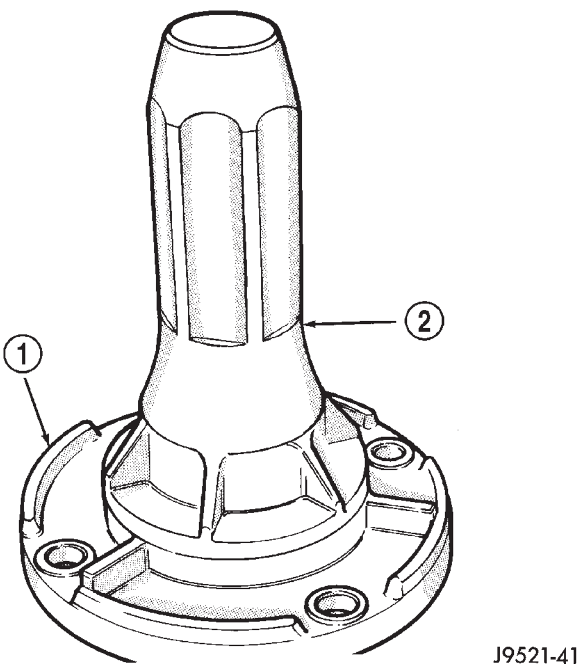


Fig. 55 Front Bearing Retainer Seal Installation

1 – FRONT BEARING RETAINER
2 – SPECIAL TOOL 7884

(12) Remove output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 56).

(13) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 57). Lubricate bearing after installation.

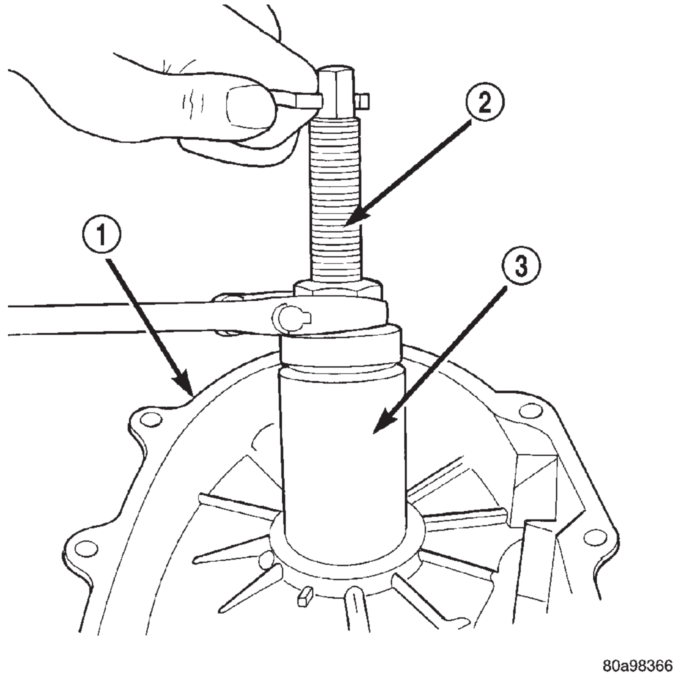


Fig. 56 Remove Front Output Shaft Rear Bearing

1 – REAR CASE
2 – SPECIAL TOOL L-4454–1 AND L-4454–3
3 – SPECIAL TOOL 8148

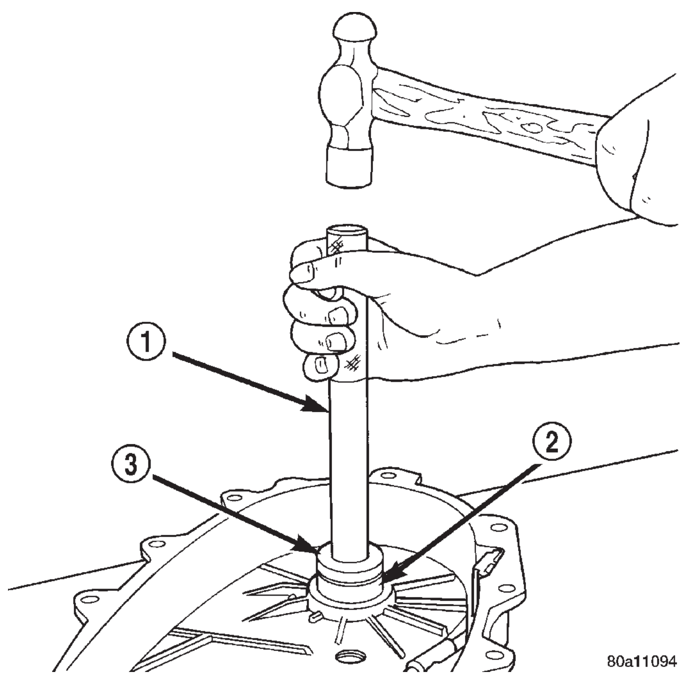


Fig. 57 Install Front Output Shaft Rear Bearing

1 – HANDLE C-4171
2 – OUTPUT SHAFT INNER BEARING
3 – INSTALLER 5066

DISASSEMBLY AND ASSEMBLY (Continued)

(14) Install new seal in oil pump feed housing with Special Tool 7888 (Fig. 58).

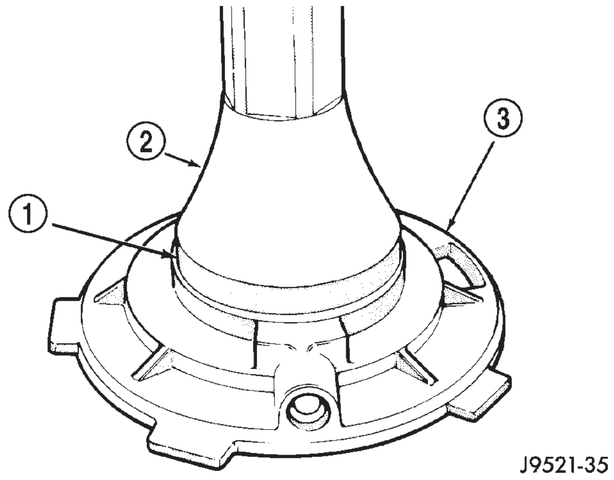


Fig. 58 Oil Pump Seal Installation

1 – HOUSING SEAL
2 – SPECIAL TOOL 7888
3 – OIL PUMP FEED HOUSING

(15) Install new pickup tube O-ring in oil pump (Fig. 59).

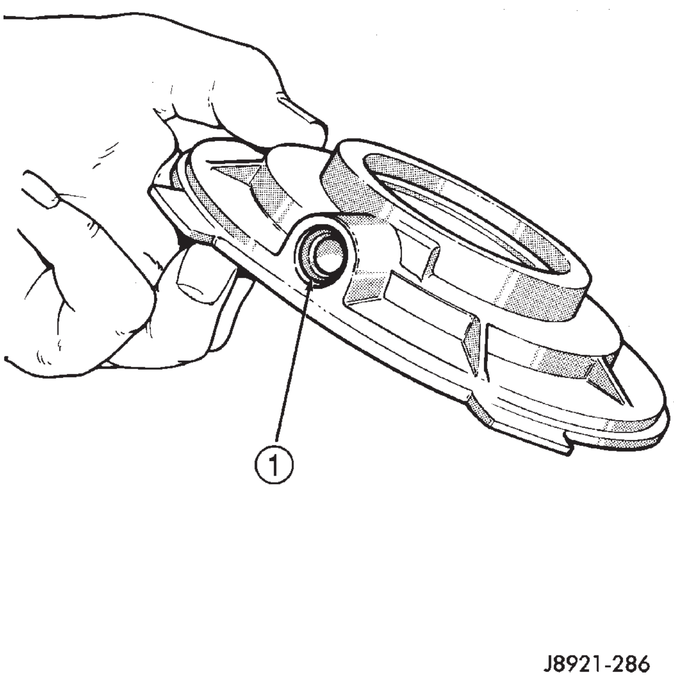


Fig. 59 Pickup Tube O-Ring Installation

1 – PICKUP TUBE O-RING

(16) Remove rear retainer bearing with Installer 8128 and Handle C-4171.

(17) Install rear bearing in retainer with Handle C-4171 and Installer 5064 (Fig. 60).

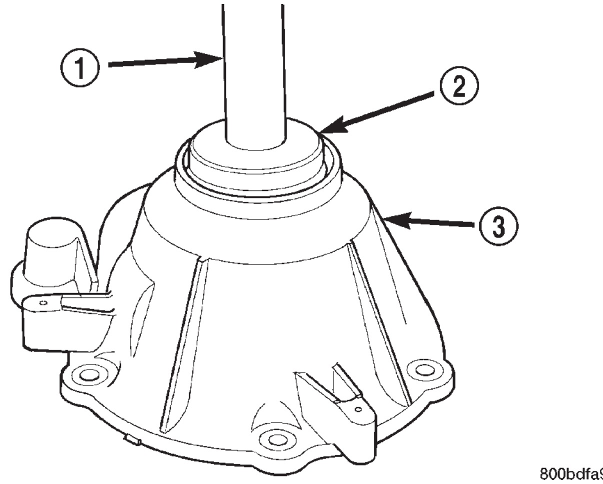


Fig. 60 Installing Rear Bearing In Retainer

1 – SPECIAL TOOL C-4171
2 – SPECIAL TOOL 5064
3 – REAR RETAINER

DIFFERENTIAL

(1) Lubricate differential components with automatic transmission fluid.

(2) Install sprocket gear in differential bottom case (Fig. 61).

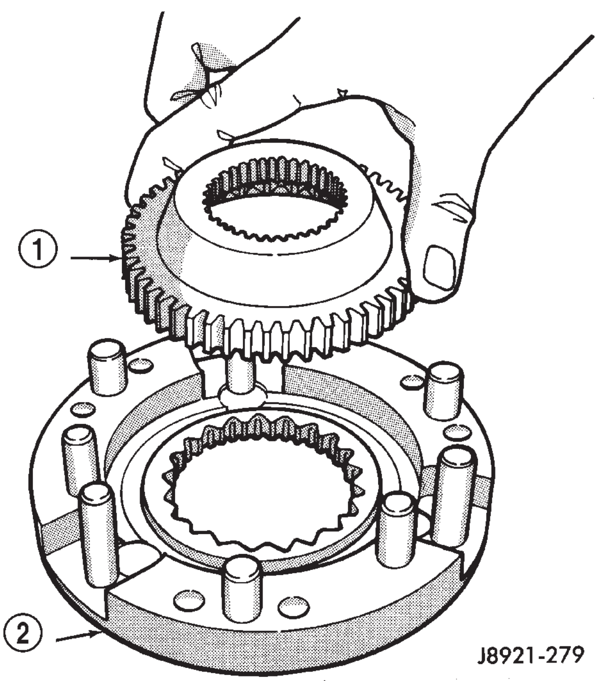


Fig. 61 Installing Differential Sprocket Gear

1 – SPROCKET GEAR
2 – BOTTOM CASE

(3) Install differential planet gears and new thrust washers (Fig. 62). **Be sure thrust washers are installed at top and bottom of each planet gear.**

(4) Install differential mainshaft gear (Fig. 62).

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Align and position differential top case on bottom case (Fig. 63). Align using scribe marks made at disassembly.

(6) While holding differential case halves together, invert the differential and start the differential case bolts.

(7) Tighten differential case bolts to specified torque.

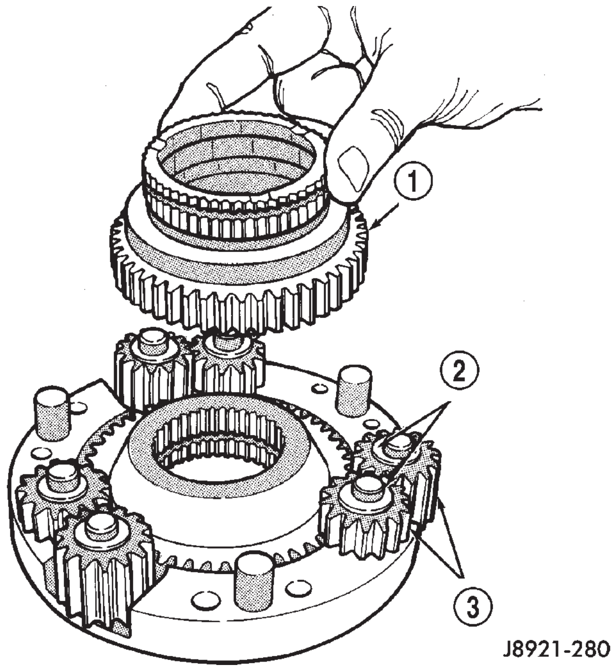


Fig. 62 Installing Mainshaft And Planet Gears

1 – MAINSHAFT GEAR
2 – THRUST WASHERS (12)
3 – PLANET GEARS (6)

INPUT GEAR/LOW RANGE

(1) Assemble low range gear, input gear thrust washers, input gear and input gear retainer (Fig. 64).

(2) Install low range gear snap ring (Fig. 65).

(3) Lubricate input gear and low range gears with automatic transmission fluid.

(4) Start input gear shaft into front case bearing.

(5) Press input gear shaft into front bearing.

(6) Install new input gear snap ring (Fig. 66).

(7) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to seal surface of front bearing retainer.

(8) Install front bearing retainer (Fig. 67). Tighten retainer bolts to 16 ft. lbs. (21 N·m) torque.

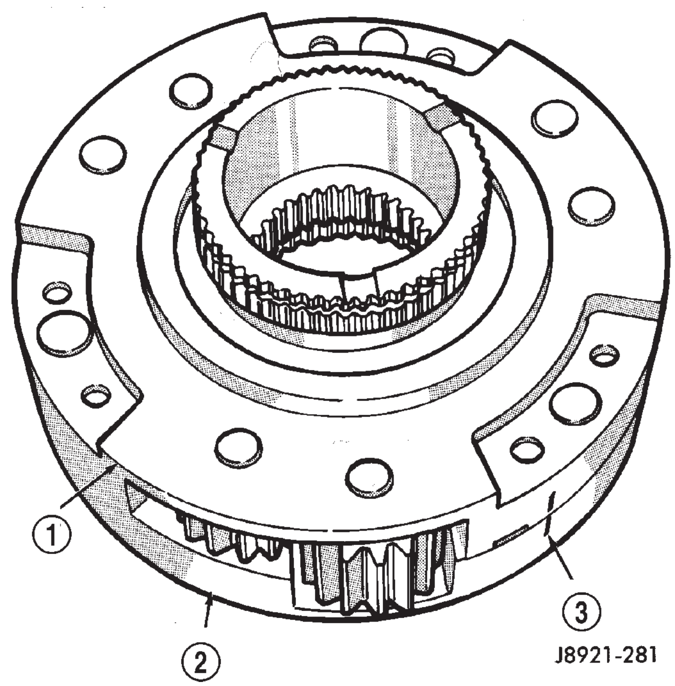


Fig. 63 Differential Case Assembly

1 – TOP CASE
2 – BOTTOM CASE
3 – CASE ALIGNMENT MARKS

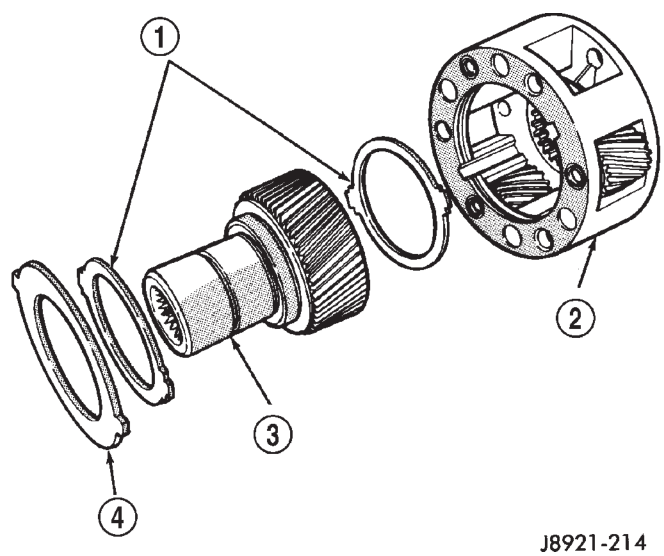


Fig. 64 Low Range And Input Gear Assembly

1 – THRUST WASHERS
2 – LOW RANGE GEAR
3 – INPUT GEAR
4 – RETAINER

DISASSEMBLY AND ASSEMBLY (Continued)

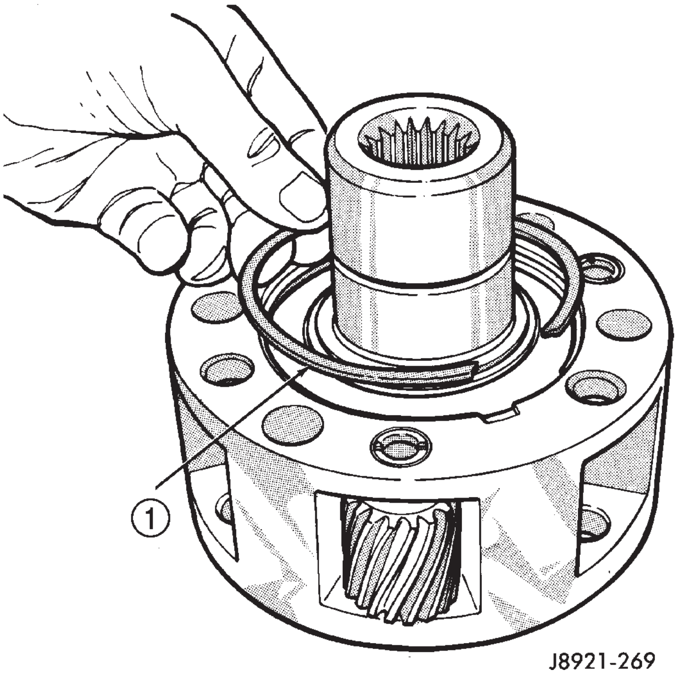


Fig. 65 Install Low Range Gear Snap Ring

1 – LOW RANGE GEAR SNAP RING

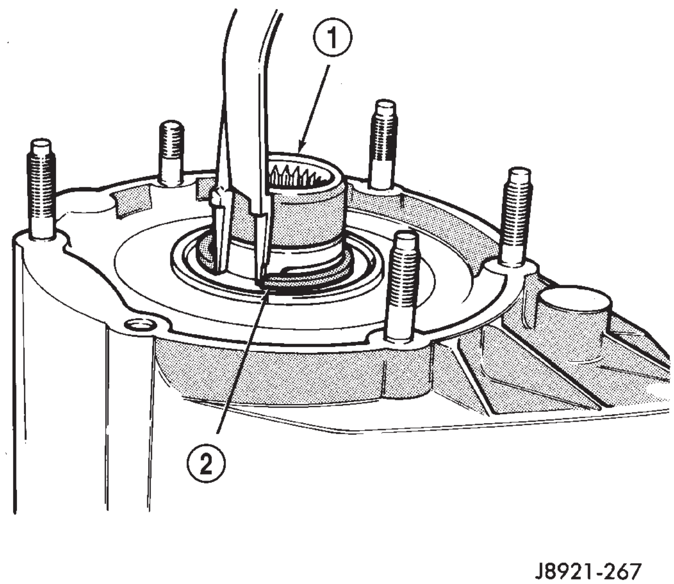


Fig. 66 Input Gear Snap Ring Installation

1 – INPUT GEAR

2 – SNAP RING

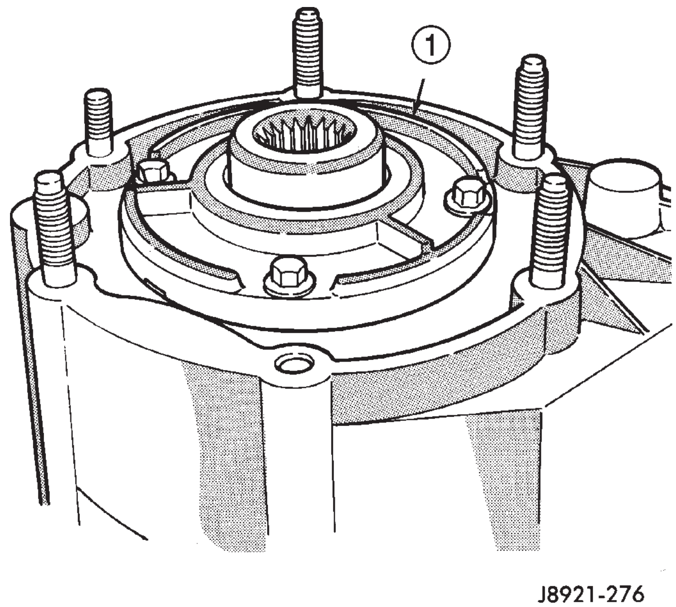


Fig. 67 Installing Front Bearing Retainer

1 – FRONT BEARING RETAINER

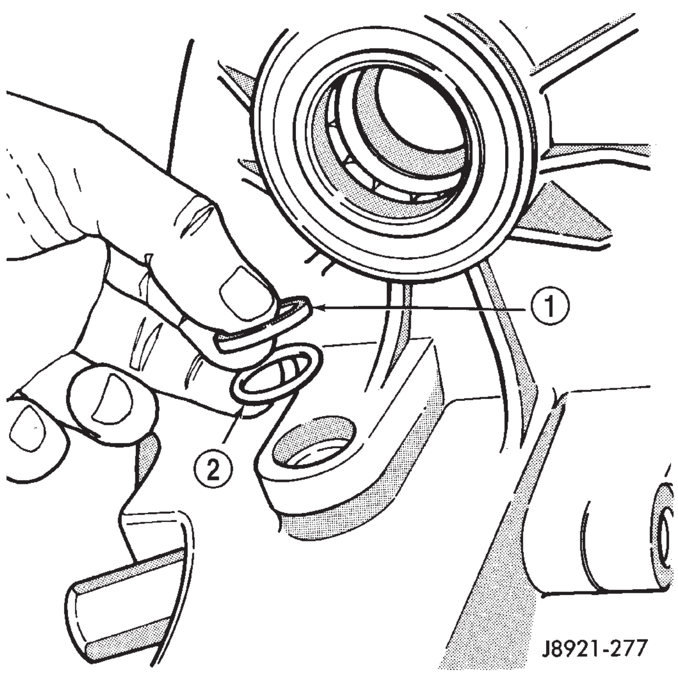


Fig. 68 Sector O-Ring And Bushing Installation

1 – SECTOR BUSHING

2 – O-RING

SHIFT FORKS AND MAINSHAFT

(1) Install new sector shaft O-ring and bushing (Fig. 68).

(2) Install shift sector.

(3) Install new pads on low range fork, if necessary, (Fig. 69).

(4) Assemble low range fork and hub (Fig. 69).

(5) Position low range fork and hub in case. Be sure low range fork pin is engaged in shift sector slot (Fig. 70).

(6) Install first mainshaft bearing spacer on mainshaft (Fig. 71).

DISASSEMBLY AND ASSEMBLY (Continued)

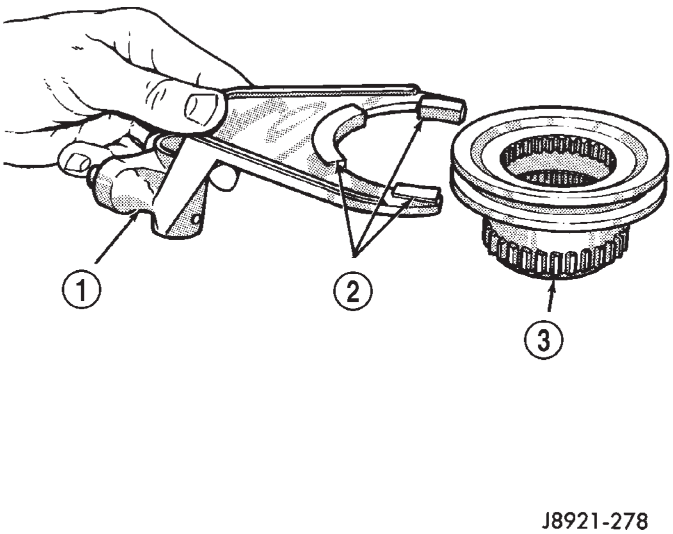


Fig. 69 Assembling Low Range Fork And Hub

1 – LOW RANGE FORK
2 – PADS
3 – HUB

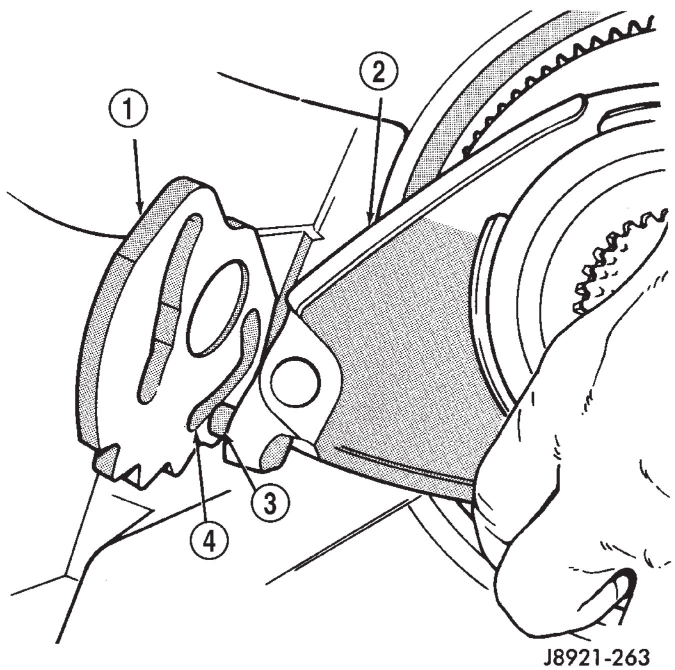


Fig. 70 Positioning Low Range Fork

1 – SHIFT SECTOR
2 – LOW RANGE FORK
3 – PIN
4 – SLOT

(7) Install bearing rollers on mainshaft (Fig. 71). **Coat bearing rollers with generous quantity of petroleum jelly to hold them in place.**

(8) Install remaining bearing spacer on mainshaft (Fig. 71). Do not displace any bearings while installing spacer.

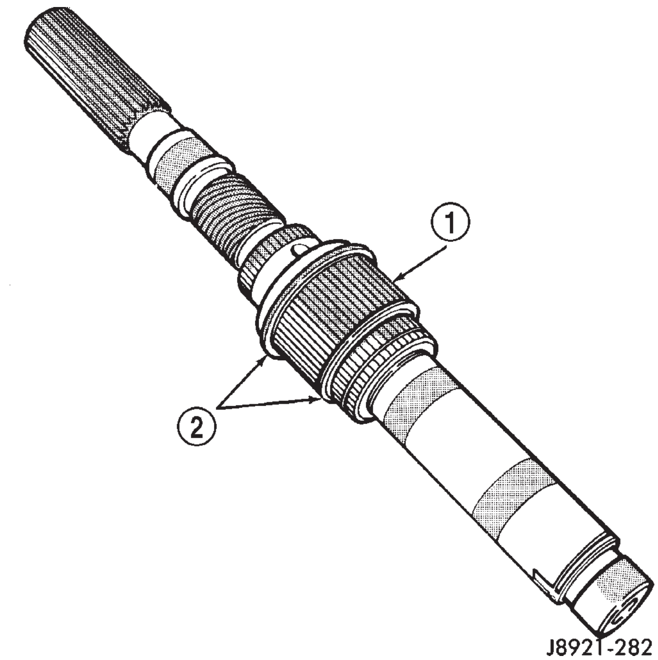


Fig. 71 Installing Mainshaft Bearing Rollers and Spacers

1 – MAINSHAFT BEARING ROLLERS
2 – BEARING SPACERS

(9) Install differential (Fig. 72). **Do not displace mainshaft bearings when installing differential.**

(10) Install differential snap-ring (Fig. 73).

(11) Install intermediate clutch shaft (Fig. 74).

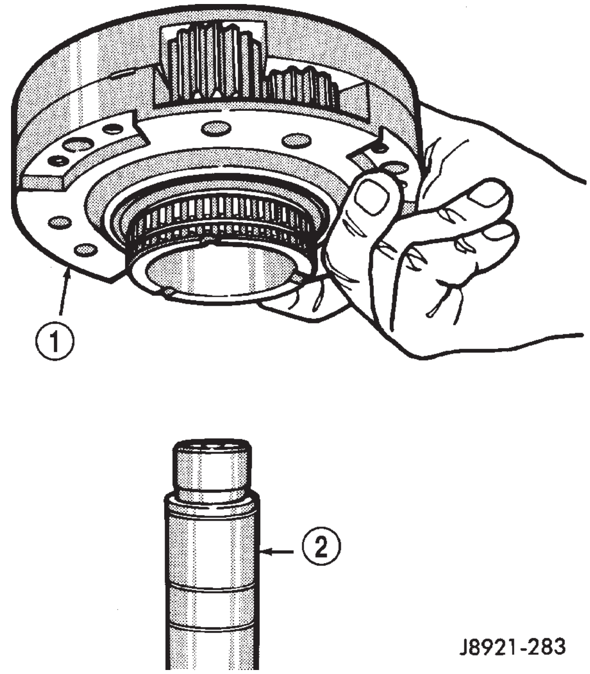


Fig. 72 Differential Installation

1 – DIFFERENTIAL
2 – MAINSHAFT

DISASSEMBLY AND ASSEMBLY (Continued)

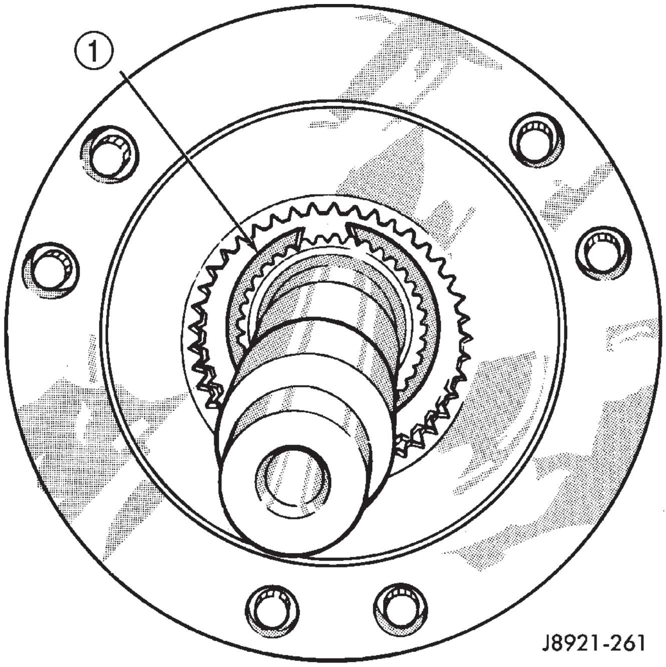


Fig. 73 Installing Differential Snap-Ring

1 – DIFFERENTIAL SNAP RING

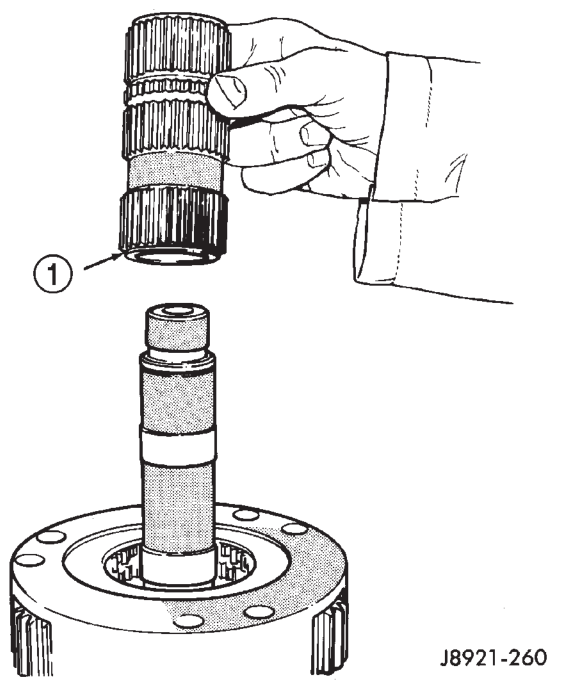


Fig. 74 Installing Intermediate Clutch Shaft

1 – INTERMEDIATE CLUTCH SHAFT

(12) Install clutch shaft thrust washer (Fig. 75).

(13) Install clutch shaft snap-ring (Fig. 76).

(14) Inspect mode fork assembly (Fig. 77). Replace pads and bushing if necessary. Replace fork tube if bushings inside tube are worn or damaged. Also check springs and slider bracket (Fig. 77). Replace worn, damaged components.

Fig. 75 Installing Clutch Shaft Thrust Washer

1 – CLUTCH SHAFT THRUST RING

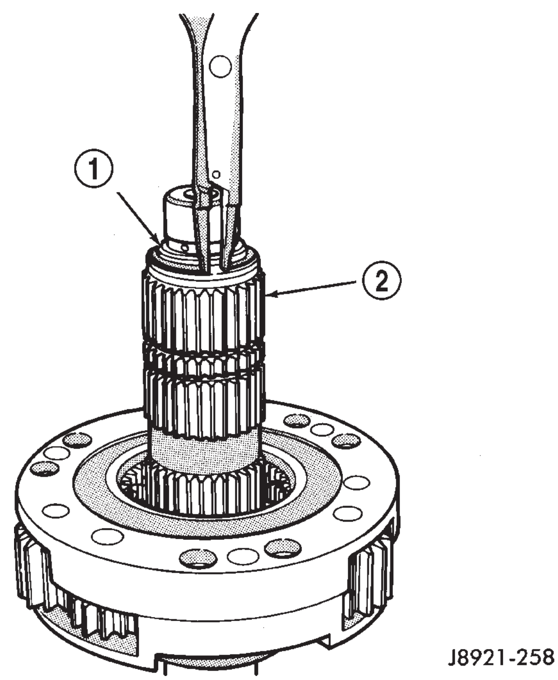


Fig. 76 Installing Clutch Shaft Snap-Ring

1 – SNAP RING
2 – INTERMEDIATE CLUTCH SHAFT

(15) Install mode sleeve in mode fork (Fig. 78). Then install assembled sleeve and fork on mainshaft. Be sure mode sleeve splines are engaged in differential splines.

(16) Install mode fork and mainshaft assembly in case (Fig. 79). Rotate mainshaft slightly to engage shaft with low range gears.

DISASSEMBLY AND ASSEMBLY (Continued)

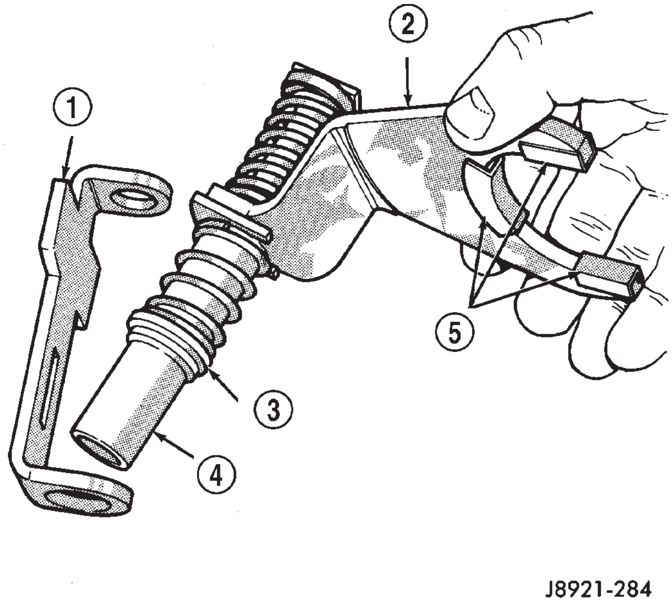


Fig. 77 Mode Fork Assembly Inspection

1 – SLIDER
2 – MODE FORK
3 – BUSHING/SPRING
4 – TUBE
5 – PADS

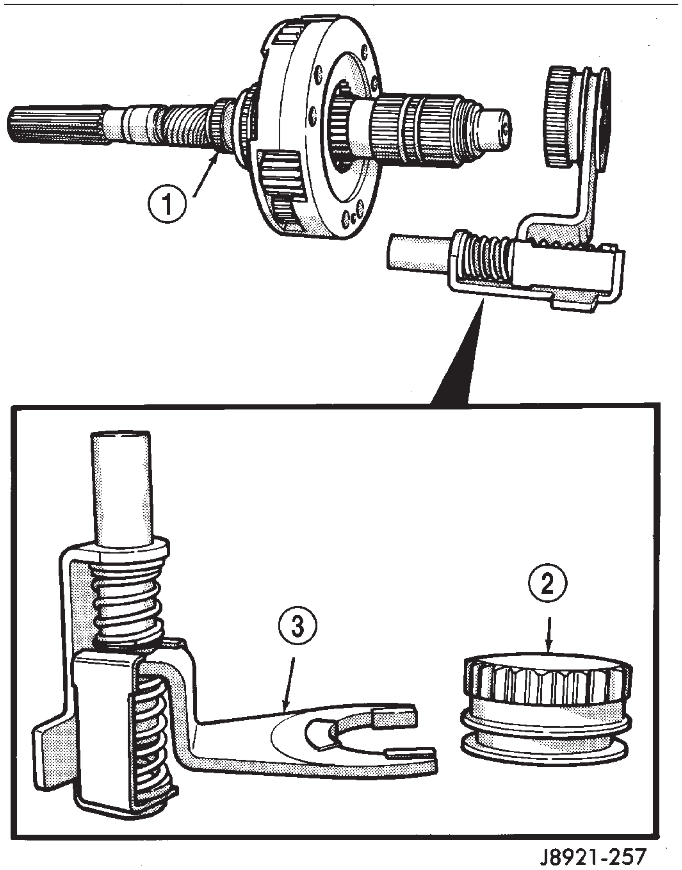


Fig. 78 Installing Mode Fork And Sleeve

1 – MAINSHAFT
2 – SLEEVE
3 – MODE FORK ASSEMBLY

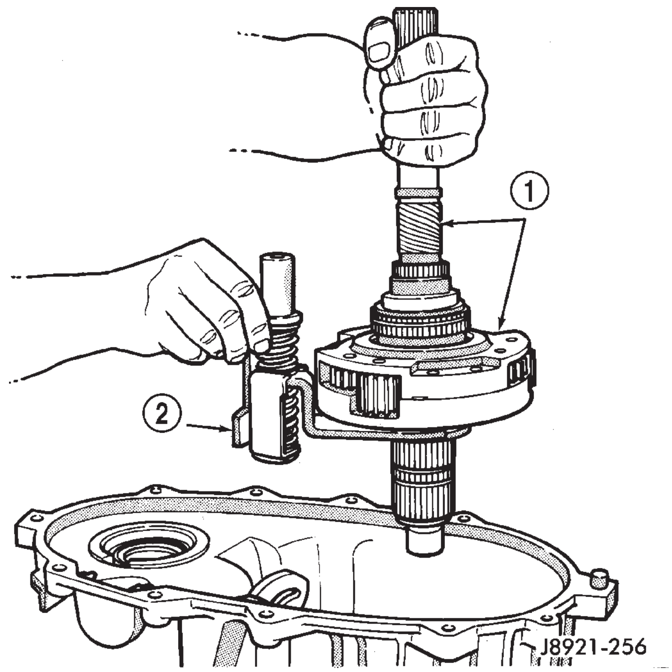


Fig. 79 Assembled Mainshaft And Mode Fork Installation

1 – MAINSHAFT ASSEMBLY
2 – MODE FORK

(17) Rotate mode fork pin into shift sector slot.

(18) Install shift rail (Fig. 80). **Be sure rail is seated in both shift forks.**

(19) Rotate shift sector to align lockpin hole in low range fork with access hole in case.

(20) Insert an easy-out in range fork lockpin to hold it securely for installation (Fig. 81). **Lockpin is slightly tapered on one end. Insert tapered end into fork and rail.**

(21) Insert lockpin through access hole and into shift fork (Fig. 81). Then remove easy-out and seat the pin with pin punch.

(22) Install plug in lockpin access hole.

(23) Install detent plunger, detent spring and detent plug in case (Fig. 82).

FRONT OUTPUT SHAFT AND DRIVE CHAIN

(1) Install front output shaft (Fig. 83).

(2) Install drive chain (Fig. 83). Engage chain with front output shaft sprocket teeth.

(3) Install drive sprocket (Fig. 83). Engage drive sprocket teeth with chain. Then engage sprocket splines with mainshaft splines.

(4) Install drive sprocket snap-ring (Fig. 84).

DISASSEMBLY AND ASSEMBLY (Continued)

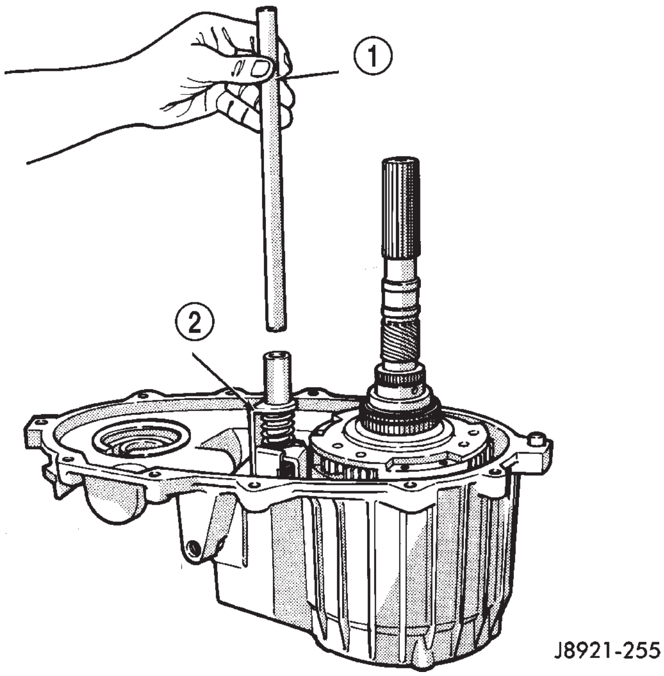


Fig. 80 Shift Rail Installation

1 – SHIFT RAIL
2 – MODE FORK

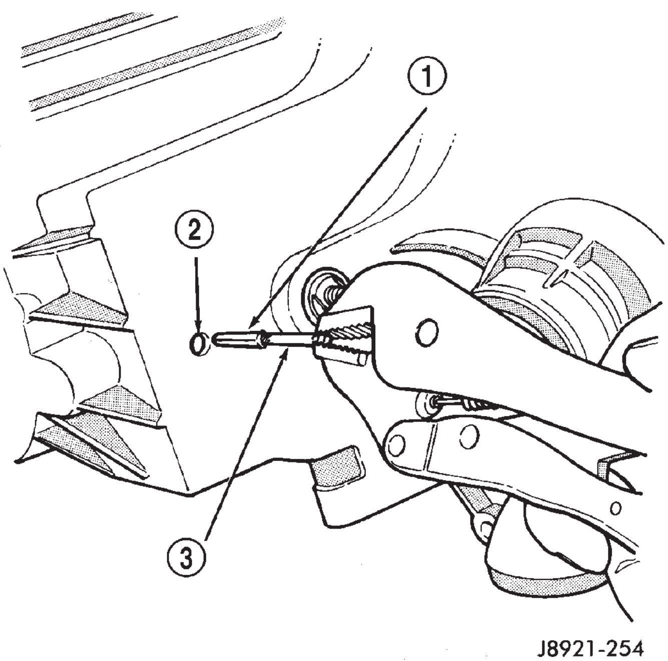


Fig. 81 Installing Low Range Fork Lockpin

1 – LOW RANGE FORK LOCK PIN
2 – ACCESS HOLE
3 – EASY-OUT

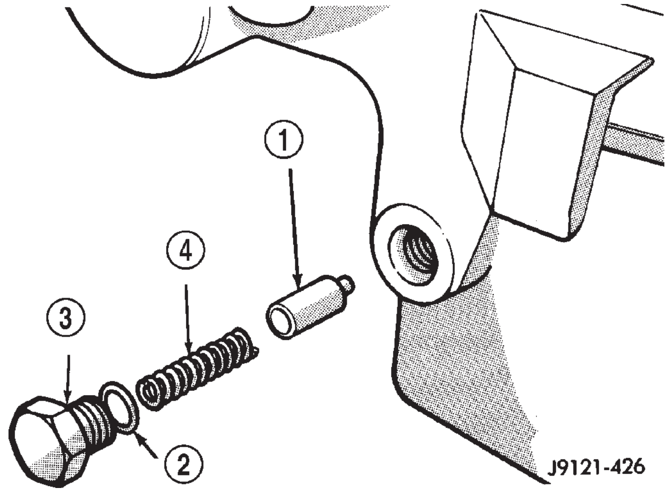


Fig. 82 Detent Pin, Spring And Plug Installation

1 – PLUNGER
2 – O-RING
3 – PLUG
4 – SPRING

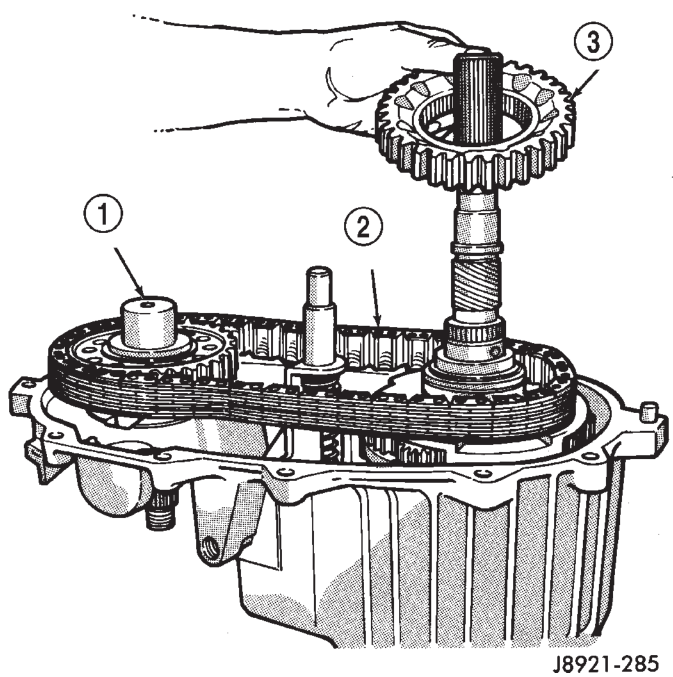


Fig. 83 Drive Chain And Sprocket Installation

1 – FRONT OUTPUT SHAFT
2 – DRIVE CHAIN
3 – DRIVE SPROCKET

DISASSEMBLY AND ASSEMBLY (Continued)

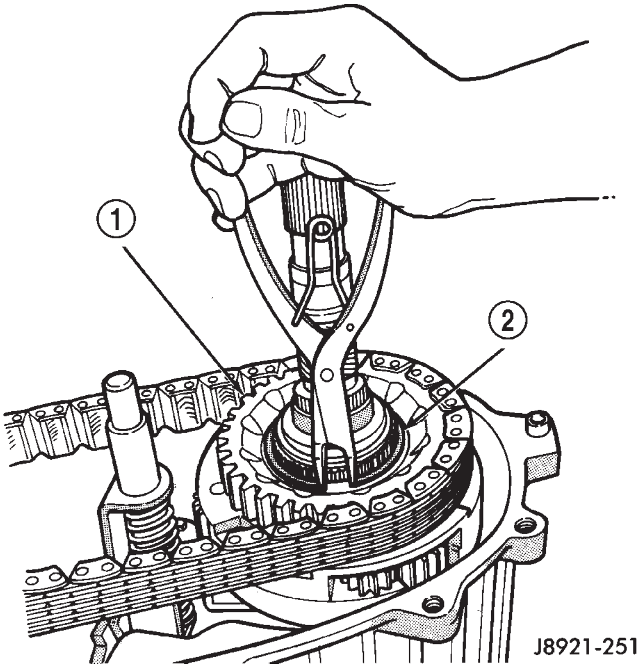


Fig. 84 Drive Sprocket Snap-Ring Installation

1 – DRIVE SPROCKET
2 – DRIVE SPROCKET SNAP RING

OIL PUMP AND REAR CASE

(1) Insert oil pickup tube in oil pump and attach oil screen and connector hose to pickup tube. Then install assembled pump, tube and screen in rear case (Fig. 85). Be sure screen is seated in case slot as shown.

(2) Install magnet in front case pocket (Fig. 86).

(3) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker or silicone adhesive sealer to seal surface of front case.

(4) Align and install rear case on front case. Be sure case locating dowels are in place and that mainshaft splines are engaged in oil pump inner gear.

(5) Install and tighten front case-to-rear case bolts to 41 N·m (30 ft. lbs.) torque. **Be sure to install a washer under each bolt used at case dowel locations.**

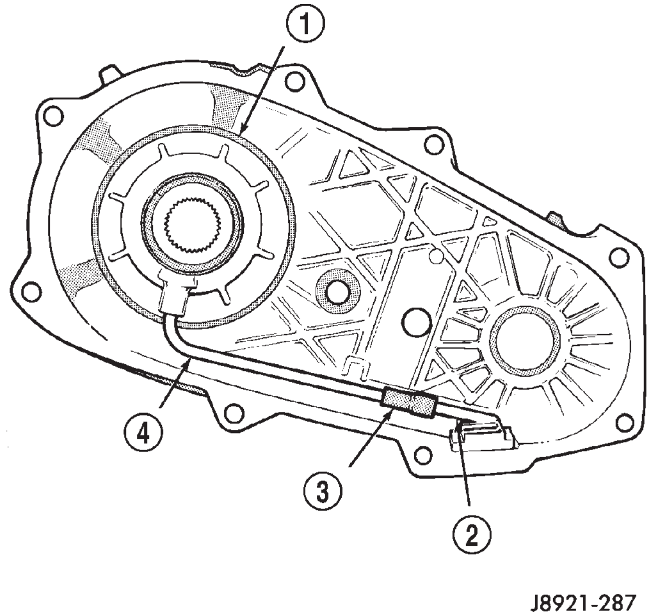


Fig. 85 Oil Screen And Pickup Tube Installation

1 – OIL PUMP
2 – OIL SCREEN
3 – CONNECTOR
4 – PICKUP TUBE

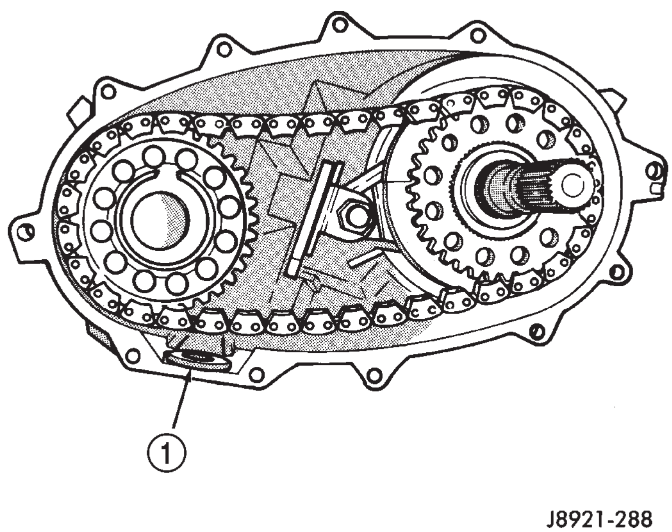


Fig. 86 Installing Case Magnet

1 – MAGNET

DISASSEMBLY AND ASSEMBLY (Continued)

REAR RETAINER

(1) Install rear bearing O.D. retaining ring with snap-ring pliers (Fig. 87). Be sure retaining ring is fully seated in retainer groove.

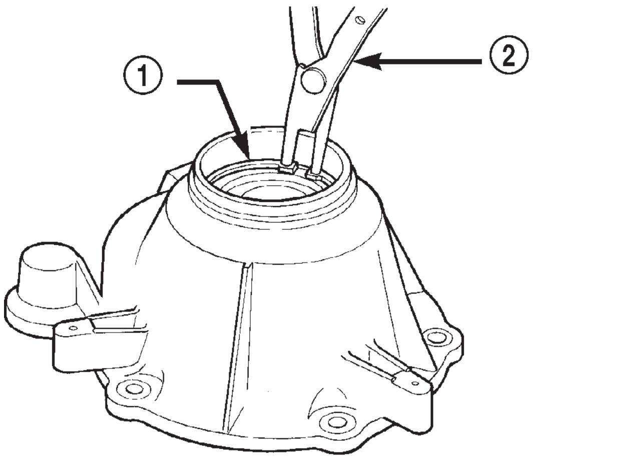


Fig. 87 Rear Bearing Retaining Ring Installation

1 – REAR BEARING O.D. RETAINING RING
2 – SNAP RING PLIERS

(2) Apply bead of Mopar® Sealer P/N 82300234, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 in.

(3) Install rear retainer on rear case. Tighten retainer bolts to 20–27 N·m (15–20 ft. lbs.) torque.

(4) Install new output shaft bearing snap-ring (Fig. 88). Lift mainshaft slightly to seat snap-ring in shaft groove, if necessary.

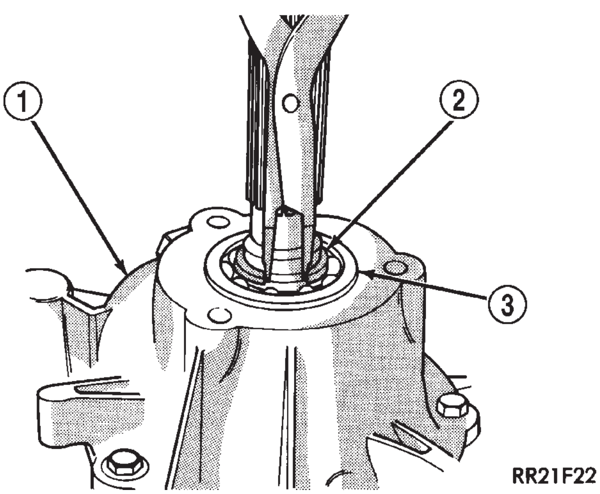


Fig. 88 Install Output Bearing Snap-ring

1 – REAR RETAINER
2 – SNAP RING
3 – REAR BEARING

(5) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting surface of extension housing. Allow sealer to set-up slightly before proceeding.

(6) Install extension housing on rear retainer.

(7) Install extension housing bolts and tighten to 35–46 N·m (26–34 ft. lbs.).

FRONT YOKE AND SWITCH

(1) Install indicator switch in front case. Tighten switch to 20–34 N·m (15–25 ft. lbs.) torque.

(2) Lubricate yoke hub with transmission fluid and install yoke on front shaft.

(3) Install new seal washer on front shaft.

(4) Install yoke on front shaft. Secure yoke with new nut.

CLEANING AND INSPECTION

NV242 TRANSFER CASE

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

The oil pickup screen can be cleaned with solvent. Shake excess solvent from the screen after cleaning and allow it to air dry. Do not use compressed air.

MAINSHAFT/SPROCKET/HUB INSPECTION

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone. However, replace any part is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320–400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER

Check the teeth on the gear (Fig. 89). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300–400 grit emery cloth if necessary.

Examine the carrier body and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the lock ring and both thrust washers for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

CLEANING AND INSPECTION (Continued)

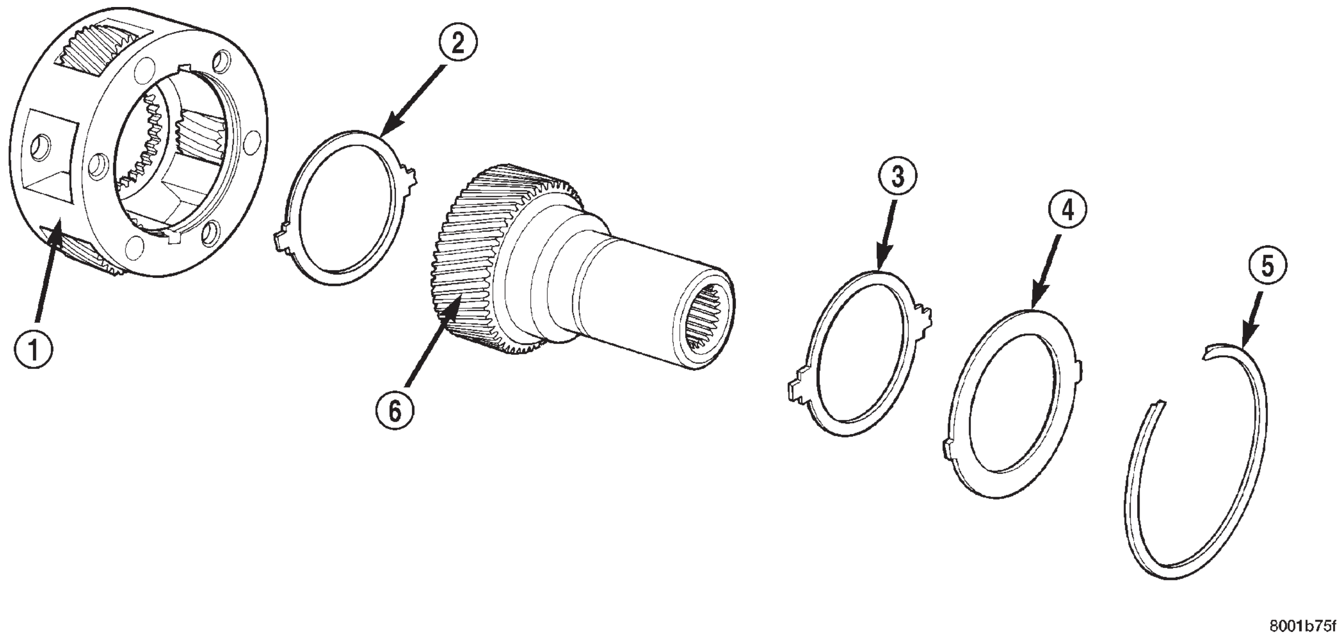


Fig. 89 Input Gear And Carrier Components

1 – PLANETARY CARRIER
2 – REAR THRUST WASHER
3 – FRONT THRUST WASHER
4 – CARRIER LOCK RING
5 – CARRIER LOCK RETAINING RING
6 – INPUT GEAR

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (Fig. 90). Minor nicks on the shift rail can be smoothed with 320–400 grit emery cloth.

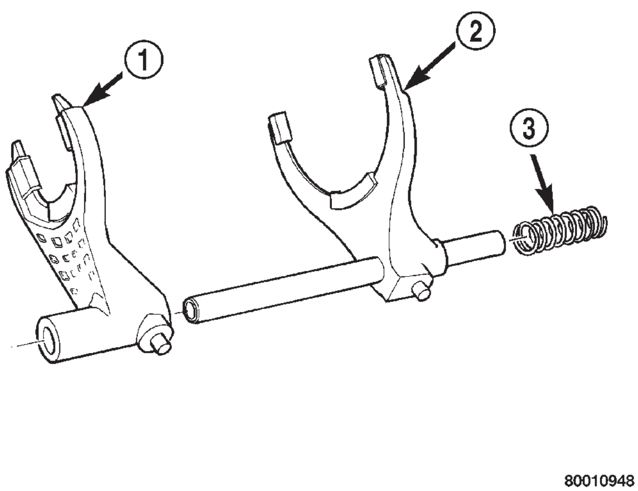


Fig. 90 Shift forks

1 – RANGE FORK
2 – MODE FORK AND RAIL
3 – MODE SPRING

Inspect the shift fork wear pads. The mode fork pads are serviceable and can be replaced if necessary. The range fork pads are also serviceable.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

REAR RETAINER AND EXTENSION HOUSING

Inspect the retainer components. Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

Inspect the retaining rings and washers. Replace any part if distorted, bent, or broken. Reuse is not recommended.

Inspect the extension housing seal and bushing. Replace both components if either shaoe any sign of wear or damage.

FRONT OUTPUT SHAFT/YOKE/DRIVE CHAIN

Check condition of the seal contact surfaces of the yoke slinger (Fig. 91). This surface must be clean and smooth to ensure proper seal life. Replace the yoke nut and seal washer as neither part should be reused.

Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320–400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is

CLEANING AND INSPECTION (Continued)

stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

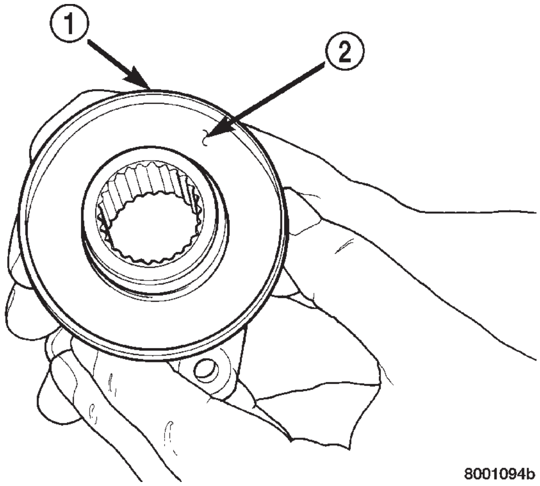


Fig. 91 Seal Contact Surface Of Yoke Slinger

1 – FRONT SLINGER (PART OF YOKE)
2 – SEAL CONTACT SURFACE MUST BE CLEAN AND SMOOTH

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (Fig. 92).

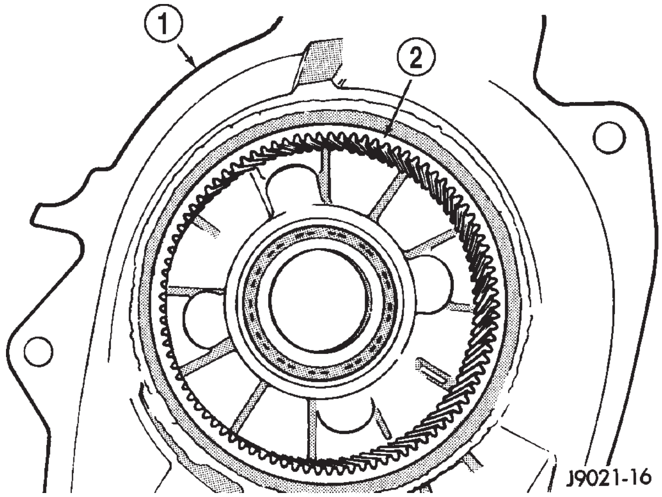


Fig. 92 Low Range Annulus Gear

1 – FRONT CASE
2 – LOW RANGE ANNULUS GEAR

FRONT-REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Clean the sealing surfaces with a scraper and all purpose cleaner. This will ensure proper sealer adhesion at assembly. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil stainless steel inserts if required.

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

ADJUSTMENTS

SHIFTER ADJUSTMENT

(1) Shift transfer case into the 4WD position.

(2) Raise vehicle.

(3) Loosen the trunnion lock bolt (Fig. 93).

(4) Make sure the shift rod slides freely in the adjusting swivel. Lube rod and swivel if necessary.

(5) Verify that transfer case range lever is in 4WD detent. The 4WD detent is the second detent position from the full forward position.

(6) Align the adjustment locating hole in the lower shift lever to the adjustment channel in the shifter body (Fig. 94).

(7) Insert an appropriately sized pin through the adjustment hole and channel.

(8) Tighten the trunnion lock bolt to 10 N·m (90 in. lbs.) torque.

(9) Lower vehicle just enough to enter vehicle. Be sure all wheels are off shop floor. Then start engine, shift transmission into gear, and shift transfer case through all ranges to verify correct adjustment.

ADJUSTMENTS (Continued)

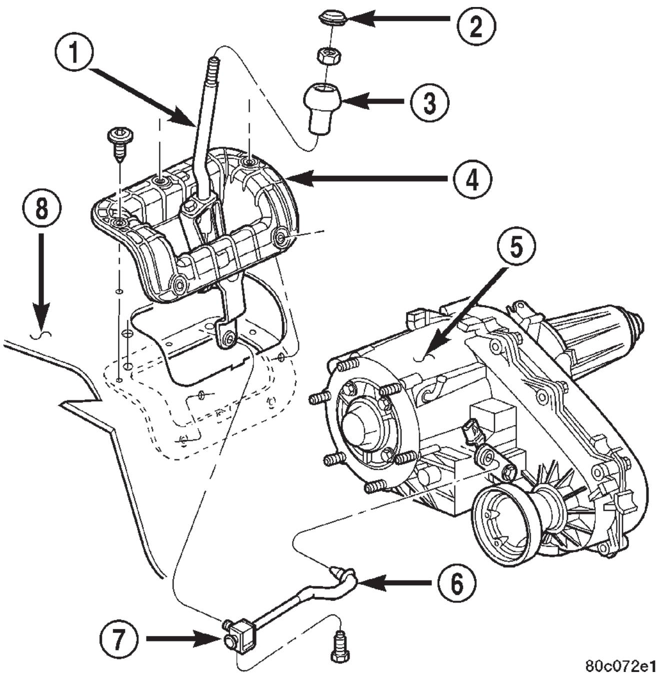


Fig. 93 Transfer Case Shift Linkage

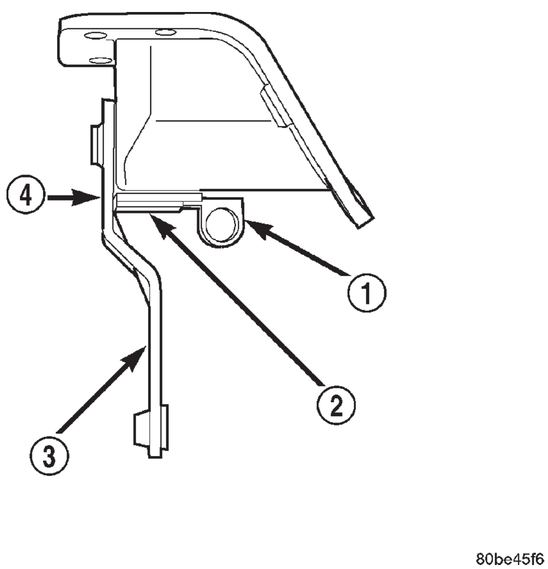


Fig. 94 Shifter Adjustment Channel and Hole

1 – LOCATING PIN
2 – ADJUSTMENT CHANNEL
3 – LOWER SHIFTER LEVER
4 – LOCATING HOLE

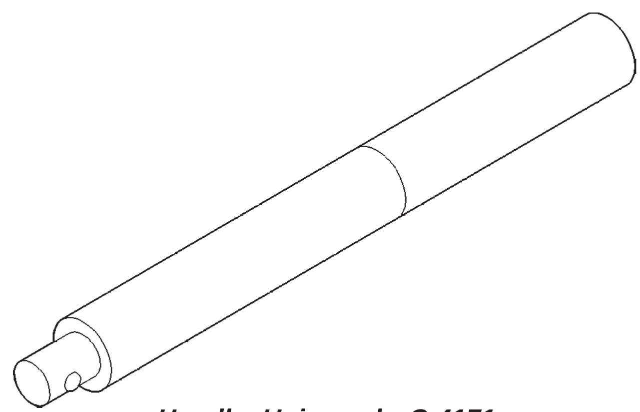
SPECIFICATIONS

TORQUE

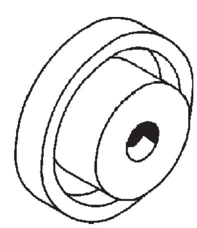
DESCRIPTION	TORQUE
Plug, Detent	16–24 N·m (12–18 ft. lbs.)
Bolt, Diff. Case	17–27 N·m (15–24 ft. lbs.)
Plug, Drain/Fill	20–25 N·m (15–25 ft. lbs.)
Bolt, Front Brg. Retainer	16–27 N·m (12–20 ft. lbs.)
Bolt, Case Half	35–46 N·m (26–34 ft. lbs.)
Nut, Front Yoke	122–176 N·m (90–130 ft. lbs.)
Screw, Oil Pump	1.2–1.8 N·m (12–15 in. lbs.)
Nut, Range Lever	27–34 N·m (20–25 ft. lbs.)
Bolt, Rear Retainer	20–27 N·m (15–20 ft. lbs.)
Nuts, Mounting	30–41 N·m (20–30 ft. lbs.)
Bolts, U-Joint	19 N·m (17 ft. lbs.)
Nut, Shifter Knob	11.3–13.6 N·m) 100–120 in.lbs.)
Bolt, Shift Lever	22.6–33.9 N·m (200–300 in.lbs.)

SPECIAL TOOLS

NV242

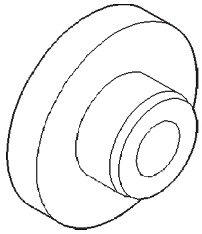


Handle, Universal—C-4171

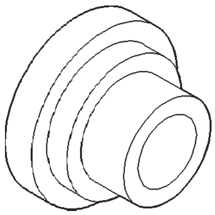


Remover—C-4210

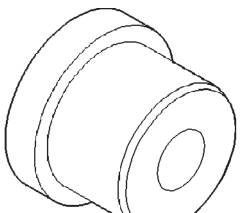
SPECIAL TOOLS (Continued)



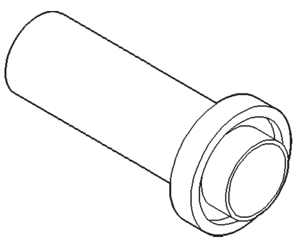
Installer, Bearing—5064



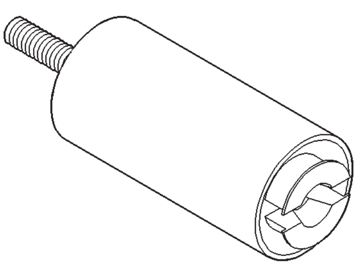
Installer—8128



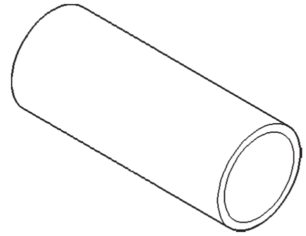
Installer—5066



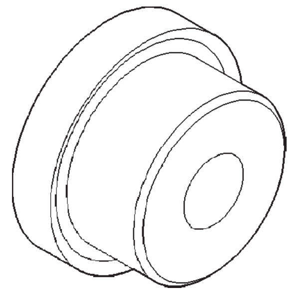
Installer—6952-A



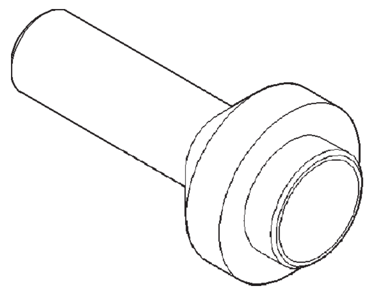
Remover—L-4454



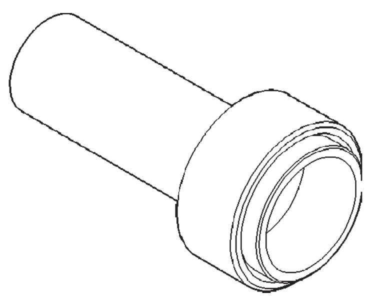
Cup—8148



Installer, Input Gear Bearing—7829-A

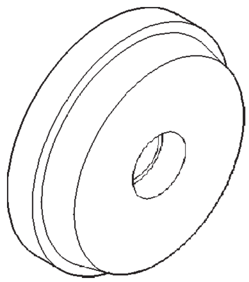


Installer, Seal—7884

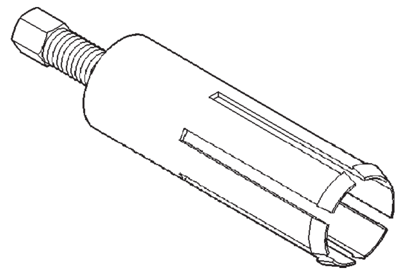


Installer, Pump Housing Seal—7888

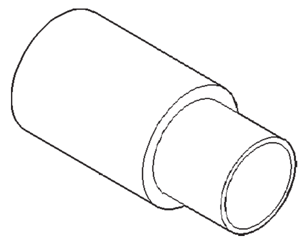
SPECIAL TOOLS (Continued)



Installer, Bearing—8033-A



Remover, Bushing—6957



Installer, Bushing—8160

TIRES AND WHEELS

TABLE OF CONTENTS

page page

TIRES 1
WHEELS 7

TIRES

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
TIRES 1
RADIAL-PLY TIRES 2
SPARE TIRE–TEMPORARY 2
TIRE INFLATION PRESSURES 2
TIRE PRESSURE FOR HIGH SPEED. 3
REPLACEMENT TIRES 3
DIAGNOSIS AND TESTING
PRESSURE GAUGES 3
TREAD WEAR INDICATORS 3
TIRE WEAR PATTERNS. 3
TIRE NOISE OR VIBRATION 4
SERVICE PROCEDURES
ROTATION. 4
MATCH MOUNTING. 4
REPAIRING LEAKS 5
CLEANING AND INSPECTION
CLEANING TIRES 6
SPECIFICATIONS
TIRE REVOLUTION PER MILE. 6

DESCRIPTION AND OPERATION

TIRES

DESCRIPTION

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe brake applications
- High speed driving
- Excessive speeds on turns
- Striking curbs and other obstacles

Radial-ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval shown in the section on Tire Rotation. This will help to achieve a greater tread life.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code (Fig. 1).

Performance tires have a speed rating letter after the aspect ratio number. The speed rating is not always printed on the tire sidewall. These ratings are:

- **Q** up to 100 mph
- **S** up to 112 mph
- **T** up to 118 mph
- **U** up to 124 mph
- **H** up to 130 mph
- **V** up to 149 mph
- **Z** more than 149 mph (consult the tire manufacturer for the specific speed rating)

An All Season type tire will have either **M + S, M & S or M–S** (indicating mud and snow traction) imprinted on the side wall.

TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to the Owner's Manual for more information.

DESCRIPTION AND OPERATION (Continued)

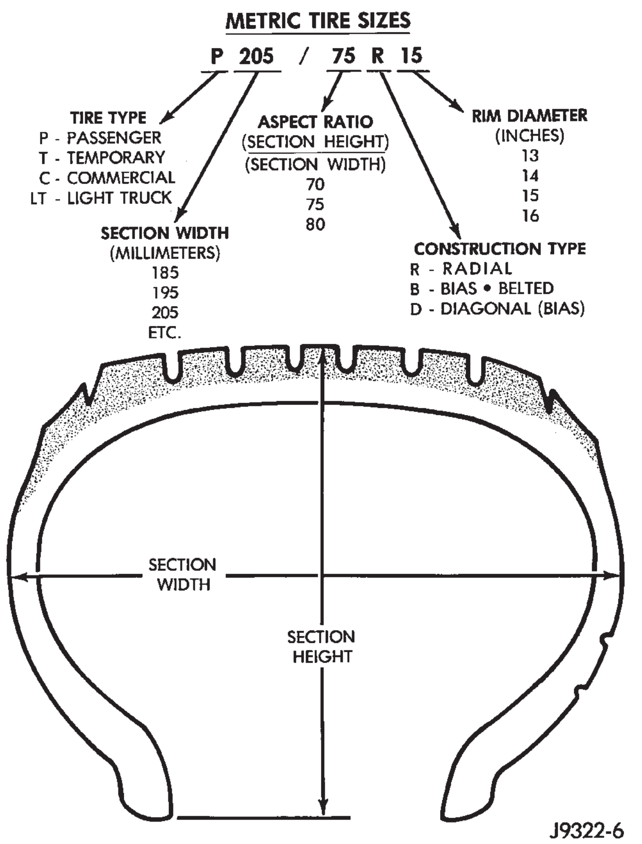


Fig. 1 Tire Identification

RADIAL-PLY TIRES

DESCRIPTION

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

SPARE TIRE–TEMPORARY

DESCRIPTION

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity, then reinstalled. Do not exceed speeds of 50 M. P. H. when using the temporary spare tire. Refer to Owner's Manual for complete details.

TIRE INFLATION PRESSURES

DESCRIPTION

Under inflation will cause rapid shoulder wear, tire flexing, and possible tire failure (Fig. 2).

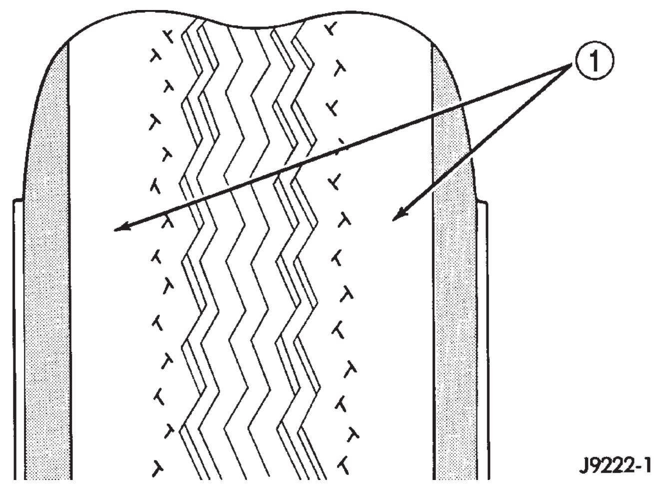


Fig. 2 Under Inflation Wear

1 – THIN TIRE THREAD AREAS

Over inflation will cause rapid center wear and loss of the tire's ability to cushion shocks (Fig. 3).

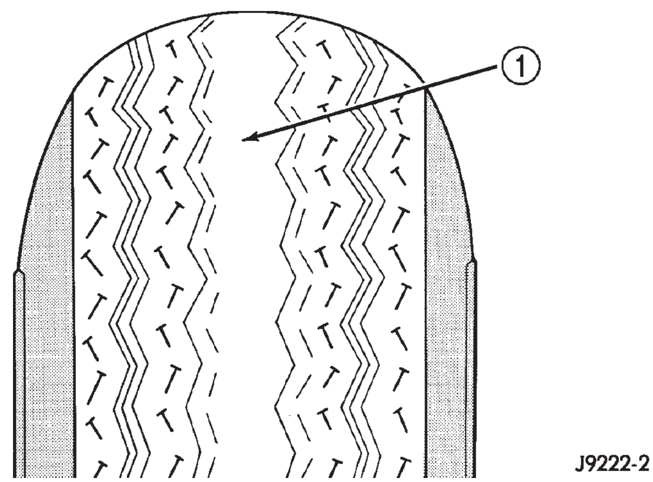


Fig. 3 Over Inflation Wear

1 – THIN TIRE THREAD AREA

DESCRIPTION AND OPERATION (Continued)

Improper inflation can cause:
- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- Vehicle drift

For proper tire pressure specification refer to the Tire Inflation Pressure Chart provided with the vehicles Owners Manual. A Certification Label on the drivers side door pillar provides the minimum tire and rim size for the vehicle. The label also list the cold inflation pressure for these tires at full load operation

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once a month. Tire pressure decreases as the ambient temperature drops. Check tire pressure frequently when ambient temperature varies widely.

Tire inflation pressures are cold inflation pressure. The vehicle must sit for at least 3 hours to obtain the correct cold inflation pressure reading. Or be driven less than one mile after sitting for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation. Do not reduce this normal pressure build-up.

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING AND TREAD WEAR. THIS MAY CAUSE THE TIRE TO FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

TIRE PRESSURE FOR HIGH SPEED

DESCRIPTION

Where speed limits allow the vehicle to be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 120 km/h (75 mph), tires must be inflated to the pressures shown on the tire placard. For continuous speeds in excess of 120 km/h (75 mph), tires must be inflated to the maximum pressure specified on the tire sidewall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

For emergency vehicles that are driven at speeds over 90 mph (144 km/h), special high speed tires must be used. Consult tire manufacturer for correct inflation pressure recommendations.

REPLACEMENT TIRES

DESCRIPTION

The original equipment tires provide a proper balance of many characteristics such as:
- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

DIAGNOSIS AND TESTING

PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band (Fig. 4).

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other (Fig. 5).

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 5).

DIAGNOSIS AND TESTING (Continued)

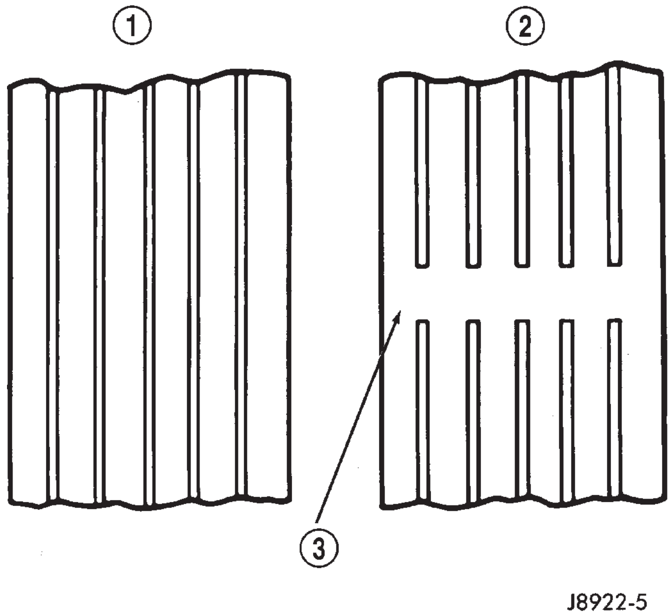
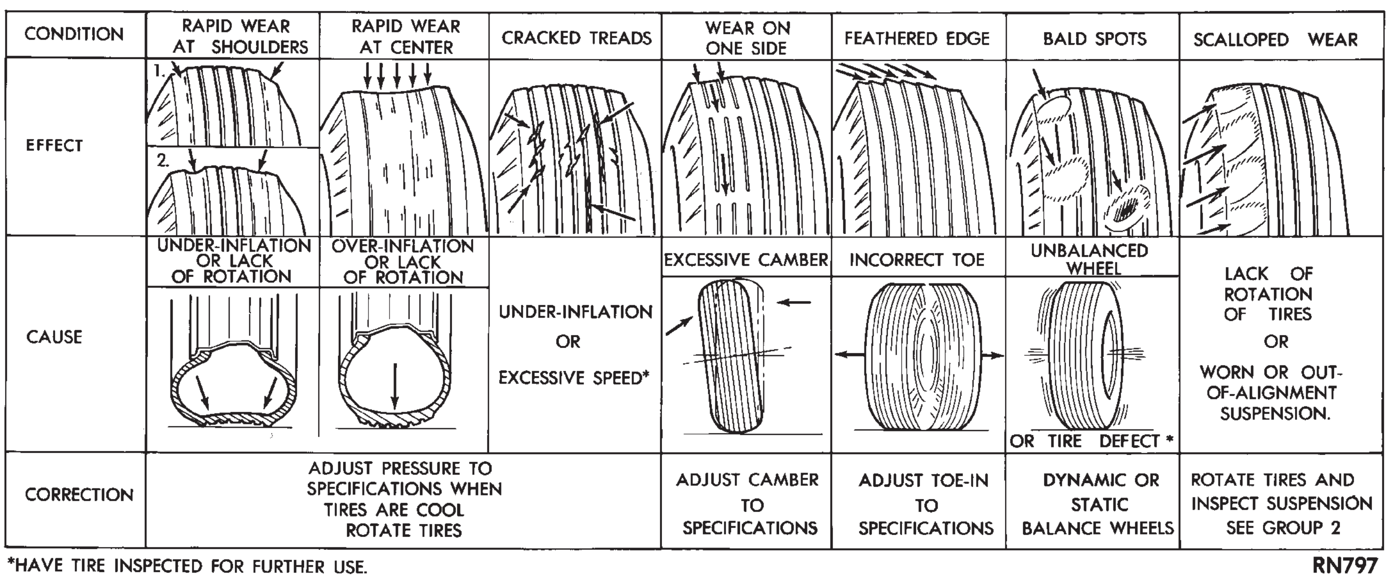


Fig. 4 Tread Wear Indicators

1 – TREAD ACCEPTABLE
2 – TREAD UNACCEPTABLE
3 – WEAR INDICATOR



CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT	1. 2.						
CAUSE	UNDER-INFLATION OR LACK OF ROTATION	OVER-INFLATION OR LACK OF ROTATION	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER	INCORRECT TOE	UNBALANCED WHEEL OR TIRE DEFECT *	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF-ALIGNMENT SUSPENSION.
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

*HAVE TIRE INSPECTED FOR FURTHER USE.

RN797

Fig. 5 Tire Wear Patterns

TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

SERVICE PROCEDURES

ROTATION

Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals. The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

The suggested method of tire rotation is (Fig. 6). Other rotation methods can be used, but they will not provide all the tire longevity benefits.

MATCH MOUNTING

Wheels and tires are match mounted at the factory. This means that the high spot of the tire is matched to the low spot on the wheel rim. Each are marked with a bright colored temporary label on the outboard surface for alignment. The wheel is also marked permanently on the inside of the rim in the tire well. This permanent mark may be a paint dot or line, a permanent label or a stamped impression such as an X. An optional location mark is a small spherical indentation on the vertical face of the outboard flange on some non styled base steel wheels. The tire must be removed to locate the permanent mark on the inside of the wheel.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve

SERVICE PROCEDURES (Continued)

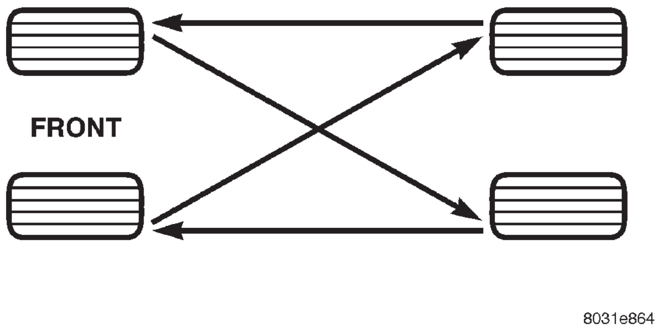


Fig. 6 Tire Rotation Pattern

stem location. This reference will ensure that it is remounted in the original position on the wheel.

(1) Remove the tire and wheel assembly from the vehicle and mount on a service dynamic balance machine.

(2) Measure the total runout on the center of the tire tread rib with a dial indicator. Record the indicator reading. Mark the tire to indicate the high spot. Place a mark on the tire at the valve stem location (Fig. 7).

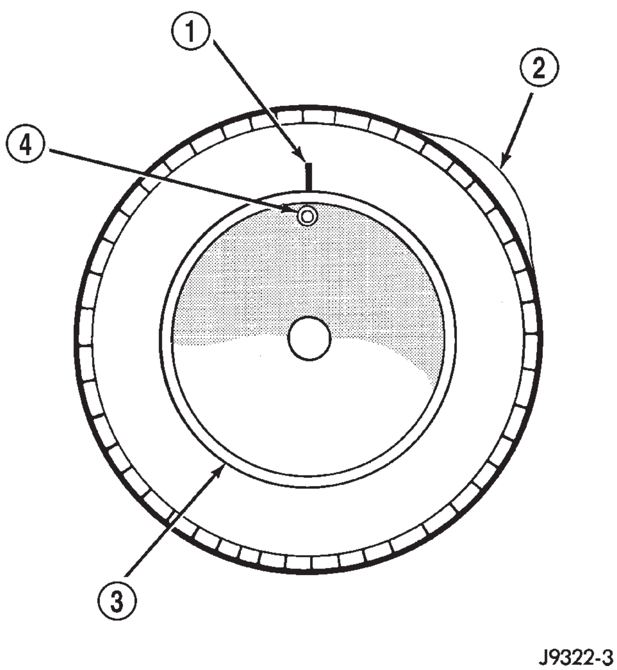


Fig. 7 First Measurement On Tire

1 – REFERENCE MARK
2 – 1ST MEASUREMENT HIGH SPOT MARK TIRE AND RIM
3 – WHEEL
4 – VALVE STEM

(3) Break down the tire and remount it 180 degrees on the rim (Fig. 8).

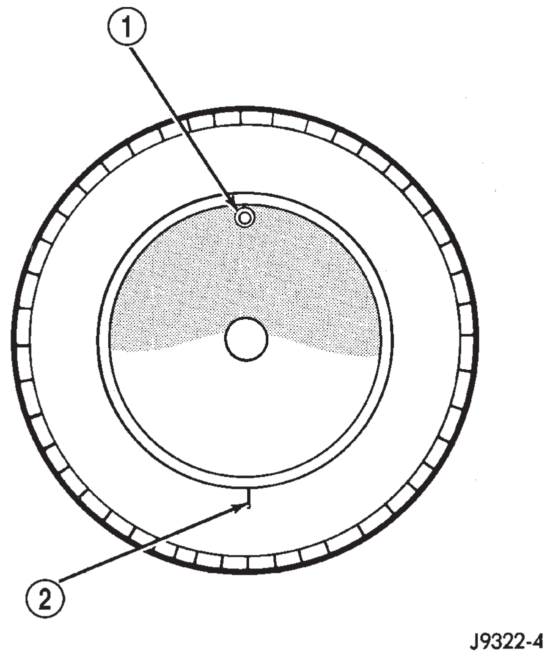


Fig. 8 Remount Tire 180 Degrees

1 – VALVE STEM
2 – REFERENCE MARK

(4) Measure the total indicator runout again. Mark the tire to indicate the high spot.

(5) If runout is still excessive, the following procedures must be done.

- If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
- If the high spot is NOT within 101.6 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction (Fig. 9). This procedure will normally reduce the runout to an acceptable amount, if not replace the rim.

REPAIRING LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 10). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before removing the tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

SERVICE PROCEDURES (Continued)

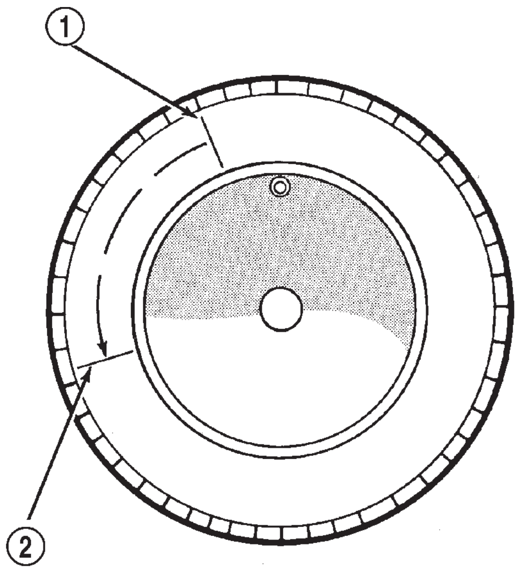


Fig. 9 Remount Tire 90 Degrees In Direction of Arrow

1 – 2ND HIGH SPOT ON TIRE
2 – 1ST HIGH SPOT ON TIRE

Install wheel on vehicle, and tighten to proper torque specification.

CLEANING AND INSPECTION

CLEANING TIRES

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

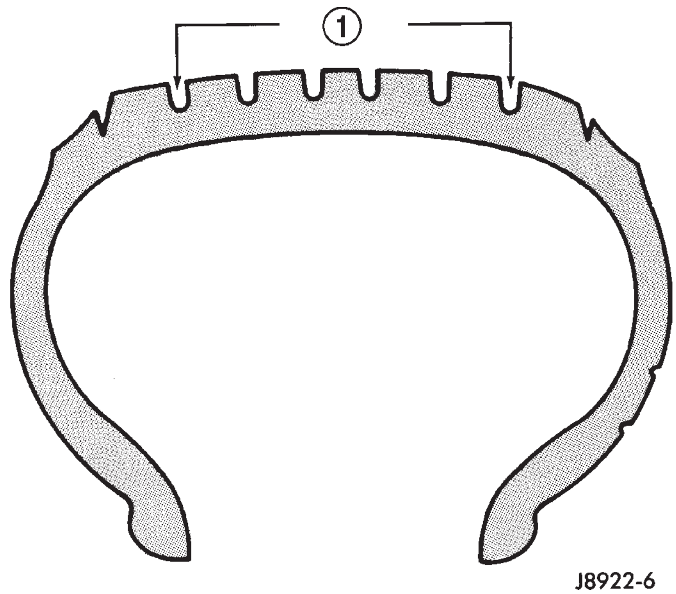


Fig. 10 Tire Repair Area

1 – REPAIRABLE AREA

NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or a wire brush for cleaning.

SPECIFICATIONS

TIRE REVOLUTION PER MILE

TIRE SIZE	SUPPLIER	REVOLUTION PER MILE
P215/75R15	Goodyear	760
P235/75R15 XL	Goodyear	729
P255/65R15	Goodyear	755
P255/55R17	Goodyear	750
31x10.50R15 LT	Goodyear	689

WHEELS

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
WHEEL	7
DIAGNOSIS AND TESTING	
WHEEL INSPECTION	7
TIRE AND WHEEL RUNOUT	7
SERVICE PROCEDURES	
WHEEL INSTALLATION	8
TIRE AND WHEEL BALANCE	9
SPECIFICATIONS	
TORQUE CHART	11

DESCRIPTION AND OPERATION

WHEEL

DESCRIPTION

The rim size is on the vehicle safety certification label located on the drivers door shut face. The size of the rim is determined by the drivetrain package. Original equipment wheels/rims are designed for operation up to the specified maximum vehicle capacity.

All models use stamped steel, cast aluminum or forged aluminum wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 1).

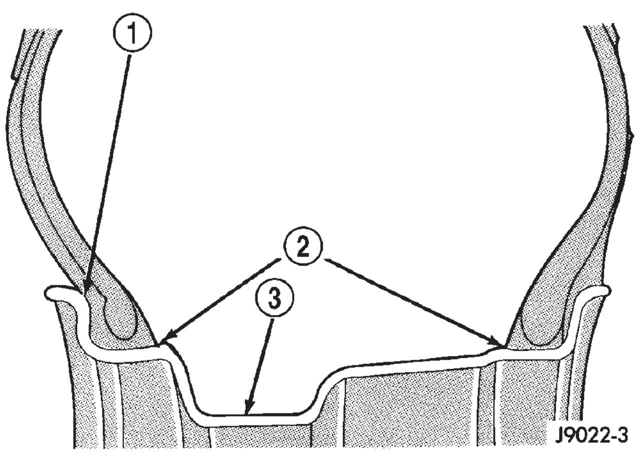


Fig. 1 Safety Rim

1 – FLANGE
2 – RIDGE
3 – WELL

Initial inflation of the tire forces the bead over these raised sections. In case of rapid loss of air pressure, the raised sections help hold the tire on the wheel.

The wheel studs and nuts are designed for specific applications. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels. Do not use replacement studs or nuts with a different design or lesser quality.

DIAGNOSIS AND TESTING

WHEEL INSPECTION

Inspect wheels for:

- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

NOTE: Do not attempt to repair a wheel by hammering, heating or welding.

If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE. USED WHEELS ARE NOT RECOMMENDED. THE SERVICE HISTORY OF THE WHEEL MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

TIRE AND WHEEL RUNOUT

Radial runout is the difference between the high and low points on the tire or wheel (Fig. 2).

Lateral runout is the **wobble** of the tire or wheel.

DIAGNOSIS AND TESTING (Continued)

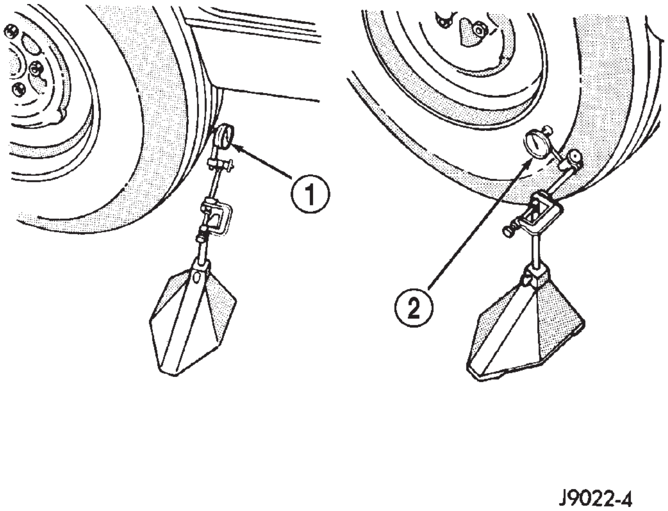


Fig. 2 Checking Tire/Wheel/Hub Runout

1 – RADIAL RUNOUT
2 – LATERAL RUNOUT

Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

METHOD 1 (RELOCATE WHEEL ON HUB)

(1) Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

(2) Check wheel bearings and adjust if adjustable or replace if necessary.

(3) Check the wheel mounting surface.

(4) Relocate wheel on the mounting, two studs over from the original position.

(5) Tighten wheel nuts until all are properly torqued, to eliminate brake distortion.

(6) Check radial runout. If still excessive, mark tire sidewall, wheel, and stud at point of maximum runout and proceed to Method 2.

METHOD 2 (RELOCATE TIRE ON WHEEL)

NOTE: Rotating the tire on wheel is particularly effective when there is runout in both tire and wheel.

(1) Remove tire from wheel and mount wheel on service dynamic balance machine.

(2) Check wheel radial runout (Fig. 3) and lateral runout (Fig. 4).

- STEEL WHEELS: Radial runout 0.040 in., Lateral runout 0.045 in. (maximum)
- ALUMINUM WHEELS: Radial runout 0.030 in., Lateral runout 0.035 in. (maximum)

(3) If point of greatest wheel lateral runout is near original chalk mark, remount tire 180 degrees. Recheck runout, Refer to match mounting procedure.

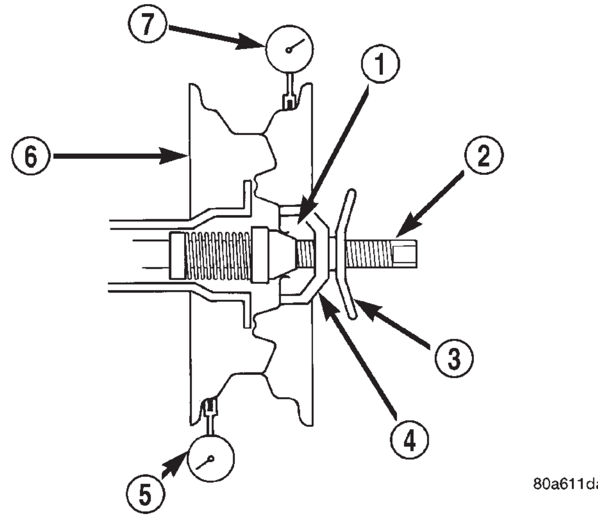


Fig. 3 Radial Runout

1 – MOUNTING CONE
2 – SPINDLE SHAFT
3 – WING NUT
4 – PLASTIC CUP
5 – DIAL INDICATOR
6 – WHEEL
7 – DIAL INDICATOR

SERVICE PROCEDURES

WHEEL INSTALLATION

The wheel studs and nuts are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design. All aluminum and some steel wheels have wheel stud nuts which feature an enlarged nose. This enlarged nose is necessary to ensure proper retention of the aluminum wheels.

NOTE: Do not use chrome plated lug nuts with chrome plated wheels.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in

SERVICE PROCEDURES (Continued)

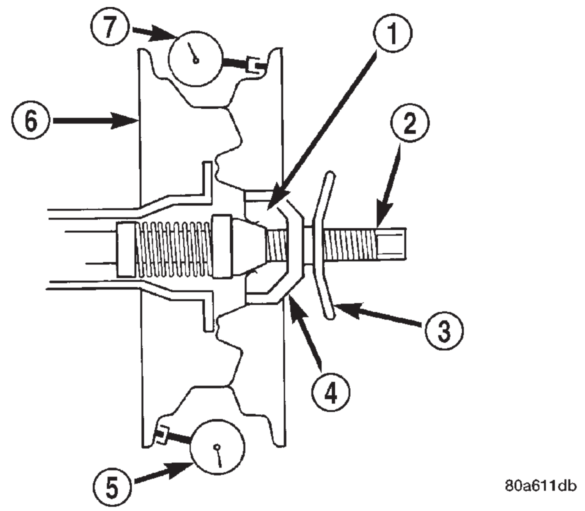


Fig. 4 Lateral Runout

1 – MOUNTING CONE
2 – SPINDLE SHAFT
3 – WING NUT
4 – PLASTIC CUP
5 – DIAL INDICATOR
6 – WHEEL
7 – DIAL INDICATOR

sequence to the proper torque specification (Fig. 5). **Never use oil or grease on studs or nuts.**

WHEEL REPLACEMENT

Wheels must be replaced if they have:
- Excessive runout
- Bent or dented

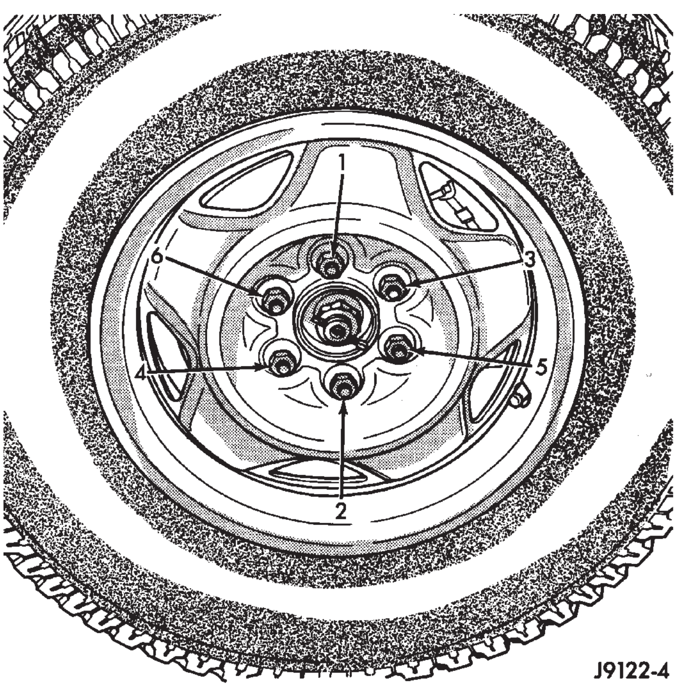


Fig. 5 Lug Nut Tightening Pattern

- Leak air through welds
- Have damaged bolt holes

Wheel repairs employing hammering, heating, or welding are not allowed.

Original equipment wheels are available through your dealer. Replacement wheels from any other source should be equivalent in:
- Load carrying capacity
- Diameter
- Width
- Offset
- Mounting configuration

Failure to use equivalent replacement wheels may affect the safety and handling of your vehicle. Replacement with **used** wheels is not recommended. Their service history may have included severe treatment.

TIRE AND WHEEL BALANCE

It is recommended that a two plane service dynamic balancer be used when a tire and wheel assembly require balancing. Refer to balancer operation instructions for proper cone mounting procedures. Typically use front cone mounting method for steel wheels. For aluminum wheel use back cone mounting method without cone spring.

NOTE: Static should be used only when a two plane balancer is not available.

NOTE: Cast aluminum and forged aluminum wheels require coated balance weights and special alignment equipment.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire. Off-vehicle balancing is recommended.

For static balancing, find the location of the heavy spot causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counter balance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 6).

For dynamic balancing, the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange (Fig. 7).

SERVICE PROCEDURES (Continued)

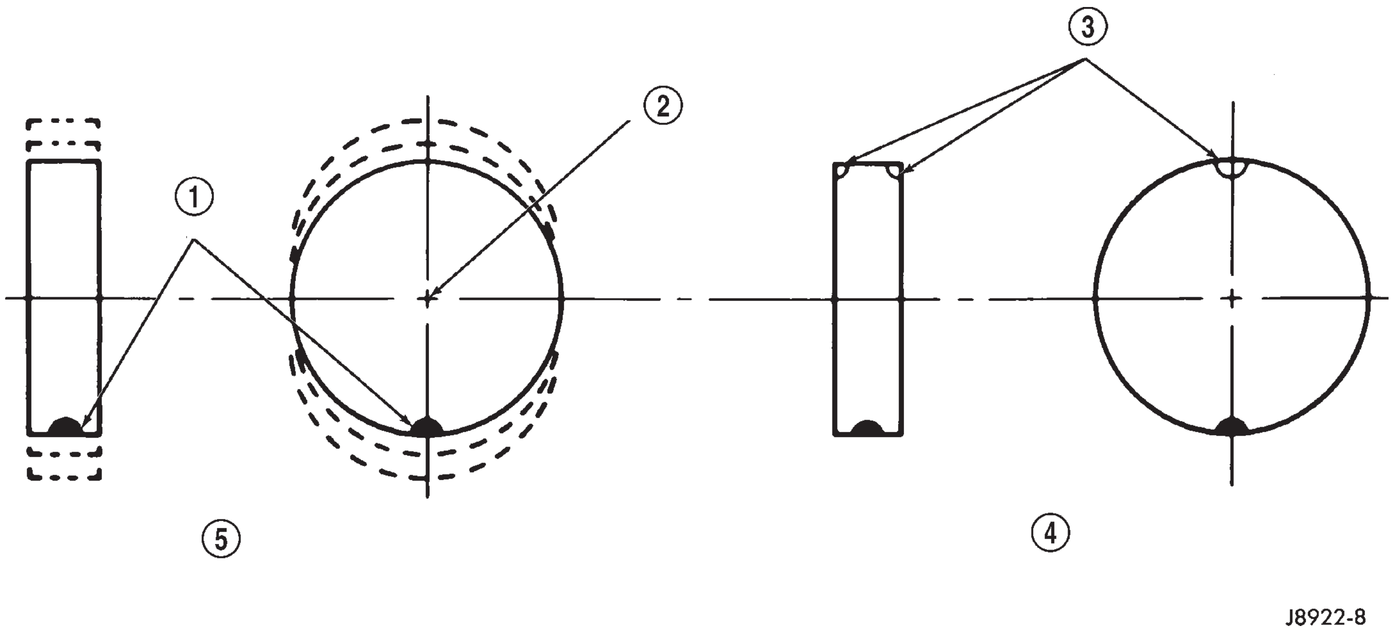


Fig. 6 Static Unbalance & Balance

1 – HEAVY SPOT
2 – CENTER LINE OF SPINDLE
3 – ADD BALANCE WEIGHTS HERE
4 – CORRECTIVE WEIGHT LOCATION
5 – TIRE OR WHEEL TRAMP, OR WHEEL HOP

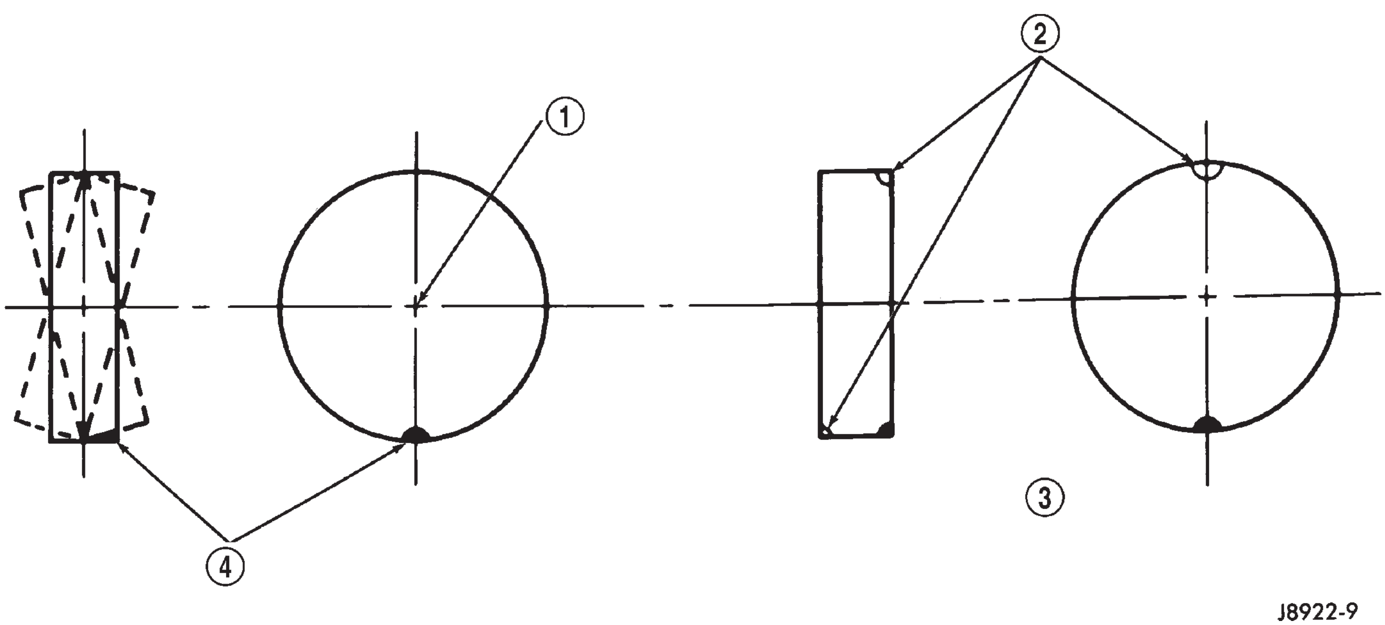


Fig. 7 Dynamic Unbalance & Balance

1 – CENTER LINE OF SPINDLE
2 – ADD BALANCE WEIGHTS HERE
3 – CORRECTIVE WEIGHT LOCATION
4 – HEAVY SPOT WHEEL SHIMMY AND VIBRATION

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Wheel	
Lug Nut	115 to 157 N·m (85 to 115 ft. lbs.)

CAUTION: DO NOT USE CHROME PLATED LUG NUTS WITH CHROME PLATED WHEELS.

BODY

TABLE OF CONTENTS

page page

PAINT 1
STATIONARY GLASS. 4
SEATS 8
BODY COMPONENT SERVICE 17

PAINT

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
PAINT CODE 1
BASE COAT/CLEAR COAT FINISH. 1
FINESSE SANDING, BUFFING, AND POLISHING. 1
PAINTED SURFACE TOUCH-UP 2
AFTERMARKET REPAIR PRODUCTS 2

DESCRIPTION AND OPERATION

PAINT CODE

Exterior vehicle body colors are identified on the Body Code plate. The plate is located on the cab back panel. Refer to the Introduction section for body code plate decoding. The paint code is also identified on the Vehicle Safety Certification Label. The label is located on the drivers door shut face.

The color names provided in the Aftermarket Repair Product charts are the color names used on most repair product containers.

BASE COAT/CLEAR COAT FINISH

DESCRIPTION

The original equipment finish is a multi-step process that involves cleaning, electrodeposition (e-coat), base coat, and clear coat steps. Additionally, selected areas of the vehicle may be coated with an anti-chip finish.

OPERATION

On most vehicles a two-part paint application (base coat/clear coat) is used. Color paint that is applied to primer is called base coat. The clear coat protects the base coat from ultraviolet light and provides a durable high-gloss finish.

CAUTION: Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted surfaces. Damage to finish or color can result.

FINESSE SANDING, BUFFING, AND POLISHING

Minor acid etching, orange peel, or surface scratches in clear coat or single-stage finishes can be reduced with light finesse sanding, buffing, and polishing. **If the finish has been finesse sanded in the past, it cannot be repeated. Finesse sanding operation should be performed by a trained automotive paint technician.**

CAUTION: Do not remove clear coat finish more than.5 mils, if equipped (Use a paint thickness gauge to verify paint thickness). Base coat paint must retain clear coat for durability.

DESCRIPTION AND OPERATION (Continued)

PAINTED SURFACE TOUCH-UP

DESCRIPTION

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch-Up Paints and Clear Top Coat. Refer to Introduction group of this manual for Body Code Plate information.

WARNING: USE A OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

OPERATION

(1) Scrape loose paint and corrosion from inside scratch or chip.

(2) Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.

(3) Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the defect without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.

(4) Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.

(5) On vehicles without clear coat, the touch-up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clear coat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

WARNING: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

AFTERMARKET REPAIR PRODUCTS

EXTERIOR PAINT CODES AND SUPPLIER STOCK NUMBERS

COLOR NAME	CHRY. CODE*	PPG	DuPONT	S-W** M-S**	AKZO NOBEL SIKKENS	SPIES HECKER	ICI**
Metallic Red Clear Coat	LRF	4447	B9230	45860	CHA92:LRF	99739	1AJ7B
Flame Red Pearl Coat	PR4	4679	B9326	46916	CHA93:PR4	30116	RNN6B
Light Driftwood Satin Glow	MFA	4569	B9263	46579	CHA92:MFA	71201	2NN5B
Bright Sliver Metallic	WSB	N/A	B9883	57270	CHA99:WSB	74610	MCK3B
Forest Green Pearl Coat	SG8	5065	B9609	51062	CHA95:SG8	61633	7MR8B
Solar Yellow Clear Coat	VYH	5513	B9845	56092	CHA99:VYH	22546	KDG7B
Deep Amethyst Pearl Coat	TCU	5247	B9751	52565	CHA97:TCU	54754	FNE3B
Intense Blue Pearl Coat	VB3	5357	B9822	54468	CHA98:VB3	55321	HMR9B
Black Clear Coat	DX8	9700	99	34858 90-5950	CHA85:DX8	73328	TC60B
Bright White Clear Coat	GW7	4037	B8833	37298	CHA88:GW7	11751	TA45B

DESCRIPTION AND OPERATION (Continued)

INTERIOR PAINT CODES AND SUPPLIER STOCK NUMBERS

INTERIOR COLOR	CHRY CODE	PPG	DuPONT	S-W** M-S**	AKZO NOBEL SIKKENS	SPIES HECKER	ICI**
Agate	AZ	9856 2–1461	C9208	45994	CHALAZI	75016	7WC8
Mist Gray	C3	35799 2–1576	C9507	50508	CHARC3I	74339	7WB2
Camel	K9	28589 2–1647	N/A	55935	CHAVK9I	81849	KGC6

NOTE: *Herberts Standox and BASF use the Chrysler paint code as listed on the Body Code Plate and the Vehicle Safety Certification label. ** S-W = Sherwin-Williams, M-S = Martin Senour, ICI = ICI Autocolor.

STATIONARY GLASS

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
STATIONARY GLASS 4
SERVICE PROCEDURES
WINDSHIELD SAFETY PRECAUTIONS 4

page

REMOVAL AND INSTALLATION
WINDSHIELD 4
BACKLITE 6

DESCRIPTION AND OPERATION

STATIONARY GLASS

DESCRIPTION

Windshields are made of two pieces of glass with a plastic inner layer. Windshields and selected stationary glass are structural members of the vehicle. The windshield glass is bonded to the windshield frame with urethane adhesive.

OPERATION

Windshields and other stationary glass protect the occupants from the effects of the elements. Windshields are also used to retain some airbags in position during deployment. Urethane bonded glass is difficult to salvage during removal. The urethane bonding is difficult to cut or clean from any surface. Before removing the glass, check the availability of replacement components.

SERVICE PROCEDURES

WINDSHIELD SAFETY PRECAUTIONS

WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT.

URETHANE ADHESIVES ARE APPLIED AS A SYSTEM. USE GLASS CLEANER, GLASS PREP SOLVENT, GLASS PRIMER, PVC (VINYL) PRIMER AND PINCH WELD (FENCE) PRIMER PROVIDED BY THE ADHESIVE MANUFACTURER. IF NOT, STRUCTURAL INTEGRITY COULD BE COMPROMISED.

DAIMLERCHRYSLER DOES NOT RECOMMEND GLASS ADHESIVE BY BRAND. TECHNICIANS SHOULD REVIEW PRODUCT LABELS AND TECHNICAL DATA SHEETS, AND USE ONLY ADHESIVES THAT THEIR MANUFACTURES WARRANT WILL RESTORE A VEHICLE TO THE REQUIREMENTS OF FMVSS 212. TECHNICIANS SHOULD ALSO INSURE THAT PRIMERS AND CLEANERS ARE COMPATIBLE WITH THE PARTICULAR ADHESIVE USED.

BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.

VAPORS THAT ARE EMITTED FROM THE URETHANE ADHESIVE OR PRIMER COULD CAUSE PERSONAL INJURY. USE THEM IN A WELL-VENTILATED AREA.

SKIN CONTACT WITH URETHANE ADHESIVE SHOULD BE AVOIDED. PERSONAL INJURY MAY RESULT.

ALWAYS WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS.

CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers.

Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.

REMOVAL AND INSTALLATION

WINDSHIELD

REMOVAL

(1) Remove rear view mirror.
(2) Remove wipers and cowl grille.
(3) With doors open, remove the weatherstrip from the side windshield moldings.
(4) Remove the screws attaching the side windshield molding to the A-pillars (Fig. 1).
(5) Cut urethane bonding from around windshield using a suitable sharp cold knife (Fig. 2).
(6) Using a long knife, cut urethane bonding from inside the cab at the base of the windshield.

REMOVAL AND INSTALLATION (Continued)

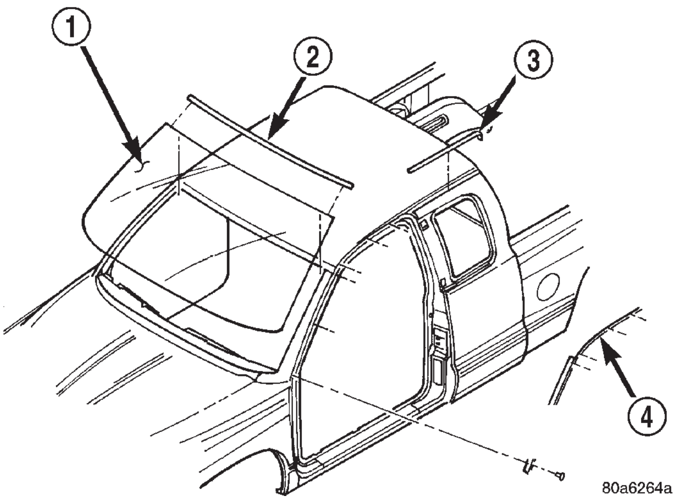


Fig. 1 Windshield Moldings

1 – WINDSHIELD
2 – WINDSHIELD MOLDING
3 – ROOF JOINT MOLDING
4 – WINDSHIELD MOLDING

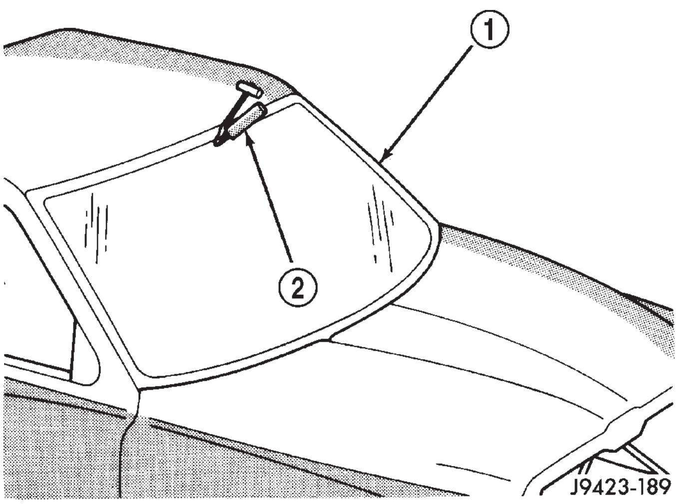


Fig. 2 Cut Urethane Around Windshield

1 – WINDSHIELD
2 – COLD KNIFE

INSTALLATION

WARNING: Allow the urethane at least 24 hours to cure before returning the vehicle to use.

CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing windshield to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.

The windshield fence should be cleaned of most of its old urethane bonding material. A small amount of old urethane, approximately 1-2 mm in height, should remain on the fence. Do not grind off or completely remove all old urethane from the fence, the paint finish and bonding strength will be adversely affected. Support spacers located on the cowl at the bottom of the windshield opening (Fig. 3) should be replaced with new parts. Replace any missing or damaged spacers around the perimeter of the windshield opening.

(1) Place replacement windshield into windshield opening and position glass in the center of the opening against the support spacers. Mark the glass at the support spacers with a grease pencil or pieces of masking tape and ink pen to use as a reference for installation. Remove replacement windshield from windshield opening (Fig. 4).

(2) Position the windshield inside up on a suitable work surface with two padded, wood 10 cm by 10 cm by 50 cm (4 in. by 4 in. by 20 in.) blocks, placed parallel 75 cm (2.5 ft.) apart (Fig. 5).

(3) Clean inside of windshield with MOPAR Glass Cleaner and lint-free cloth.

(4) Apply clear glass primer 25 mm (1 in.) wide around perimeter of windshield and wipe with a new clean and dry lint- free cloth.

(5) Apply the header molding to the windshield.

(6) Apply pinchweld primer 15 mm (.75 in.) wide around the windshield fence. Allow at least three minutes drying time.

(7) Apply a 13mm (1/2 in.) high and 10mm (3/8 in.) wide bead of urethane around the perimeter of windshield. At the bottom, apply the bead 7 mm (1/4 in.) inboard from the glass edge. On the three sides where the molding is on the glass, follow the edge of molding. The urethane bead should be shaped in a triangular cross-section, this can be achieved by notching the tip of the applicator (Fig. 6).

(8) With the aid of a helper, position the windshield over the windshield opening. Align the reference marks at the bottom of the windshield to the support spacers.

(9) Slowly lower windshield glass to the fence opening guiding the lower corners into proper position. Beginning at the bottom and continuing to the top, push glass onto fence along the A-Pillars. Push windshield inward to the fence at the bottom corners.

(10) Clean excess urethane from exterior with MOPAR Super Clean or equivalent.

(11) Apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold molding in place until urethane cures.

(12) Install **new** screws attaching the side windshield moldings to the A-pillars.

(13) Install the weatherstrip onto side windshield moldings.

(14) Install cowl grille and wipers.

REMOVAL AND INSTALLATION (Continued)

(15) Install rear view mirror.

(16) After urethane has cured, remove tape strips and water test windshield to verify repair.

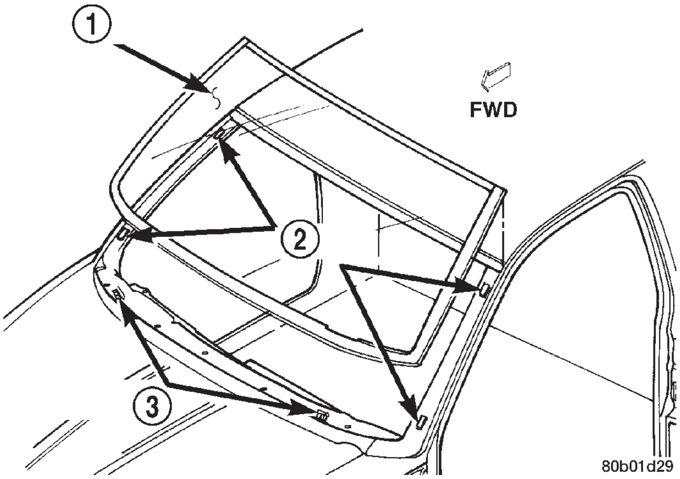


Fig. 3 Support Spacers

1 – WINDSHIELD
2 – SPACERS
3 – SUPPORTS

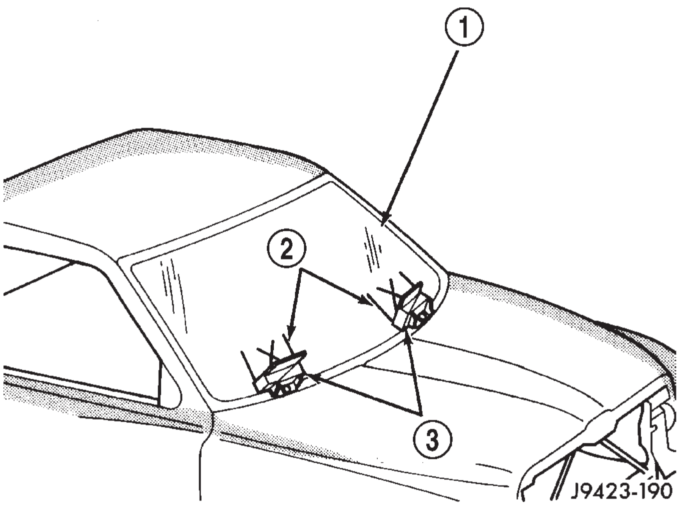


Fig. 4 Center Windshield and Mark at Support Spacers

1 – WINDSHIELD
2 – INDEX MARKS
3 – SUPPORT SPACERS

BACKLITE

Review Safety Precautions and Warnings paragraph at the front of this section before removing glass.

REMOVAL

(1) Remove B-pillar/quarter trim panels.

(2) Remove cab back panel trim.

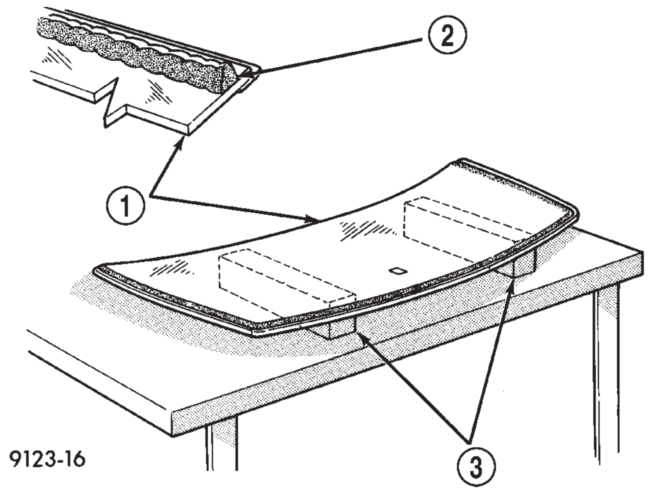


Fig. 5 Work Surface Set up and Molding Installation

1 – WINDSHIELD AND MOULDINGS
2 – URETHANE BEAD AROUND GLASS 7mm (.3 in.) FROM EDGE
3 – BLOCKS

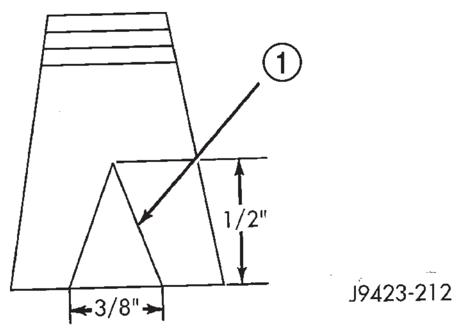


Fig. 6 Applicator Tip

1 – APPLICATOR TIP

(3) Bend backlite retaining tabs (Fig. 7) inward against glass.

(4) Using a long knife from inside the vehicle, cut urethane holding backlite frame to opening fence.

(5) Separate glass from vehicle.

INSTALLATION—SLIDING BACKLITE

(1) Trim urethane adhesive from around rear glass opening fence leaving 1–2 mm of urethane on fence.

(2) Apply RIM primer 25 mm (1 in.) wide to the mating surface of the backlite encapsulation.

(3) Apply Gurit-Essex® Betawipe 4000 25 mm (1 in.) wide to the mating surface of the backlite encapsulation.

(4) Apply blackout primer 25 mm (1 in.) wide to the mating surface of the backlite encapsulation.

(5) Apply pinchweld primer 25 mm (1 in.) wide to the backlite opening fence.

REMOVAL AND INSTALLATION (Continued)

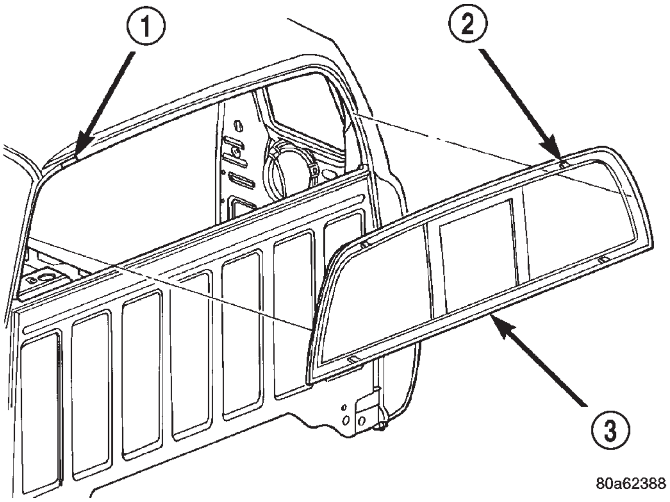


Fig. 7 Backlite

1 – URETHANE
2 – TAB
3 – BACKLITE

(6) Apply a 10 mm (0.4 in.) bead of urethane around perimeter of backlite along the inside of the encapsulation.

(7) Position backlite into backlite opening using alignment pins in lower corners.

(8) Firmly push glass against rear window glass opening fence.

(9) Bend tabs around edges of backlite opening fence to retain glass.

(10) Clean excess urethane from exterior with Mopar, Super Clean or equivalent.

(11) Install interior trim.

INSTALLATION—FIXED BACKLITE

(1) Trim urethane adhesive from around rear glass opening fence leaving 1–2 mm of urethane on fence.

(2) Apply PVC primer 25 mm (1 in.) wide to the mating surface of the backlite encapsulation.

(3) Apply blackout primer 25 mm (1 in.) wide to the mating surface of the backlite encapsulation.

(4) Apply pinchweld primer 25 mm (1 in.) wide to the backlite opening fence.

(5) Apply a 10 mm (0.4 in.) bead of urethane around perimeter of backlite along the inside of the encapsulation.

(6) Position backlite into backlite opening using alignment pins in lower corners.

(7) Firmly push glass against rear window glass opening fence.

(8) Bend tabs around edges of backlite opening fence to retain glass.

(9) Clean excess urethane from exterior with Mopar, Super Clean or equivalent.

(10) Install interior trim.

SEATS

TABLE OF CONTENTS

page page

DESCRIPTION AND OPERATION
SEAT SYSTEMS 8
REMOVAL AND INSTALLATION
BENCH SEAT. 8
BENCH SEAT TRACK 9
BENCH SEAT BACK 9
BENCH SEAT BACK PAD/COVER 10
BENCH SEAT CUSHION/COVER 10
BUCKET SEAT. 10
BUCKET SEAT TRACK. 11
BUCKET SEAT BACK. 11
BUCKET SEAT BACK PAD/COVER. 11
BUCKET SEAT CUSHION/COVER 11
CENTER SEAT/CONSOLE 12
CENTER ARMREST/CONSOLE LATCH 12
CENTER ARMREST UPPER INERTIA LATCH COVER. 13
CONSOLE LID/SEAT BACK 13
CENTER SEAT CUSHION/COVER 13
REAR SEAT BACK—CLUB CAB. 14
REAR SEAT CUSHION—CLUB CAB. 15
REAR SEAT QUAD CAB 16
QUAD CAB REAR SEAT CUSHION COVER 16

DESCRIPTION AND OPERATION

SEAT SYSTEMS

DESCRIPTION

Seat modules are made up of a seat frame, seat cushion, seat back cushion, a covering material, and the electrical components used for power operation, if equipped. Some seat systems also contain seat belt components and supplemental restraint systems.

OPERATION

Seat assemblies transport the occupants in comfort and safety. Seat assemblies also help position occupants correctly in the event of airbag deployment. Seat cushions, coverings, and electrical components are serviceable. Refer to the appropriate group in this manual.

REMOVAL AND INSTALLATION

BENCH SEAT

REMOVAL

(1) Move seat to full forward position.
(2) Remove bolts attaching seat track to floor pan.
(3) Move seat to full rearward position.
(4) Remove bolts attaching seat track to floor pan (Fig. 1).
(5) Tilt setback forward and lift seat out through door.

NOTE: Do not activate seat track adjusters once bolts are removed.

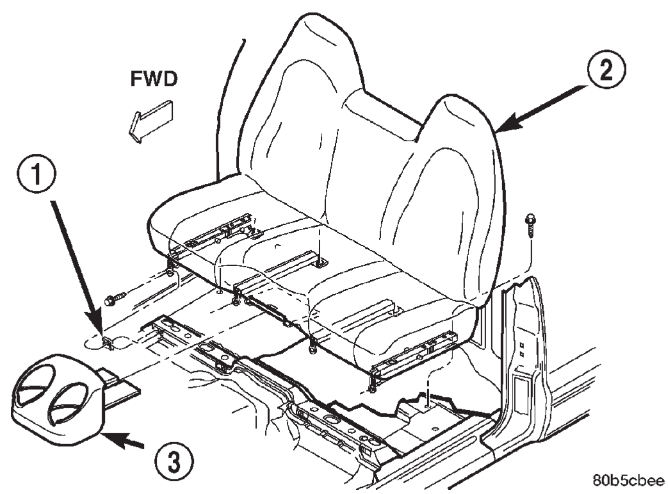


Fig. 1 Bench Seat

1 – U-NUT
2 – BENCH SEAT
3 – CUP HOLDER

INSTALLATION

(1) Position seat in vehicle.

NOTE: Ensure each seat track is equally positioned in the full rearward position.

(2) Install the front bolts attaching seat track to floor pan. Tighten bolts to 28 N·m (20 ft. lbs.) torque.
(3) Move seat to full forward position.
(4) Install rear bolts attaching seat track to floor pan. Tighten bolts to 40 N·m (30 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

BENCH SEAT TRACK

REMOVAL

(1) Remove seat from vehicle.

(2) Adjust the tracks as necessary to remove the bolts attaching the seat tracks to the cushion frame (Fig. 2).

(3) Remove the push nut from the seat adjuster lever.

(4) Separate the seat track from the frame.

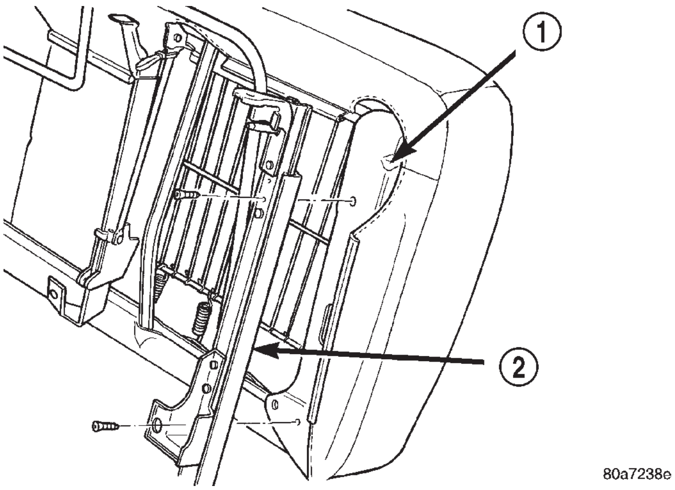


Fig. 2 Seat Track

1 – SEAT CUSHION FRAME
2 – SEAT TRACK

INSTALLATION

(1) Position the seat track on the frame.

(2) Install the push nut on the seat adjuster lever.

(3) Install the bolts attaching the seat tracks to the cushion frame. Tighten bolts to 24 N·m (17 ft. lbs.) torque.

(4) Install the seat.

BENCH SEAT BACK

REMOVAL

(1) Move seat to full forward position.

(2) Disengage outer, lower J-strap at base of seat back.

(3) Disengage hook and loop fastener on rear of seat back cover (Fig. 3).

(4) Peel back lower corners of seat back cover to expose hinge bolts (Fig. 4).

(5) Remove the bolts attaching the hinge bracket to the seat back frame.

(6) Remove seat back from vehicle.

INSTALLATION

(1) Position seat back in the vehicle.

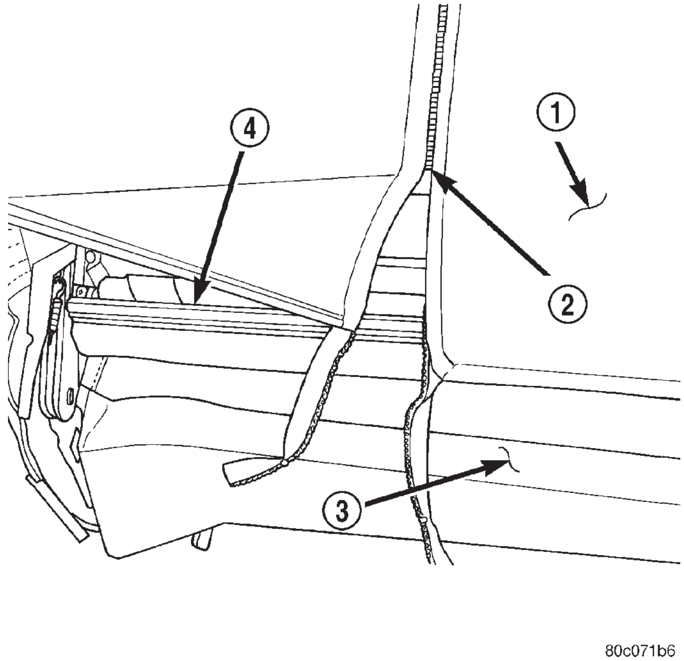


Fig. 3 Seat Back Hook and Loop Fastener

1 – SEAT BACK COVER
2 – HOOK AND LOOP FASTENER
3 – SEAT CUSHION
4 – J—STRAP

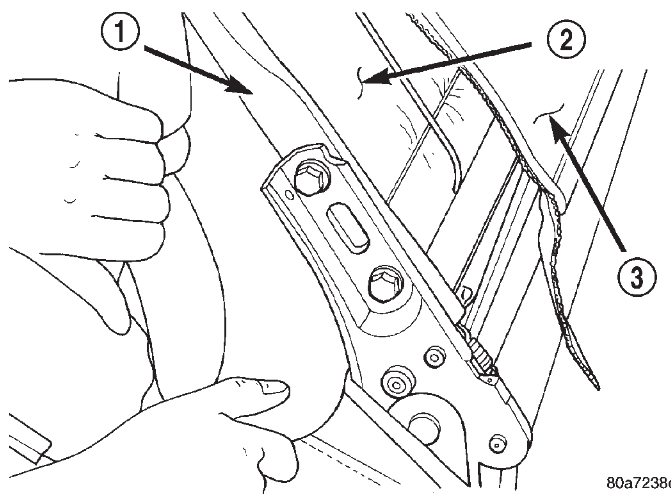


Fig. 4 Hinge Bolts

1 – SEAT BACK FRAME
2 – SEAT BACK CUSHION
3 – SEAT BACK COVER

(2) Install the bolts attaching the seat back frame to the hinge bracket.

(3) Roll the lower corners of seat back cover over the hinge bolts.

(4) Engage hook and loop fastener on rear of seat back cover.

(5) Engage outer, lower J-strap at base of seat back.

(6) Return seat to normal position.

REMOVAL AND INSTALLATION (Continued)

BENCH SEAT BACK PAD/COVER

REMOVAL

(1) Move seat to full forward position.

(2) Disengage outer, lower J-strap at base of seat back.

(3) Pull seat back pad/cover upward and separate from seat back frame.

INSTALLATION

(1) Position seat back pad/cover on the seat back frame.

(2) Engage outer, lower J-strap at base of seat back.

(3) Return seat to normal position.

BENCH SEAT CUSHION/COVER

REMOVAL

(1) Remove seat from vehicle.

(2) Remove the bolts attaching the outer seat tracks to the cushion frame (Fig. 2).

(3) Remove push nuts from seat adjuster lever.

(4) Disengage the J-straps around the perimeter of the cushion.

(5) Route the seat belt/buckles through the access hole in the cushion cover.

(6) Remove the cushion/cover from the frame.

INSTALLATION

(1) Position the cushion/cover on the frame.

(2) Route the seat belt/buckles through the access hole in the cushion cover.

(3) Engage the J-straps around the perimeter of the cushion.

(4) Install the push nuts on the seat adjuster lever.

(5) Install the bolts attaching the outer seat tracks to the cushion frame. Tighten the bolts to 24 N·m (17 ft. lbs.).

(6) Install the seat.

BUCKET SEAT

REMOVAL

(1) If equipped, remove side shield and disengage power seat switch connector.

If the vehicle is equipped with a 40/20/40 seat, remove bucket seats and console as one assembly (Fig. 5).

(2) Move seat to full forward position.

(3) Remove rear screws attaching trim cover to seat track (Fig. 6).

(4) Remove rear bolts attaching rear seat track to floor pan.

(5) Move seat to full rearward position.

(6) Remove front screws attaching trim cover to seat track (Fig. 6).

(7) Remove front bolts attaching front seat track to floor pan.

NOTE: Do not actuate recliner or track adjuster once bolts are removed.

(8) Tilt setback forward and lift seat out through door.

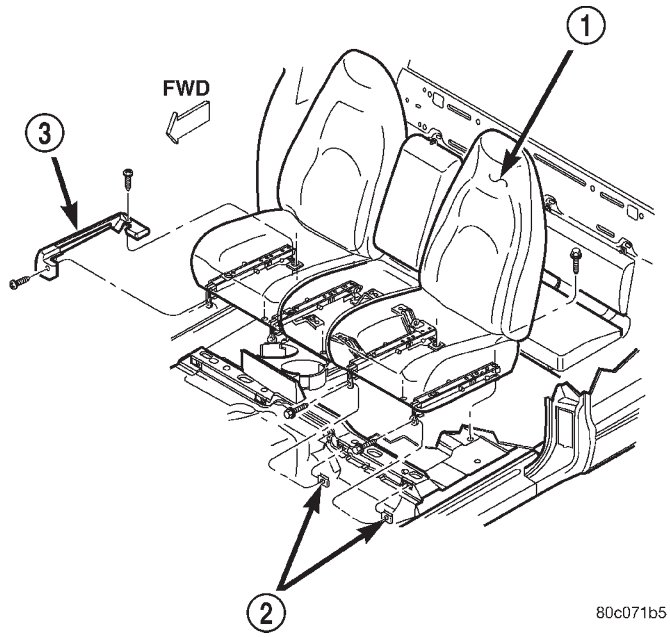


Fig. 5 40/20/40/ Front Seat

1 – 40/20/40 FRONT SEAT
2 – U—NUT
3 – TRIM COVER

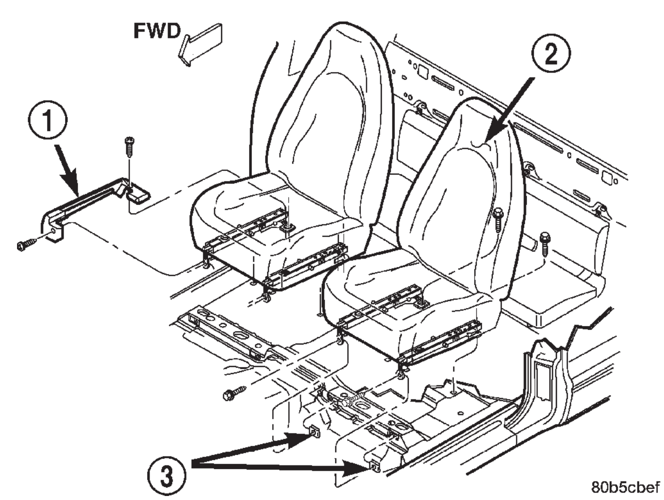


Fig. 6 Bucket Seat & Seat Track Trim Cover

1 – TRIM COVER
2 – BUCKET SEAT
3 – U-NUT

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position seat in vehicle.

NOTE: Ensure each seat track is equally positioned in the full rearward position.

(2) Install bolts attaching front seat track to floor pan. Tighten to 28 N·m (20 ft. lbs.) torque.

(3) Install front screws attaching trim cover to seat track.

(4) Move seat to full forward position.

(5) Install bolts attaching rear inboard seat track to floor pan. Tighten to 40 N·m (30 ft. lbs.) torque.

(6) Install bolts attaching rear outboard seat track to floor pan. Tighten to 28 N·m (20 ft. lbs.) torque.

(7) Install rear screws attaching trim cover to seat track.

(8) If equipped, engage power seat switch connector and install side shield.

BUCKET SEAT TRACK

REMOVAL

(1) Remove seat.

(2) Adjust the seat track to gain access to the torx bolts attaching the seat track to the cushion frame.

(3) Remove the torx bolts (Fig. 7).

(4) Remove the push nuts from the seat lever adjuster.

(5) Separate the seat track from the frame.

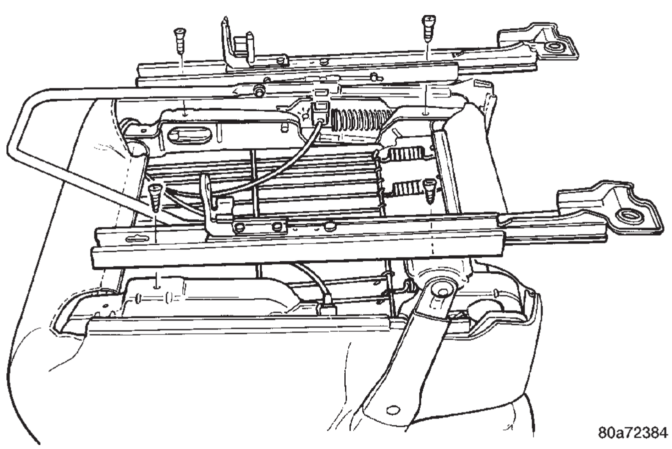


Fig. 7 Bucket Seat Track

INSTALLATION

(1) Position the seat track on the frame.

(2) Install the push nuts on the seat lever adjuster.

(3) Install the torx bolts attaching the seat track to the cushion frame. Tighten the bolts to 24 N·m (17 ft. lbs.) torque.

(4) Install seat.

BUCKET SEAT BACK

The bucket seat back frame, seat cushion frame and recliner mechanism is serviced as a complete assembly. Refer to the Bucket Seat Cushion/Cover and Bucket Seat Back Pad/Cover for service procedures.

BUCKET SEAT BACK PAD/COVER

REMOVAL

(1) Position seat in full forward position.

(2) If equipped, remove seat release handle on rear of seat back.

(3) Disengage J-strap at base of seat back.

(4) Disengage hook and loop fastener on rear of seat back (Fig. 8).

(5) Using a trim stick, carefully pry off lumbar handle.

(6) Separate pad/cover from seat back frame.

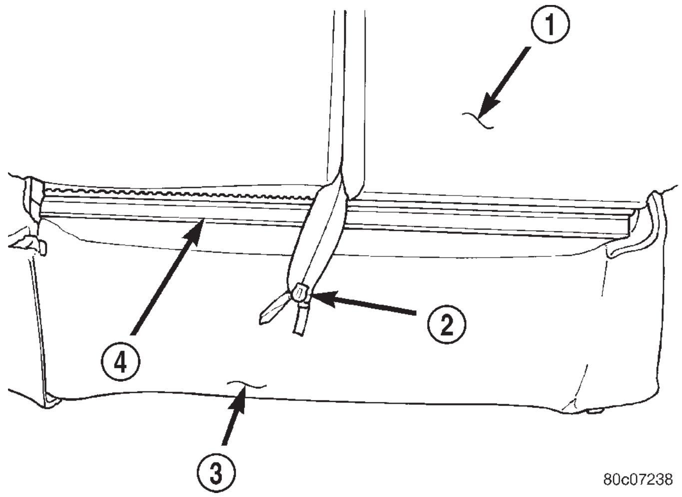


Fig. 8 Seat Back Cover

1 – SEAT BACK COVER
2 – HOOK AND LOOP FASTENER
3 – SEAT CUSHION
4 – J—STRAP

INSTALLATION

(1) Position pad/cover on seat back frame.

(2) Position lumbar handle on lumbar adjuster and press into place.

(3) Engage hook and loop fastener on rear of seat back.

(4) Engage J-straps at base of seat back.

(5) If removed, install seat release handle on rear of seat back.

(6) Return seat to normal position.

BUCKET SEAT CUSHION/COVER

REMOVAL

(1) Remove seat.

(2) Remove the anchor bolt attaching the buckle to the seat track (Fig. 9).

REMOVAL AND INSTALLATION (Continued)

(3) Remove the screw attaching the recliner handle to the recliner mechanism.

(4) Disengage the rearward corner J-straps.

(5) Disengage the side J-straps.

(6) Disengage the front J-strap.

(7) Disengage the rear J-strap.

(8) Separate the cushion/cover from the frame.

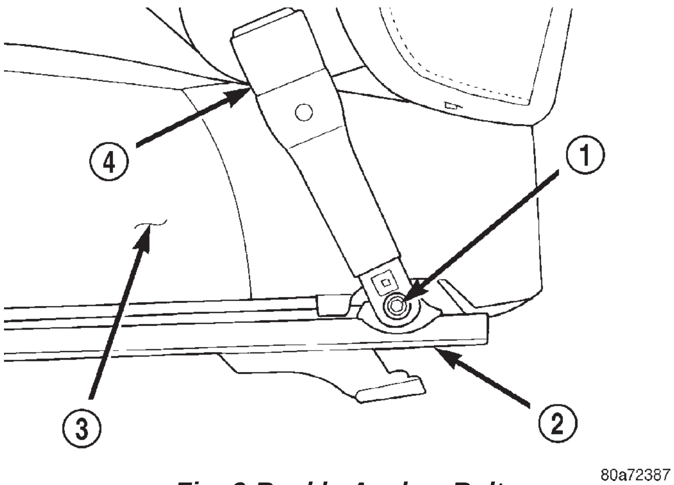


Fig. 9 Buckle Anchor Bolt

1 – ANCHOR BOLT
2 – SEAT TRACK
3 – SEAT CUSHION
4 – BUCKLE

INSTALLATION

(1) Position the cushion/cover on the frame.

(2) Engage the rear J-strap.

(3) Engage the front J-strap.

(4) Engage the side J-straps.

(5) Engage the rearward corner J-straps.

(6) Install the recliner handle.

(7) Install seat. Tighten the front seat track bolts to 22–34 N·m (16–25 ft. lbs.). Tighten the rear seat track bolts to 89–140 N·m (66–103 ft. lbs.).

(8) Install the anchor bolt attaching the buckle to the seat track. Tighten the bolt to 40 N·m (29 ft. lbs.).

CENTER SEAT/CONSOLE

REMOVAL

(1) Remove bucket seats

(2) Remove the bolts attaching the center seat to the bucket seat inboard seat tracks (Fig. 10).

(3) Route the seat belt buckles through the elastic retaining straps.

(4) Separate the center seat/console from the bucket seats.

INSTALLATION

(1) Position the center seat/console onto the bucket seat inboard seat tracks.

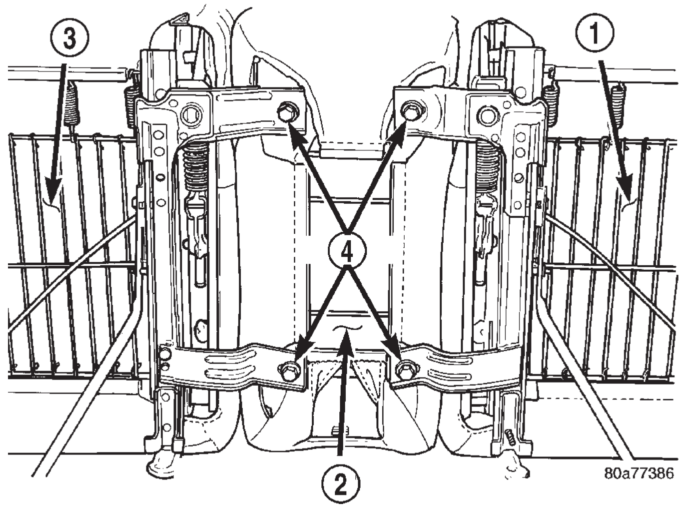


Fig. 10 Center Seat/Console

1 – PASSENGER SEAT
2 – CENTER SEAT/CONSOLE
3 – DRIVERS SEAT
4 – BOLTS

(2) Route the seat belt buckles through the elastic retaining straps.

(3) Install the bolts attaching the center seat to the bucket seat inboard tracks. Tighten the bolts to 24 N·m (17 ft. lbs.) torque.

(4) Install bucket seats

CENTER ARMREST/CONSOLE LATCH

REMOVAL

(1) Place the armrest/console in the down position.

(2) Open the armrest/console lid and remove the two screws attaching the latch bezel cover and remove the latch cover bezel and the latch button (Fig. 11).

(3) Using a drill stop, and protecting the surrounding trim and upholstery, drill the heads off the two rivets holding the latch to the armrest/console. Do not penetrate the latch bracket.

(4) Remove the latch assembly.

(5) Using the correct size drill bit, remove the remaining portion of the rivet.

INSTALLATION

(1) Before installing the latch assembly, clean the area of any debris.

(2) Align the latch with the hole openings in the bin.

(3) Secure the latch assembly with new rivets.

(4) Place the button in position and retain with the latch cover bezel.

(5) Attach the latch cover bezel with the screws.

(6) Inspect the latch assembly by cycling through a full range of lid motions.

REMOVAL AND INSTALLATION (Continued)

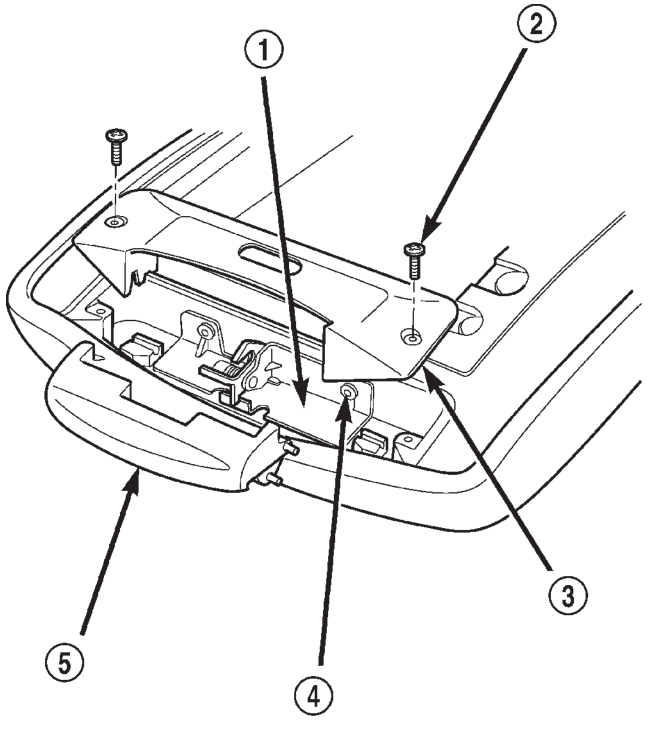


Fig. 11 Center Armrest/Console

1 – LATCH ASSEMBLY
2 – SCREW
3 – LATCH COVER BEZEL
4 – RIVET
5 – BUTTON

CENTER ARMREST UPPER INERTIA LATCH COVER

REMOVAL

(1) Move the drivers seat position to full forward with seat back full forward.

(2) Place center arm rest in the down position.

(3) Remove the screw securing the cover to the inertia latch (Fig. 12).

(4) Remove the upper and lower inertia latch covers.

INSTALLATION

(1) Install the upper latch cover onto the upper latch inertia arm. Ensure the check strap loops under the stud on the side of the lower stanchion/post.

(2) Install the lower latch cover onto the inertia latch upper arm working it around the latch bracket.

(3) Align the lower latch cover, the upper latch cover, and the latch bracket to the screw hole on the arm.

(4) Secure the cover with the screw and tighten to 4.15N·m (37 in. lbs.).

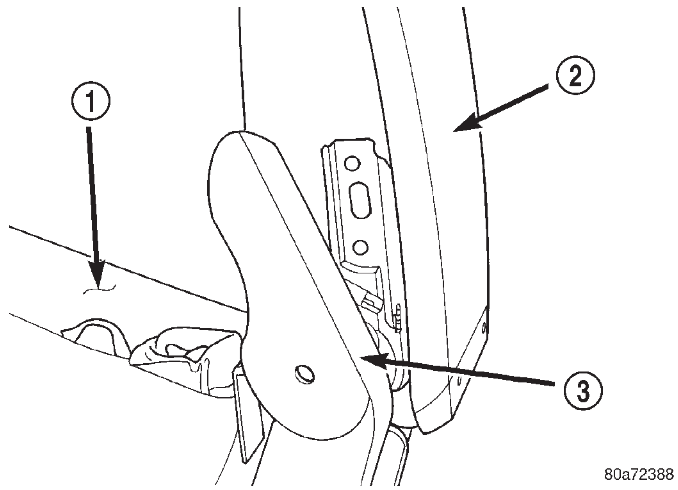


Fig. 12 Armrest/Console Inertia Latch Hinge Cover

1 – SEAT CUSHION
2 – SEAT BACK/CONSOLE LID
3 – HINGE COVER

(5) Cycle the armrest through a full range of travel and check for freedom of movement. Adjust the latch covers as necessary.

CONSOLE LID/SEAT BACK

REMOVAL

(1) Remove the hinge pivot bolt.

(2) Remove the left upper hinge bracket cover.

(3) Remove the torx screws attaching the left hinge bracket to the console lid/seat back (Fig. 13).

(4) Peel back the right pivot bracket cover and carefully pry the pivot from the pivot bracket (Fig. 14).

(5) Separate the console lid/seat back from the seat cushion.

INSTALLATION

(1) Position the console lid/seat back on the seat cushion.

(2) Align the pivot in the pivot bracket.

(3) Install the torx screws attaching the left hinge bracket to the console lid/seat back. Tighten the torx screws to 24 N·m (17 ft. lbs.) torque.

(4) Align the left upper hinge bracket cover and install the bolt.

(5) Install the hinge pivot bolt. Tighten the bolt to 24 N·m (17 ft. lbs.) torque.

CENTER SEAT CUSHION/COVER

REMOVAL

(1) Remove the bucket seats.

(2) Separate the center seat from the bucket seats.

(3) Remove the seat back/console lid.

REMOVAL AND INSTALLATION (Continued)

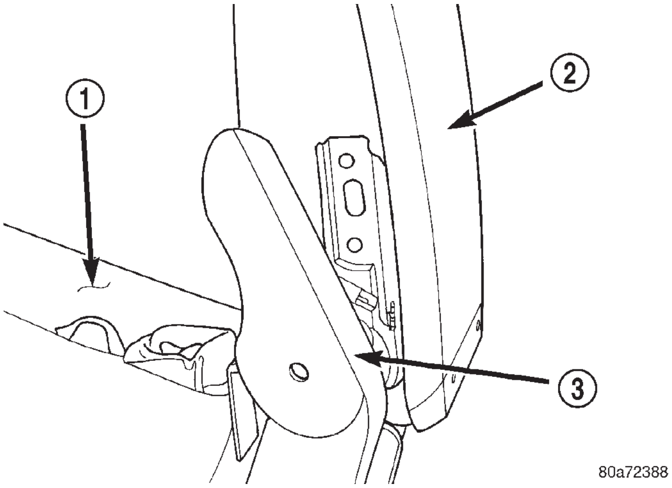


Fig. 13 Hinge Bracket

1 – SEAT CUSHION
2 – SEAT BACK/CONSOLE LID
3 – HINGE COVER

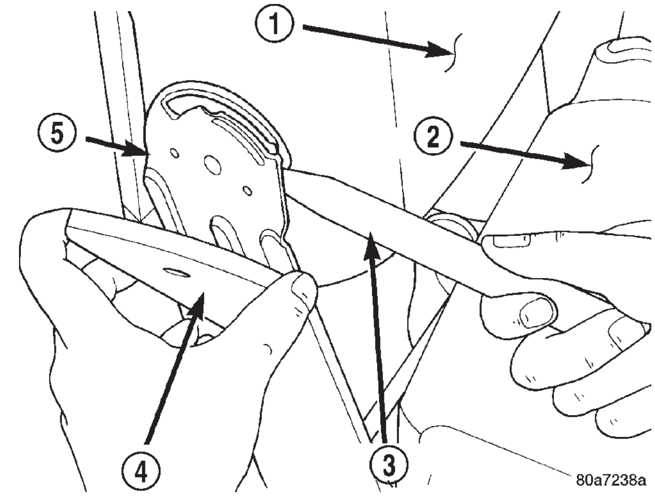


Fig. 14 Pivot Bracket

1 – SEAT BACK
2 – CUSHION
3 – TRIM STICK
4 – COVER
5 – PIVOT BRACKET

(4) Disengage the J-straps from the cushion frame (Fig. 15).
(5) Separate the cushion/cover from the frame.

INSTALLATION

(1) Position the cushion/cover on the frame.
(2) Engage the J-straps from the cushion frame.
(3) Install the seat back/console lid.
(4) Attach the center seat to the bucket seats.
(5) Install the bucket seats.

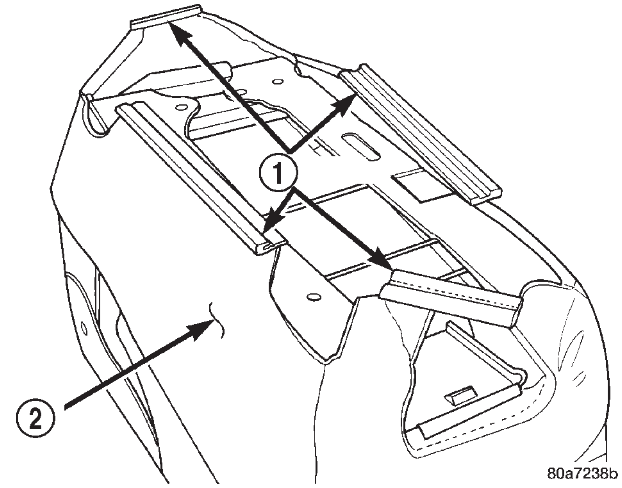


Fig. 15 Center Seat Cushion/Cover

1 – J-STRAPS
2 – CENTER SEAT CUSHION COVER

REAR SEAT BACK—CLUB CAB

REMOVAL

(1) Unsnap upper bolster assembly by pulling forward, and remove rear panel (Fig. 16).
(2) Push seat back firmly downward to disengage retaining tabs on seat back lower edge.
(3) Disengage seat belt/buckle retaining loops (Fig. 17).
(4) Remove cab back bolster assembly..

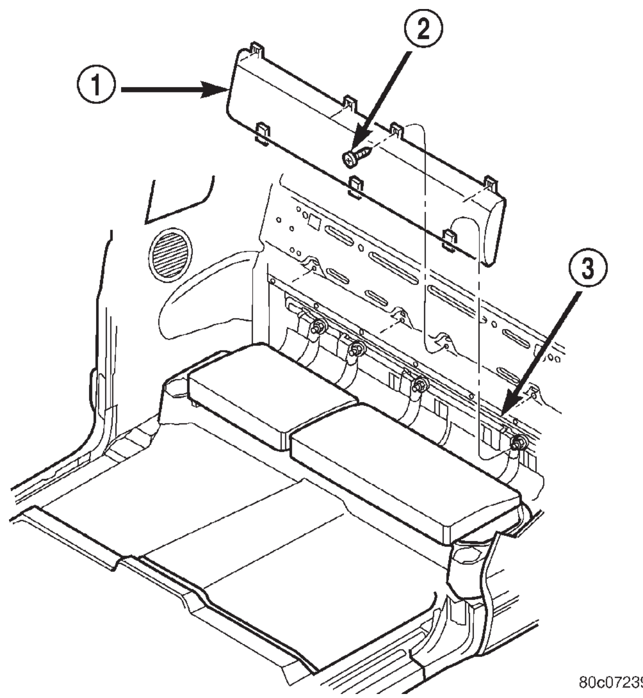


Fig. 16 Rear Seat Back

1 – SEAT BACK
2 – SCREW
3 – SEAT PIVOT BRACKET

REMOVAL AND INSTALLATION (Continued)

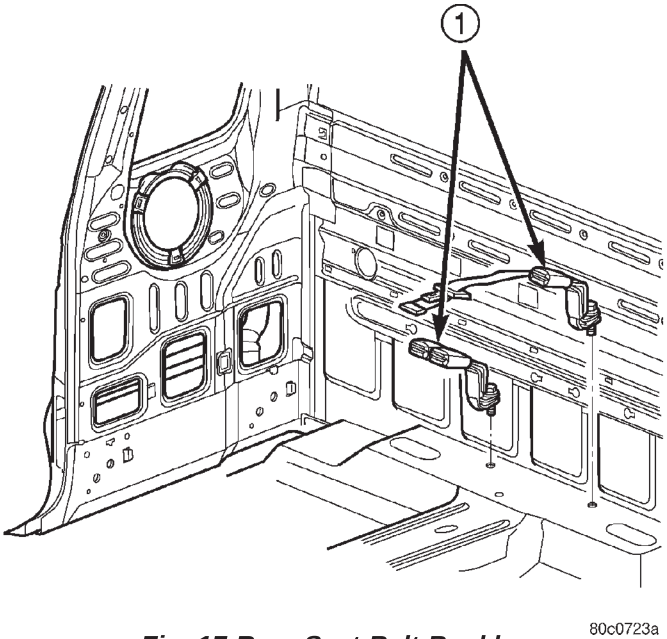


Fig. 17 Rear Seat Belt Buckles

1 – REAR SEAT BUCKLES

INSTALLATION

(1) Position rear seat back in vehicle.

(2) Position rear seat belt/buckle in the retaining loops.

(3) Position seat back at cab back panel, align retaining tabs and lift seat back upward to secure seat back.

(4) Secure cab back bolster assembly by aligning upper bolster assembly push pins with holes in cab back sheetmetal and pushing rearward.

REAR SEAT CUSHION—CLUB CAB

REMOVAL

(1) Remove rear seat back

(2) Remove nuts attaching rear seat cushion hinge to cab back panel.

(3) Separate rear seat cushion from vehicle.

INSTALLATION

(1) Position rear seat cushion in vehicle.

(2) Install nuts attaching rear seat cushion hinge to cab back panel.

(3) Install rear seat back

REMOVAL AND INSTALLATION (Continued)

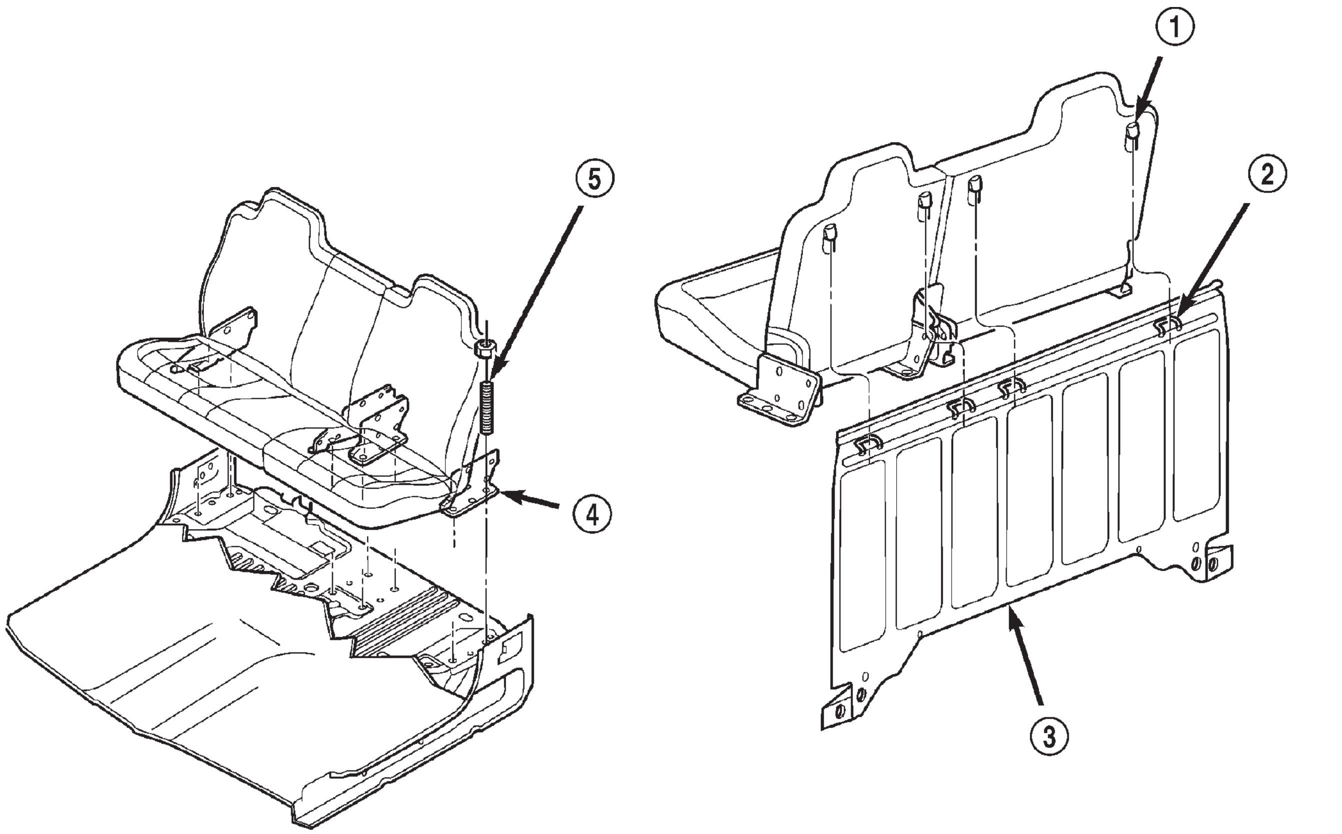


Fig. 18

1 – HOOK
2 – RETAINER
3 – CAB BACK
4 – SEAT BRACKET
5 – CAB FLOOR STUD

REAR SEAT QUAD CAB

The quad cab rear seat is a 60/40 seat. Each seat is serviceable separately.

Removal

(1) Fold the seating cushion up.
(2) Remove the fasteners retaining the seat to the cab floor.
(3) Lift the seat assembly off the retaining studs and the cab back hooks (Fig. 18).
(4) Feed the seat belt between the seat cushion and seat back.
(5) Remove the seat through the rear door.

Installation

(1) Position the seat on the cab back hooks and the floor studs.
(2) Feed the seat belt between the seat cushion and the seat back.
(3) Ensure the seat back is firmly hooked to the cab back retainers.
(4) Tighten the cab floor fasteners.

QUAD CAB REAR SEAT CUSHION COVER

Removal

(1) Remove rear seat.
(2) Disengage J strap from seat cushion.
(3) Remove cup holder, if equipped.
(4) Disengage hook and loop fasteners.
(5) Roll seat cushion cover off seat cushion.

Installation

(1) Position cover on seat cushion.
(2) Roll cover onto cushion.
(3) Engage the hook and loop fasteners.
(4) Install the cup holder, if equipped.
(5) Engage the J strap.
(6) Install rear seat.

BODY COMPONENT SERVICE

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
BODY COMPONENTS	18
INTERIOR TRIM PANELS	18
DIAGNOSIS AND TESTING	
WATER LEAKS	18
WIND NOISE	19
SERVICE PROCEDURES	
BODY LUBRICATION	20
HEAT STAKING	20
REMOVAL AND INSTALLATION	
GRILLE	20
HOOD	21
HOOD SILENCER PAD	21
HOOD HINGE	21
HOOD SAFETY LATCH	22
HOOD LATCH STRIKER	22
HOOD LATCH	22
HOOD RELEASE CABLE	23
COWL GRILLE	23
COWL SEAL	24
HOOD SEAL	24
FRONT WHEELHOUSE LINER	24
LEFT FRONT FENDER	24
RIGHT FRONT FENDER	26
EXTERIOR NAMEPLATES	27
SIDE VIEW MIRROR	28
FRONT DOOR TRIM PANEL	29
FRONT DOOR WATERDAM	30
FRONT DOOR	31
FRONT DOOR HINGE	31
FRONT DOOR OUTSIDE HANDLE	32
FRONT DOOR LOCK CYLINDER	33
LOCK CYLINDERS	33
FRONT DOOR LATCH	33
FRONT DOOR LATCH STRIKER	34
FRONT DOOR INSIDE HANDLE ACTUATOR	34
FRONT DOOR INNER BELT WEATHERSTRIP	34
FRONT DOOR OUTER BELT WEATHERSTRIP	34
FRONT DOOR GLASS	34
FRONT DOOR WINDOW REGULATOR	35
FRONT DOOR LOWER GLASS RUN CHANNELS	36
FRONT DOOR GLASS RUN WEATHERSTRIP	36
FRONT DOOR SEAL	36
FRONT DOOR SECONDARY SEAL	37
REAR DOOR	37
REAR DOOR HINGE	37
REAR DOOR TRIM PANEL	37
REAR DOOR WATERDAM	38
REAR DOOR LATCH STRIKER	39
REAR DOOR LATCH	39
REAR DOOR OUTSIDE HANDLE	39
REAR DOOR INSIDE HANDLE ACTUATOR	40
REAR DOOR GLASS RUN CHANNELS	40
REAR DOOR GLASS RUN WEATHERSTRIP	40
REAR DOOR INNER BELT WEATHERSTRIP	40
REAR DOOR OPENING WEATHERSTRIP	41
REAR DOOR OUTER BELT WEATHERSTRIP	41
REAR DOOR SECONDARY SEAL	41
REAR DOOR GLASS	41
REAR DOOR QUARTER GLASS	42
REAR DOOR WINDOW REGULATOR	42
ROOF RAIL WEATHERSTRIP AND RETAINER	43
ROOF JOINT MOLDING	43
QUARTER VENT WINDOW	43
QUARTER VENT WINDOW WEATHERSTRIP	44
AIR EXHAUSTER	44
AIR EXHAUSTER—CAB	44
BODY SIDE MOLDINGS	45
WHEEL OPENING MOLDING	45
FUEL FILLER DOOR	45
REAR SPLASH SHIELD	46
TAILGATE CHECK CABLE	46
TAILGATE	47
TAILGATE LATCH RELEASE HANDLE	47
TAILGATE LATCH	48
TAILGATE LATCH STRIKER	48
CARGO BOX	48
CARGO BOX SEAL	49
COWL TRIM COVER	49
A-PILLAR TRIM	50
DOOR SILL TRIM COVER	50
B-PILLAR TRIM	50
QUARTER TRIM PANEL	51
REAR CAB BACK PANEL TRIM	51
BACKLITE SLIDING VENT GLASS	52
FRONT SEAT BELT RETRACTOR	52
SEAT BELT RETRACTOR—QUAD CAB	52
SEAT BELT BUCKLE	53
REAR SEAT BELT/BUCKLE—CLUB CAB	53
REAR SEAT BELT RETRACTOR—CLUB CAB	54
FLOOR SHIFT BOOT	54
SHIFT BEZEL	55
FLOOR CONSOLE	56
REAR STORAGE BOX	56
FLOOR CARPET OR MAT	57
REARVIEW MIRROR	57
REARVIEW MIRROR SUPPORT BRACKET	57

SUNVISORS 58
COAT HOOK 58
QUAD CAB ASSIST HANDLE 59
HEADLINER 59
ADJUSTMENTS
HOOD 59
HOOD LATCH STRIKER 59
HOOD LATCH 60
FRONT DOOR LATCH 60
FRONT DOOR IN/OUT 60
FRONT DOOR UP/DOWN 61
REAR DOOR ADJUSTMENT 61
SPECIFICATIONS
WELD LOCATIONS 62
STRUCTURAL ADHESIVE LOCATIONS 89
SEALER LOCATIONS 94
BODY GAP AND FLUSH MEASUREMENTS 106
BODY OPENING DIMENSIONS 113
TORQUE SPECIFICATIONS 116
SPECIAL TOOLS
BODY 116

DESCRIPTION AND OPERATION

BODY COMPONENTS

DESCRIPTION

Exterior sheet metal components make up the exterior of the vehicle. Some exterior metal systems are welded assemblies, such as doors and hoods. Some exterior trim items are made of composite.

OPERATION

The exterior is finished in various metal stampings and composite moldings. These assemblies give the vehicle a finished appearance and protect the occupants from the elements. Some components are part of the energy absorbing system used to protect the occupants in collisions. The exterior sheet metal is repairable and adjustable for fit and finish. Welded and bonded component systems are adjustable as a system. Trim components made of composite are stamped with the type of material used. DaimlerChrysler uses various fasteners to retain trim items. At times, it is not possible to remove trim items without damaging the fastener. If it is not possible to remove an item without damaging a component, cut or break the fasteners and use new ones when installing the component.

INTERIOR TRIM PANELS

CAUTION: Do not attempt to remove interior trim panels/moldings without first removing the necessary adjacent panels.

To avoid damaging the panels, ensure that all the screws and clips are removed before attempting to remove an interior trim panel/molding. **Trim panels are somewhat flexible but can be damaged if handled improperly.**

DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: DO NOT USE ELECTRIC SHOP LIGHTS OR TOOLS IN WATER TEST AREA. PERSONAL INJURY CAN RESULT.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.

DIAGNOSIS AND TESTING (Continued)

- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations refer to Group 0, Lubrication and Maintenance, General Information section.

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior moldings or body ornamentation. Loose moldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create a whistling or howling noise. Inspect the exterior of the vehicle to verify that these conditions do not exist.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

(1) Drive the vehicle to verify the general location of the wind noise.

(2) Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

DIAGNOSIS AND TESTING (Continued)

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

SERVICE PROCEDURES

BODY LUBRICATION

All mechanisms and linkages should be lubricated when necessary. This will maintain ease of operation and provide protection against rust and excessive wear. The weatherstrip seals should be lubricated to prolong their life as well as to improve door sealing.

All applicable exterior and interior vehicle operating mechanisms should be inspected and cleaned. Pivot/sliding contact areas on the mechanisms should then be lubricated.

(1) When necessary, lubricate the operating mechanisms with the specified lubricants.

(2) Apply silicone lubricant to a cloth and wipe it on door seals to avoid over-spray that can soil passenger's clothing.

(3) Before applying lubricant, the component should be wiped clean. After lubrication, any excess lubricant should be removed.

(4) The hood latch, latch release mechanism, latch striker, and safety latch should be lubricated periodically.

(5) The door lock cylinders should be lubricated twice each year (preferably autumn and spring).

- Spray a small amount of lock cylinder lubricant directly into the lock cylinder.
- Apply a small amount to the key and insert it into the lock cylinder.
- Rotate it to the locked position and then back to the unlocked position several times.
- Remove the key. Wipe the lubricant from it with a clean cloth to avoid soiling of clothing.

HEAT STAKING

(1) Remove trim panel.

(2) Bend or move the trim panel components at the heat staked joints. Observe the heat staked locations and/or component seams for looseness.

(3) Heat stake the components.

(a) If the heat staked or component seam location is loose, hold the two components tightly together and using a soldering gun with a flat tip, melt the material securing the components together. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

(b) If the heat staked material is broken or missing, use a hot glue gun to apply new material to the area to be repaired. The panels that are being heat staked must be held together while the applying the glue. Once the new material is in place, it may be necessary to use a soldering gun to melt the newly applied material. Do not over heat the affected area, damage to the exterior of the trim panel may occur.

(4) Allow the repaired area to cool and verify the repair.

(5) Install trim panel.

REMOVAL AND INSTALLATION

GRILLE

REMOVAL

(1) Release primary hood latch.

(2) Release hood safety catch and open hood.

(3) Remove screws attaching bottom of grille to grille mounting bracket.

(4) Remove nuts attaching grille to hood (Fig. 1).

(5) Separate grille from vehicle.

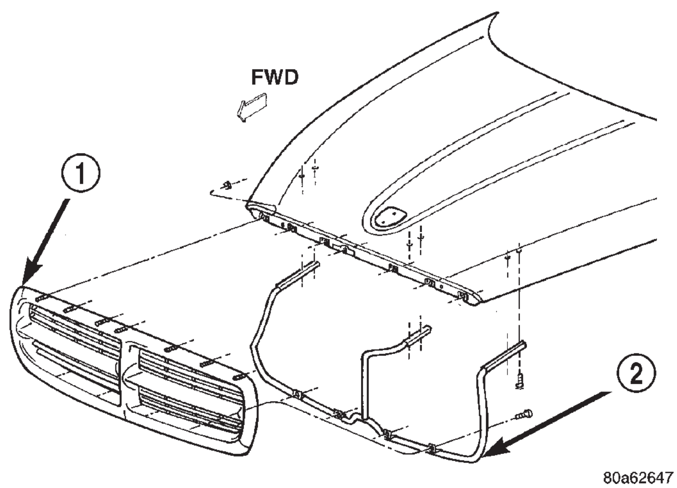


Fig. 1 Grille

1 – GRILLE
2 – GRILLE MOUNTING BRACKET

INSTALLATION

(1) Position grille on hood.

(2) Install nuts attaching grille to hood.

(3) Install screws attaching bottom of grille to grille mounting bracket.

(4) Close hood.

REMOVAL AND INSTALLATION (Continued)

HOOD

REMOVAL

(1) Release primary hood latch.
(2) Release hood safety catch and open hood.
(3) Disconnect the under hood lamp wire connector.
(4) Mark all nut and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation.
(5) Remove the top nuts attaching hood to hinge and loosen the bottom nuts until they can be removed by hand (Fig. 2).
(6) With assistance of a helper, support the hood at the opposite side of the vehicle.
(7) Remove the bottom nuts and separate the hood from the vehicle.

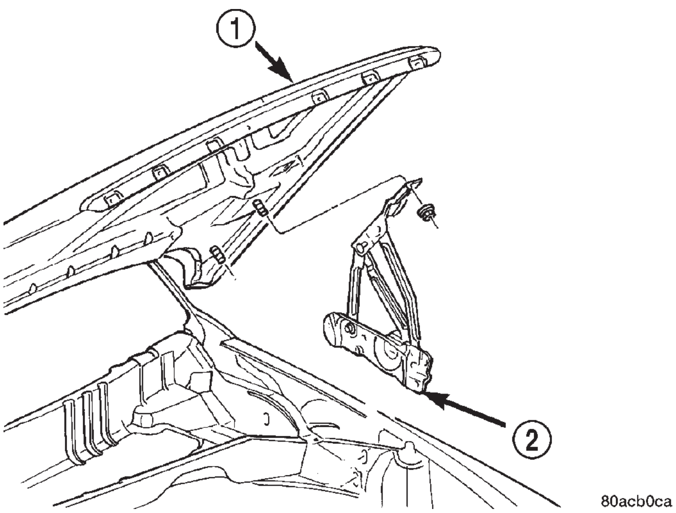


Fig. 2 Hood

1 – HOOD
2 – HOOD HINGE

INSTALLATION

(1) With assistance of a helper, position the hood on hinges.
(2) Align all marks and install the nuts. The hood should be aligned to 5 mm (0.2 in.) gap to the front fenders and flush across the top surfaces along fenders.
(3) Connect the under hood lamp wire connector.
(4) Close hood and adjust as necessary.

HOOD SILENCER PAD

REMOVAL

(1) Raise the hood.
(2) Remove the retainers attaching the silencer pad to the hood (Fig. 3).
(3) Remove the silencer pad from the hood.

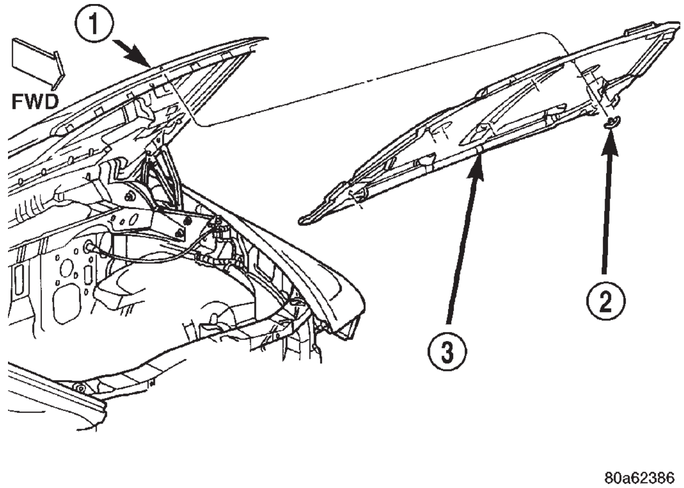


Fig. 3 Hood Silencer Pad

1 – HOOD
2 – RETAINER
3 – HOOD SILENCER PAD

INSTALLATION

(1) Position the silencer pad on the hood.
(2) Install the retainers attaching the silencer pad to the hood.
(3) Close the hood.

HOOD HINGE

REMOVAL

(1) Open hood and support the side that requires hinge replacement.
(2) Remove cowl grille.
(3) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to provide reference marks for installation.
(4) Remove the nuts attaching the hinge to the hood (Fig. 4).
(5) Remove the bolts attaching the hinge to the inner fender (Fig. 4).
(6) Separate hinge from vehicle.

INSTALLATION

(1) If necessary, paint new hinge before installation.
(2) Position the hinge on the vehicle and align all marks.
(3) Install the bolts attaching the hinge to the inner fender.Tighten the bolts to 28.2N·m (250 in. lbs.) torque.
(4) Install the nuts attaching the hinge to the hood. Tighten the nuts to 22.6 N·m (200 in. lbs) torque.
(5) Install cowl grille.

REMOVAL AND INSTALLATION (Continued)

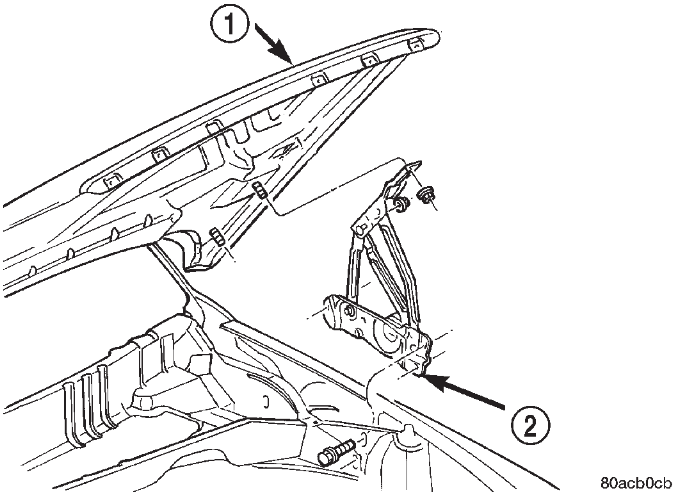


Fig. 4 Hood Hinge

1 – HOOD
2 – HOOD HINGE

(6) Remove support and verify hood operation. The hood should be aligned to 5 mm (0.2 in.) gap to the front fenders.

HOOD SAFETY LATCH

REMOVAL

(1) Release primary hood latch.
(2) Release hood safety catch and open hood.
(3) Remove bolts attaching hood safety latch to hood (Fig. 5).
(4) Separate safety latch from hood.

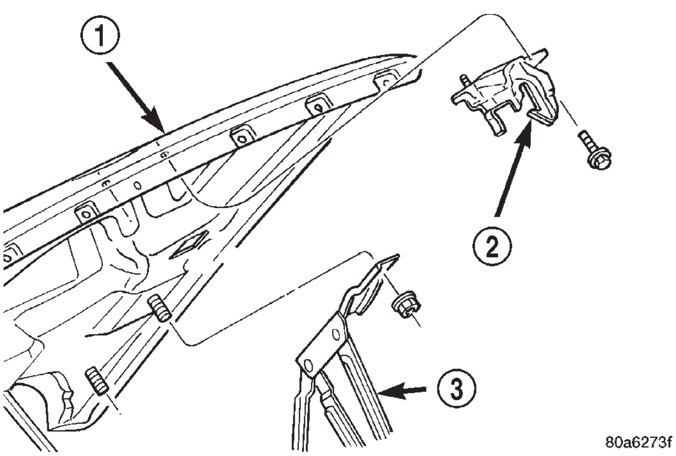


Fig. 5 Hood Safety Latch

1 – HOOD
2 – SAFETY LATCH
3 – HINGE

INSTALLATION

(1) Position safety latch on hood.
(2) Install bolts attaching safety latch to hood. Tighten the bolts to 9.6 N·m (85 in. lbs.) torque.
(3) Close hood and verify operation. Adjust as necessary.

HOOD LATCH STRIKER

The hood latch striker is incorporated with the hood safety latch. Refer to the Hood Safety Latch paragraph in this group for service procedures

HOOD LATCH

REMOVAL

(1) Release primary hood latch.
(2) Release hood safety catch and open hood.
(3) Using a grease pencil, mark latch position for installation alignment.
(4) Remove bolts attaching hood latch to radiator closure panel crossmember (Fig. 6).
(5) Separate hood latch from crossmember.
(6) Disconnect release cable from hood latch (Fig. 7).

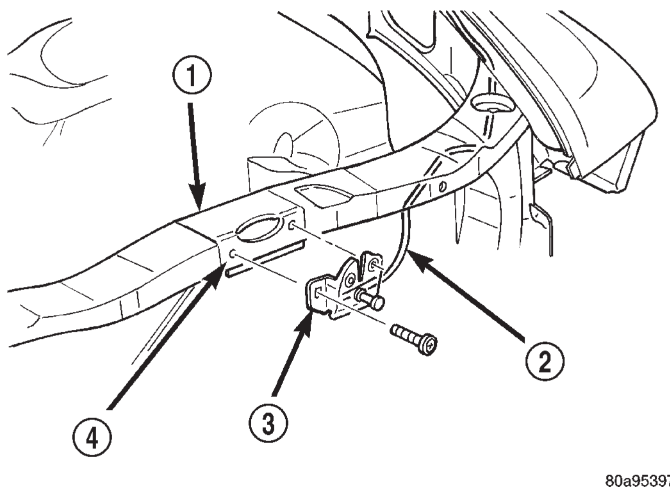


Fig. 6 Hood Latch

1 – RADIATOR CLOSURE PANEL
2 – HOOD RELEASE CABLE
3 – HOOD LATCH
4 – LATCH BRACKET

INSTALLATION

(1) Connect release cable to hood latch.
(2) Position hood latch on crossmember. Ensure the bottom flange of hood latch (Fig. 7) is secured around the latch bracket (Fig. 6).
(3) Install the bolts attaching hood latch to radiator closure panel crossmember. Tighten the bolts to 10.7 N·m (80 in. lbs.) torque.
(4) Close hood.
(5) Adjust latch as necessary.

REMOVAL AND INSTALLATION (Continued)

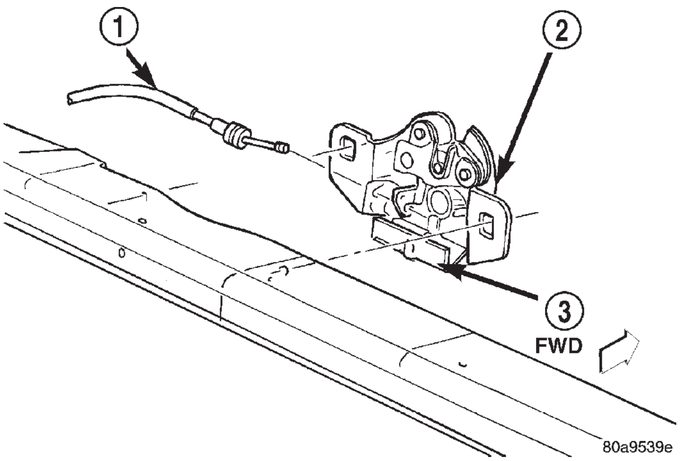


Fig. 7 Hood Release Cable

1 – HOOD RELEASE CABLE
2 – HOOD LATCH
3 – BOTTOM FLANGE

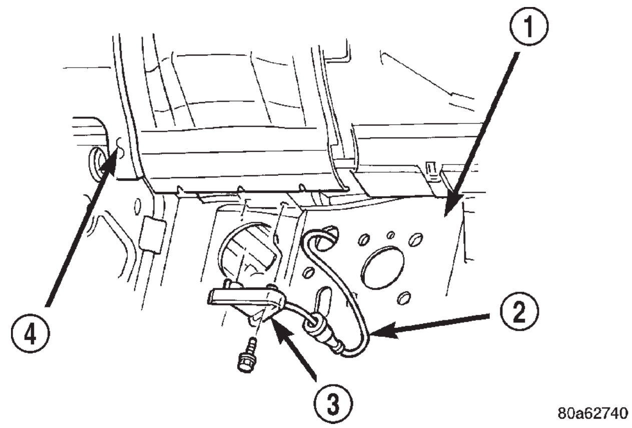


Fig. 8 Hood Release Cable

1 – DASH PANEL
2 – HOOD RELEASE CABLE
3 – HOOD RELEASE HANDLE
4 – INSTRUMENT PANEL

HOOD RELEASE CABLE

REMOVAL

(1) Release primary hood latch.
(2) Release hood safety catch and open hood.
(3) Remove hood latch.
(4) Disconnect release cable from hood latch (Fig. 7).
(5) Detach the release cable and the retainer clips in the engine compartment.
(6) Separate the release cable grommet from the dash panel hole.
(7) From the inside of the vehicle, remove the screws attaching the hood release handle to the bottom of the instrument panel (Fig. 8).
(8) Pull/route the hood release cable through the dash panel hole and remove it via the inside of the vehicle.

INSTALLATION

NOTE: If replacement hood latch is also being installed, ensure that it is thoroughly lubricated.

(1) From inside the vehicle, pull/route the hood release cable through the dash panel hole and into the engine compartment.
(2) Install the hood release handle.
(3) Install the cable grommet in the dash panel hole.
(4) Attach the retainer clips to the release cable and install them into the holes in the engine compartment.
(5) Attach release cable to hood latch.
(6) Install hood latch.
(7) Test the hood latch release cable for proper operation.

COWL GRILLE

REMOVAL

(1) Open hood.
(2) Mark wiper arm locations on windshield with grease pencil.
(3) Lift cover for wiper arms and remove nuts attaching wiper arms to cowl.
(4) Remove upper plastic nuts attaching cowl grille to cowl (Fig. 9).
(5) Insert a small flat blade into the slots of the plastic rivet anchors in each cowl grille corner. Lift up on the flat blade to release the rivet anchors.
(6) Remove cowl weatherstrip.
(7) Disconnect and plug windshield washer feed line from cowl.
(8) Disconnect vacuum line from cowl.
(9) Separate cowl grille from cowl.

INSTALLATION

(1) Position cowl grille on cowl.
(2) Connect vacuum line to cowl.
(3) Remove the plug and connect windshield washer feed line to cowl.
(4) Install cowl weatherstrip.
(5) Position rivet anchors in place and press down to engage.
(6) Install upper plastic nuts attaching cowl grille to cowl.
(7) Align wiper arms and install the nuts.

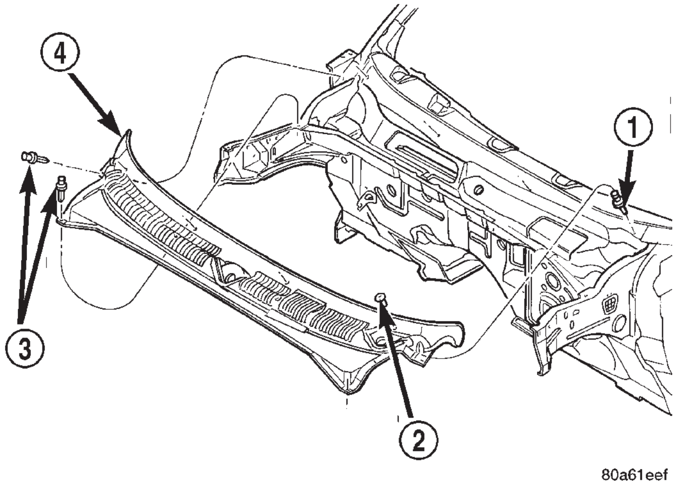


Fig. 9 Cowl Grille

1 – STUD
2 – PLASTIC NUT
3 – PLASTIC RIVET
4 – COWL GRILLE

COWL SEAL

REMOVAL

(1) Grasp cowl seal and pull seal from flange (Fig. 10).

(2) Separate cowl seal from vehicle.

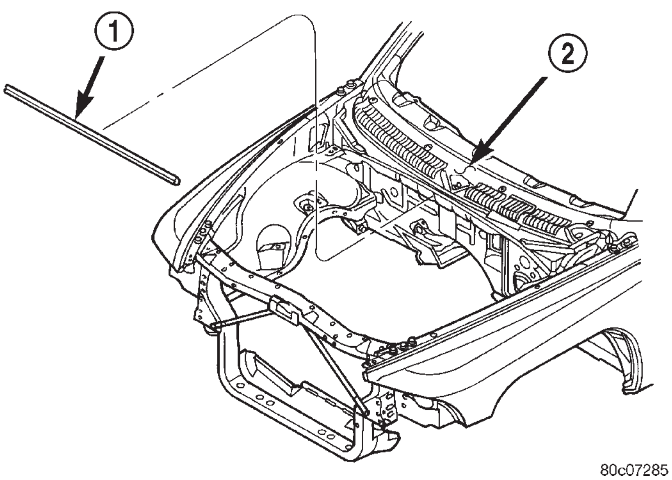


Fig. 10 Cowl Seal

1 – COWL TO HOOD SEAL
2 – COWL

INSTALLATION

(1) Position cowl seal on flange and press into place.

HOOD SEAL

REMOVAL

(1) Remove push-in fasteners attaching hood seal to inner hood panel (Fig. 11).

(2) Separate hood seal from vehicle.

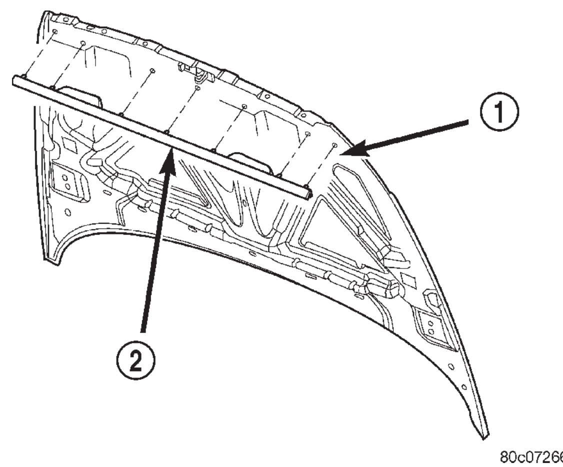


Fig. 11 Hood Seal

1 – INNER HOOD PANEL
2 – HOOD PANEL

INSTALLATION

(1) Position hood seal on inner hood panel.

(2) Install push-in fasteners attaching hood seal to inner hood panel.

FRONT WHEELHOUSE LINER

REMOVAL

(1) Raise and support the front wheel.

(2) Remove the front wheel.

(3) Remove wheel opening molding.

(4) Remove plastic rivets attaching wheelhouse liner to wheelhouse (Fig. 12).

(5) Separate liner from vehicle.

INSTALLATION

(1) Position liner in wheelhouse.

(2) Install plastic rivets attaching wheelhouse liner to wheelhouse.

(3) Install wheel opening molding.

(4) Install the front wheel.

(5) Remove the support and lower the vehicle.

LEFT FRONT FENDER

REMOVAL

(1) Remove battery.

(2) Raise and support the vehicle.

(3) Remove left front wheel.

(4) Remove wheel opening molding.

REMOVAL AND INSTALLATION (Continued)

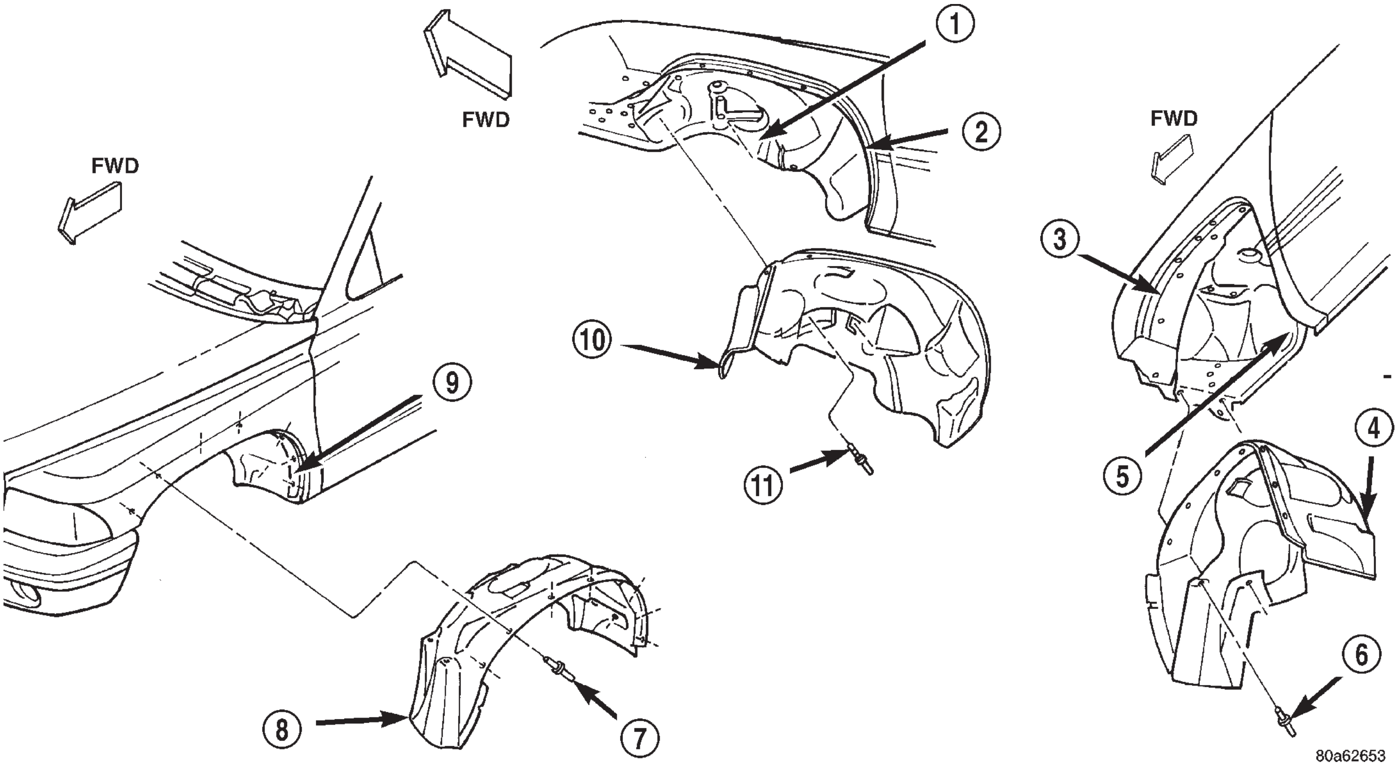


Fig. 12 Front Wheelhouse Liner

1 – FENDER SPLASH SHIELD
2 – INNER FENDER
3 – INNER FENDER
4 – WHEELHOUSE LINER
5 – FENDER SPLASH SHIELD
6 – PLASTIC RIVET
7 – PLASTIC RIVET
8 – WHEELHOUSE LINER
9 – INNER FENDER
10 – WHEELHOUSE LINER
11 – PLASTIC RIVET

(5) Remove wheelhouse liner.
(6) Remove left headlamp module.
(7) Remove PDC (power distribution center).
(8) Remove battery tray and battery support bracket (Fig. 13).
(9) Remove HCU (hydraulic control unit) if equipped. Refer to Group 5, Brakes for service procedures.
(10) Disengage clips attaching hood release cable to inner fender.
(11) Disengage clips attaching wire harness to inner fender and wheelhouse.
(12) Remove bolt attaching fender to lower rocker panel.
(13) Remove bolts attaching fender to lower radiator closure panel (Fig. 15).
(14) Remove bolts attaching fender to hood hinge support bracket.
(15) Remove bolts attaching fender to upper cowl (Fig. 14).
(16) Remove bolts attaching fender to upper radiator closure panel.
(17) Separate fender and wheelhouse from vehicle.

INSTALLATION

(1) Position fender and wheelhouse from vehicle.
(2) Install bolts attaching fender to upper radiator closure panel.
(3) Install bolts attaching fender to upper cowl.
(4) Install bolts attaching fender to hood hinge support bracket.
(5) Install bolts attaching fender to lower radiator closure panel.
(6) Install bolt attaching fender to lower rocker panel.
(7) Position the hood release cable to inner fender and engage clips.
(8) Position the wire harnesses on the inner fender and wheelhouse and engage clips.
(9) Install HCU if equipped. Refer to Group 5, Brakes for service procedures.
(10) Install battery support bracket and battery tray.
(11) Install PDC (power distribution center).
(12) Install left headlamp module.
(13) Install battery.
(14) Install wheelhouse liner.

REMOVAL AND INSTALLATION (Continued)

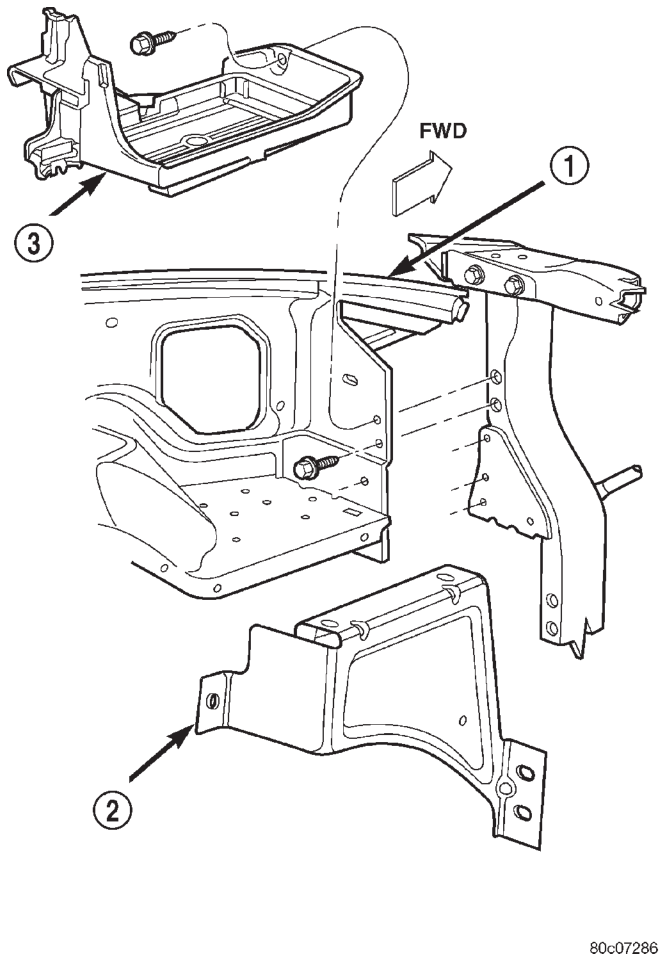


Fig. 13 Battery Tray and Support Bracket

1 – FRONT FENDER
2 – BATTERY TRAY SUPPORT BRACKET
3 – BATTERY TRAY

(15) Install wheel opening molding.
(16) Install left front wheel.
(17) Remove the support and lower the vehicle.

RIGHT FRONT FENDER

REMOVAL

(1) Disconnect battery negative cable.
(2) Raise and support the vehicle.

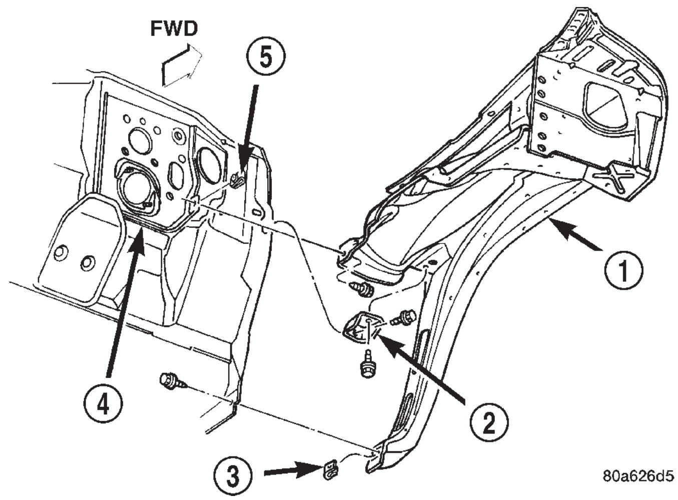


Fig. 14 Front Fender

1 – FRONT FENDER
2 – BRACKET
3 – U-NUT
4 – DASH PANEL
5 – U-NUT

(3) Remove right front wheel.
(4) Remove wheel opening molding.
(5) Remove wheelhouse liner.
(6) Remove right headlamp module.
(7) Remove air cleaner element housing.
(8) Remove powertrain control module.
(9) Disengage clips attaching wire harnesses to inner fender and wheelhouse.
(10) Remove bolt attaching fender to lower rocker panel.
(11) Remove bolts attaching fender to lower radiator closure panel (Fig. 15).
(12) Remove bolts attaching fender to hood hinge support bracket.
(13) Remove bolts attaching fender to upper cowl.
(14) Remove bolts attaching fender to upper radiator closure panel.
(15) Separate fender and wheelhouse from vehicle.

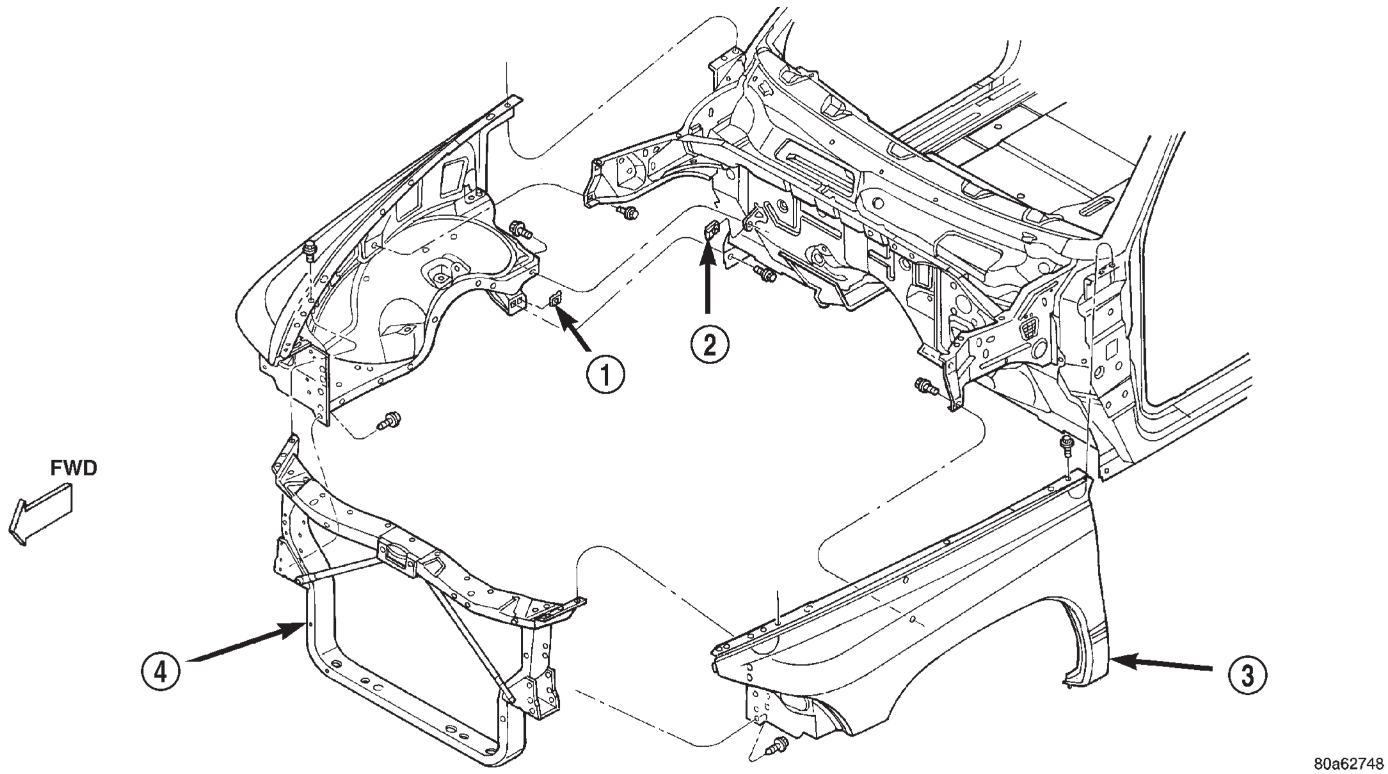


Fig. 15 Front Fender

1 – U-NUT
2 – U-NUT
3 – FRONT FENDER
4 – RADIATOR CLOSURE PANEL

INSTALLATION

(1) Position fender and wheelhouse from vehicle.
(2) Install bolts attaching fender to upper radiator closure panel.
(3) Install bolts attaching fender to upper cowl.
(4) Install bolts attaching fender to hood hinge support bracket.
(5) Install bolts attaching fender to lower radiator closure panel.
(6) Install bolt attaching fender to lower rocker panel.
(7) Position the wire harnesses on the inner fender and wheelhouse and engage clips.
(8) Install powertrain control module.
(9) Install air cleaner element housing.
(10) Install right headlamp module.
(11) Install wheelhouse liner.
(12) Install wheel opening molding.
(13) Install right front wheel.
(14) Remove the support and lower the vehicle.
(15) Connect battery negative cable.

EXTERIOR NAMEPLATES

REMOVAL

NOTE: Exterior nameplates are attached to body panels with adhesive tape.

(1) Apply a length of masking tape on the body, parallel to the top edge of the nameplate to use as a guide, if necessary.
(2) If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun. Do not exceed 52°C (120°F) when heating emblem.
(3) Insert a plastic trim stick or a hard wood wedge behind the emblem to separate the adhesive backing from the body.
(4) Clean adhesive residue from body with MOPAR Super Clean solvent or equivalent.

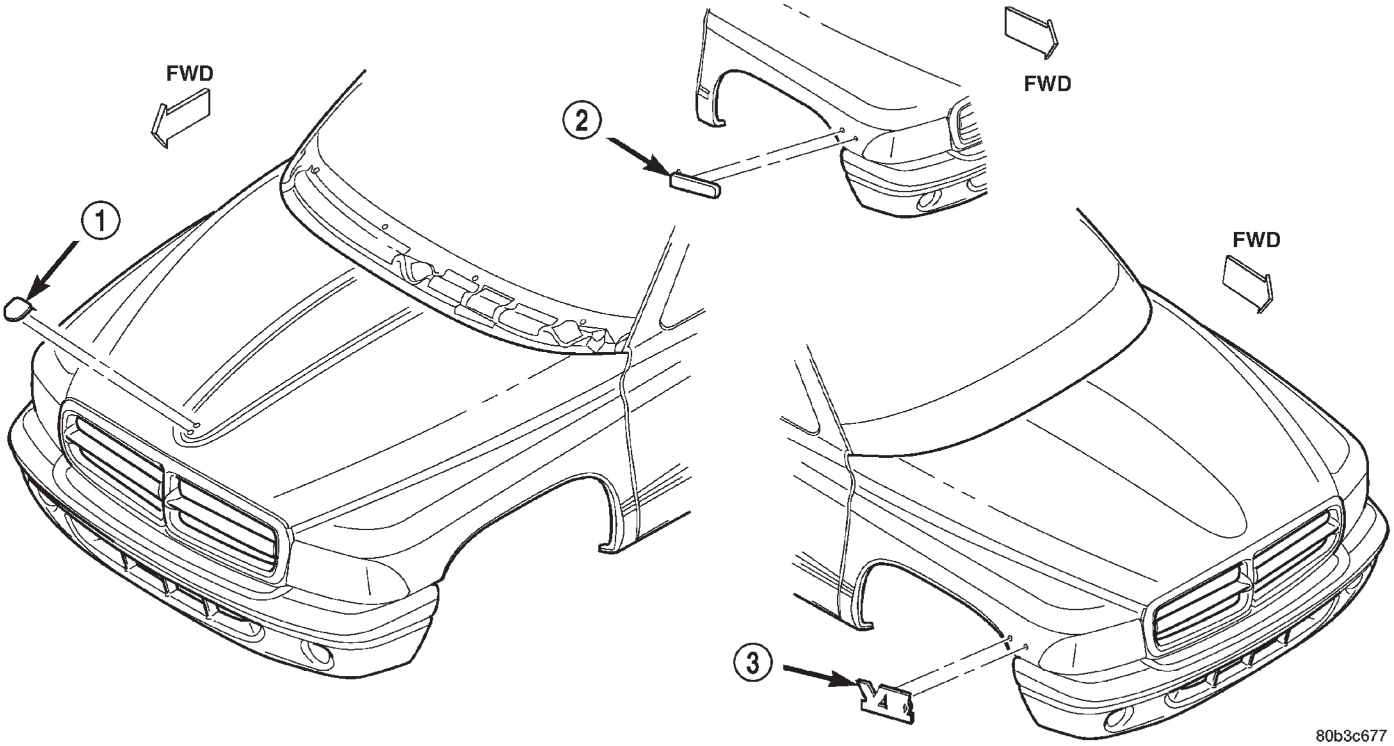


Fig. 16 Exterior Nameplates

1 – HOOD NAME PLATE
2 – MAGNUM POWER NAME PLATE
3 – ENGINE NAME PLATE

INSTALLATION

(1) Remove carrier from back of emblem.
(2) Position emblem properly on body (Fig. 16).
(3) Press emblem firmly to body with palm of hand.
(4) If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun to assure adhesion. Do not exceed 52°C (120°F) when heating emblem.

SIDE VIEW MIRROR

REMOVAL

(1) Remove door trim panel.
(2) Remove mirror flag seal (Fig. 17).
(3) Disengage power mirror wire connector from door harness, if equipped (Fig. 18).
(4) Remove nuts attaching side view mirror to door frame.
(5) Separate harness grommet form door frame, if equipped.
(6) Separate side view mirror from vehicle.

INSTALLATION

(1) Position side view mirror on vehicle.
(2) Install harness grommet in door frame, if equipped.
(3) Install nuts attaching side view mirror to door frame. Tighten nuts to 7 N·m (65 in. lbs.) torque.

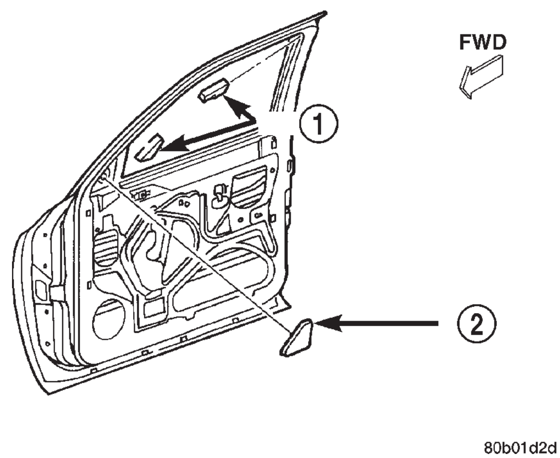


Fig. 17 Mirror Flag Door Seal

1 – STUFFERS
2 – MIRROR FLAG SEAL

(4) Engage power mirror wire connector from door harness, if equipped.
(5) Install mirror flag seal.
(6) Install door trim panel.

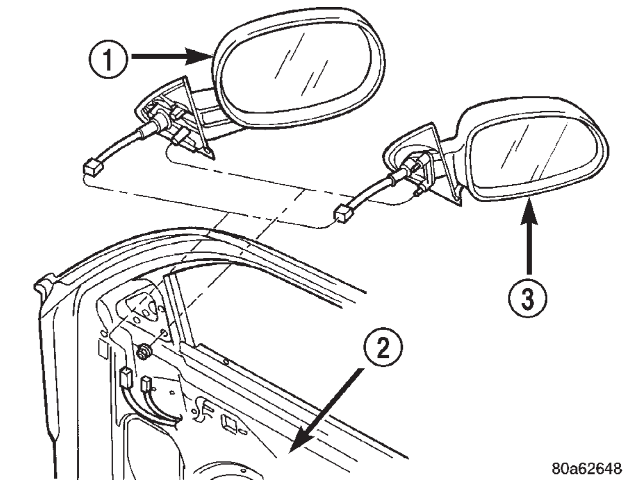


Fig. 18 Side View Mirror Connectors

1 – ELECTRIC FOLD AWAY SIDEVIEW MIRROR
2 – DOOR
3 – ELECTRIC SIDEVIEW MIRROR

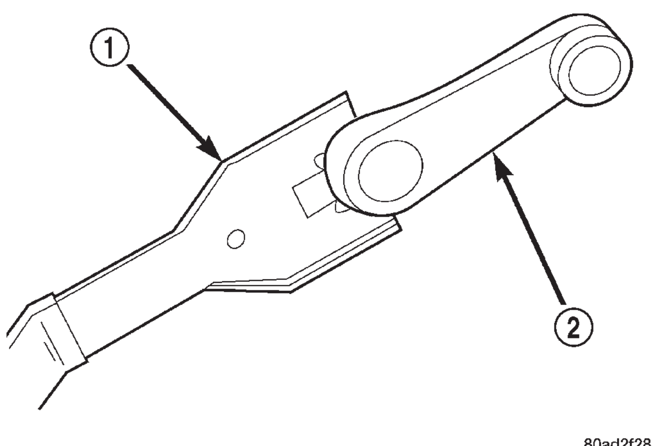


Fig. 19 Window Crank—Typical

1 – WINDOW CRANK REMOVAL TOOL
2 – WINDOW CRANK

FRONT DOOR TRIM PANEL

REMOVAL

(1) Release door latch and open door.

(2) Roll window down.

(3) Remove window crank (Fig. 19), if equipped.

(4) Remove screws attaching trim panel to door (Fig. 20) and (Fig. 21).

CAUTION: Do not forcibly pull trim panel from door, damage to trim panel may occur.

(5) Simultaneously lift upward and outward to release retainer steps from inner door panel (Fig. 22).

(6) Disengage inside handle linkage rod from inside handle.

(7) Disconnect speaker harness wire connector (Fig. 23).

(8) Disengage power mirror wire connector, if equipped (driver's side only) (Fig. 23).

(9) Disengage clips attaching power window/lock switch panel to door trim panel. Disengage wire connector from switch panel, if equipped (Fig. 24).

(10) Separate door trim panel from vehicle.

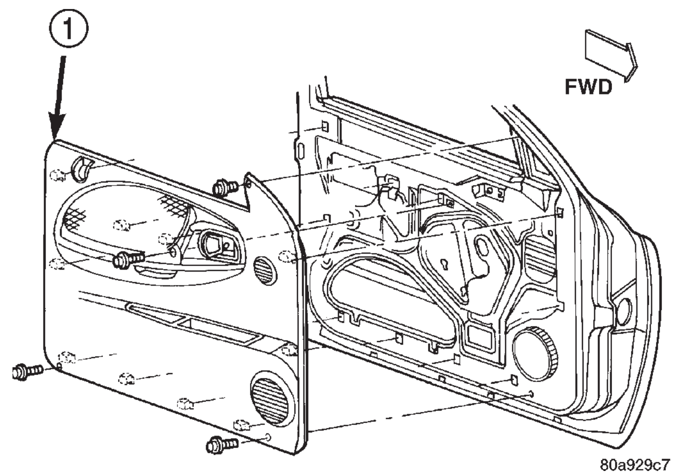


Fig. 20 Door Trim Panel

1 – TRIM PANEL

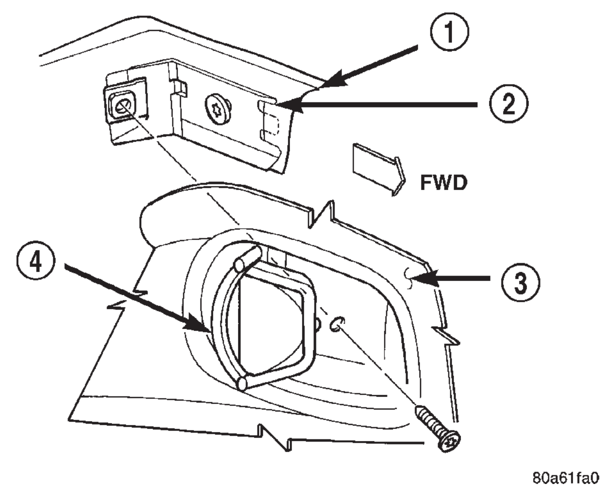


Fig. 21 Trim Panel Screw

1 – INNER DOOR PANEL
2 – INSIDE DOOR HANDLE BRACKET
3 – TRIM PANEL
4 – INSIDE DOOR HANDLE

REMOVAL AND INSTALLATION (Continued)

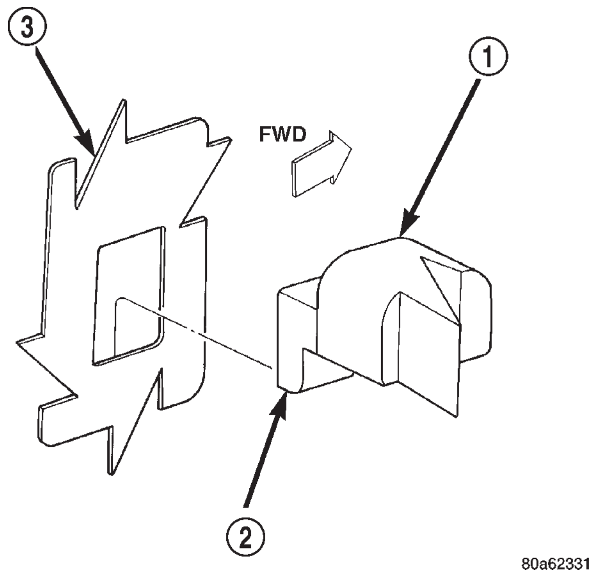


Fig. 22 Trim Panel Retainer

1 – TRIM PANEL
2 – RETAINER STEP
3 – INNER DOOR PANEL

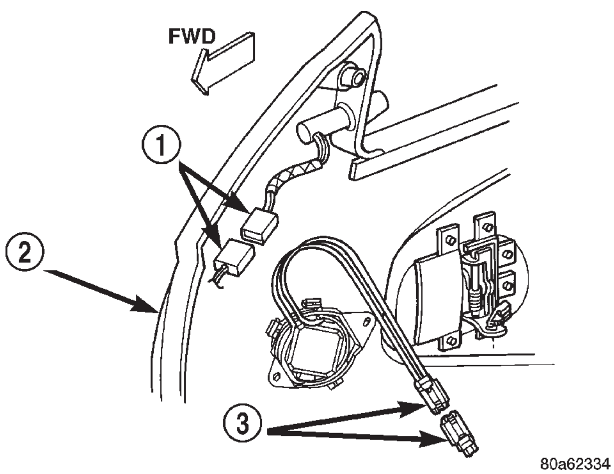


Fig. 23 Speaker And Power Mirror Connector

1 – POWER MIRROR CONNECTOR
2 – TRIM PANEL
3 – SPEAKER CONNECTOR

INSTALLATION

(1) Position trim panel at door.

(2) Engage wire connector for window/lock switch panel, if equipped. Engage clips attaching power window/lock switch panel to door trim panel.

(3) Engage power mirror wire connector, if equipped.

(4) Connect speaker harness wire connector.

(5) Engage inside handle linkage rod to inside handle.

(6) Align trim panel retainer steps with inner door panel and slide trim panel into place.

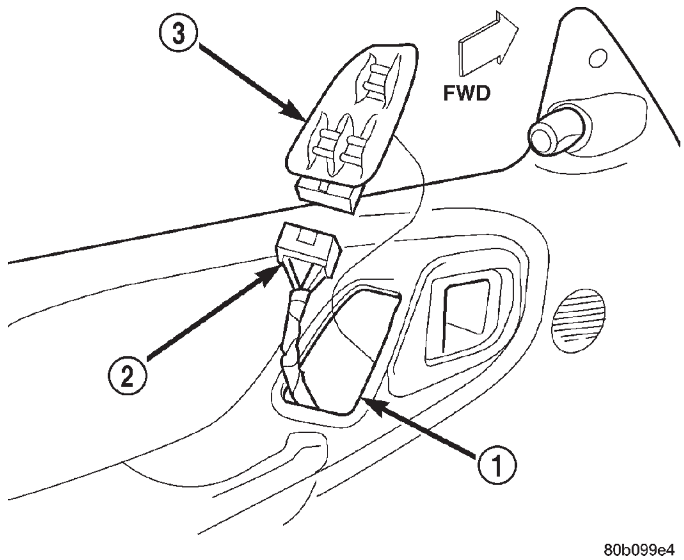


Fig. 24 Power Door Lock/Window Connector

1 – TRIM PANEL SWITCH BEZEL OPENING
2 – WIRE HARNESS CONNECTOR
3 – SWITCH AND BEZEL UNIT

(7) Install screws attaching trim panel to door.

(8) Install window crank, if equipped.

FRONT DOOR WATERDAM

REMOVAL

(1) Remove the trim panel from the door.

(2) Carefully separate the waterdam from the door inner panel at the areas with adhesive (Fig. 25). Remove the waterdam from the door inner panel.

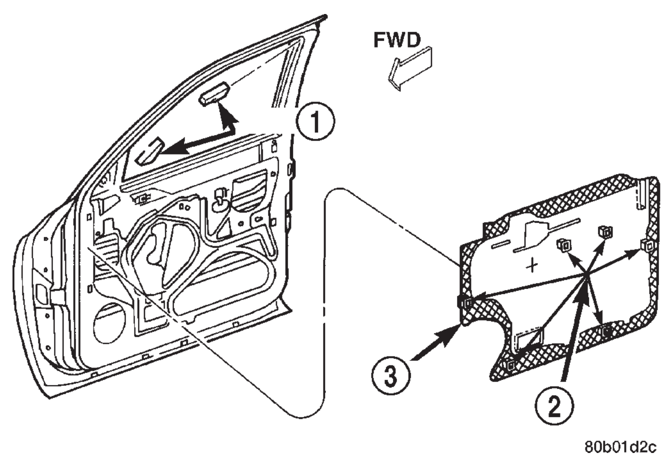


Fig. 25 Water Dam

1 – STUFFERS
2 – RETAINER STEP POCKETS
3 – WATER DAM

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Apply an appropriate adhesive/sealant to the waterdam edges before installing it.

(2) Position the waterdam on the door inner panel and press it inward at the areas with the adhesive to attach it to the inner panel.

(3) Ensure that the retainer step pockets are position correctly in the door inner panel.

(4) Install the door trim panel.

FRONT DOOR

REMOVAL

(1) Release door latch and open door.

(2) Using a suitable marker, mark the outline of the door hinges on the door end to aid installation.

(3) Remove protective boot from door wire harness connector.

(4) Disengage door wire harness connector.

(5) Support door on a suitable lifting device.

(6) While holding the door steady on lift, remove bolts and nuts attaching upper and lower door hinge to door end (Fig. 26).

(7) Separate door from vehicle.

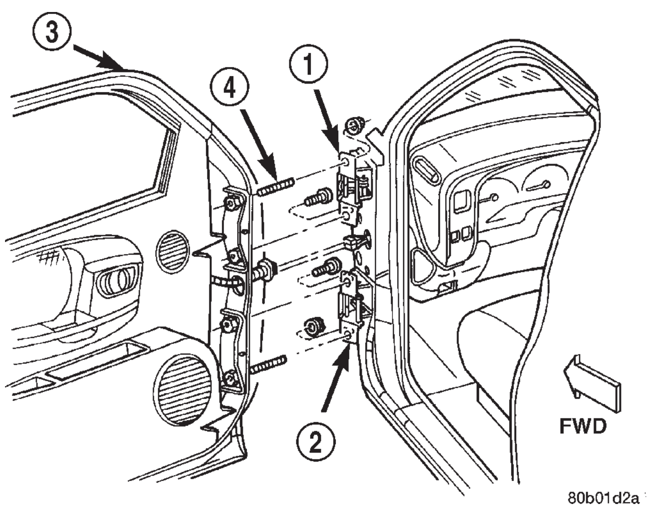


Fig. 26 Door Hinge

1 – UPPER HINGE
2 – LOWER HINGE
3 – DOOR
4 – STUD

INSTALLATION

(1) Support door on a suitable lifting device.

(2) Position door on vehicle and align with marks.

(3) Install bolts and nuts attaching upper and lower door hinge to door end. Tighten fasteners to 28 N·m (21 ft. lbs.) torque.

(4) Engage door wire harness connector.

(5) Install protective boot on door wire harness connector.

FRONT DOOR HINGE

The hinge pin is not serviceable. Replace the hinge if the hinge pin is damaged.

REMOVAL

(1) Release door latch and open door.

(2) Support door on a suitable lifting device.

(3) Using a suitable marker, mark the outline of the door hinge on the hinge pillar and door end frame to aid installation.

(4) Remove bolts attaching hinge to door.

(5) Remove cowl trim panel.

(6) Remove the instrument panel. Refer to Group 8E, Instrument Panel Systems for service procedures (Upper hinge only).

(7) Remove heater box (Right upper hinge only).

(8) Remove parking brake pedal assembly. (Left upper hinge only).

(9) Remove hidden bolt attaching door hinge to hinge pillar (Fig. 27).

(10) Remove bolts attaching door hinge to hinge pillar.

(11) Separate door hinge from vehicle.

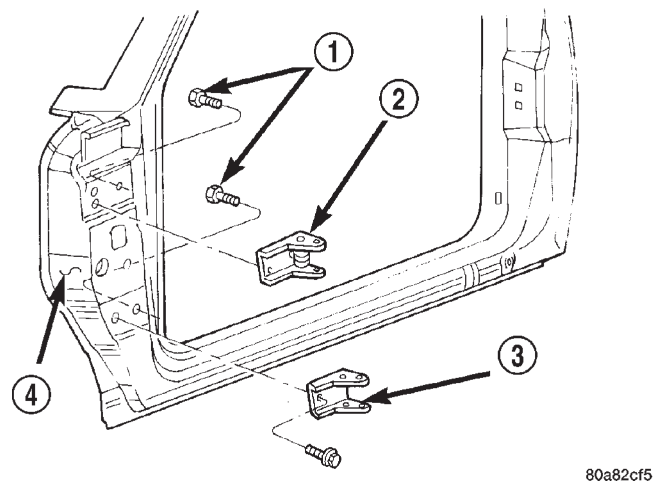


Fig. 27 Door Hinge

1 – HIDDEN BOLT
2 – UPPER HINGE
3 – LOWER HINGE
4 – HINGE PILLAR

INSTALLATION

(1) If necessary, paint replacement door hinge before installation.

(2) Position door hinge on hinge pillar using alignment marks.

(3) Install bolts attaching door hinge to hinge pillar. Tighten bolts to 28 N·m (21 ft. lbs.) torque.

(4) Install hidden bolt attaching door hinge to hinge pillar. Tighten bolt to 28 N·m (21 ft. lbs.) torque.

(5) If removed, install the heater box.

REMOVAL AND INSTALLATION (Continued)

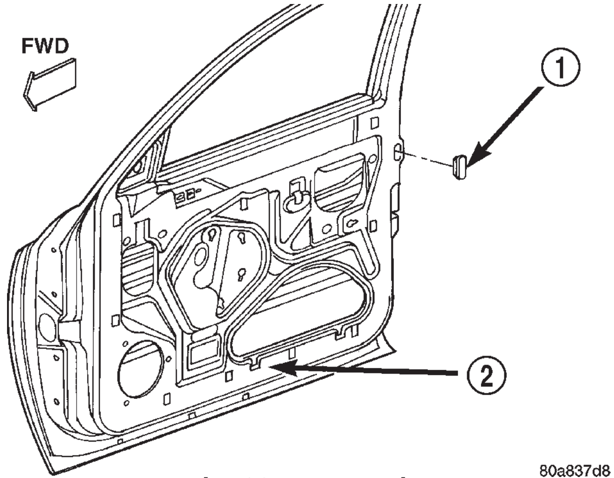


Fig. 28 Access Plug

1 – ACCESS PLUG
2 – DOOR

(6) If removed, install the instrument panel. Refer to Group 8E, Instrument Panel Systems for service procedures.
(7) Install cowl trim panel.
(8) Install bolts attaching hinge to door. Tighten bolts to 28 N·m (21 ft. lbs.) torque.

FRONT DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove door trim panel.
(2) Remove water dam as necessary to gain access to door handle.
(3) Roll glass up.
(4) Remove fastener access plug from door end panel (Fig. 28).
(5) Disengage lock cylinder to latch rod from the latch (Fig. 29).
(6) Disengage outside handle to latch rod from the latch.
(7) Remove nuts attaching outside door handle to door.
(8) Separate outside handle from the door.

INSTALLATION

(1) Position outside handle in the door.
(2) Install nuts attaching outside door handle to door. Tighten the nuts to 5.0 N·m (45 in. lbs) torque.
(3) Engage outside handle to latch rod to the latch.
(4) Engage lock cylinder to latch rod to the latch.
(5) Install fastener access plug in the door end panel.
(6) Install water dam.
(7) Install door trim panel.

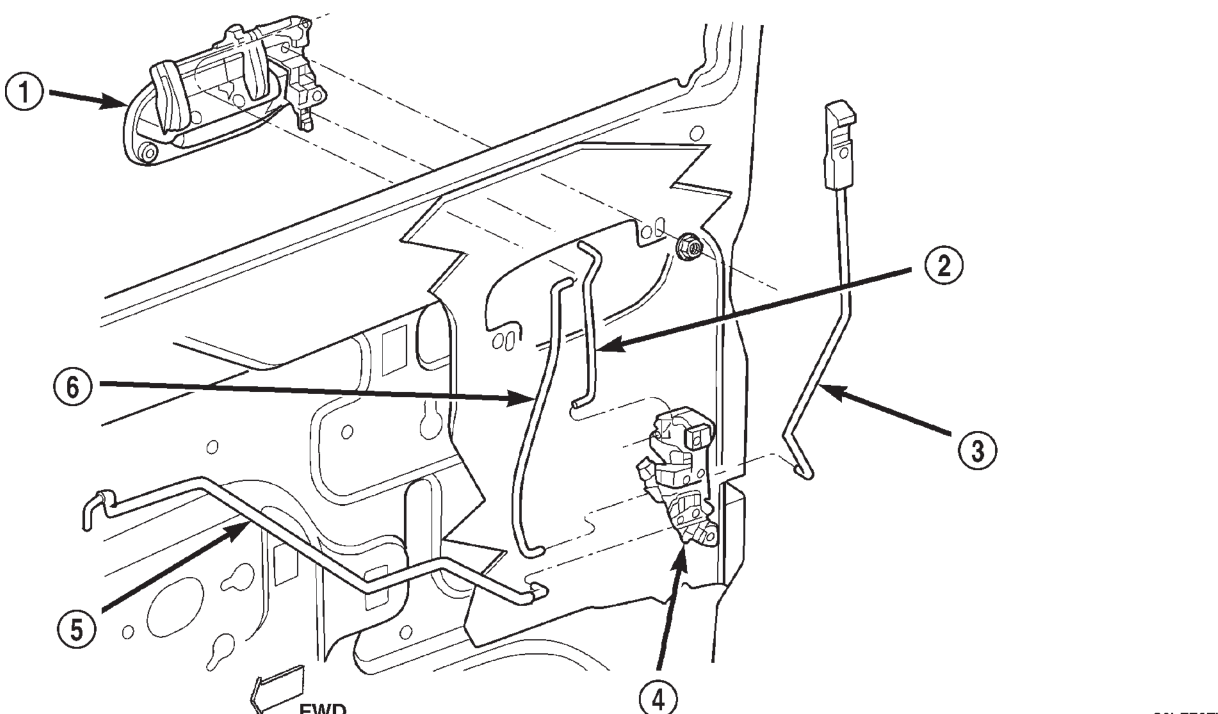


Fig. 29 Outside Door Handle

1 – OUTSIDE HANDLE
2 – LOCK CYLINDER TO LATCH ROD
3 – LOCK BUTTON TO LATCH ROD
4 – LATCH
5 – INSIDE HANDLE TO LATCH ROD
6 – OUTSIDE HANDLE TO LATCH ROD

REMOVAL AND INSTALLATION (Continued)

FRONT DOOR LOCK CYLINDER

REMOVAL

(1) Remove door trim panel.
(2) Remove outside handle.
(3) Disengage lock cylinder to latch rod from the lock cylinder.
(4) Using a small flat blade, pry lock cylinder retaining clip from lock cylinder housing/outside handle (Fig. 30).
(5) Push lock cylinder out of lock cylinder housing/outside handle.

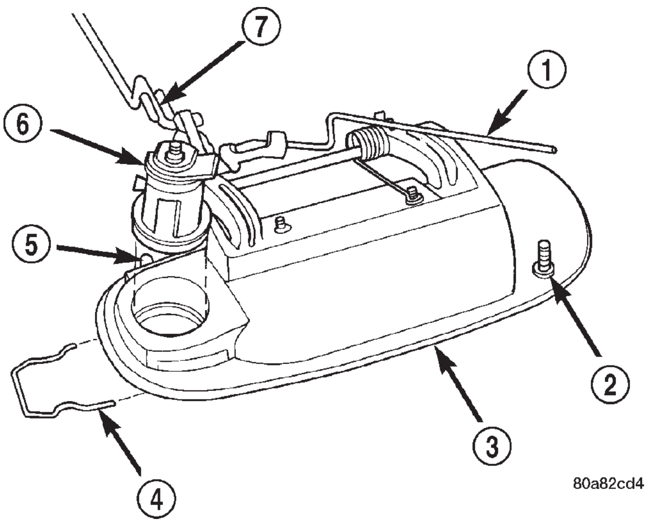


Fig. 30 Lock Cylinder

1 – LOCK CYLINDER TO LATCH ROD
2 – STUD
3 – OUTSIDE HANDLE
4 – RETAINING CLIP
5 – STUD
6 – LOCK CYLINDER
7 – LOCK BUTTON ROD

INSTALLATION

(1) Push lock cylinder into lock cylinder housing/outside handle. Ensure the lock cylinder is fully seated in the handle.
(2) Install lock cylinder retaining clip. Ensure the clip is fully seated.
(3) Engage lock cylinder to latch rod to the lock cylinder.
(4) Install outside handle.
(5) Install door trim panel.

LOCK CYLINDERS

Ignition, door, deck lid, and rear hatch lock cylinders are all codable to the key. Lock barrels, tumblers, and tumbler springs are available to allow the technician to change replacement locks cylinders to match the customer's original key set. See the appropriate section in this manual for lock cylinder removal. See the Mopar® catalogue for part numbers and lock coding procedures.

FRONT DOOR LATCH

REMOVAL

(1) Remove door trim panel.
(2) Peel back water dam as necessary.
(3) For access to latch, roll up glass and remove bolts attaching rearward glass run channel to door. Move and secure glass run channel.
(4) Remove screws attaching latch to door shut face (Fig. 31).
(5) Disengage wire harness connector for power door locks, if equipped.
(6) Disengage lock button to latch rod from the latch.
(7) Disengage lock cylinder to latch rod from the latch (Fig. 29).
(8) Disengage inside handle to latch rod from the latch.
(9) Disengage outside handle to latch rod from the latch.
(10) Separate latch from door.

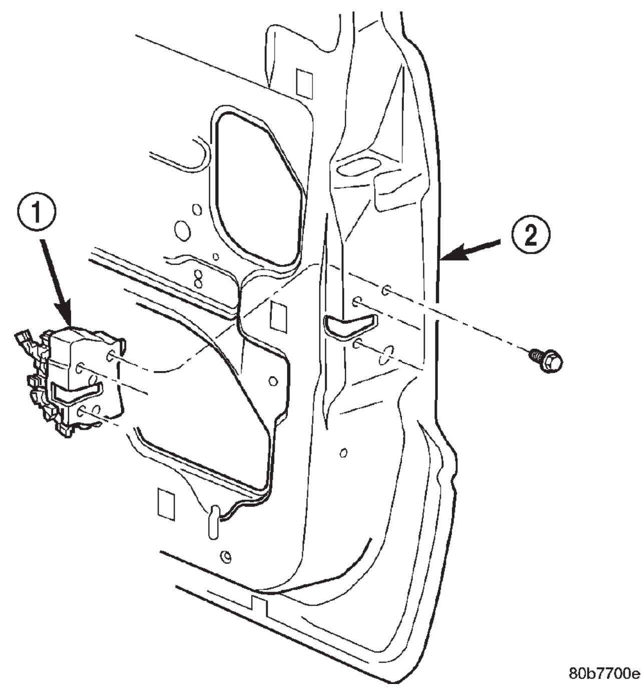


Fig. 31 Latch

1 – LATCH
2 – DOOR

INSTALLATION

(1) Engage latch rod to outside handle.
(2) Engage inside handle to latch rod to the latch.
(3) Engage lock cylinder to latch rod to the latch.
(4) Engage lock button to latch rod to the latch.

REMOVAL AND INSTALLATION (Continued)

(5) Position latch in door.

(6) Install screws attaching latch to door shut face. Tighten the screws to 9.6 N·m (85 in. lbs.) torque.

(7) Engage outside handle to latch rod to the latch.

(8) Engage wire harness connector for power door locks, if equipped.

(9) Install rearward glass run channel.

(10) Install water dam.

(11) Install door trim panel.

(12) Using the access hole in the door shut face, loosen the latch adjustment screw and ensure the outside door handle is flush with door outer panel. Tighten the adjustment screw.

FRONT DOOR LATCH STRIKER

REMOVAL

(1) Use a wax crayon or equivalent and mark the position of the striker on the B-pillar.

(2) Remove the screws attaching the striker and spacer to the B-pillar (Fig. 32).

(3) Separate the striker from the B-pillar.

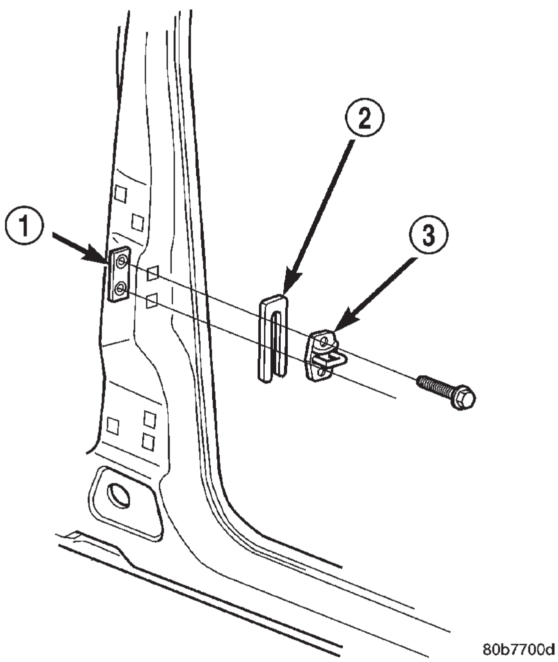


Fig. 32 Front Door Latch Striker

1 – TAPPING PLATE
2 – SPACER
3 – STRIKER

INSTALLATION

(1) Using the alignment marks, position the spacer and striker on the B-Pillar.

(2) Install the screws. Tighten the screw to 28.2 N·m (250 in. lbs.) torque.

FRONT DOOR INSIDE HANDLE ACTUATOR

The front door inside handle actuator is heat staked to the trim panel. If the handle needs servicing, refer to the heat staking procedure located in this section.

FRONT DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove screws attaching trim panel to door.

(2) Lift trim panel up and over inner belt seal.

(3) Peel seal from door (Fig. 33).

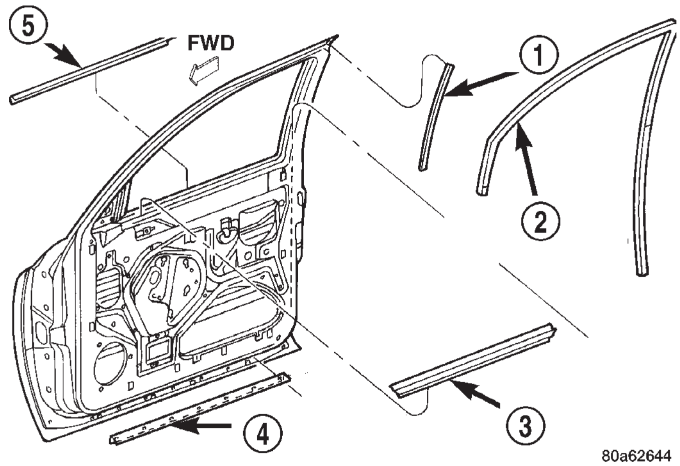


Fig. 33 Front Door Weatherstrip/Seals

1 – B-PILLAR SECONDARY SEAL
2 – GLASS RUN WEATHERSTRIP
3 – INNER BELT WEATHERSTRIP
4 – SECONDARY SEAL
5 – OUTER BELT WEATHERSTRIP

INSTALLATION

(1) Slide seal into position on door.

(2) Position trim panel over inner belt seal and install screws.

FRONT DOOR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Lower glass.

(2) Lift rearward corner of weatherstrip and slide weatherstrip rearward (Fig. 33).

INSTALLATION

(1) Lightly lubricate weatherstrip with silicone and slide weatherstrip behind mirror.

(2) Push weatherstrip down to seat onto door.

FRONT DOOR GLASS

REMOVAL

(1) Remove door trim panel.

REMOVAL AND INSTALLATION (Continued)

(2) Remove water dam as necessary to gain access to glass regulator arm.

(3) Remove inner door belt weatherstrip.

(4) Remove outer door belt weatherstrip.

(5) Lower glass to full down position and align glass regulator arm with access holes in inner door panel.

(6) Remove front glass run channel.

(7) Remove nuts attaching glass channel to regulator arm (Fig. 34).

(8) Separate glass from regulator arm.

(9) Lift glass upward and out of opening at top of door.

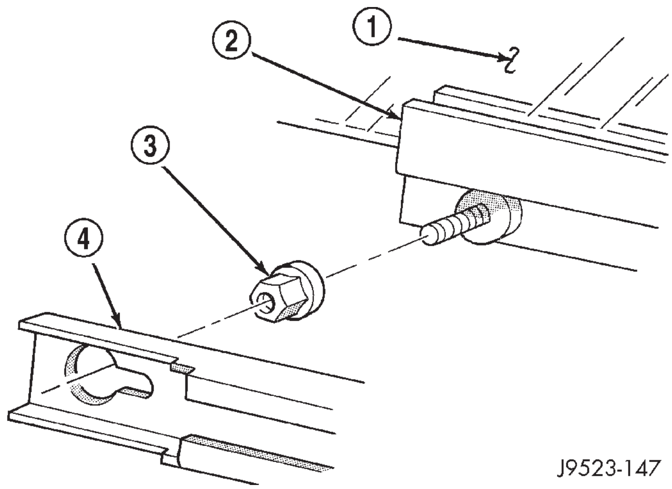


Fig. 34 Door Glass

1 – GLASS
2 – GLASS CHANNEL
3 – NUT
4 – REGULATOR ARM

INSTALLATION

(1) Slowly lower glass into door.

(2) Position glass in regulator arm.

(3) Install front glass run channel.

(4) Install nuts attaching glass channel to regulator arm.

(5) Ensure glass is aligned in run channels and tighten run channel bolts.

(6) Install outer door belt weatherstrip.

(7) Install inner door belt weatherstrip.

(8) Install water dam.

(9) Install door trim panel.

FRONT DOOR WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel.

(2) Remove water dam as necessary to access window regulator.

(3) Remove glass from door.

(4) Disengage power window motor wire connector from door harness, if equipped (Fig. 35).

(5) Loosen bolts in slotted holes attaching regulator to door inner panel (Fig. 36).

(6) Remove bolts attaching window regulator to inner door panel.

(7) Extract window regulator through access hole in inner door panel.

(8) Separate window regulator from door panel.

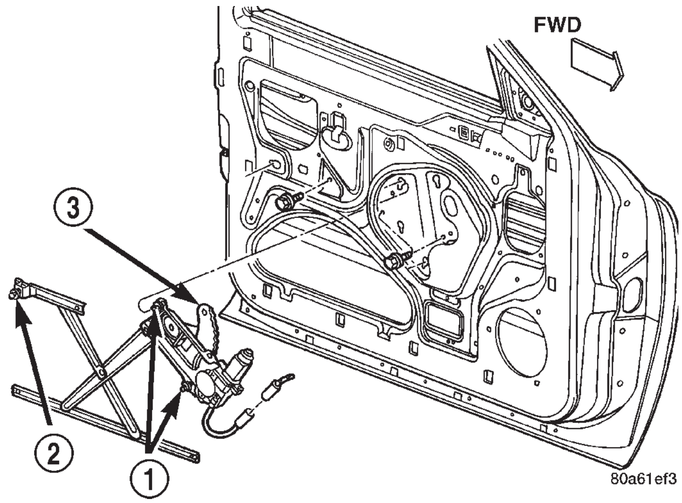


Fig. 35 Power Regulator

1 – SCREW
2 – SCREW
3 – POWER WINDOW REGULATOR

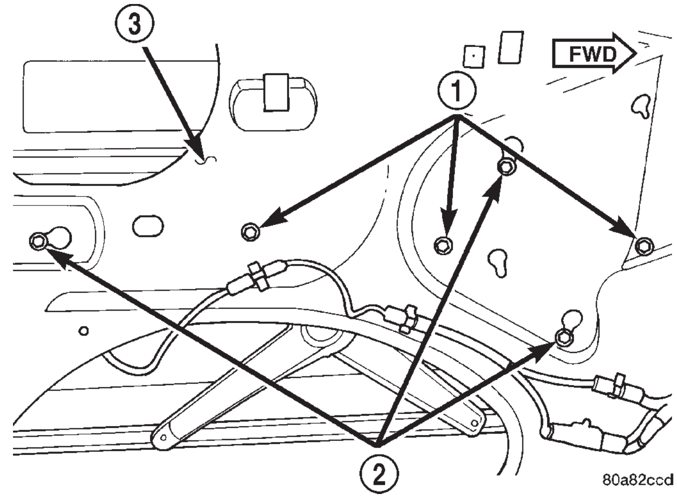


Fig. 36 Power Regulator Bolts

1 – REMOVE BOLTS
2 – LOOSEN BOLTS
3 – DOOR INNER PANEL

INSTALLATION

(1) Position regulator in door and align bolts with slotted holes in door inner panel.

REMOVAL AND INSTALLATION (Continued)

(2) Install bolts attaching window regulator to inner door panel.
(3) Engage power window motor wire connector to door harness, if equipped.
(4) Install glass in door.
(5) Install outer belt weatherstrip.
(6) Install inner belt weatherstrip.
(7) Install water dam.
(8) Install door trim panel.
(9) Verify operation.

FRONT DOOR LOWER GLASS RUN CHANNELS

REMOVAL

(1) Remove trim panel.
(2) Remove water dam as necessary to access lower run channels.
(3) Remove bolts attaching lower glass run channels to door panel (Fig. 37).
(4) Remove glass.
(5) Slide lower run channels downward to disengage from upper run channels.
(6) Remove lower run channels from door.

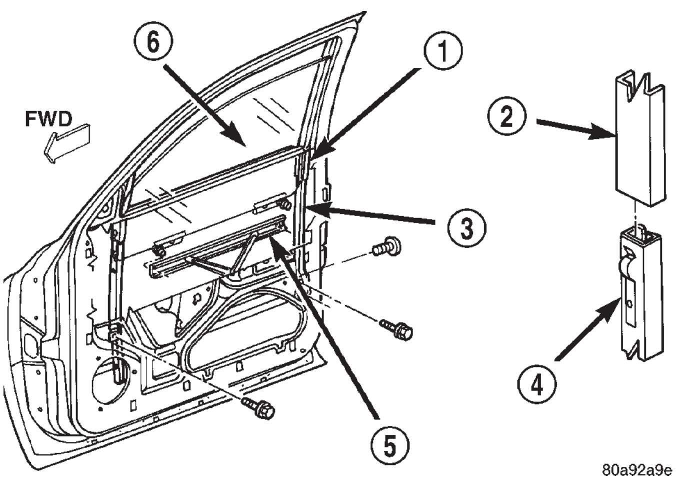


Fig. 37 Lower Glass Run Channels

1 – UPPER GLASS RUN CHANNEL
2 – UPPER CHANNEL
3 – LOWER GLASS RUN CHANNEL
4 – LOWER CHANNEL
5 – REGULATOR
6 – DOOR GLASS

INSTALLATION

(1) Position lower run channels in door.
(2) Slide lower run channels upward to engage into upper run channels.
(3) Install glass.
(4) Install bolts attaching lower glass run channels to door panel.
(5) Install water dam.
(6) Install trim panel.

FRONT DOOR GLASS RUN WEATHERSTRIP

REMOVAL

(1) Remove door trim panel.
(2) Remove water dam as necessary to access lower glass run channels.
(3) Remove the bolts attaching the glass run channels.
(4) Remove glass.
(5) Pull the glass run weatherstrip and run channels from the window opening (Fig. 33).
(6) Pull the glass run weatherstrip from the run channels.

INSTALLATION

(1) Install the glass run weatherstrip in the run channels.
(2) Install the glass run weatherstrip in the window opening.
(3) Position the run channels in the door.
(4) Install glass.
(5) Install the glass run channels.
(6) Install inner belt weatherstrip.
(7) Install outer belt weatherstrip.
(8) Install door trim panel.

FRONT DOOR SEAL

REMOVAL

(1) Remove A-pillar trim.
(2) Remove cowl panel and sill cover.
(3) Remove upper turning loop anchor bolt.
(4) Pull B-pillar trim/quarter panel trim outward to access weatherstrip.
(5) Pull weatherstrip from pinch flange around door opening (Fig. 38).

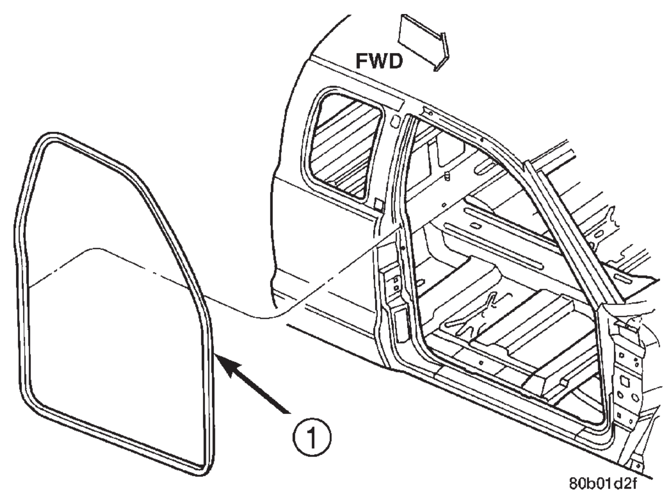


Fig. 38 Door Seal

1 – DOOR SEAL

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position the weatherstrip on the pinch flange around door opening and press into place.

(2) Press into place B-pillar trim/quarter panel trim.

(3) Install upper turning loop anchor bolt.

(4) Install cowl panel and sill cover. Ensure the clips attaching the sill cover to the door sill are fully seated.

(5) Install A-pillar trim.

FRONT DOOR SECONDARY SEAL

REMOVAL

The secondary seal is attached with two sided adhesive tape.

(1) Separate the secondary seal and the tape from the inner door panel. (Fig. 33).

INSTALLATION

(1) Clean the inner door panel seal area with MOPAR Super Kleen solvent or equivalent.

(2) Peel the carrier from the seal, position the seal on the inner door panel and press firmly in place.

REAR DOOR

Removal

(1) Remove B-pillar trim.

(2) Disconnect door wire harness connector.

(3) Support door on suitable stand.

(4) Using a wax crayon or equivalent, mark hinge position on B-pillar.

(5) Remove bolts attaching hinge to B-pillar (Fig. 39).

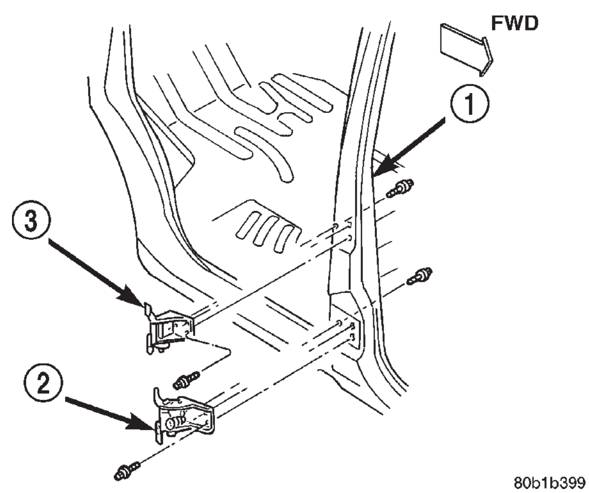


Fig. 39 Rear Door Hinge

1 – B-PILLAR
2 – LOWER HINGE
3 – UPPER HINGE

Installation

(1) Align and position door on vehicle.

(2) Install bolts attaching hinge to B-pillar (Fig. 39). Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(3) Connect door wire harness connector.

(4) Install B-pillar trim.

REAR DOOR HINGE

REMOVAL

(1) Remove B-pillar trim.

(2) Disconnect door wire harness connector.

(3) Support door on suitable stand.

(4) Using a wax crayon or equivalent, mark hinge position on B-pillar.

(5) Remove bolts attaching hinge to B-pillar (Fig. 39).

(6) Separate door from vehicle.

(7) Using a wax crayon or equivalent, mark hinge position on door.

(8) Remove bolts attaching hinge to door.

INSTALLATION

(1) Align and position hinge on door.

(2) Install bolts attaching hinge to door. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(3) Align and position door on vehicle.

(4) Install bolts attaching hinge to B-pillar (Fig. 39). Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(5) Connect door wire harness connector.

(6) Install B-pillar trim.

REAR DOOR TRIM PANEL

REMOVAL

(1) Release door latch and open door.

(2) Roll window down.

(3) Remove window crank (Fig. 40), if equipped.

(4) Remove screws attaching trim panel to door.

CAUTION: Do not forcibly pull trim panel from door, damage to trim panel may occur.

(5) Simultaneously lift upward and outward to release retainer steps from inner door panel (Fig. 41).

(6) Disengage inside handle linkage rod from inside handle.

(7) Disconnect power widow/lock harness connector, if equipped (Fig. 42).

(8) Separate door trim panel from vehicle.

(9) If necessary, pull upper trim extension outward to disengage from rear door.

INSTALLATION

(1) If removed, install upper trim extension on rear door.

REMOVAL AND INSTALLATION (Continued)

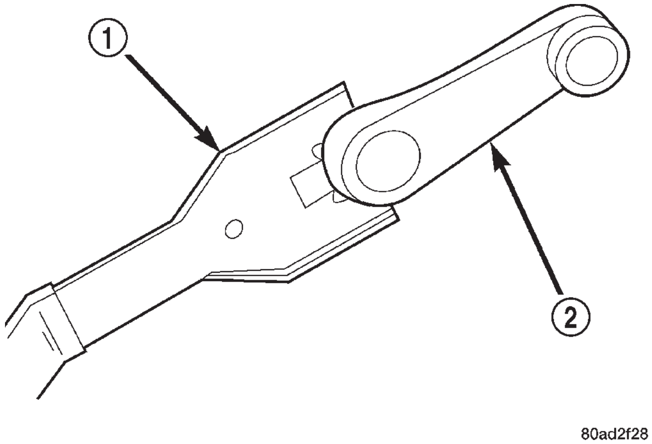


Fig. 40 Window Crank—Typical

1 – WINDOW CRANK REMOVAL TOOL
2 – WINDOW CRANK

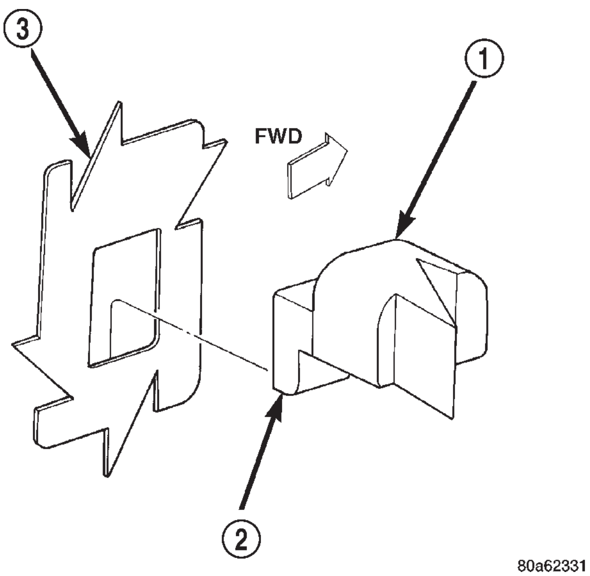


Fig. 41 Trim Panel Retainer

1 – TRIM PANEL
2 – RETAINER STEP
3 – INNER DOOR PANEL

(2) Position trim panel at door.
(3) Engage harness connector for power window/ lock, if equipped.
(4) Engage inside handle linkage rod to inside handle.
(5) Align trim panel retainer steps with inner door panel and slide trim panel into place.
(6) Install screws attaching trim panel to door.
(7) Install window crank, if equipped.

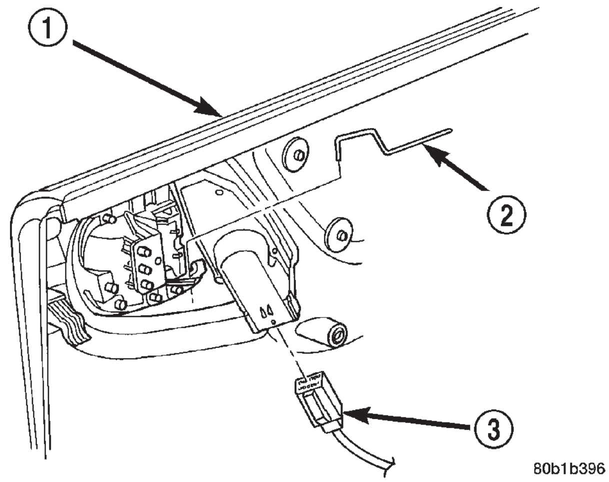


Fig. 42 Power Window/Lock Connector

1 – TRIM PANEL
2 – INSIDE HANDLE LATCH ROD
3 – POWER WINDOW/LOCK CONNECTOR

REAR DOOR WATERDAM

REMOVAL

(1) Remove door trim panel.
(2) Peel the waterdam from the door.
(3) Route the latch rods and wire harnesses through the waterdam.
(4) Separate the waterdam from the door inner panel (Fig. 43).

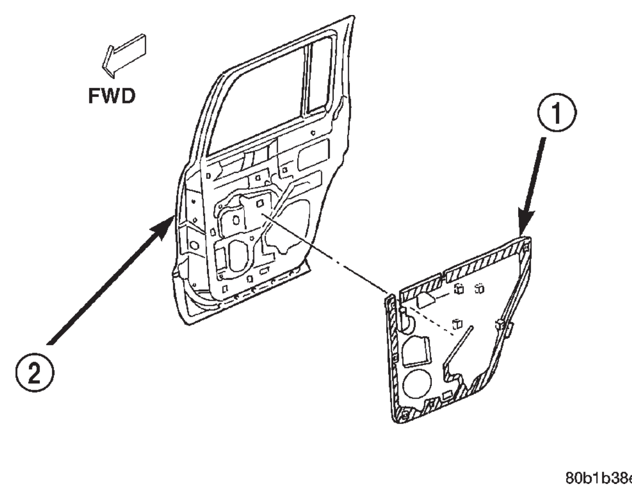


Fig. 43 Rear Door Waterdam

1 – WATER DAM
2 – REAR DOOR

INSTALLATION

(1) Route the latch rods and wire harnesses through the waterdam.
(2) Position the waterdam on the door, apply adhesive as necessary and press into place.
(3) Install door trim panel.

REMOVAL AND INSTALLATION (Continued)

REAR DOOR LATCH STRIKER

REMOVAL

(1) Use a wax crayon or equivalent and mark position of striker on C-pillar.

(2) Remove bolts attaching striker and shim to C-pillar.

(3) Separate striker from C-pillar.

INSTALLATION

(1) Using alignment marks, position shim and striker on C-Pillar.

(2) Install bolts. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

REAR DOOR LATCH

REMOVAL

(1) Remove trim panel.

(2) Peel waterdam back to access latch.

(3) Disconnect latch rods from latch (Fig. 44).

(4) Disconnect the latch harness connector.

(5) Remove screws attaching latch to rear door (Fig. 45).

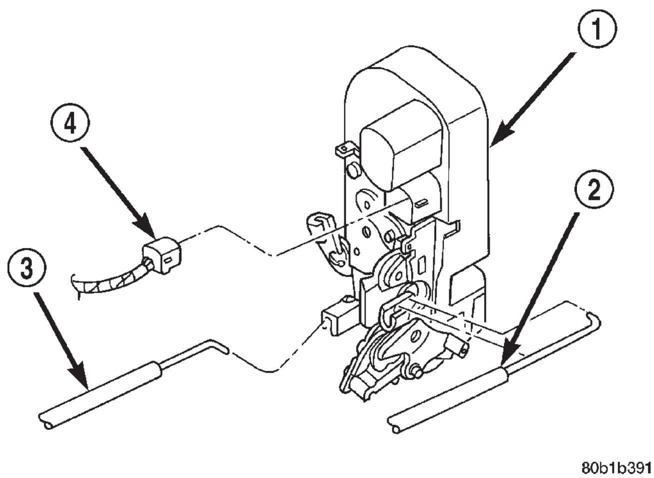


Fig. 44 Rear Door Latch Rods

1 – LATCH
2 – LATCH ROD
3 – LATCH ROD
4 – CONNECTOR

INSTALLATION

(1) Connect the latch harness connector.

(2) Install screws attaching latch to rear door.

(3) Connect latch rods to latch.

(4) Install waterdam.

(5) Install trim panel.

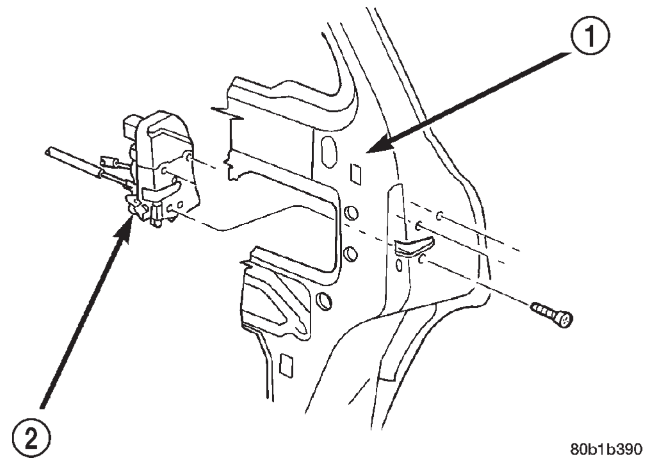


Fig. 45 Rear Door Latch

1 – REAR DOOR
2 – LATCH

REAR DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove trim panel.

(2) Peel back waterdam to access outside handle.

(3) Remove glass run channel.

(4) Disconnect latch rod (Fig. 46).

(5) Remove nuts attaching handle to outer door panel (Fig. 47).

(6) Separate outside handle from rear door.

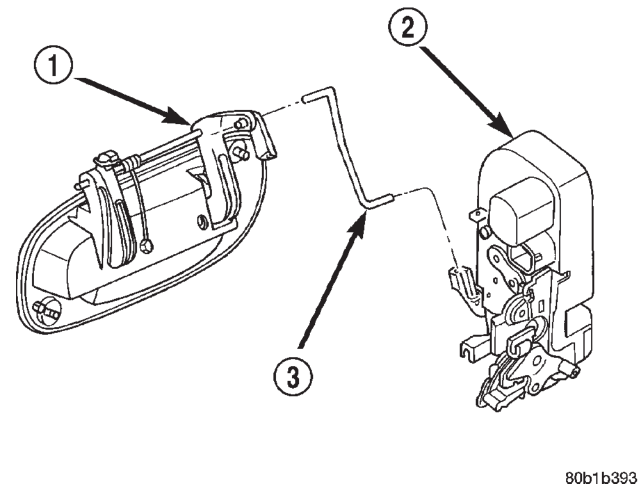


Fig. 46 Latch Rod

1 – OUTSIDE HANDLE
2 – LATCH
3 – LATCH ROD

INSTALLATION

(1) Position outside handle in rear door.

(2) Install nuts attaching handle to outer door panel (Fig. 47).

(3) Connect latch rod (Fig. 46).

REMOVAL AND INSTALLATION (Continued)

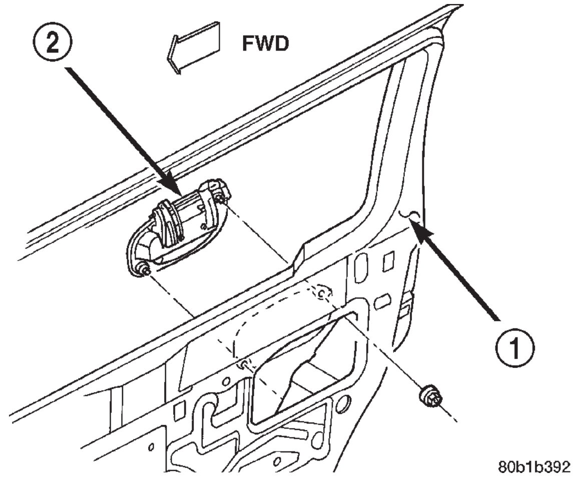


Fig. 47 Rear Door Outside Handle

1 – REAR DOOR
2 – HANDLE

(4) Install glass run channel.
(5) Install waterdam.
(6) Install trim panel.

REAR DOOR INSIDE HANDLE ACTUATOR

The rear door inside handle actuator is heat staked to the trim panel. If the handle needs servicing, refer to the heat staking procedure located in this section.

REAR DOOR GLASS RUN CHANNELS

REMOVAL

(1) Remove trim panel.
(2) Remove waterdam.
(3) Ensure glass is in full up position and supported. Remove bolts attaching the run channels to door inner panel (Fig. 48).
(4) Remove speaker, if necessary.
(5) Separate run channels from door.

INSTALLATION

(1) Position run channels in door.
(2) Install bolts attaching the run channels to door inner panel (Fig. 48).
(3) Install speaker, if necessary.
(4) Install waterdam.
(5) Install trim panel.

REAR DOOR GLASS RUN WEATHERSTRIP

REMOVAL

(1) Remove trim panel.
(2) Remove inner beltline weatherstrip.
(3) Remove outer beltline weatherstrip.
(4) Pull weatherstrip from door frame and divider bar channel (Fig. 49).

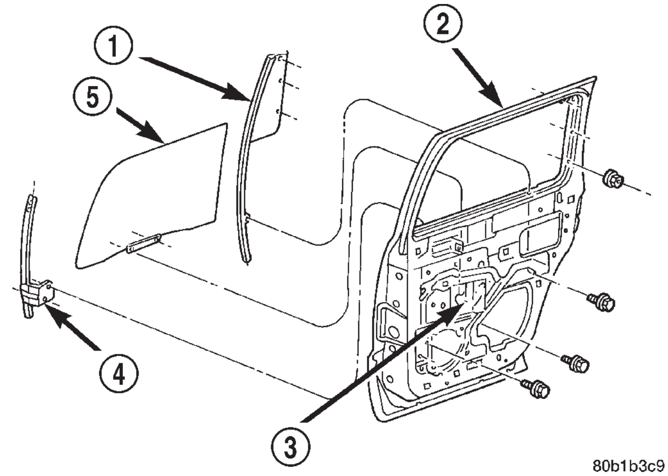


Fig. 48 Rear Door Glass Run Channels

1 – RUN CHANNEL WITH STATIONARY GLASS
2 – REAR DOOR
3 – REGULATOR
4 – RUN CHANNEL
5 – DOOR GLASS

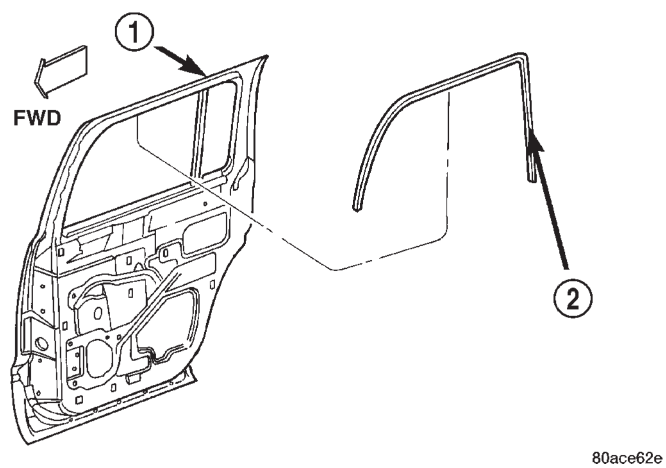


Fig. 49 Glass Run Weatherstrip

1 – REAR DOOR
2 – GLASS RUN WEATHERSTRIP

INSTALLATION

(1) Position weatherstrip in door frame and divider bar channel.
(2) Install outer beltline weatherstrip.
(3) Install inner beltline weatherstrip.
(4) Install trim panel.

REAR DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove trim panel.
(2) Pull weatherstrip from inner door panel (Fig. 50).

REMOVAL AND INSTALLATION (Continued)

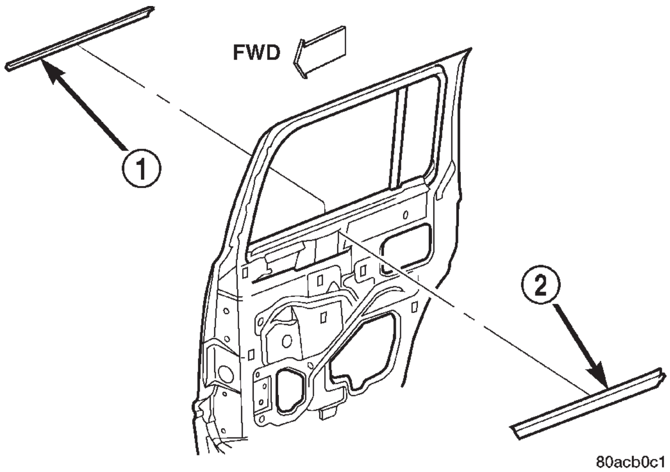


Fig. 50 Inner/Outer Belt Weatherstrip

1 – OUTER BELT WEATHERSTRIP
2 – INNER BELT WEATHERSTRIP

INSTALLATION

(1) Position weatherstrip on inner door panel (Fig. 50).
(2) Press into place.
(3) Install trim panel.

REAR DOOR OPENING WEATHERSTRIP

REMOVAL

(1) Remove door sill trim.
(2) Loosen upper and lower B-pillar trim to access weatherstrip.
(3) Remove C-pillar trim.
(4) Pull quarter panel trim outward to access weatherstrip.
(5) Pull weatherstrip from pinch flange around door opening.

INSTALLATION

(1) Clean pinch flange
(2) Position the weatherstrip on the pinch flange around door opening and press into place.
(3) Install quarter panel trim.
(4) Install C-pillar trim.
(5) Install B-pillar trim.
(6) Install door sill trim. Ensure the clips attaching the sill trim to the door sill are fully seated.
(7) Install A-pillar trim.

REAR DOOR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Lower glass.
(2) Lift corner of weatherstrip upward and remove weatherstrip from outer door panel.

INSTALLATION

(1) Position weatherstrip on outer door panel.
(2) Press into place.
(3) Raise glass.

REAR DOOR SECONDARY SEAL

REMOVAL

(1) Separate the secondary seal from the inner door panel

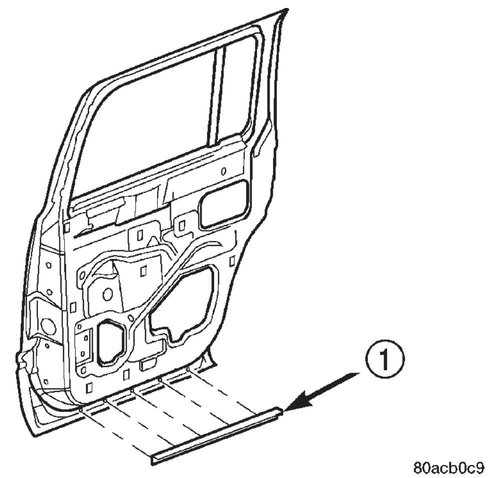


Fig. 51 Rear Door Secondary Seal

1 – REAR DOOR SILL SECONDARY SEAL

INSTALLATION

(1) Thoroughly clean the area of old adhesive. Use Mopar Super Kleen or equivalent.
(2) Position the secondary seal on the inner door panel.

REAR DOOR GLASS

REMOVAL

(1) Remove the door outer trim panel.
(2) Remove inner and outer beltline weatherstrip.
(3) Remove the door waterdam. Remove the radio speaker, if equipped.
(4) Lower the window glass enough to access the regulator bolt. (Fig. 52)
(5) Remove the window glass to regulator bolts.
(6) Raise the window glass manually.
(7) Remove the front lower glass run channel.
(8) Lower the glass.
(9) Using a trim stick or other suitable device, pry up the inside edge of the quarter glass trim. (Fig. 53)
(10) Partially remove front upper window weatherstrip.
(11) Raise the glass and remove.

INSTALLATION

(1) Lower the glass into the door.

REMOVAL AND INSTALLATION (Continued)

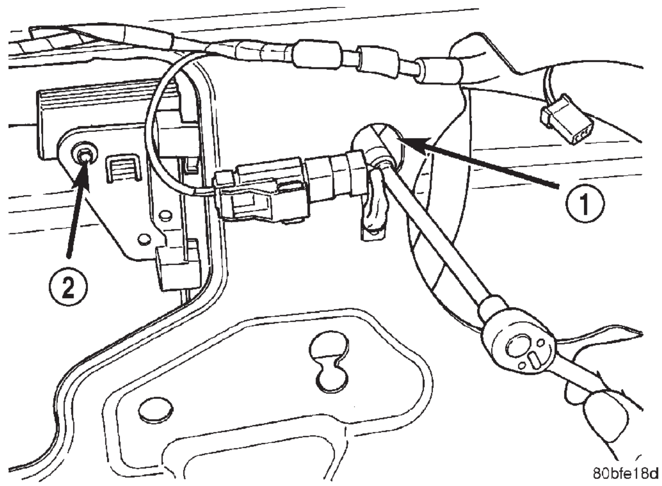


Fig. 52 Window Regulator Bolt Access

1 – GLASS TO REGULATOR BOLT ACCESS
2 – GLASS TO REGULATOR BOLT

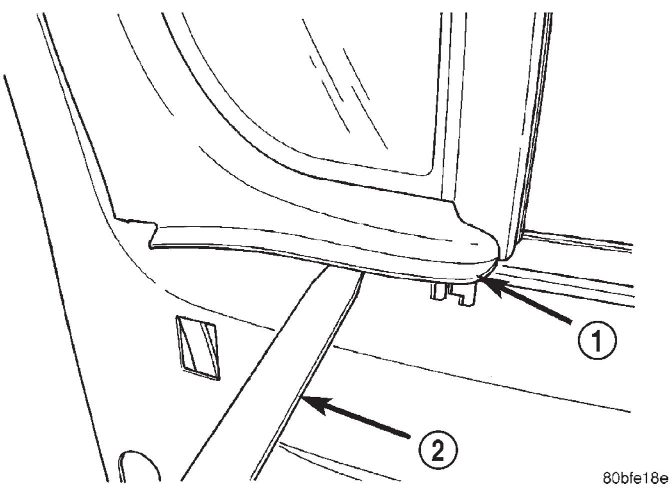


Fig. 53 Quarter Window Trim

1 – QUARTER GLASS TRIM
2 – TRIM STICK

(2) Install the front glass weatherstrip and the quarter glass trim.
(3) Raise the glass manually and secure in the door frame.
(4) Install the front lower glass channel.
(5) Lower the glass and install the regulator bolts.
(6) Cycle the glass to ensure proper operation.
(7) Install the waterdam and radio speaker, if equipped.
(8) Install the door trim panel.

REAR DOOR QUARTER GLASS

REMOVAL

CAUTION: The quarter glass trim panel will be difficult to remove without damage. Check availability of replacement before removal.

(1) Remove the rear door trim panel.
(2) Remove the door waterdam.
(3) Remover inner and outer beltline weatherstrip.
(4) Remove the door glass from the door. Refer to door glass procedure in this section.
(5) Remove the bolts attaching bottom of rearward run channel to door inner panel.
(6) Remove nuts attaching stationary glass to door frame.
(7) Separate the reward run channel/stationary glass from door.

INSTALLATION

(1) Position the rearward run channel/stationary glass in the door.
(2) Install the nuts attaching stationary glass to door frame.
(3) Install the bolts attaching rearward run channel to door inner panel.
(4) Install the rear door glass. Refer to door glass procedure in this section.
(5) Install inner and outer belt weatherstrip.
(6) Install the door waterdam.
(7) Install the rear door trim panel.

REAR DOOR WINDOW REGULATOR

REMOVAL

(1) Remove the door inner trim panel.
(2) Remove the door waterdam and speaker, if equipped.
(3) Remove the inner and outer beltline weatherstrip.
(4) Lower the door glass.
(5) Remove the bolts attaching the regulator to the glass.
(6) Raise the glass manually and secure in the door frame.
(7) Loosen the regulator attachment nuts and remove the regulator attachment bolts.
(8) Disengage regulator wire harness.
(9) Remove the regulator. (Fig. 54)

INSTALLATION

(1) Position the window regulator in the door.
(2) Install the fasteners attaching the regulator to the inner door panel.
(3) Engage the regulator wire harness.

REMOVAL AND INSTALLATION (Continued)

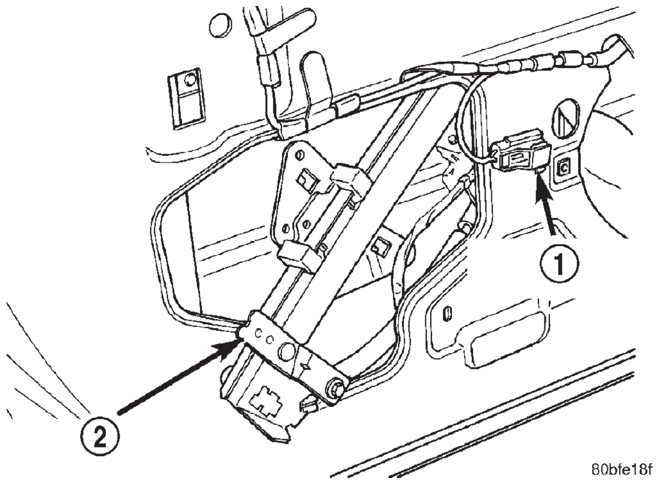


Fig. 54 Rear Door Window Regulator

1 – HARNESS CONNECTOR
2 – POWER WINDOW REGULATOR

(4) Lower the glass manually and install the bolts attaching the regulator to the glass.

(5) Cycle the glass to ensure correct operation.

(6) Install the inner and outer beltline weatherstrip.

(7) Install the door waterdam and radio speaker, if equipped.

(8) Install the door trim panel.

ROOF RAIL WEATHERSTRIP AND RETAINER

REMOVAL

(1) Release door latch and open door.

(2) The rearward corner of the weatherstip is adhesively attached to the body. Peel back the corner of the weatherstrip to release it from the body.

(3) Pull weatherstrip from retainer.

(4) Remove screws attaching retainer to roof rail (Fig. 55).

(5) Separate retainer from vehicle.

INSTALLATION

NOTE: The screws attaching the retainer to the roof are coated with wax to prevent water leakage. If the retainer has been removed from the roof, replace the screws.

(1) Ensure the area where tape secures the weatherstrip is clean. Use Mopar Super Clean or equivalent.

(2) Position retainer on vehicle.

(3) Install screws attaching retainer to roof rail.

(4) Starting at the forward end of retainer, push weatherstrip on until seated.

(5) Peel the backing from the rearward end of the weatherstrip and press to secure.

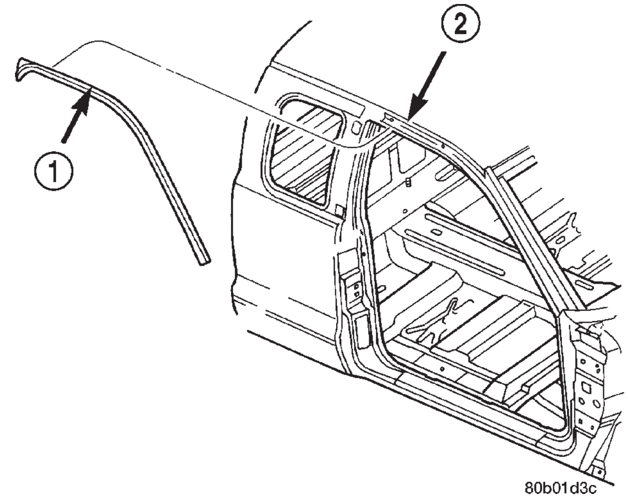


Fig. 55 Roof Rail Weatherstrip and Retainer

1 – ROOF RAIL WEATHERSTRIP
2 – RETAINER

ROOF JOINT MOLDING

REMOVAL

(1) Warm the roof joint molding and roof panel to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

(2) Pull molding from roof joint.

INSTALLATION

(1) Remove adhesive tape residue from roof joint.

(2) If molding is to be reused, remove tape residue from back of molding. Clean molding with MOPAR, Super Kleen solvent or equivalent. Wipe molding dry with lint free cloth. Apply new body side molding (two sided adhesive) tape to back of molding.

(3) Clean roof joint with MOPAR, Super Kleen solvent or equivalent. Wipe dry with lint free cloth.

(4) Remove protective cover from tape on back of molding and apply molding to roof joint.

(5) Heat roof and molding, see step one. Firmly press molding into roof joint to assure adhesion.

QUARTER VENT WINDOW

REMOVAL

(1) Remove quarter trim panel.

(2) Remove the bolts attaching the latch to the cab side panel (Fig. 56).

(3) Remove the nuts attaching the frame/hinge to the B-pillar (Fig. 57).

(4) Remove the glass from the cab.

(5) If necessary, remove the latch from the glass.

INSTALLATION

(1) If removed, install the latch to the glass.

REMOVAL AND INSTALLATION (Continued)

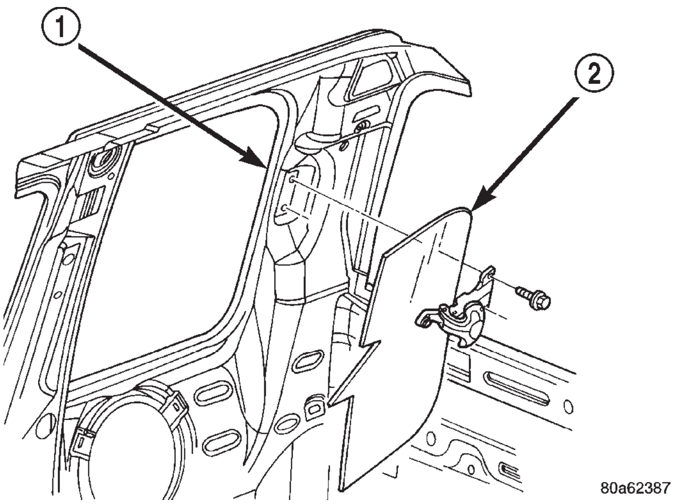


Fig. 56 Quarter Glass Latch

1 – CAB
2 – QUARTER GLASS

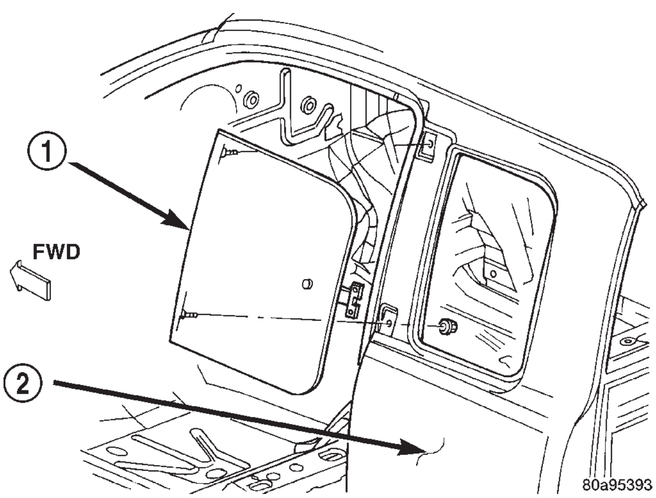


Fig. 57 Quarter Glass

1 – QUARTER GLASS
2 – QUARTER PANEL

(2) Center the window glass at the opening, insert the hinge studs in the B-pillar holes, and install the nuts.
(3) Attach the latch to the rear side panel with the bolts. Tighten the bolts with the latch in the lock position and pushing rearward on the latch.
(4) Test the vent window for water leaks.
(5) Install quarter trim panel.

QUARTER VENT WINDOW WEATHERSTRIP

REMOVAL

(1) Remove the quarter window. If necessary, refer to the removal procedure.
(2) Pull the seal away from the flange around the perimeter of the window opening (Fig. 58).
(3) Clean the flange as necessary.

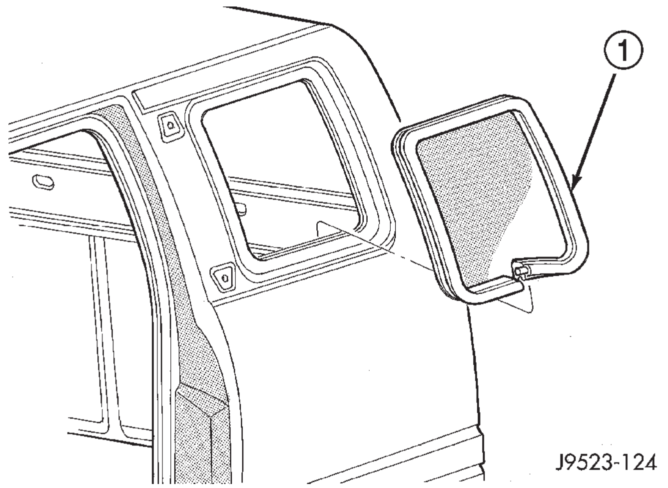


Fig. 58 Quarter Vent Weatherstrip

1 – QUARTER GLASS SEAL

INSTALLATION

(1) Center and butt the seal ends together at the bottom, centerline of the opening.
(2) Mate the seal with the bottom flange.
(3) Mate the seal with the front, vertical flange.
(4) Move upward and mate the seal with the top flange.
(5) Mate the seal with the rear, vertical flange.
(6) Install the quarter window.

AIR EXHAUSTER

REMOVAL

(1) Release door latch and open door.
(2) Using a small flat blade, depress the clips under the top of the exhauster frame.
(3) Separate air exhauster from vehicle.

INSTALLATION

(1) Position air exhauster on door shut face (Fig. 59).
(2) Engage clips and press into place.

AIR EXHAUSTER—CAB

REMOVAL

(1) Remove cab back panel carpet/trim.
(2) Position a long flat blade between cab and cargo box and depress air exhauster upper retaining tabs and disengage from cab back panel.
(3) From inside the vehicle separate air exhauster from cab back panel (Fig. 60).

REMOVAL AND INSTALLATION (Continued)

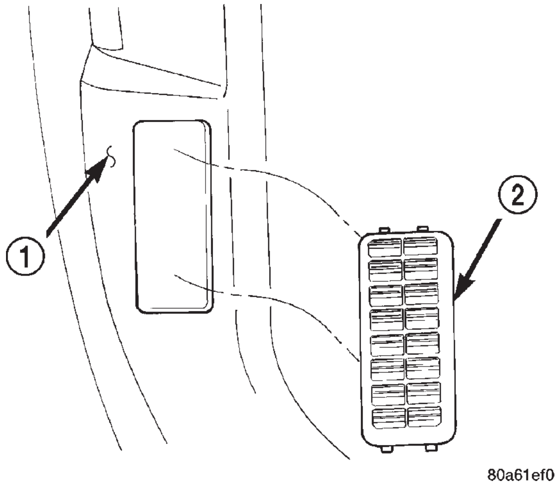


Fig. 59 Air Exhauster

1 – DOOR SHUT FACE
2 – AIR EXHAUSTER

INSTALLATION

(1) From inside the vehicle position air exhauster in cab back panel.

(2) Press air exhauster inward to engage retaining tabs.

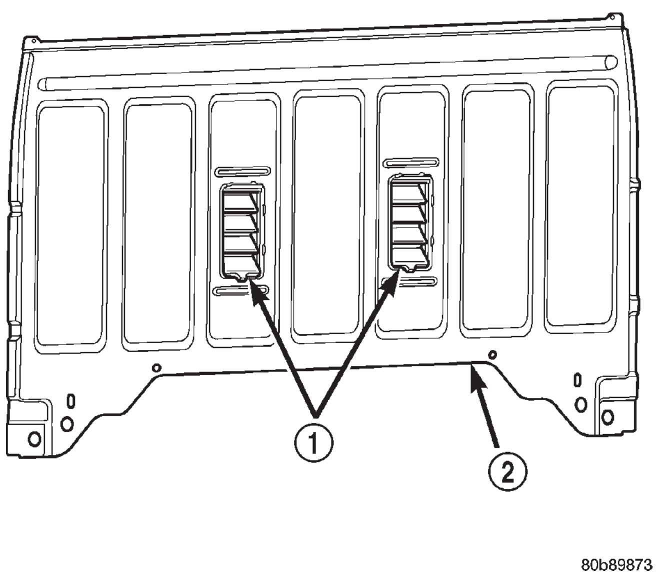


Fig. 60 In Cab Air Exhausters

1 – AIR EXHAUSTERS
2 – CAB BACK PANEL

BODY SIDE MOLDINGS

REMOVAL

(1) Apply a length of masking tape on the body, parallel to the top edge of the molding to use as a guide, if necessary.

(2) Warm the effected stick-on molding and body metal to approximately 38°C (100°F) using a suitable heat lamp or heat gun.

(3) Pull stick-on molding from painted surface (Fig. 61).

INSTALLATION

(1) Clean body surface with MOPAR Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(2) Remove protective cover from tape on back of molding. Apply molding to body below the masking tape guide.

(3) Remove masking tape guide and heat body and molding. Firmly press molding to body surface to assure adhesion.

WHEEL OPENING MOLDING

REMOVAL

(1) Remove the screws attaching the wheel opening molding to the fender (Fig. 61).

(2) Separate the molding from the wheel opening.

INSTALLATION

(1) Clean body surface with MOPAR Super Kleen solvent or equivalent. Wipe surface dry with lint free cloth.

(2) Position the molding in the wheel opening.

(3) Remove the backing and press to secure molding.

(4) Install the screws attaching the wheel opening molding to the fender.

FUEL FILLER DOOR

REMOVAL

(1) Open the fuel filler door.

(2) Remove the screws attaching the door to the cargo box outer panel (Fig. 62).

(3) Remove the door from the panel.

INSTALLATION

(1) Position the fuel filler door on the cargo box outer panel with the screw holes aligned.

(2) Install the screws attaching the fuel filler door to the cargo box outer panel.

REMOVAL AND INSTALLATION (Continued)

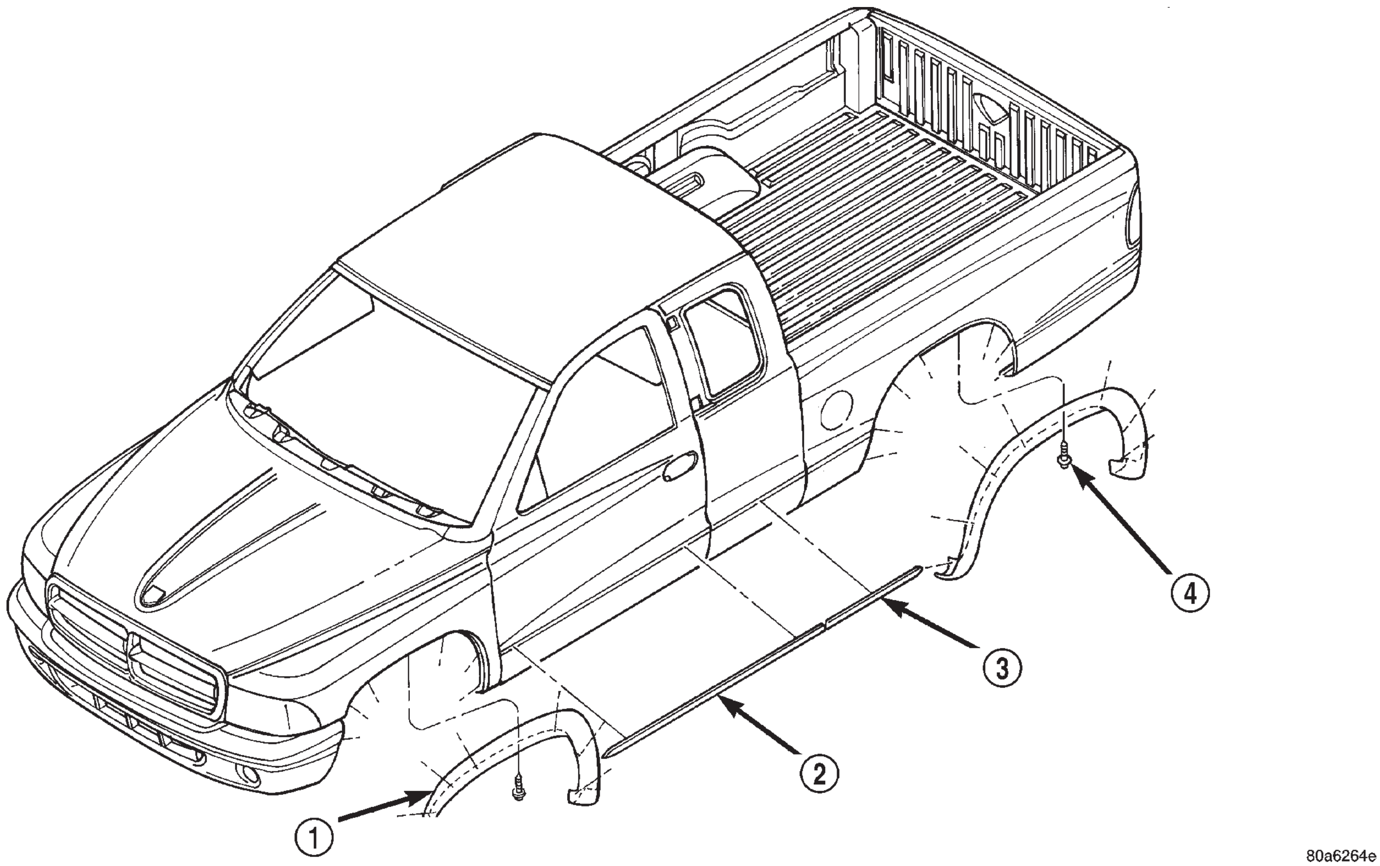


Fig. 61 Body Side Moldings—Wheel Opening Moldings

1 – FRONT WHEEL OPENING MOLDING
2 – DOOR MOLDING
3 – CAB MOLDING
4 – REAR WHEEL OPENING MOLDING

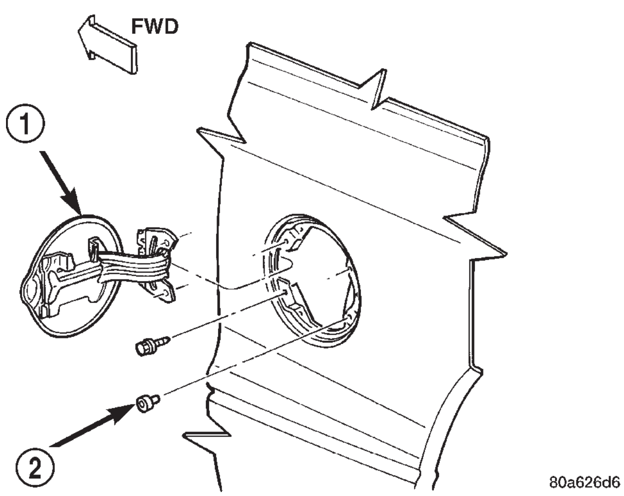


Fig. 62 Fuel Filler Door

1 – FUEL DOOR
2 – BUMPER

REAR SPLASH SHIELD

REMOVAL

(1) Remove bottom screw attaching wheel opening molding to cargo box.

(2) Remove screws attaching splash shield to inner wheel house (Fig. 63).

(3) Separate splash shield from vehicle.

INSTALLATION

(1) Position splash shield in wheel house.

(2) Install screws attaching splash shield to inner wheel house.

(3) Install bottom screw attaching wheel opening molding to cargo box.

TAILGATE CHECK CABLE

REMOVAL

(1) Release tailgate latch and open tailgate.

(2) Pry lock tab outward to clear stud head on cargo box (Fig. 64).

REMOVAL AND INSTALLATION (Continued)

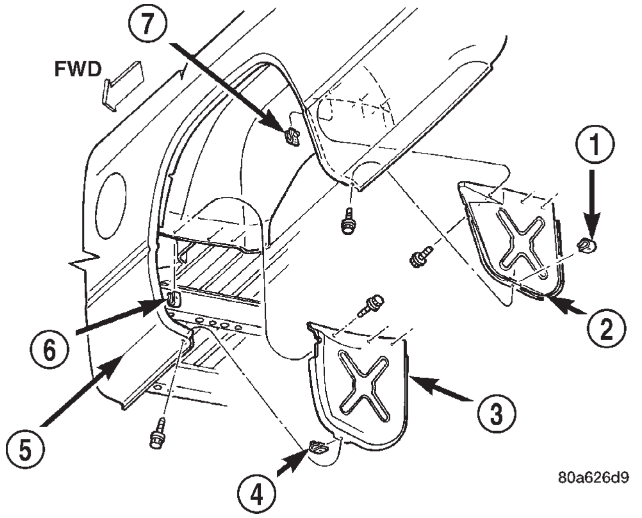


Fig. 63 Rear Splash Shield

1 – U-NUT
2 – REAR SPLASH SHIELD
3 – FRONT SPLASH SHIELD
4 – U-NUT
5 – CARGO BOX
6 – U-NUT
7 – U-NUT

(3) Push cable end forward until stud head is in clearance hole portion of cable end.
(4) Separate cable end from stud.
(5) Remove screw holding cable to tailgate.
(6) Separate check cable from tailgate.

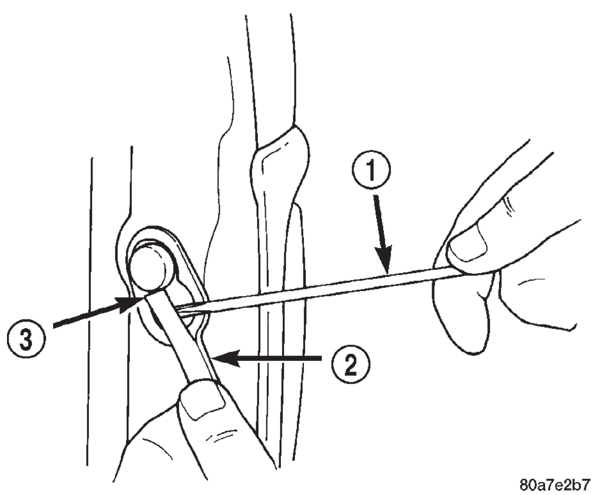


Fig. 64 Tailgate Check Cable

1 – SCREW DRIVER
2 – TAILGATE CHECK CABLE
3 – LOCK TAB

INSTALLATION

Reverse the preceding operation.

TAILGATE

REMOVAL

(1) Release tailgate latch and open tailgate.
(2) Disconnect tailgate check cable.
(3) Close tailgate until the notch in the right hand collar aligns with the pivot pin.
(4) Slip tailgate hinge collar from hinge pins.
(5) Slide tailgate to the right and separate left hand collar from the pivot pin.
(6) Separate tailgate from vehicle.

INSTALLATION

Reverse the preceding operation.

TAILGATE LATCH RELEASE HANDLE

REMOVAL

(1) Using a trim stick and starting at the bottom of the latch release handle, disengage the bottom clips attaching the bezel to the tailgate.
(2) Slide the bezel downward to remove it from the tailgate.
(3) Remove screws attaching latch release handle to tailgate (Fig. 65).
(4) Disengage latch release rods (Fig. 66).
(5) Separate latch release from tailgate.

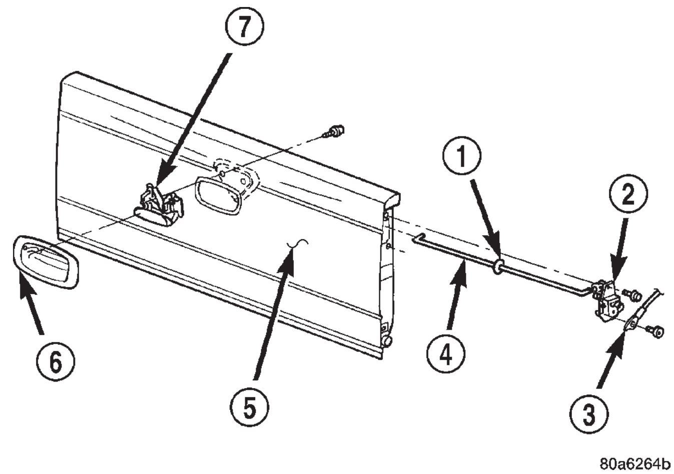


Fig. 65 Tailgate

1 – SILENCER DISC
2 – LATCH
3 – CABLE
4 – LATCH RELEASE ROD
5 – TAILGATE
6 – BEZEL
7 – LATCH RELEASE

INSTALLATION

(1) Position latch release in tailgate.
(2) Engage latch release rods.

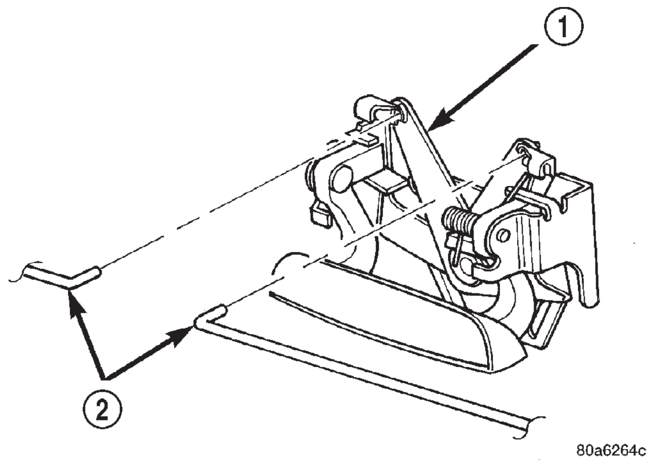


Fig. 66 Latch Release Rods

1 – TAILGATE LATCH RELEASE
2 – TAILGATE LATCH RELEASE RODS

(3) Install screws attaching latch release handle to tailgate.

(4) Position the top of the bezel in tailgate and slide the bezel upward and snap into place.

TAILGATE LATCH

REMOVAL

(1) Remove bolts attaching tailgate latch to tailgate (Fig. 65).

(2) Remove bezel for tailgate latch release handle.

(3) Remove bolts attaching tailgate latch release handle to tailgate.

(4) Disengage latch rods at tailgate latch release handle.

(5) Separate latch from tailgate and disengage latch rod from latch.

INSTALLATION

(1) Engage latch rods to tailgate latch release handle.

(2) Install tailgate latch release handle.

(3) Attach latch release rod to latch.

(4) Position latch in tailgate.

(5) Install bolts attaching tailgate latch to tailgate.

(6) Install bezel for tailgate latch release handle.

TAILGATE LATCH STRIKER

REMOVAL

(1) Release tailgate latch and open tailgate.

(2) Remove tailgate check cable.

(3) Using a grease pencil, mark the location of the striker.

(4) Remove striker from cargo box (Fig. 67).

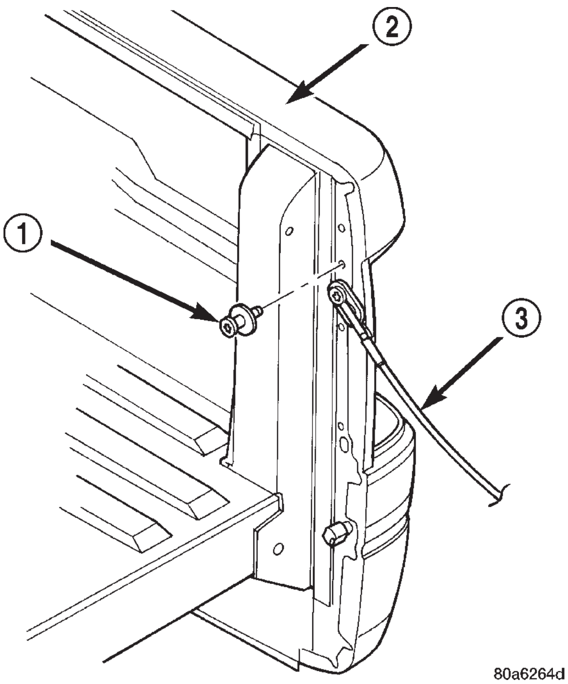


Fig. 67 Tailgate Latch Striker

1 – STRIKER
2 – BODY
3 – CABLE

INSTALLATION

(1) Align the striker using the reference marks.

(2) Install striker.

(3) Install tailgate check cable.

CARGO BOX

REMOVAL

CAUTION: The bolts attaching the cargo box to the frame are specially coated to provide a locking action. These bolts are not reusable and must be replaced each time the cargo box is removed or replaced.

(1) Open fuel fill door.

(2) Remove screws attaching fuel fill neck adaptor to cargo box side wall.

(3) Separate fuel fill neck from cargo box.

(4) Disengage tail lamp wire connector from main body harness.

(5) Remove bolts attaching cargo box to frame rails (Fig. 68).

(6) Using a suitable lifting device, separate cargo box from vehicle.

INSTALLATION

(1) Position cargo box on frame rails.

REMOVAL AND INSTALLATION (Continued)

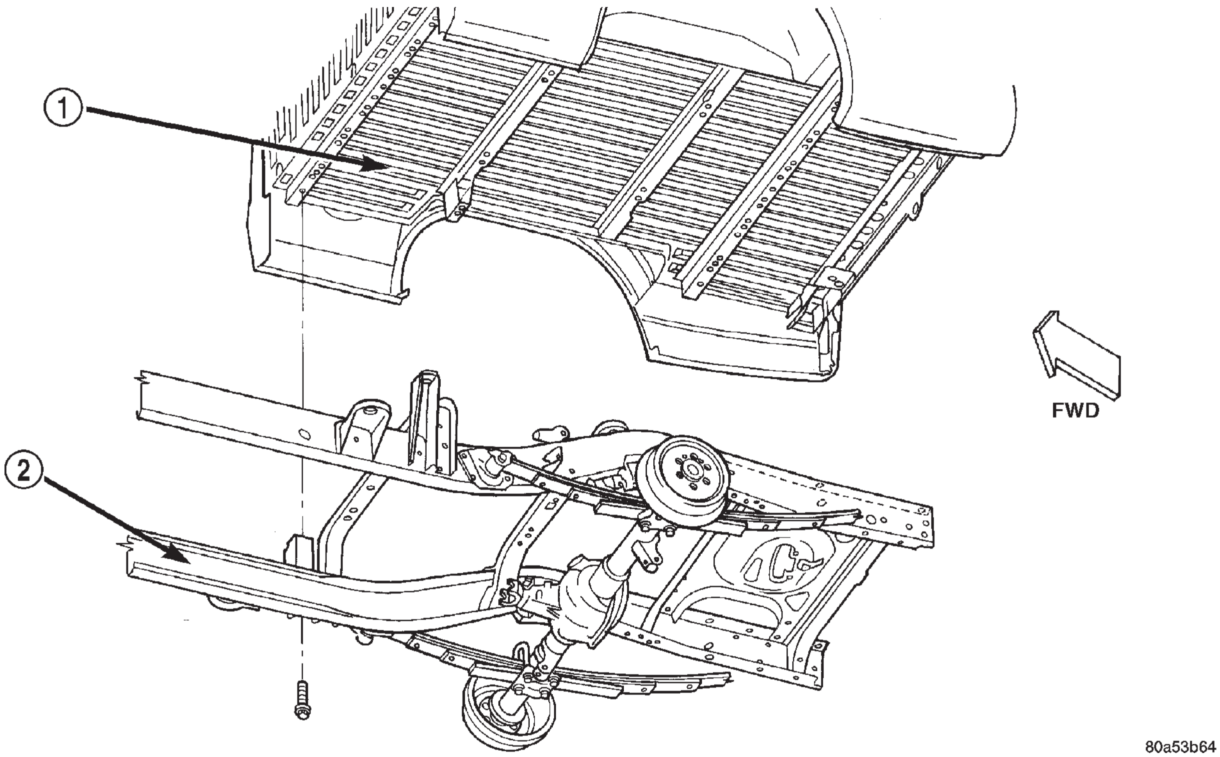


Fig. 68 Cargo Box

1 – CARGO BOX
2 – FRAME RAIL

(2) Install bolts attaching cargo box to frame rails. Tighten bolts to 27 N·m (20 ft. lbs.) torque.

(3) Engage tail lamp wire connector for main body harness.

(4) Install screws attaching fuel fill neck adaptor to cargo box side wall.

CARGO BOX SEAL

REMOVAL

(1) From under the vehicle, use a trim panel removal tool and remove the push-in fasteners attaching the cargo box seal to the cargo box (Fig. 69).

(2) Separate the seal from the cargo box

INSTALLATION

(1) Position the seal on the cargo box

(2) Install the push-in fasteners attaching the cargo box seal to the cargo box (Fig. 69).

COWL TRIM COVER

REMOVAL

(1) Using a trim stick, pry cowl trim cover from cowl to disengage clips.

(2) Separate cowl trim cover from vehicle.

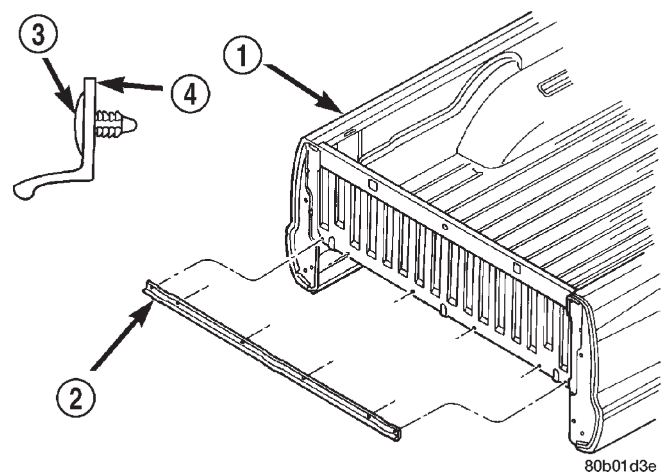


Fig. 69 Cargo Box Seal

1 – CARGO BOX
2 – BOX SEAL
3 – PUSH-IN FASTENER
4 – CARGO BOX SEAL

INSTALLATION

(1) Position cowl trim cover on cowl.

(2) Press cowl trim cover into place to engage clips.

REMOVAL AND INSTALLATION (Continued)

A-PILLAR TRIM

REMOVAL

(1) Remove A-pillar grab handle, if equipped.
(2) Remove screws from cowl trim cover.
(3) Remove cowl trim cover.
(4) Grasp A-pillar trim and pull outward to disengage clips attaching A-pillar trim to A-pillar (Fig. 70).
(5) Separate A-pillar trim from vehicle.

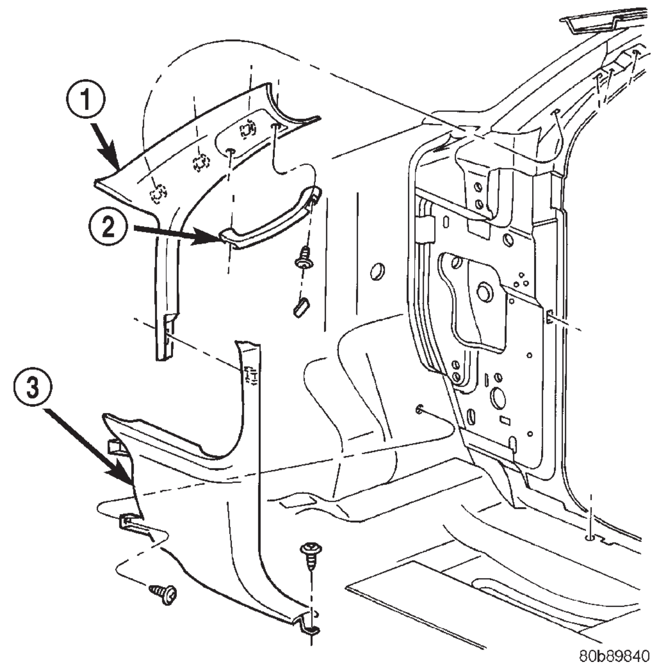


Fig. 70 A-Pillar Trim

1 – A-PILLAR TRIM
2 – GRAB HANDLE
3 – COWL TRIM COVER

INSTALLATION

(1) Position A-pillar trim at A-pillar, align clips and press into place.
(2) Install cowl trim cover.
(3) Install A-pillar grab handle, if equipped.

DOOR SILL TRIM COVER

REMOVAL

(1) Using a trim stick, pry up sill trim cover from door sill.
(2) Separate sill trim cover from vehicle (Fig. 71).

INSTALLATION

(1) Position front edge of sill cover over cowl trim cover and align tab.
(2) Align sill cover and press into place.

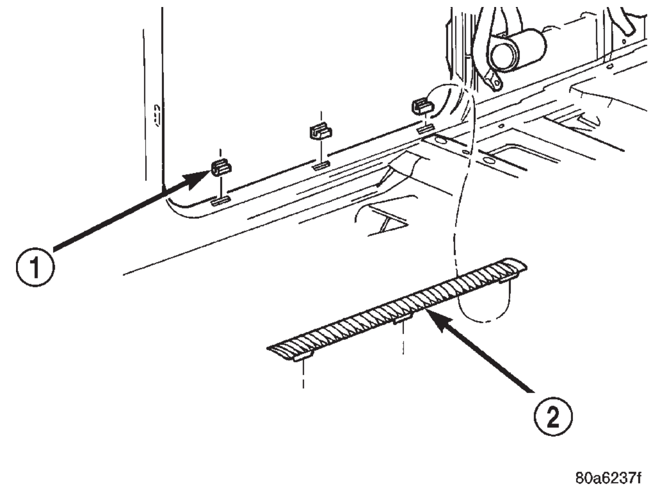


Fig. 71 Sill Trim Cover

1 – CLIP
2 – SILL TRIM COVER

B-PILLAR TRIM

REMOVAL

The B-pillar trim panel is attached to the B-pillar with push-in fasteners.
(1) Remove door sill cover as necessary to clear B-pillar trim.
(2) Remove shoulder belt turning loop.
(3) Grasp B-pillar trim panel and firmly pull outward.
(4) Disconnect speaker harness connector, if equipped.
(5) Route shoulder belt through access slots in B-pillar trim panel.
(6) Separate B-pillar trim panel from B-pillar (Fig. 72).

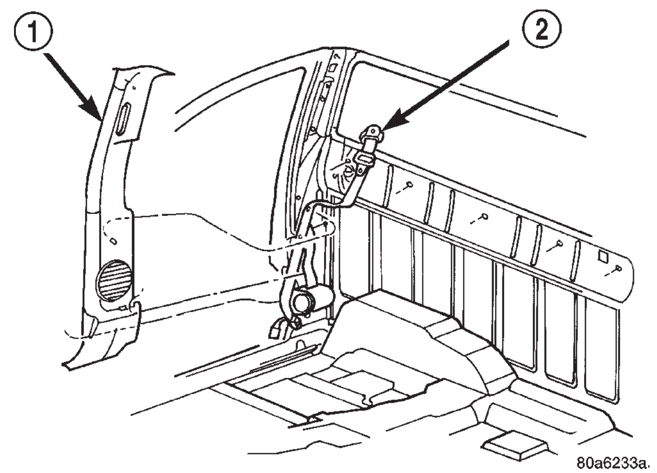


Fig. 72 B-Pillar Trim

1 – B-PILLAR TRIM
2 – TURNING LOOP

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position trim panel in vehicle.
(2) Route shoulder belt through access slots in B-pillar trim panel.
(3) Connect speaker harness connector, if equipped.
(4) Position B-pillar trim panel on B-pillar and press to seat push-in fasteners.
(5) Install shoulder belt turning loop.
(6) Install door sill cover as necessary.

QUARTER TRIM PANEL

REMOVAL

(1) Remove door sill cover as necessary to clear quarter trim.
(2) Remove cab back panel trim.
(3) Remove front and rear shoulder belt turning loops.
(4) Remove the screws attaching the quarter trim panel to the cab back panel.
(5) Grasp quarter trim panel and firmly pull outward to disengage the push-in fasteners.
(6) Route front and rear shoulder belts through access slots in quarter trim panel.
(7) Separate club cab quarter trim panel from quarter panel (Fig. 73).

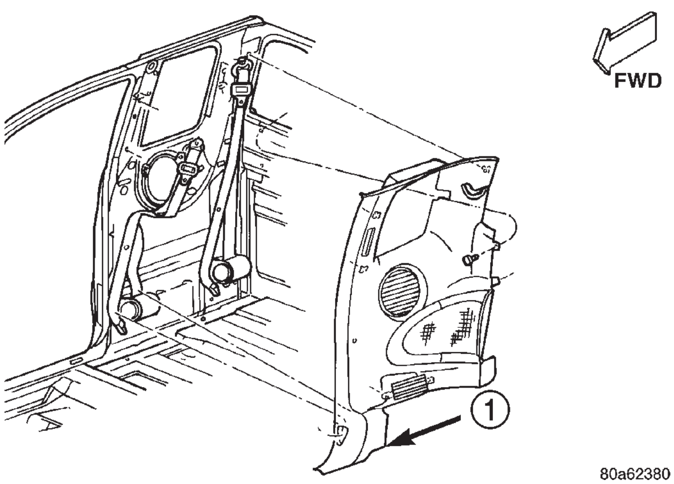


Fig. 73 Quarter Trim Panel

1 – QUARTER TRIM PANEL

INSTALLATION

(1) Position trim panel in vehicle.
(2) Route belt webbing through access slots in quarter trim panel.
(3) Position quarter trim panel on quarter panel and engage hooks at base of quarter trim panel.
(4) Press quarter trim panel inward to seat push-in fasteners.
(5) Install screws attaching quarter trim panel to cab back panel.
(6) Install cab back panel trim.
(7) Install door sill cover as necessary.

REAR CAB BACK PANEL TRIM

REMOVAL

The rear cab back panel trim is attached to the cab with push-in fasteners.
(1) Grasp rear cab back panel trim and firmly pull to release from cab (Fig. 74) and (Fig. 75).

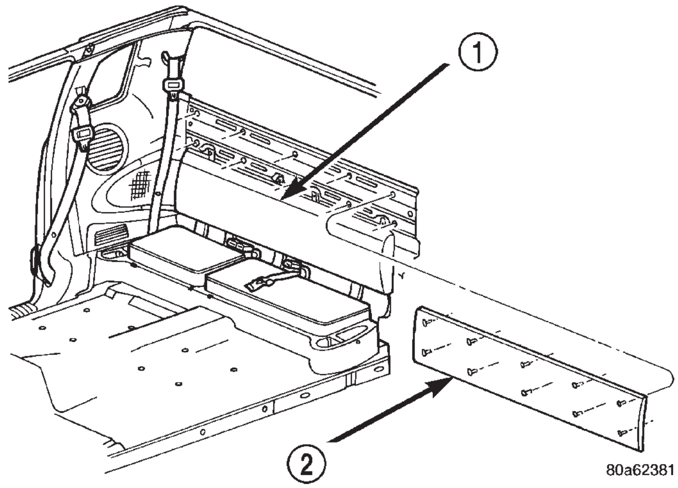


Fig. 74 Rear Cab Back Panel Trim

1 – REAR SEAT BACK
2 – REAR CAB PANEL TRIM

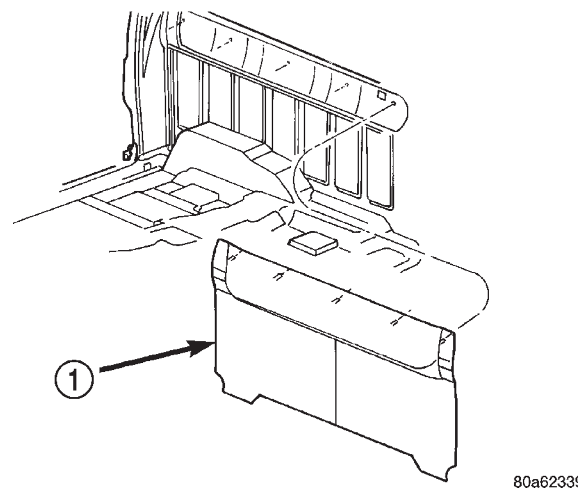


Fig. 75 Rear Cab Back Panel Trim With Carpet

1 – CAB BACK PANEL CARPET

INSTALLATION

(1) Position rear cab back panel trim on cab, align holes and press into place.

REMOVAL AND INSTALLATION (Continued)

BACKLITE SLIDING VENT GLASS

REMOVAL

(1) Open vent glass to full open position

(2) Slide the upper run channel out of the window frame.

(3) Slide the vent glass upward to remove from the window frame.

INSTALLATION

(1) Slide the vent glass downward into window frame.

(2) Position the upper run channel into the window frame and slide it into place.

(3) Verify vent glass operation.

FRONT SEAT BELT RETRACTOR

CAUTION: Inspect the condition of the shoulder belt and lap belt. Replace any belt that is cut, frayed, torn, or damaged in any way. Also, replace the shoulder belt if the retractor is either damaged or inoperative.

REMOVAL

(1) If necessary, move the front seat(s) all the way forward for access.

(2) Detach the turning loop cover from the upper anchor bolt.

(3) Remove upper anchor bolt (Fig. 76).

(4) Remove quarter panel trim panel.

(5) Remove lower anchor bolt.

(6) Remove the retractor anchor bolt.

(7) Disconnect retractor wire harness connector (driver's side).

(8) Separate retractor from vehicle.

INSTALLATION

(1) Position the retractor in the vehicle.

(2) Install the retractor anchor bolt. Tighten to 44 N·m (32 ft. lbs.) torque.

(3) Connect retractor wire harness connector (driver's side).

(4) Install the lower anchor bolt. Tighten to 44 N·m (32 ft. lbs.) torque.

(5) Route the belt webbing through the access slots in quarter trim panel.

(6) Install quarter panel trim panel.

(7) Install the upper anchor bolt. Tighten to 44 N·m (32 ft. lbs.) torque.

(8) Close turning loop covers.

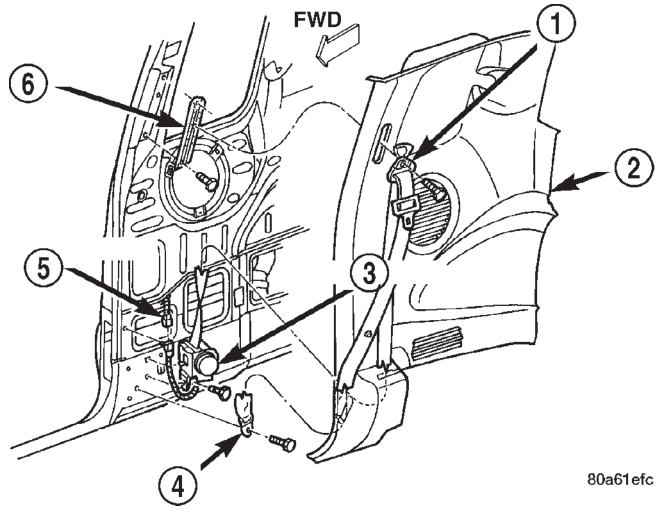


Fig. 76 Front Seat Belt Retractor

1 – TURNING LOOP
2 – TRIM PANEL
3 – RETRACTOR
4 – BELT ANCHOR
5 – CONNECTOR
6 – ADJUSTER

SEAT BELT RETRACTOR—QUAD CAB

REMOVAL

(1) Using a trim stick, pry off the turning loop cover.

(2) Remove the bolt retaining the turning loop to C pillar (Fig. 77).

(3) Remove the upper C pillar trim.

(4) Remove the screws retaining the lower C pillar trim.

(5) Pull the lower C pillar trim out far enough to access the seat belt retractor bolts.

(6) Remove the bolts retaining the lower belt loop and the retractor to the C pillar (Fig. 78).

(7) Route the seat belt through the lower C pillar trim and remove the belt assembly.

INSTALLATION

(1) Route the seat belt through the lower C pillar trim.

(2) Position the retractor assembly on the C pillar. Ensure the locating tab is positioned properly.

(3) Install the bolts retaining the lower belt loop and the retractor assembly to the C pillar. Tighten to 44 N·m (32 ft. lbs.) torque.

(4) Position the lower C pillar trim and install the screws.

(5) Install the upper C pillar trim.

(6) Install the bolt retaining the upper turning loop. Tighten to 44 N·m (32 ft. lbs.) torque.

(7) Install the upper turning loop cover.

REMOVAL AND INSTALLATION (Continued)

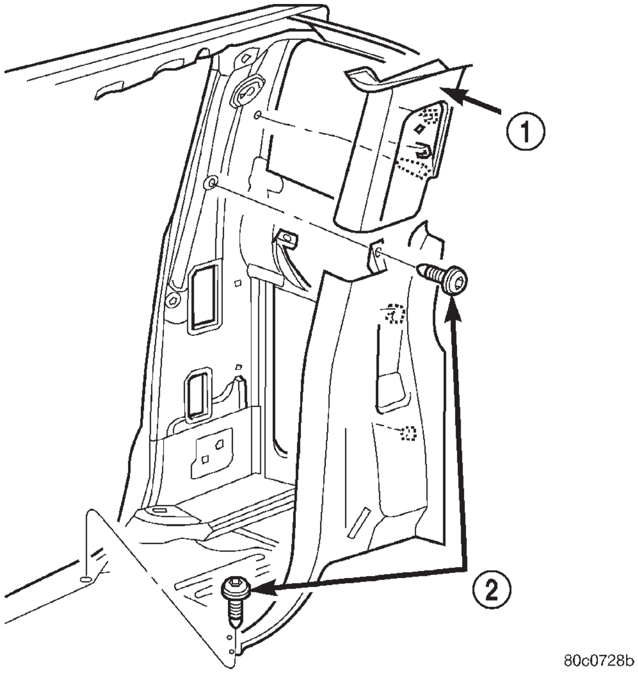


Fig. 77 Upper C Pillar Trim

1 – UPPER C PILLAR TRAY
2 – LOWER C PILLAR TRIM SCREWS

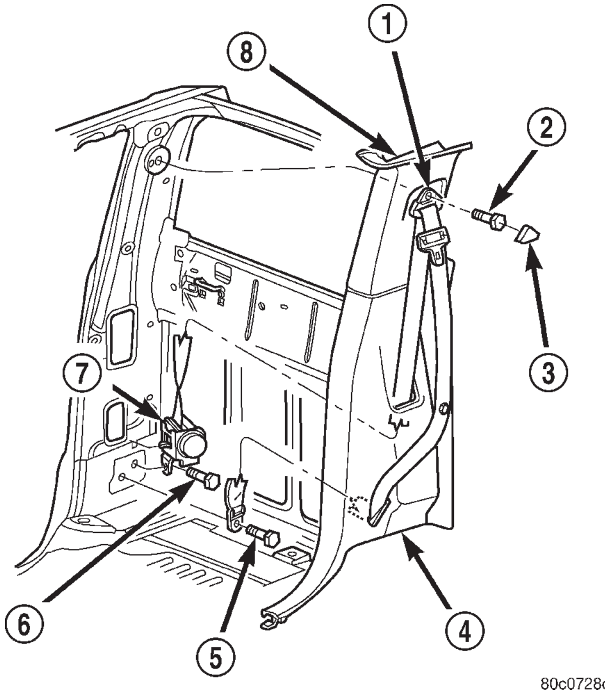


Fig. 78 Rear Seat Belt Retractor

1 – TURNING LOOP
2 – UPPER SEAT BELT BOLT
3 – TURNING LOOP COVER
4 – LOWER C PILLAR TRIM
5 – RETRACTOR BELT BOLT
6 – RETRACTOR BOLT
7 – REAR SEAT BELT RETRACTOR
8 – UPPER C PILLAR TRIM

SEAT BELT BUCKLE

REMOVAL

(1) If equipped, remove floor console.
(2) If equipped with bench seat or bucket seats with center seat, remove seats.
(3) Remove bolt attaching buckle to seat track (Fig. 79).
(4) Separate buckle from seat track.

INSTALLATION

(1) Position buckle on seat track.
(2) Install bolt attaching buckle to seat track. Tighten the bolt to 40 N·m (29 ft. lbs.) torque.
(3) If removed, install seats.
(4) If removed, install floor console.

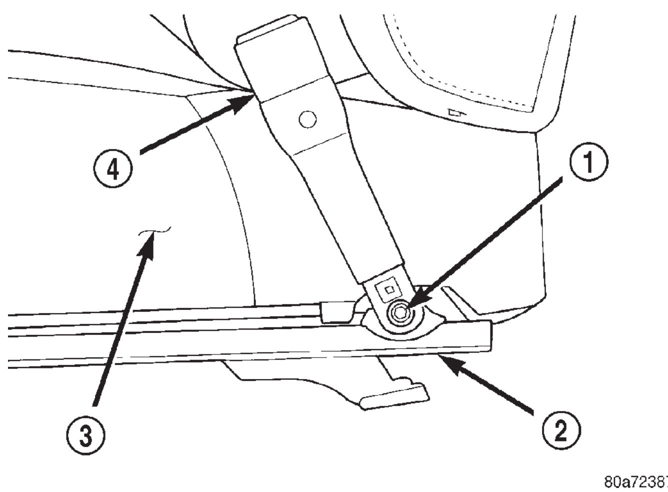


Fig. 79 Seat Belt Buckle

1 – ANCHOR BOLT
2 – SEAT TRACK
3 – SEAT CUSHION
4 – BUCKLE

REAR SEAT BELT/BUCKLE—CLUB CAB

CAUTION: Inspect the condition of the buckle. Replace any buckle that is damaged in any way.

REMOVAL

(1) Move the front seat(s) to the full forward position.
(2) Remove the rear seat.
(3) Remove seat belt/buckle anchor bolt (Fig. 80).
(4) Separate seat belt/buckle from vehicle.

INSTALLATION

(1) Position the buckle on the floor panel.

REMOVAL AND INSTALLATION (Continued)

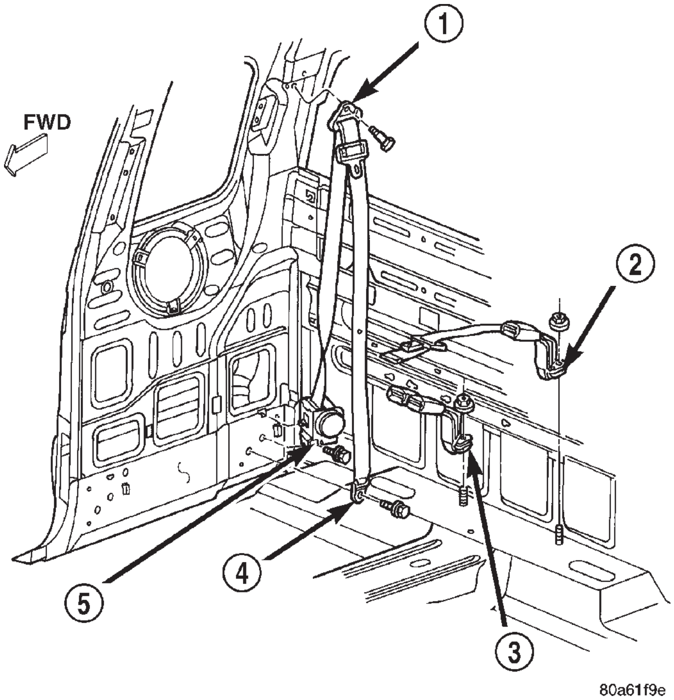


Fig. 80 Rear Seat Belt Buckle—Club Cab

1 – TURNING LOOP
2 – BUCKLE/BELT ANCHOR
3 – BUCKLE ANCHOR
4 – BELT ANCHOR
5 – RETRACTOR

(2) Install the seat belt/buckle anchor bolt. Tighten to 44 N·m (32 ft. lbs.) torque.
(3) Install the rear seat.

REAR SEAT BELT RETRACTOR—CLUB CAB

CAUTION: Inspect the condition of the shoulder belt and lap belt. Replace any belt that is cut, frayed, torn, or damaged in any way. Also, replace the shoulder belt if the retractor is either damaged or inoperative.

REMOVAL

(1) Move the front seat(s) all the way forward for access.
(2) Lift up the rear seat.
(3) Detach the turning loop cover from the upper anchor bolt.
(4) Remove upper anchor bolt (Fig. 80).
(5) Remove quarter panel trim panel.
(6) Remove storage box.
(7) Remove lower anchor bolt.
(8) Remove the retractor anchor bolt.
(9) Separate retractor from vehicle.

INSTALLATION

(1) Position the retractor in the vehicle.
(2) Install the retractor anchor bolt. Tighten to 44 N·m (32 ft. lbs.) torque.
(3) Route the lap/seat belt through the quarter trim panel.
(4) Install the lower anchor bolt. Tighten to 44 N·m (32 ft. lbs.) torque.
(5) Install storage box.
(6) Install quarter panel trim panel.
(7) Install the upper anchor bolt. Tighten to 44 N·m (32 ft. lbs.) torque.
(8) Install turning loop cover.
(9) Lower the rear seat.

FLOOR SHIFT BOOT

REMOVAL

(1) Using a small flat blade, pry out insert from shift knob (Fig. 81).
(2) Remove nut attaching shift knob to gear shift.
(3) Pull knob off gear shift.
(4) Using a small flat bladed screwdriver pry up one corner of the bezel/boot assembly. Do not separate the boot from the bezel.
(5) Lift the boot/bezel assembly off of the floor panel and over the gear shift. (Fig. 82) and (Fig. 83).

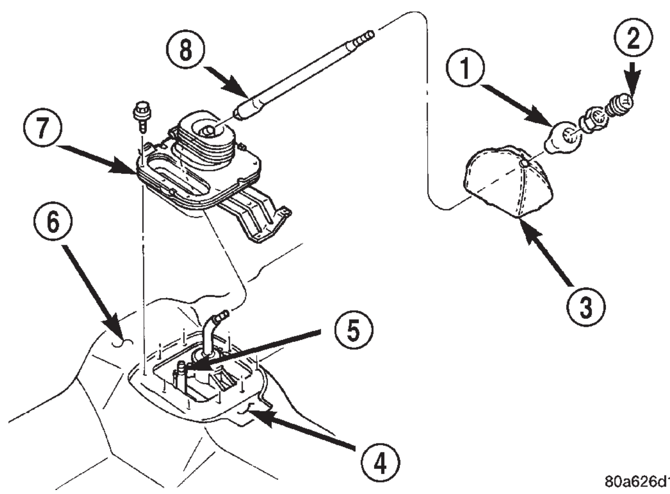


Fig. 81 Shift Knob Insert

1 – KNOB
2 – KNOB INSERT
3 – SHIFT BOOT
4 – FLOOR PAN
5 – TRANSFER CASE LEVER
6 – CARPET
7 – PLATE
8 – GEAR SHIFT

INSTALLATION

(1) Position shift boot/bezel assembly on gear shift.
(2) Press shift boot/bezel onto the floor panel.

REMOVAL AND INSTALLATION (Continued)

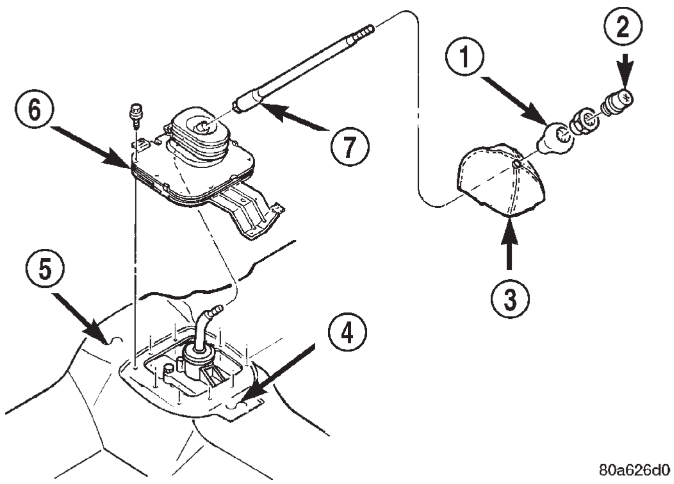


Fig. 82 Shift Boot—Manual Transmission

1 – KNOB
2 – KNOB INSERT
3 – SHIFT BOOT
4 – FLOOR PAN
5 – CARPET
6 – PLATE
7 – GEAR SHIFT

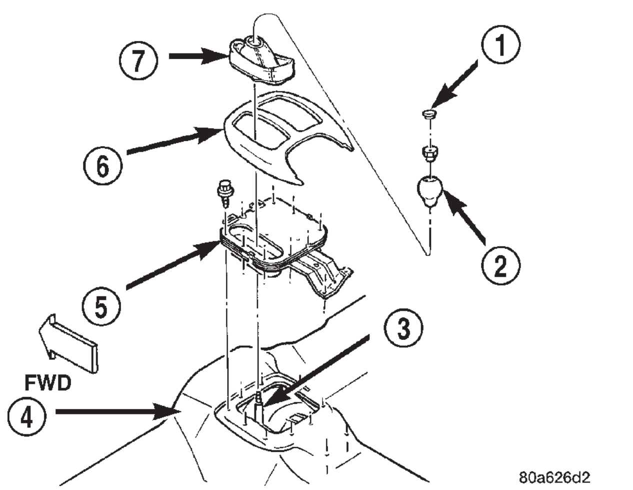


Fig. 83 Shift Boot—Transfer Case

1 – KNOB INSERT
2 – KNOB
3 – TRANSFER CASE SHIFT LEVER
4 – FLOOR PAN
5 – PLATE
6 – BEZEL
7 – TRANSFER CASE SHIFT BOOT

(3) Push knob onto gear shift.
(4) Install nut attaching shift knob to gear shift.
(5) Press insert into shift knob.

SHIFT BEZEL

REMOVAL

(1) Remove shift boot/s.
(2) Lift bin cup holder and remove bolts attaching shift bezel to floor pan (Fig. 84).
(3) Remove screw under shift boot attaching patch plate to floor pan.
(4) Disengage 4WD shift indicator lamp connector, if equipped (Fig. 85) and (Fig. 86).
(5) Separate shift bezel from vehicle.

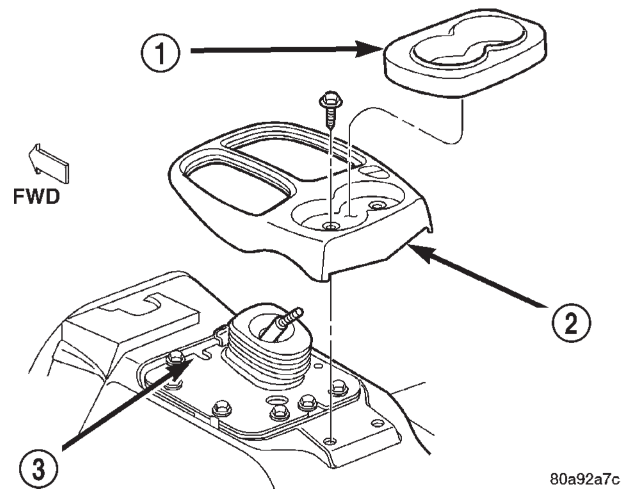


Fig. 84 Shift Bezel 4x2

1 – SHIFT BEZEL CUP HOLDER
2 – SHIFT BEZEL 4 x 2
3 – PATCH PLATE

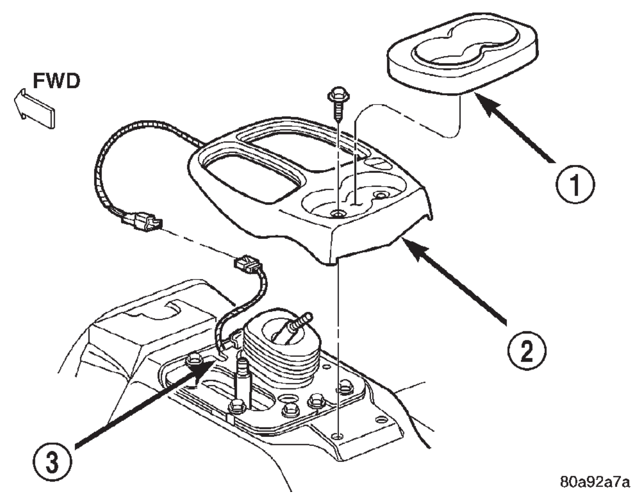


Fig. 85 Shift Bezel 4X4 Manual Trans

1 – SHIFT BEZEL CUP HOLDER
2 – SHIFT BEZEL 4 x 4
3 – PATCH PLATE

INSTALLATION

(1) Position shift bezel in vehicle.

REMOVAL AND INSTALLATION (Continued)

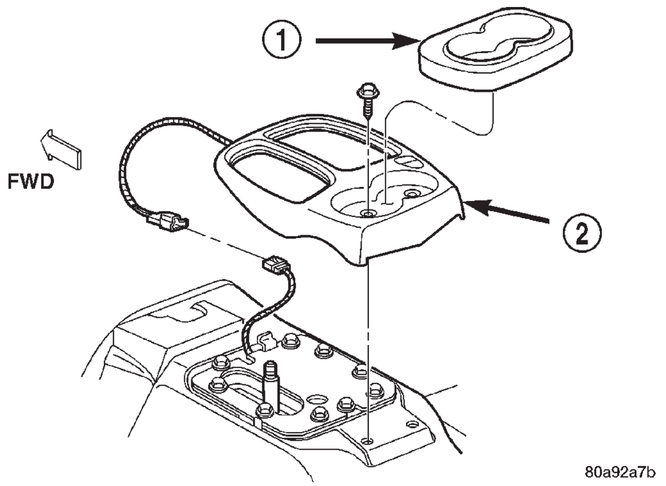


Fig. 86 Shift Bezel 4X4 Automatic Trans

1 – SHIFT BEZEL CUP HOLDER
2 – SHIFT BEZEL 4 x 4

(2) Engage 4WD shift indicator lamp connector, if equipped.

(3) Install screw under shift boot attaching patch plate to floor pan.

(4) Install bolts in cup holder attaching shift bezel to floor pan.

(5) Install shift boot/s.

FLOOR CONSOLE

REMOVAL

(1) Open console lid and remove bolts attaching console to floor pan (Fig. 87).

(2) Lift the cup holder bin mat and remove bolt attaching the console to the floor pan.

(3) Lift the cup holder mat and remove the bolts attaching the console to the floor pan.

(4) Lift the rear of the console and pull the console rearward to separate from the shift bezel.

(5) Remove the console from the vehicle.

INSTALLATION

(1) Position the console in the vehicle.

(2) While holding the console with the front of the console pointing downward, position the front of the console on top of the shift bezel.

(3) Align rear of console with the mounting bracket.

(4) Install bolts attaching console to floor pan.

REAR STORAGE BOX

REMOVAL

(1) Lift rear seat.

(2) Remove bolts attaching storage box to floor pan (Fig. 88).

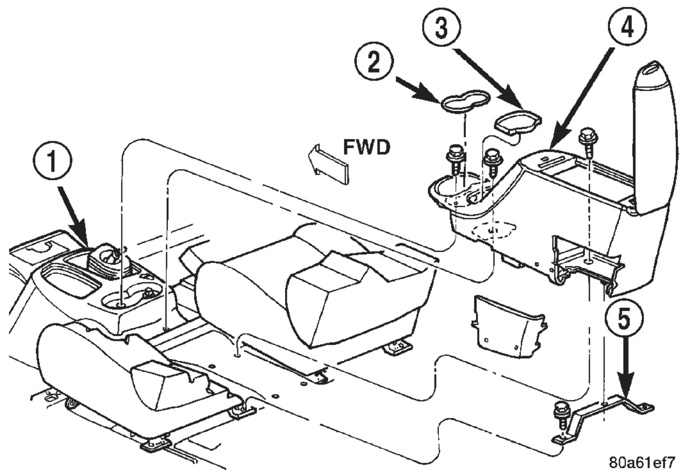


Fig. 87 Floor Console

1 – SHIFT BEZEL
2 – CUP HOLDER MAT
3 – ACCESSORY BIN MAT
4 – FLOOR CONSOLE
5 – BRACKET

(3) Remove rear seat belt/buckle anchor bolts.

(4) Route rear seat belt/buckle through slots in rear of storage box.

(5) Separate storage box from vehicle.

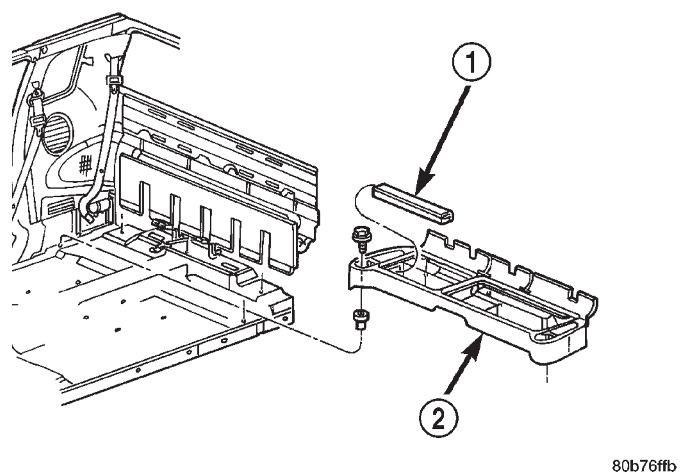


Fig. 88 Storage Box

1 – JACK STORAGE POUCH
2 – STORAGE BOX

INSTALLATION

(1) Position storage box in vehicle.

(2) Route rear seat belt/buckle through slots in rear of storage box.

(3) Install rear seat belt/buckle anchor bolts.

(4) Install bolts attaching storage box to floor pan.

(5) Lower seat.

REMOVAL AND INSTALLATION (Continued)

FLOOR CARPET OR MAT

REMOVAL

(1) Remove seat.
(2) Remove door sill and cowl trim covers.
(3) Remove seat belt anchors.
(4) Remove floor shift boot/floor console, if equipped.
(5) Remove rear stowage tray/storage box.
(6) Pull carpet out from under quarter panel trim and cab back panel trim.
(7) Fold carpet or mat toward center of cab.
(8) Remove carpet or mat through door opening (Fig. 89).

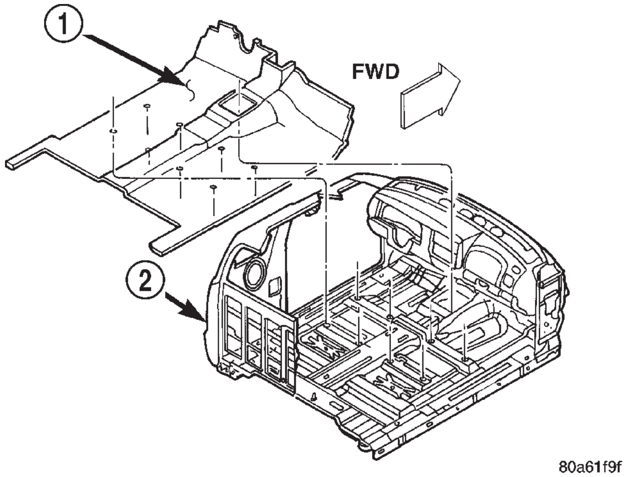


Fig. 89 Floor Carpet or Mat

1 – CARPET
2 – CAB

INSTALLATION

(1) Position the carpet in the cab and align all holes.
(2) Slide carpet under quarter panel trim and cab back panel trim.
(3) Install rear stowage tray/storage box.
(4) Install floor shift boot/floor console, if equipped.
(5) Install seat belt anchors.
(6) Install door sill and cowl trim covers.
(7) Install seat.

REARVIEW MIRROR

REMOVAL

(1) Loosen the mirror base setscrew (Fig. 90).
(2) Slide the mirror base upward and off the bracket.

INSTALLATION

(1) Position the mirror base at the bracket and slide it downward onto the support bracket.
(2) Tighten setscrew to1 N·m (9 in. lbs.) torque.

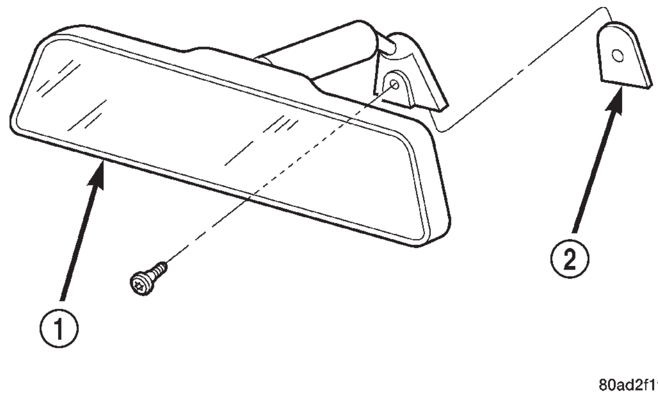


Fig. 90 Rearview Mirror

1 – MIRROR
2 – SUPPORT BUTTON

REARVIEW MIRROR SUPPORT BRACKET

INSTALLATION

(1) Mark the position for the mirror bracket on the outside of the windshield glass with a wax pencil.
(2) Clean the bracket contact area on the glass. Use a mild powdered cleanser on a cloth saturated with isopropyl (rubbing) alcohol. Finally, clean the glass with a paper towel dampened with alcohol.
(3) Sand the surface on the support bracket with fine grit-sandpaper. Wipe the bracket surface clean with a paper towel.
(4) Apply accelerator to the surface on the bracket according to the following instructions:
- Crush the vial to saturate the felt applicator.
- Remove the paper sleeve.
- Apply accelerator to the contact surface on the bracket.
- Allow the accelerator to dry for five minutes.
- Do not touch the bracket contact surface after the accelerator has been applied.

(5) Apply adhesive accelerator to the bracket contact surface on the windshield glass. Allow the accelerator to dry for one minute. Do not touch the glass contact surface after the accelerator has been applied.
(6) Install the bracket according to the following instructions:
- Apply one drop of adhesive at the center of the bracket contact-surface on the windshield glass.
- Apply an even coat of adhesive to the contact surface on the bracket.
- Align the bracket with the marked position on the windshield glass.
- Press and hold the bracket in place for at least one minute.

REMOVAL AND INSTALLATION (Continued)

NOTE: Verify that the mirror support bracket is correctly aligned, because the adhesive will cure rapidly.

(7) Allow the adhesive to cure for 8-10 minutes. Remove any excess adhesive with an alcohol-dampened cloth.

(8) Allow the adhesive to cure for an additional 8-10 minutes before installing the mirror.

SUNVISORS

NOTE: All vehicles with driver and passenger side airbags must have a colored-coded, 5-bullet point airbag warning label applied to the sunvisor face surface (in the stored position). When replacing the sunvisor, verify label availability and ensure the label is installed.

REMOVAL

(1) Remove the screws that attach the sunvisor arm support bracket to the headliner and the roof panel (Fig. 91).

(2) Detach the sunvisor from the visor supports.

(3) Remove the sunvisor from the headliner and roof panel.

(4) If necessary, remove the screw attaching the visor supports to the headliner and roof panel.

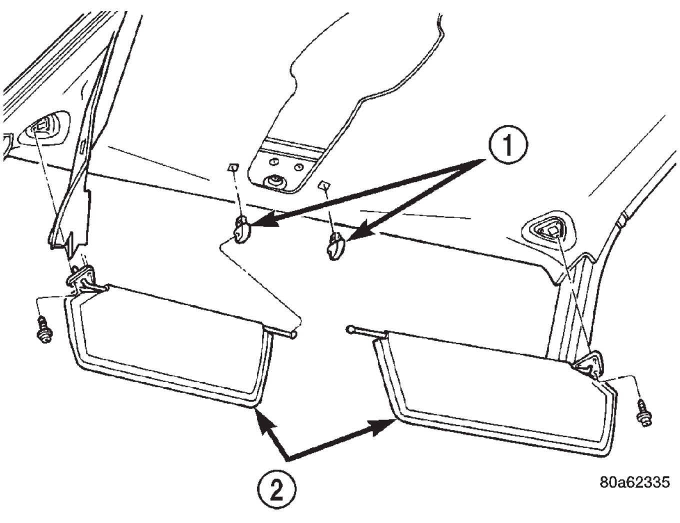


Fig. 91 Sunvisors

1 – VISOR SUPPORT
2 – SUNVISOR

INSTALLATION

(1) If removed, install the visor supports.

(2) Position the sunvisor in the visor supports and align the arm support bracket holes with the headliner holes.

(3) Install the screws that attach the sunvisor arm support bracket to the headliner and the roof panel.

COAT HOOK

REMOVAL

(1) Grasp both sides of the coat hook base and firmly pull outward to disengage the coat hook cover from the base. (Fig. 92) and (Fig. 93).

(2) Lift/rock the coat hook upward to disengage it from the roof panel.

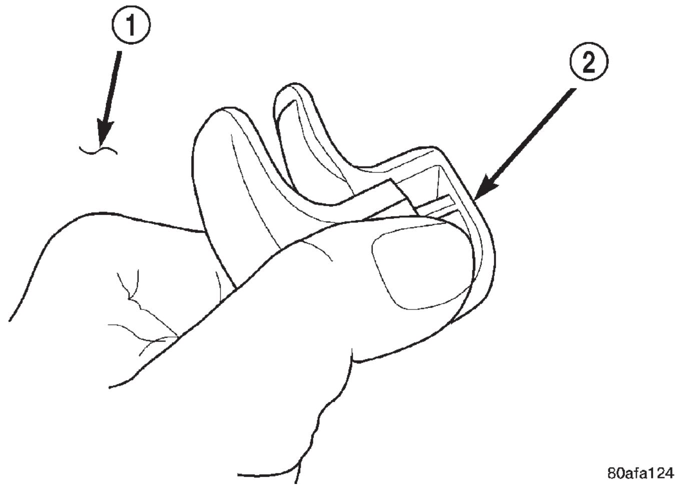


Fig. 92 Coat Hook Removal

1 – HEADLINER
2 – COAT HOOK

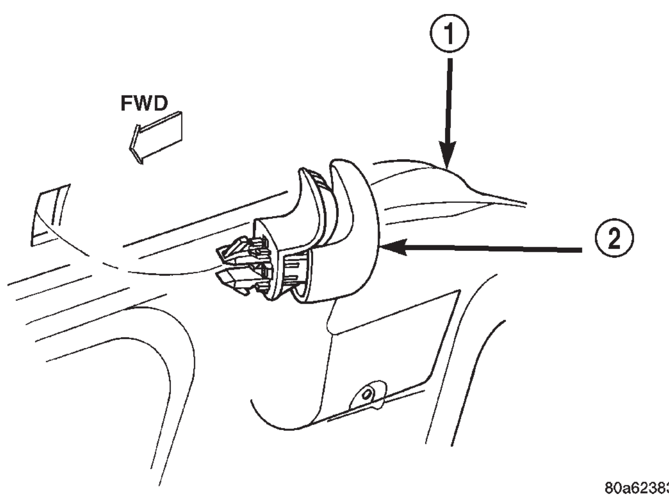


Fig. 93 Coat Hook

1 – CAB
2 – COAT HOOK

INSTALLATION

(1) Position coat hook in roof panel.

(2) Push the coat hook cover inward and secure the coat hook to the roof panel.

REMOVAL AND INSTALLATION (Continued)

QUAD CAB ASSIST HANDLE

REMOVAL

(1) Using a trim stick, remove the trim covering the assist handle attachment screws (Fig. 94).

(2) Remove the screw attaching the assist handle to the roof structure.

(3) Remove the assist handle.

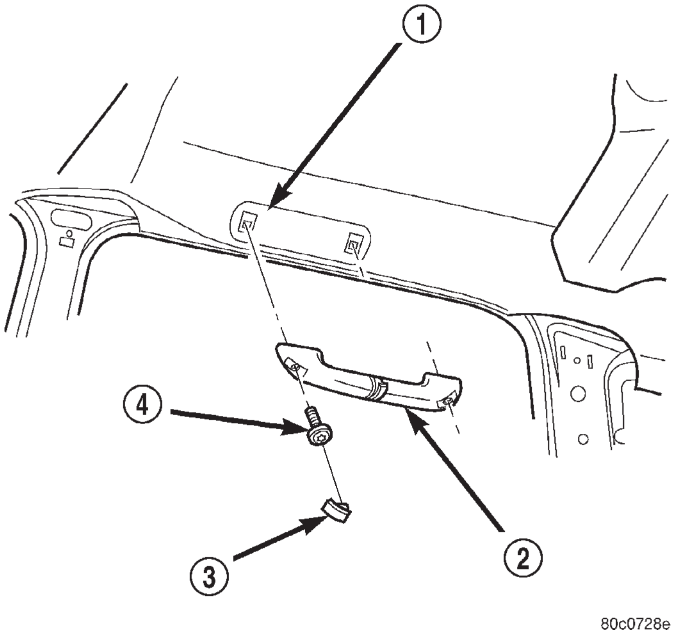


Fig. 94 Assist Handle

1 – HEADLINER
2 – GRAB HANDLE
3 – PUSH IN COVER
4 – SCREW

INSTALLATION

(1) Position the assist handle on the roof structure and headliner.

(2) Install the screws attaching the assist handle to the headliner and roof structure.

(3) Snap in the trim covers.

HEADLINER

REMOVAL

(1) Remove sun visors and visor hooks.

(2) Remove coat hooks.

(3) Remove overhead console, if equipped. Refer to Group 8V, Overhead Console for removal procedure.

(4) Remove A-pillar trim.

(5) Remove quarter trim/B-pillar trim panels.

(6) Remove dome lamp. Refer to Group 8L, Lamps for removal procedure.

(7) Separate headliner from roof panel (Fig. 95) and (Fig. 96).

(8) Extract headliner through door opening.

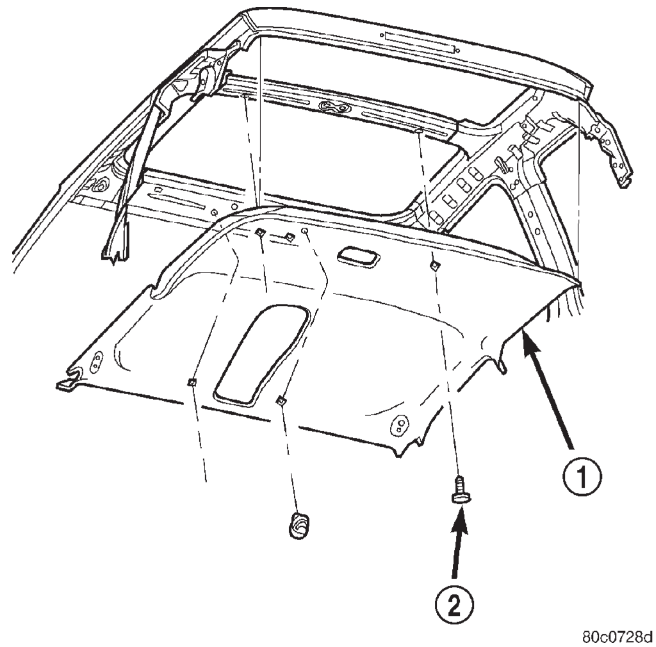


Fig. 95 Quad Cab Headliner

1 – HEADLINER
2 – PUSH IN FASTENER

INSTALLATION

(1) Position headliner in vehicle.

(2) Install dome lamp.

(3) Install quarter/B-pillar trim panels.

(4) Install A-pillar trim.

(5) Install overhead console, if equipped.

(6) Install coat hooks.

(7) Install sun visors and visor hooks.

ADJUSTMENTS

HOOD

(1) Loosen the hinge arm-to-hood panel bolts at each side of the vehicle.

(2) Loosen the hood latch screws.

(3) Close the hood. Adjust the fore/aft position.

(4) Raise the hood. Tighten the hinge arm-to-hood panel bolts.

(5) Tighten the latch screws.

(6) Lower the hood. Inspect clearance between the hood and the cowl cover.

HOOD LATCH STRIKER

(1) Open the hood.

(2) Loosen the latch striker screws.

(3) Slowly close the hood and observe the latching operation.

(3) As necessary, adjust the striker position. Tighten the screws.

ADJUSTMENTS (Continued)

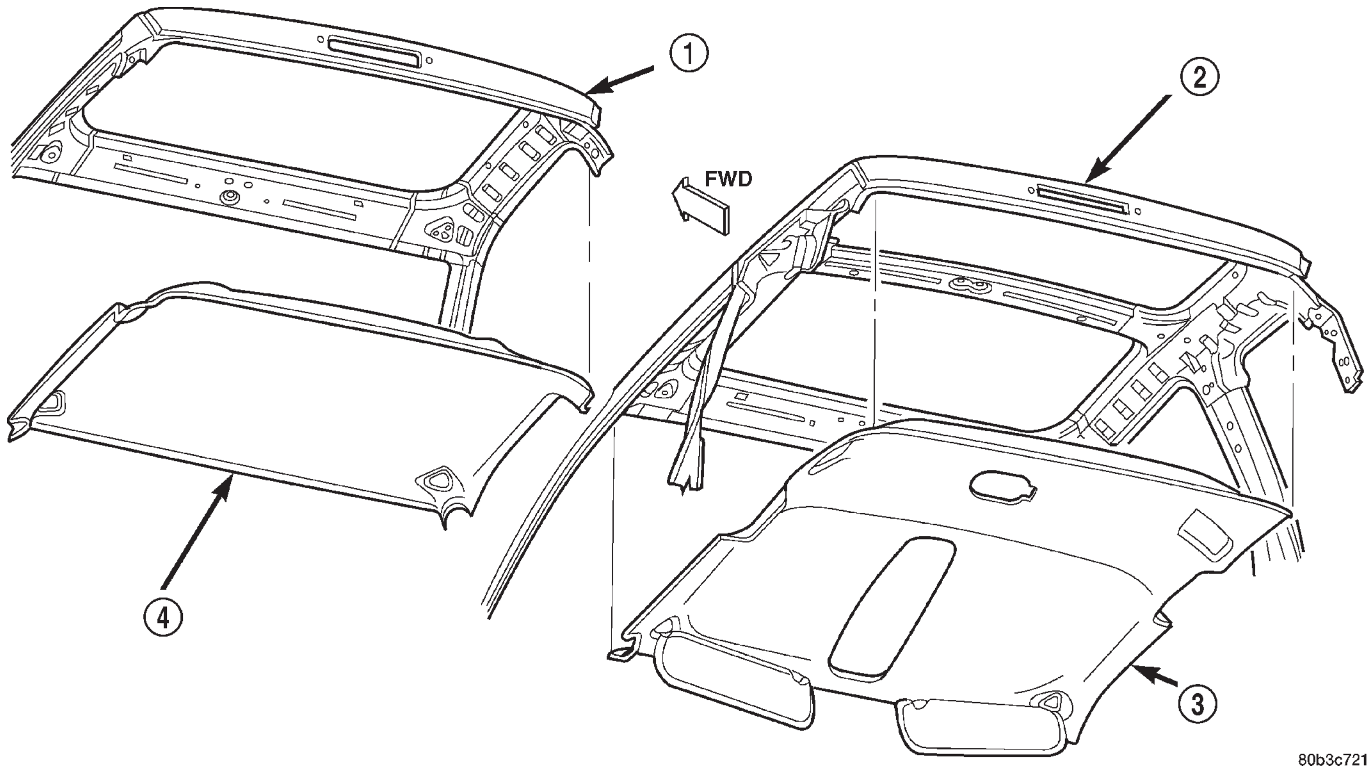


Fig. 96 Headliner

1 – STANDARD CAB
2 – EXTENDED CAB
3 – HEADLINER
4 – HEADLINER

HOOD LATCH

(1) Open the hood.
(2) Loosen the hood latch screws.
(3) Move the latch to the correct location and lightly tighten the screws.
(4) Close the hood slowly and observe the latching operation.
(5) As necessary, adjust the latch position and tighten the screws.

FRONT DOOR LATCH

(1) Insert a torx driver through the round hole in the door end frame near the latch striker opening (Fig. 97).
(2) Loosen torx head screw on the side of the latch linkage.
(3) Lift upward on outside door handle and release it.
(4) Tighten torx head screw on latch.
(5) Verify latch operation.

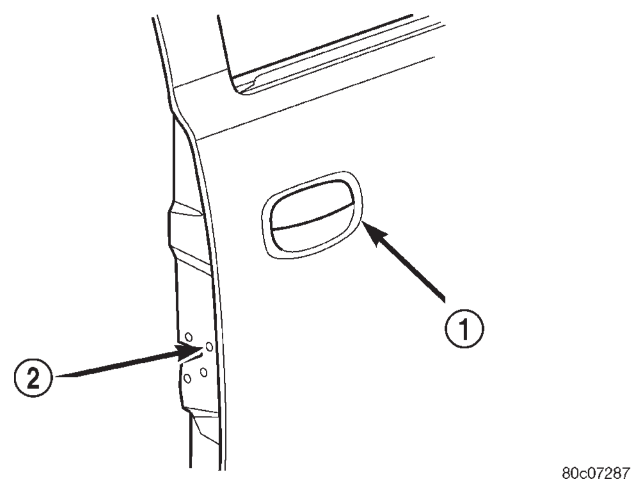


Fig. 97 Door Latch Adjustment

1 – OUTSIDE DOOR HANDLE
2 – DOOR LATCH ADJUSTMENT ACCESS

FRONT DOOR IN/OUT

In/out door adjustment is done by loosening the hinge to door fasteners. Then move the door to the correct position.
(1) Support the door with a padded floor jack.
(2) Loosen the applicable hinge to door fasteners. Move the door to the correct in/out position.
(3) If necessary, loosen the other hinge to door fasteners and move the door to the correct in/out position.
(4) Tighten the hinge to door fasteners.
(5) Remove the floor jack from the door.

ADJUSTMENTS (Continued)

FRONT DOOR UP/DOWN

Up/down door adjustment is done by loosening the hinge to cowl fasteners at both hinges. Then move the door to the correct position.

(1) Support the door with a padded floor jack.

(2) Loosen hinge to cowl fasteners at both hinges. Move the door to the correct up/down position.

(3) Tighten the hinge to cowl fasteners.

(4) Remove the floor jack from the door.

REAR DOOR ADJUSTMENT

Minor adjustment for alignment of the door is made by moving the latch striker

In and Out

(1) Loosen the latch striker.

(2) Tap the latch striker inward if the door character line is outboard of the body character line or tap the latch striker outward if the door character line is inboard of the body character line.

(3) Inspect alignment. If correct, tighten striker to 28 N·m (20 ft. lbs.) torque.

Up and Down

(1) Loosen the latch striker.

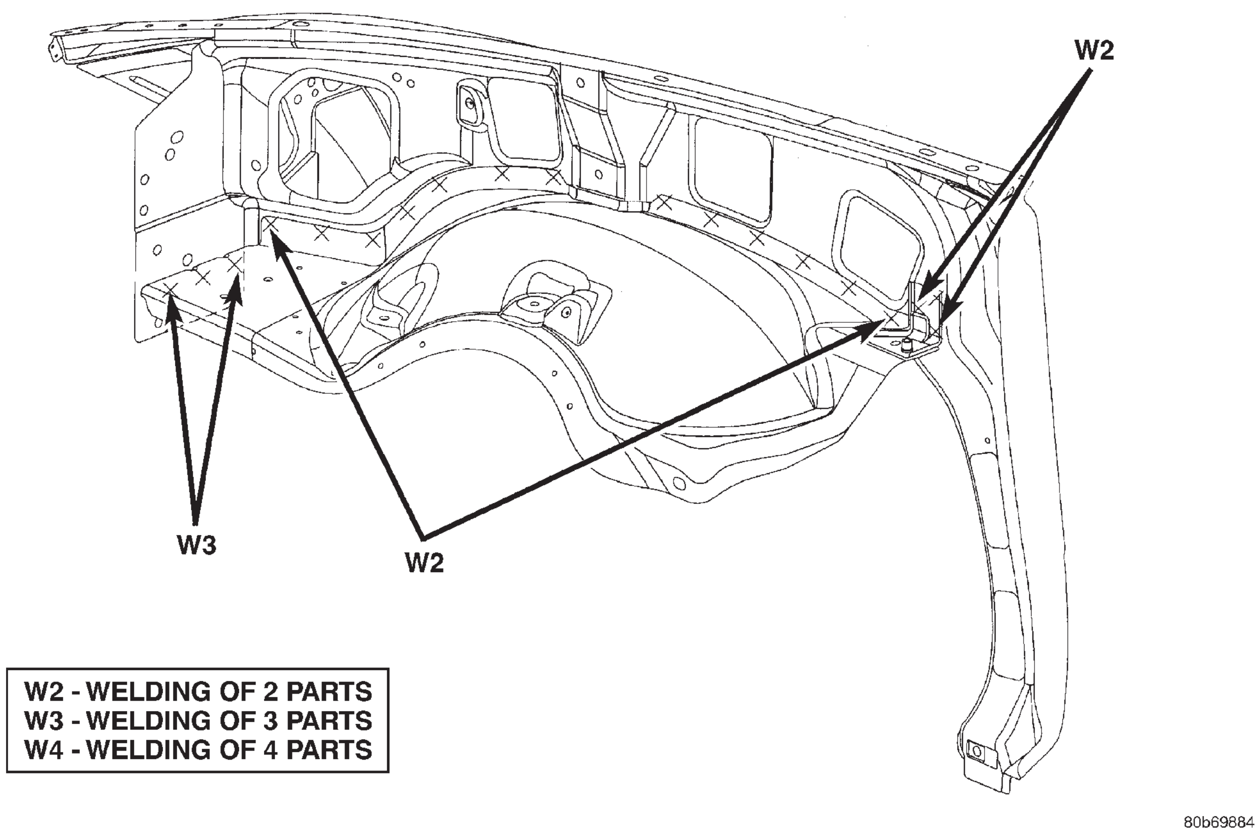
(2) Tap the latch striker downward if the door character line is higher than the body character line or tap the latch striker upward if the door character line is lower than the body character line.

(3) Inspect alignment. If correct, tighten striker to 28 N·m (20 ft. lbs.) torque.

SPECIFICATIONS

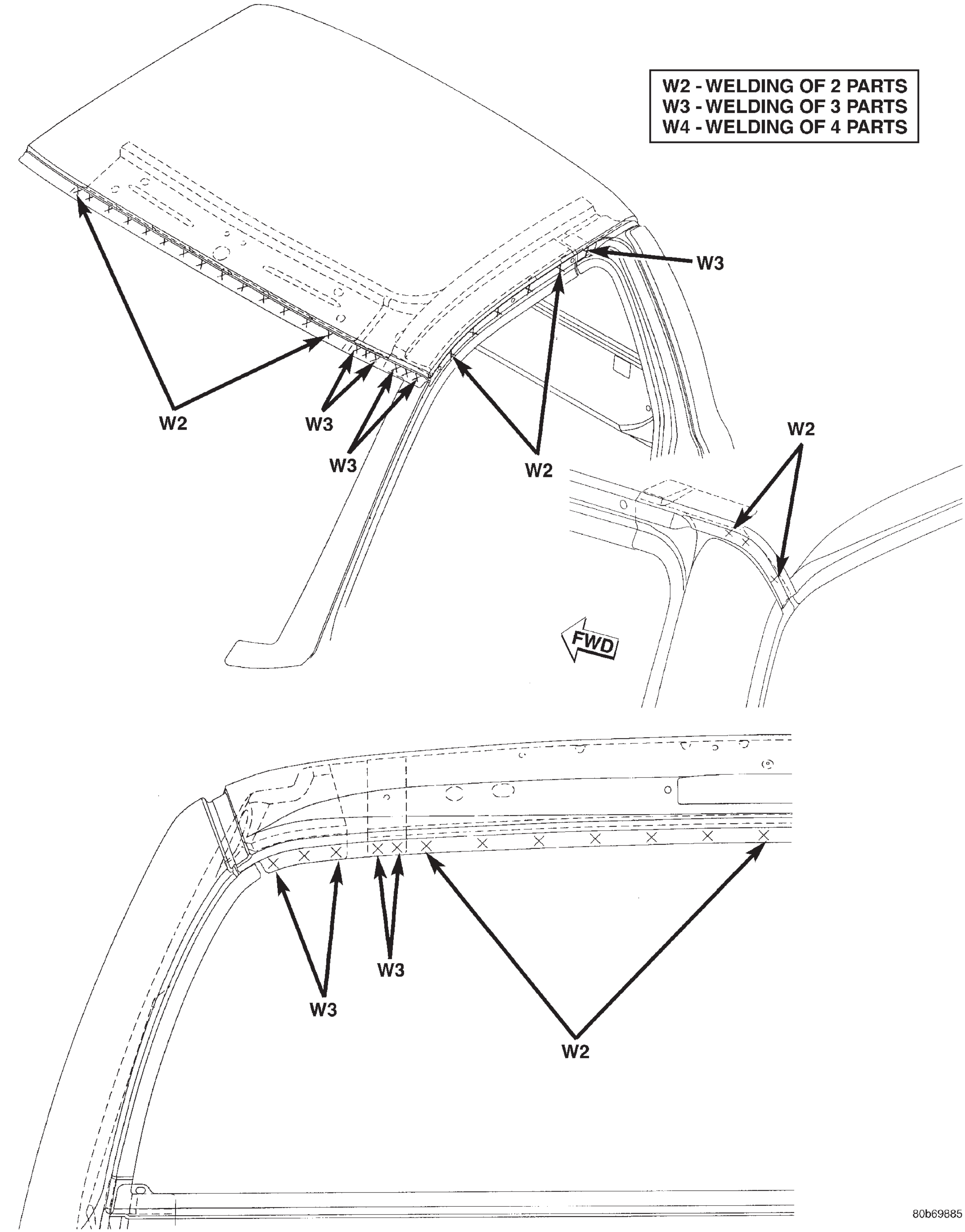
WELD LOCATIONS

FRONT FENDER AND INNER WHEELHOUSE



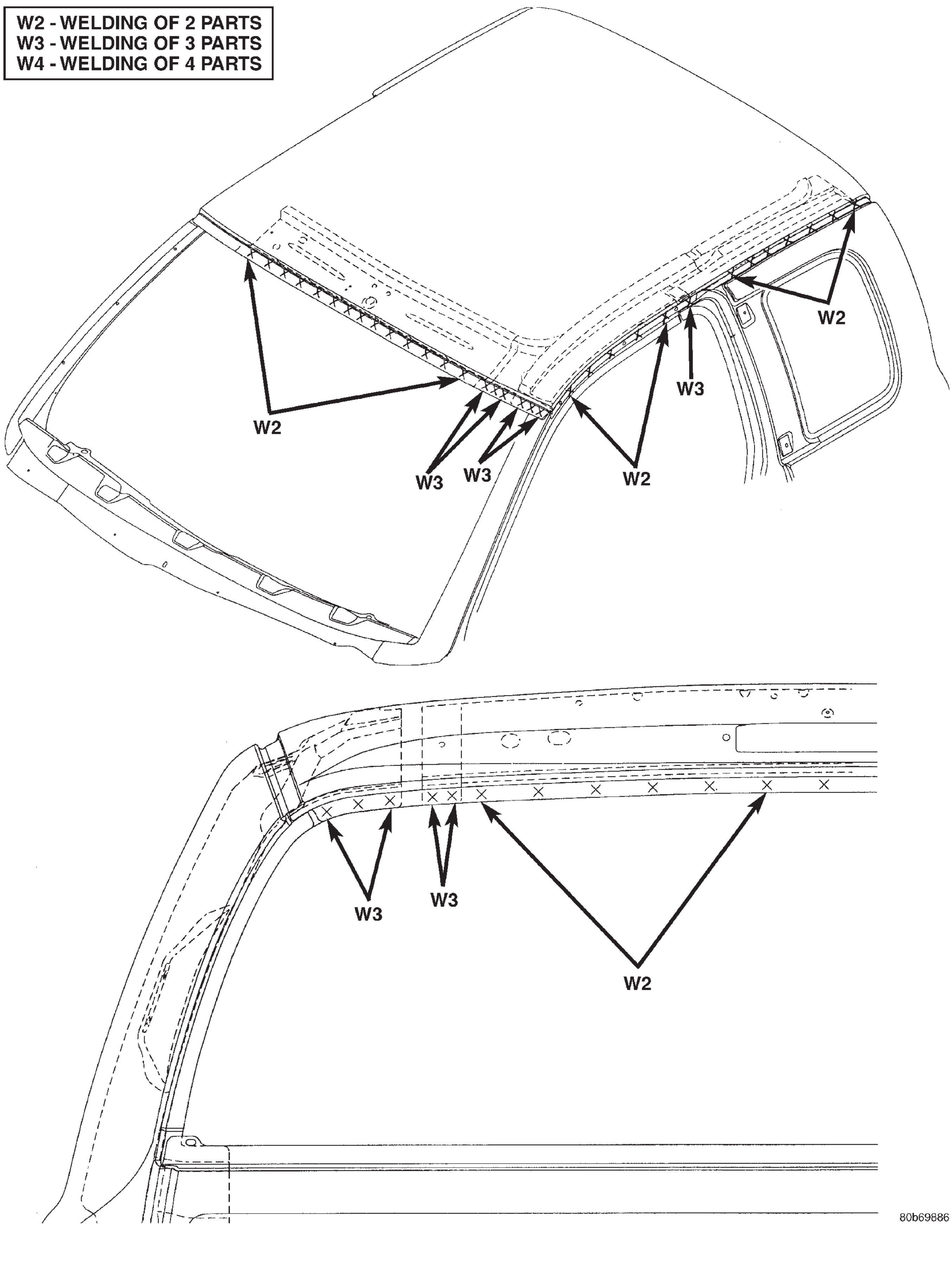
SPECIFICATIONS (Continued)

ROOF PANEL—REGULAR CAB



SPECIFICATIONS (Continued)

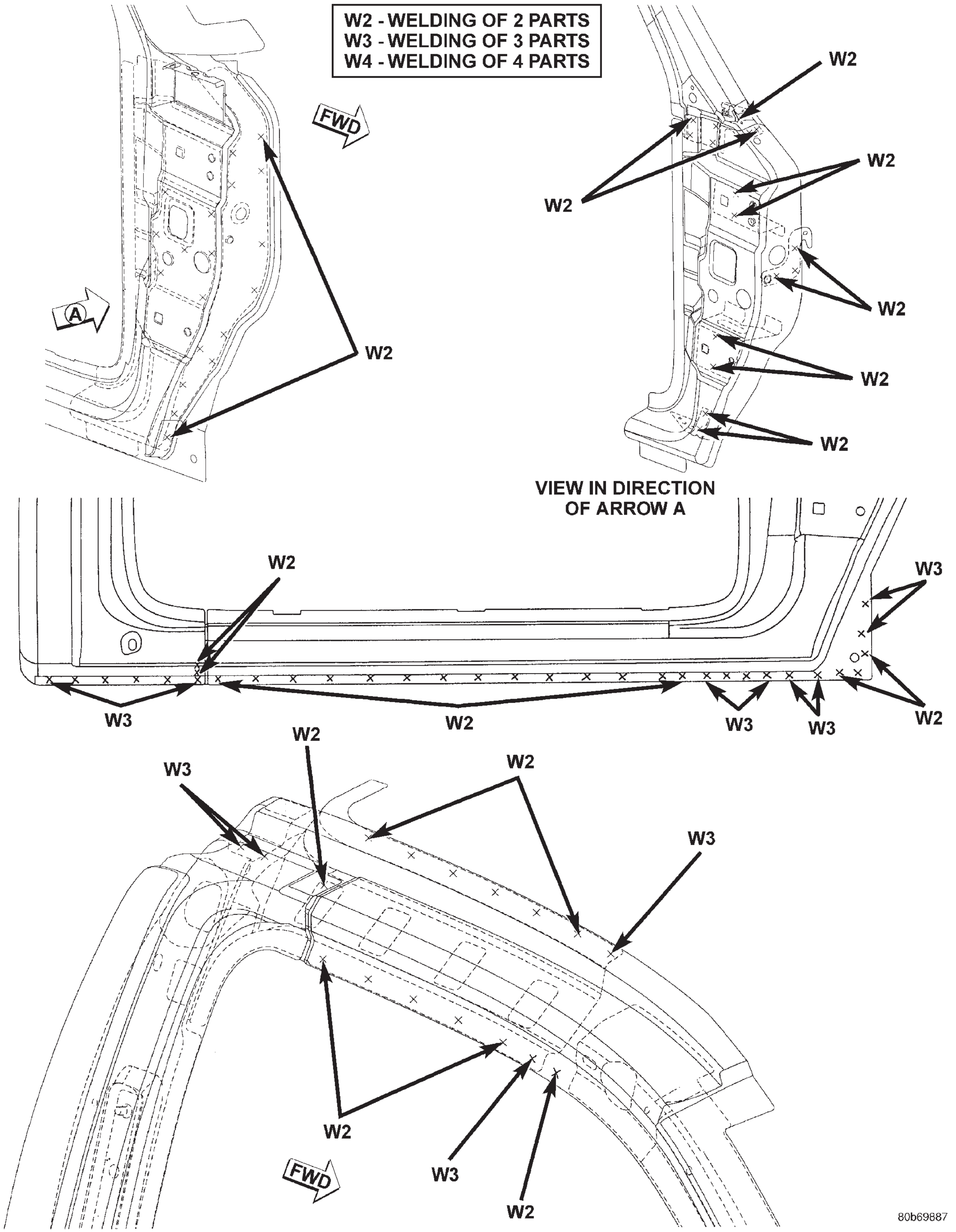
ROOF PANEL—CLUB CAB



80b69886

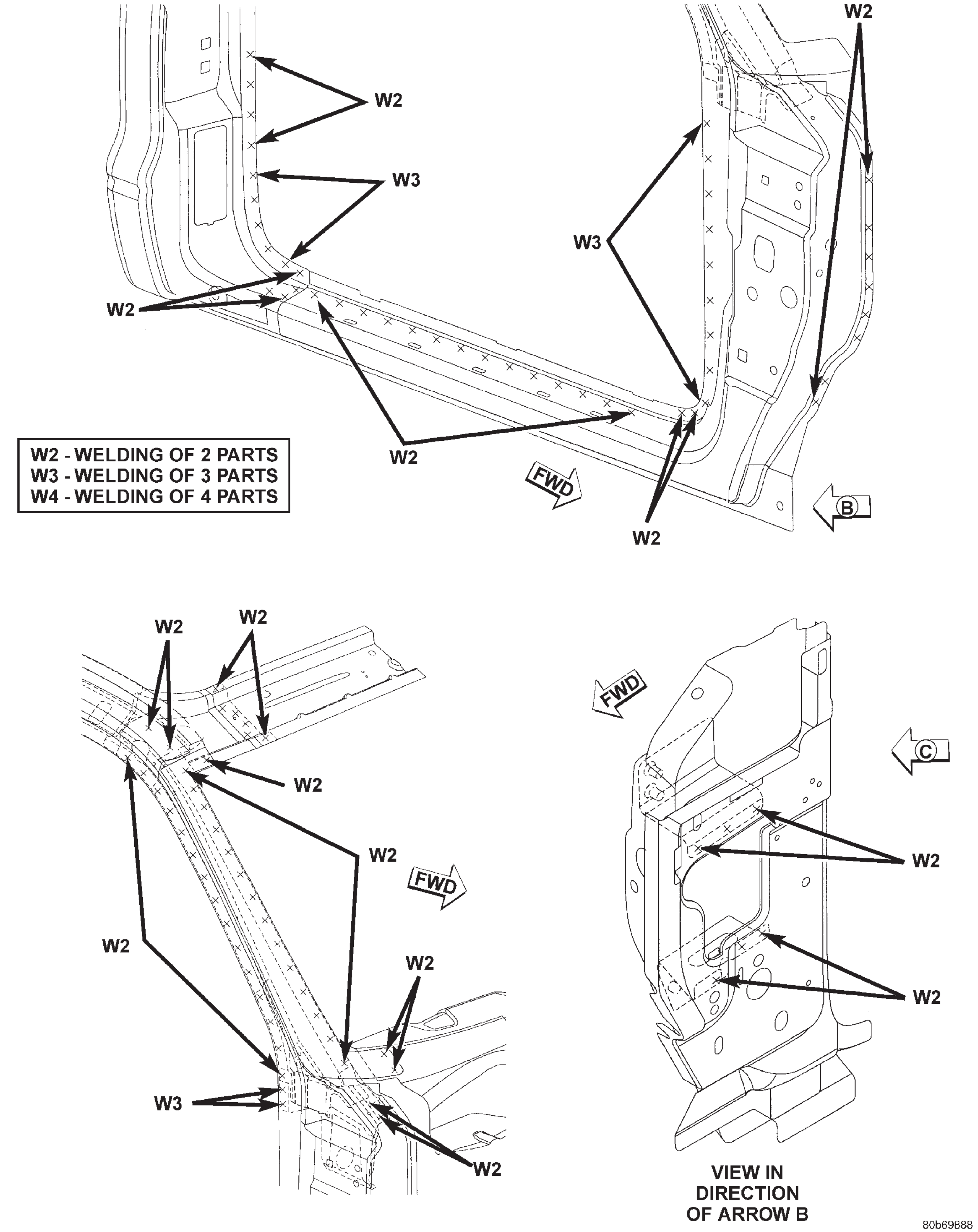
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—REGULAR CAB



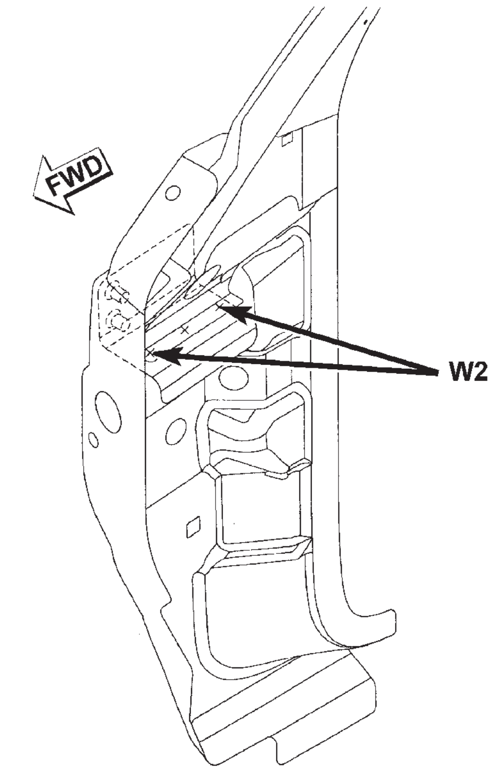
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—REGULAR CAB



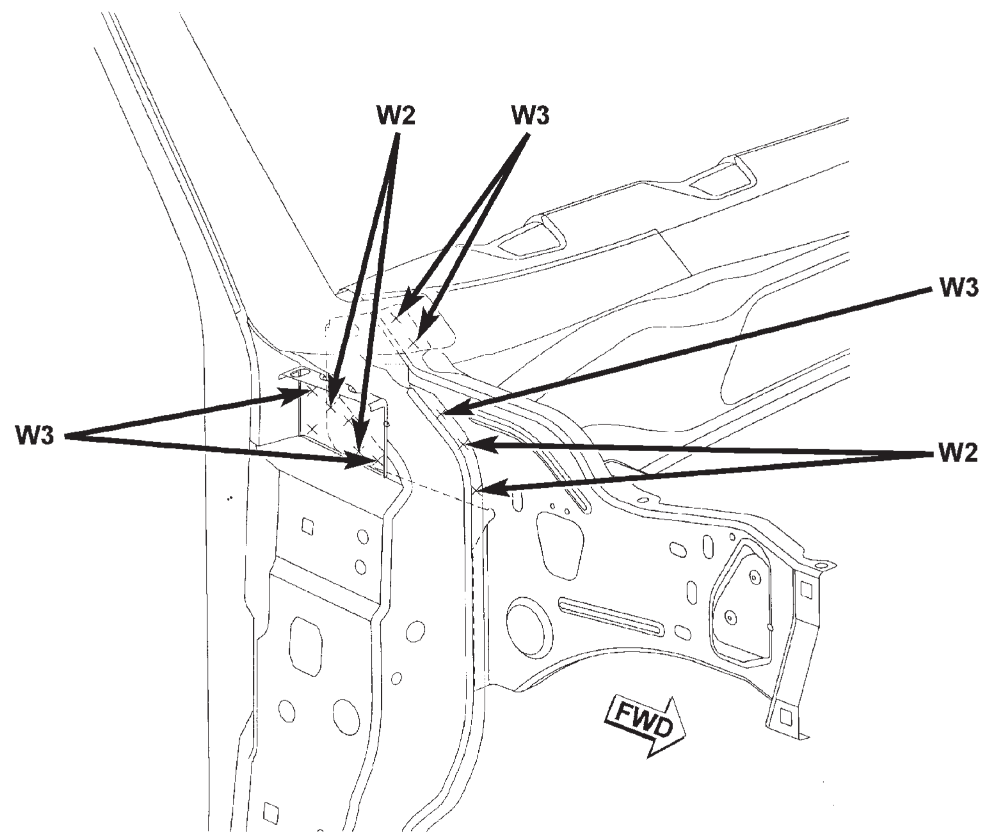
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—REGULAR CAB



W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

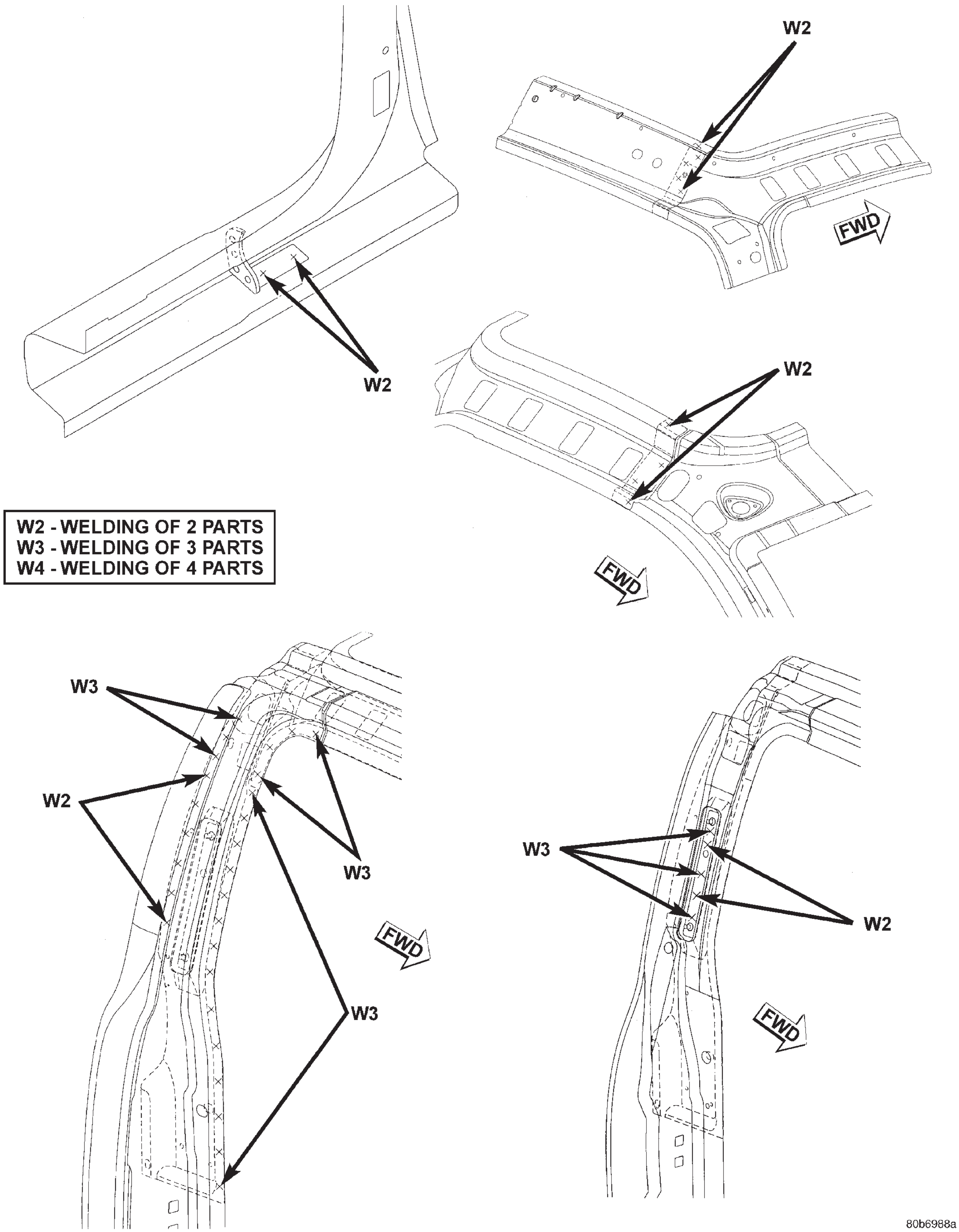
VIEW IN DIRECTION OF ARROW C



80b69889

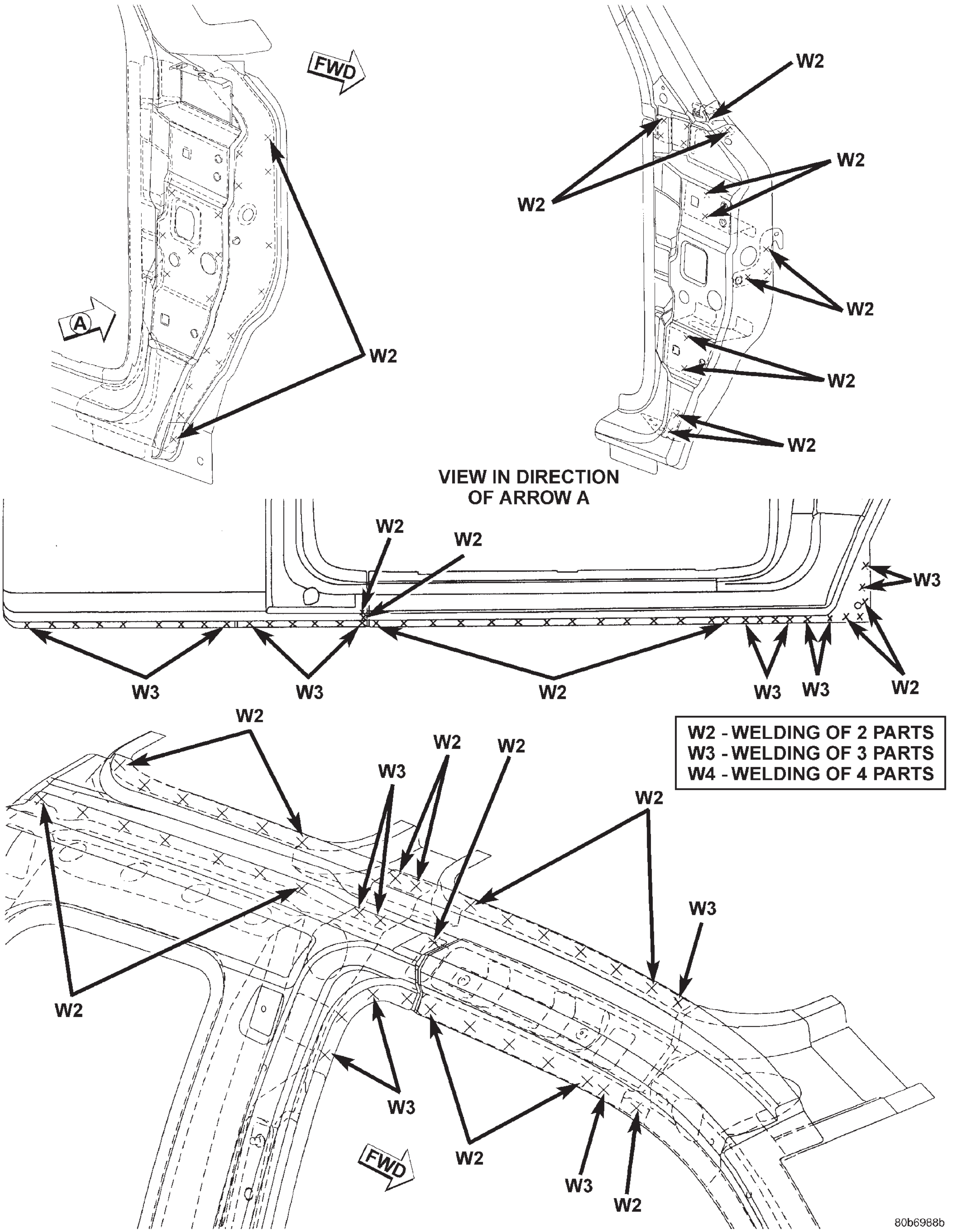
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—REGULAR CAB



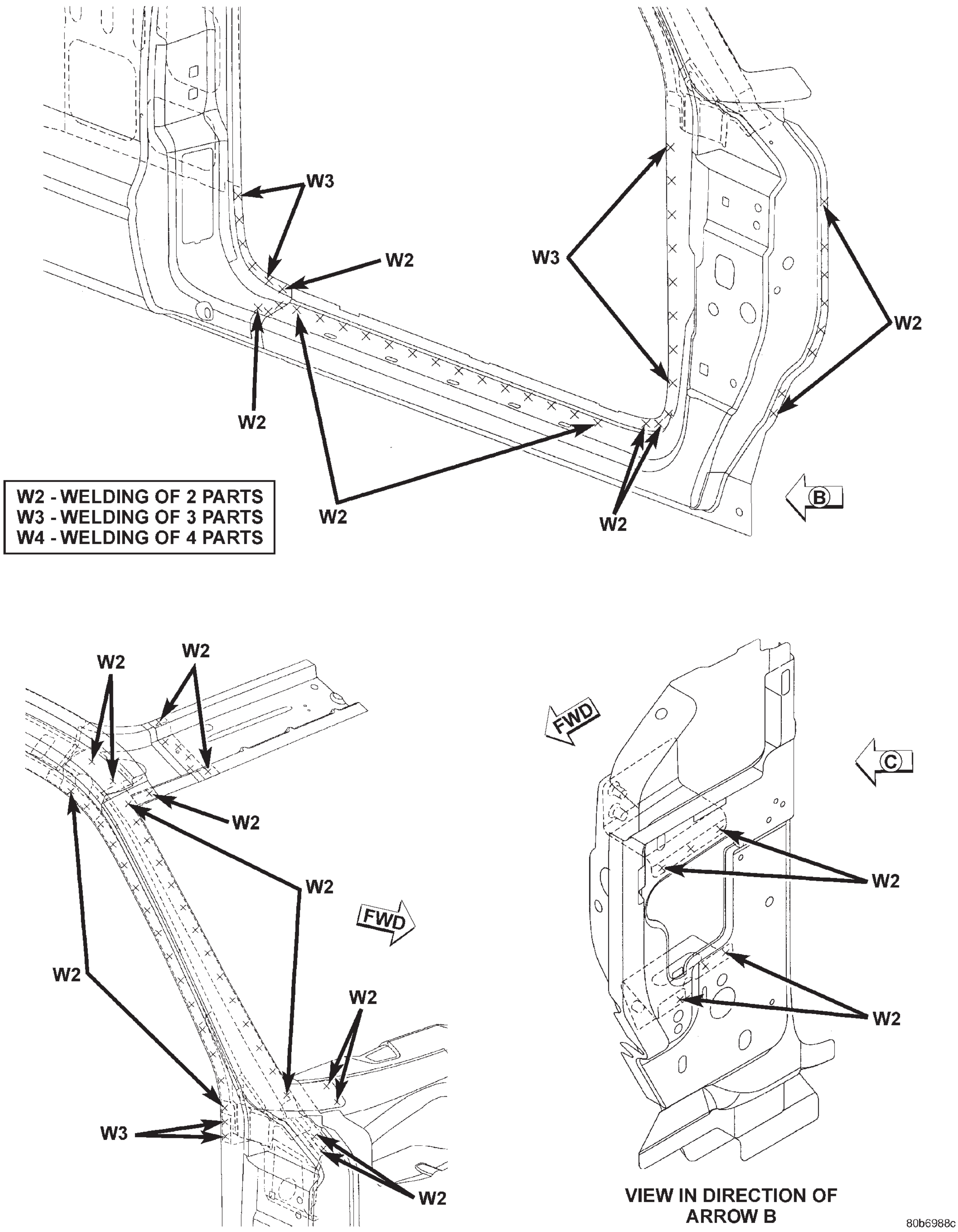
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—CLUB CAB



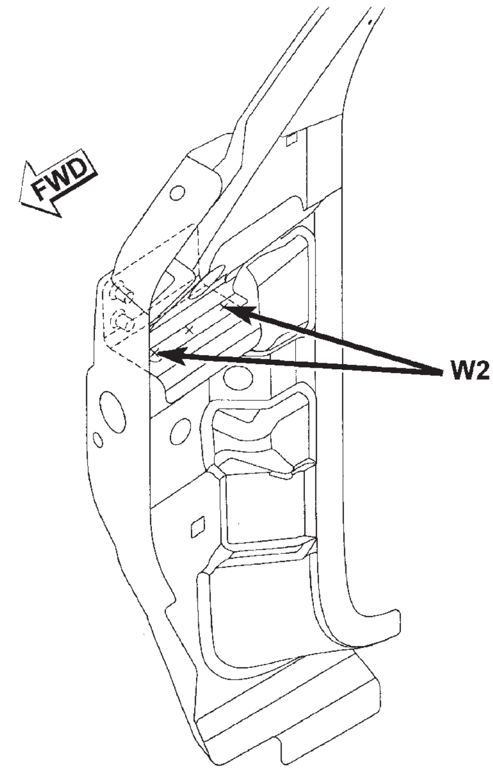
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—CLUB CAB



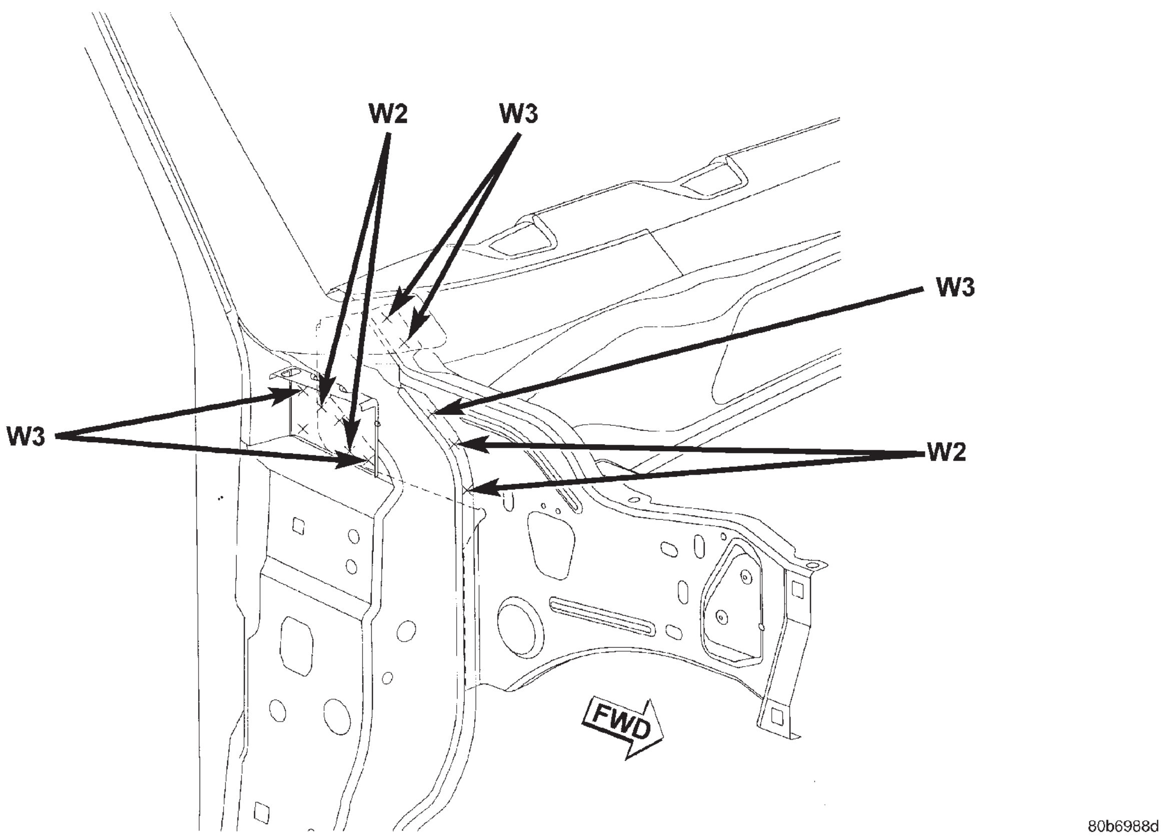
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—CLUB CAB



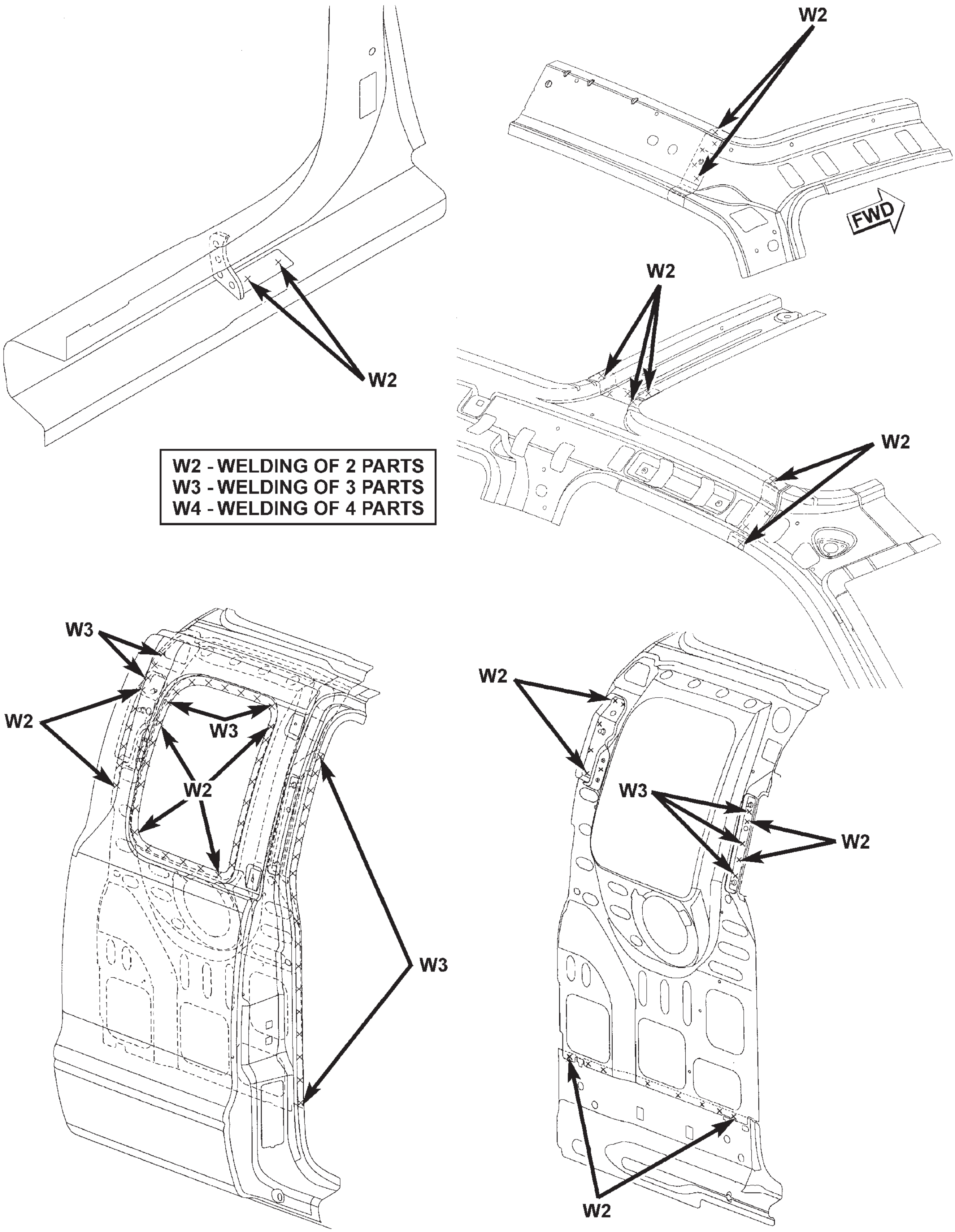
W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

VIEW IN DIRECTION OF ARROW C



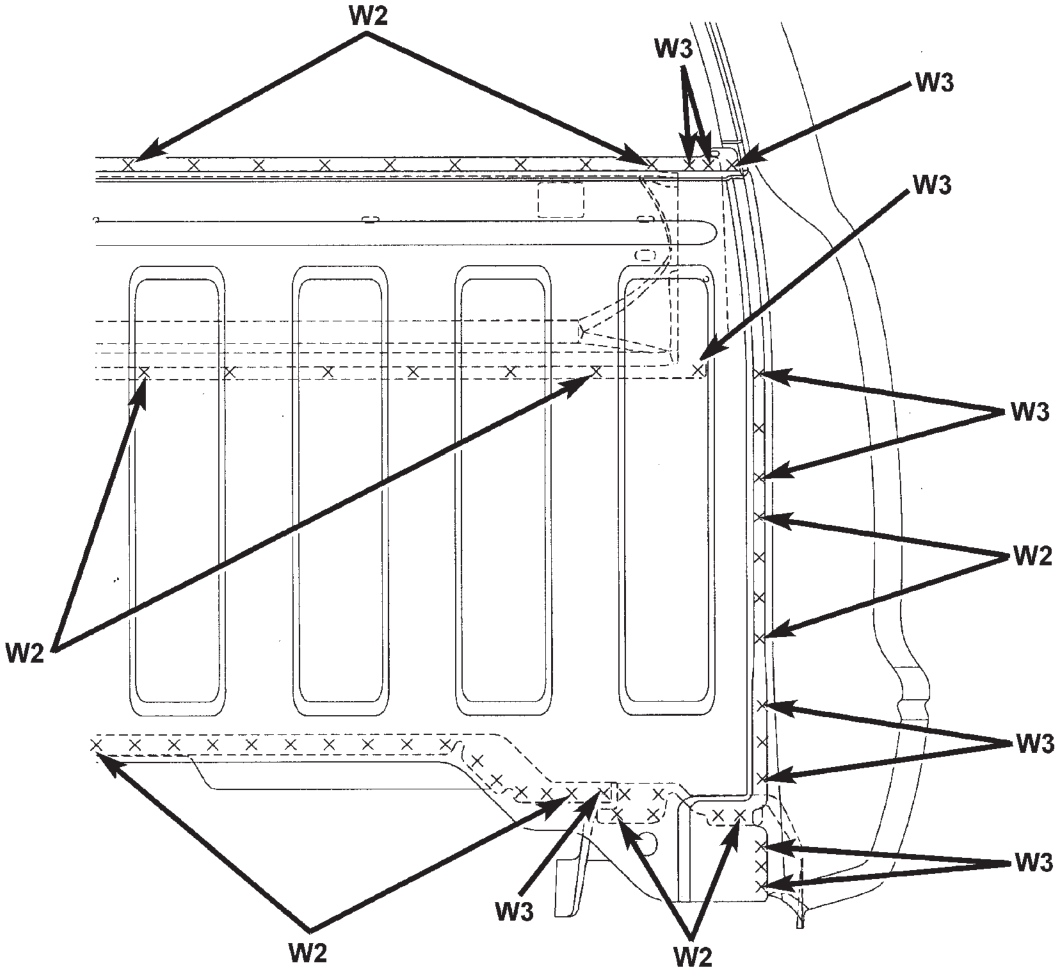
SPECIFICATIONS (Continued)

BODY SIDE APERTURE—CLUB CAB



SPECIFICATIONS (Continued)

CAB BACK PANEL—REGULAR CAB

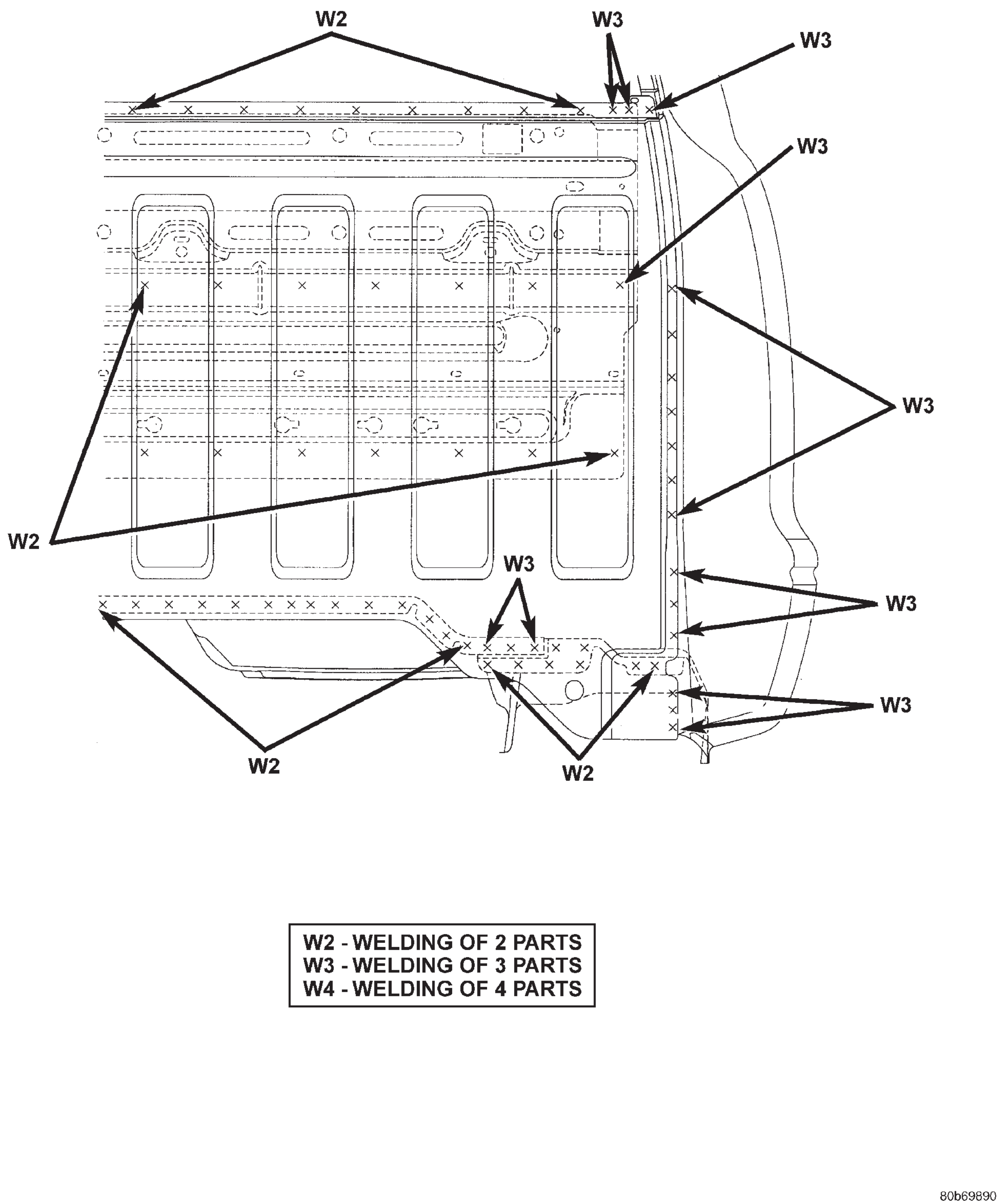


W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

80b6988f

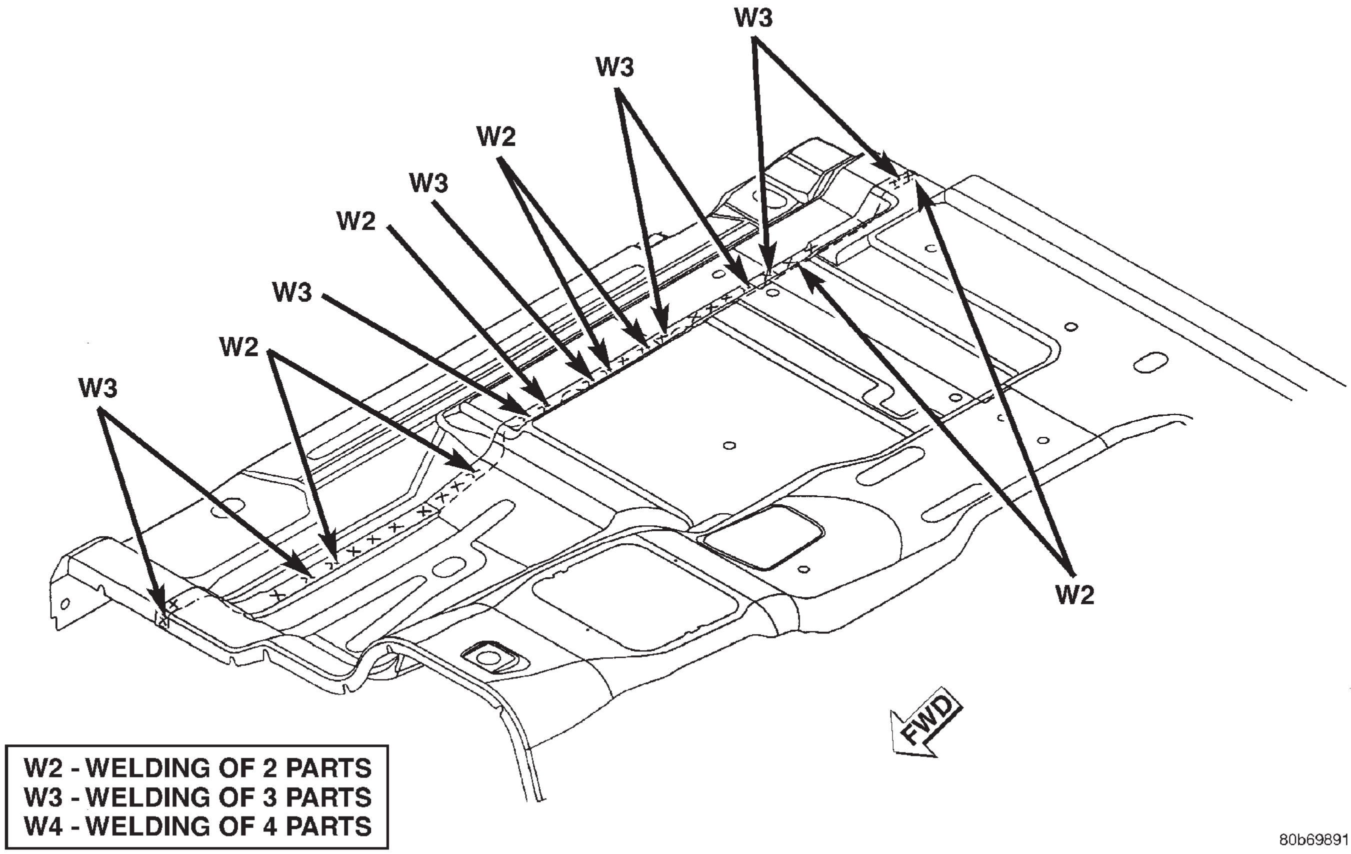
SPECIFICATIONS (Continued)

CAB BACK PANEL—CLUB CAB

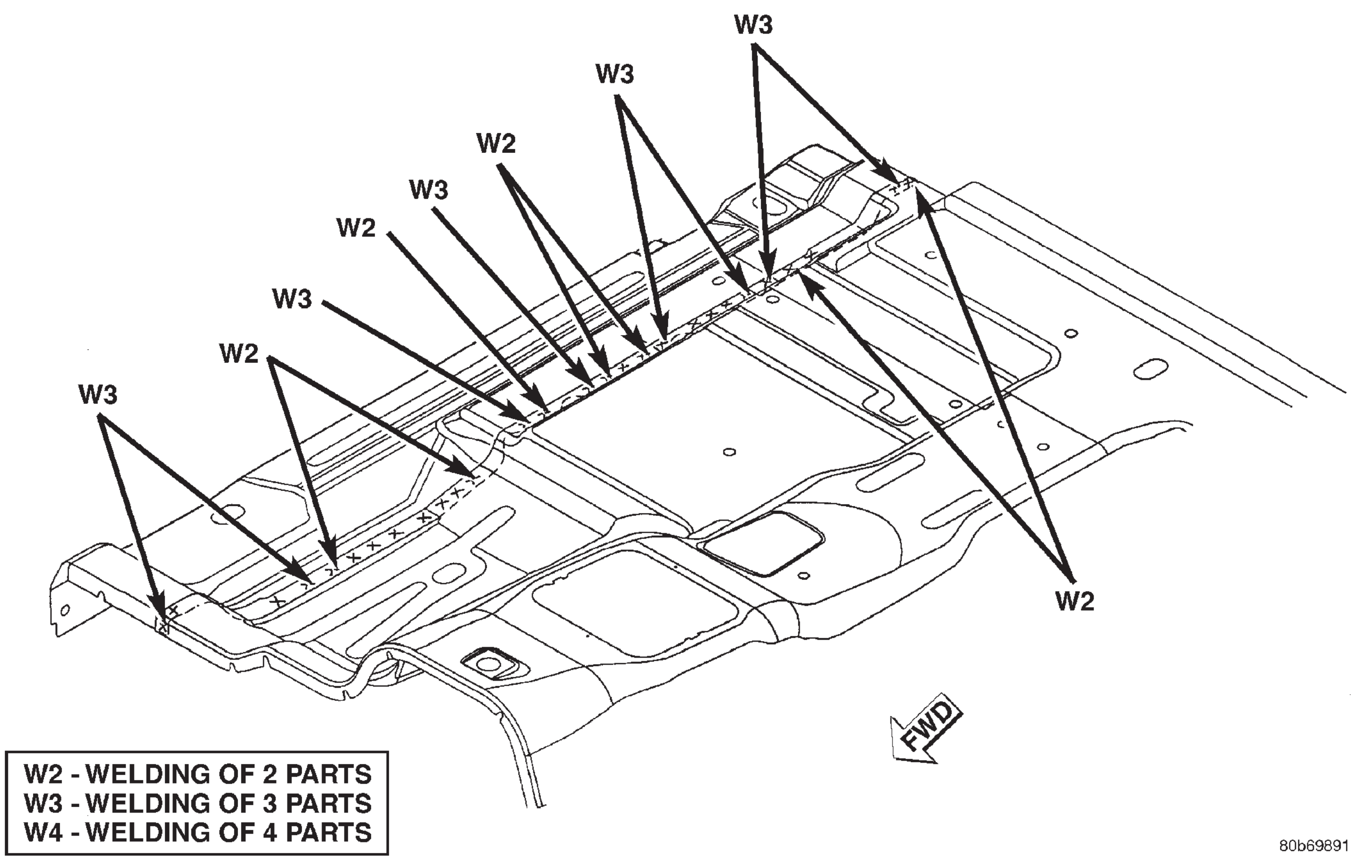


SPECIFICATIONS (Continued)

FLOOR PAN—REGULAR CAB

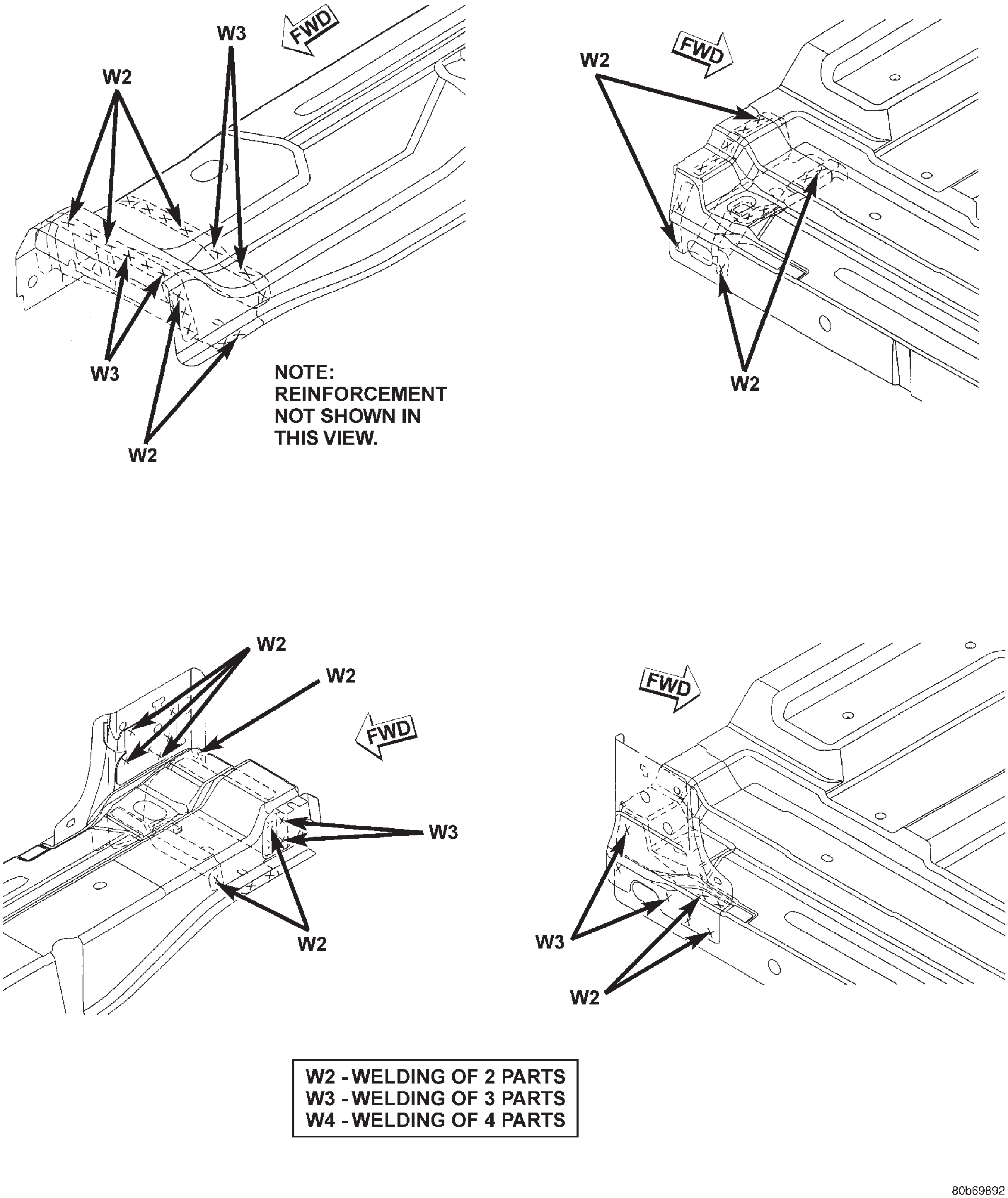


FLOOR PAN—REGULAR CAB



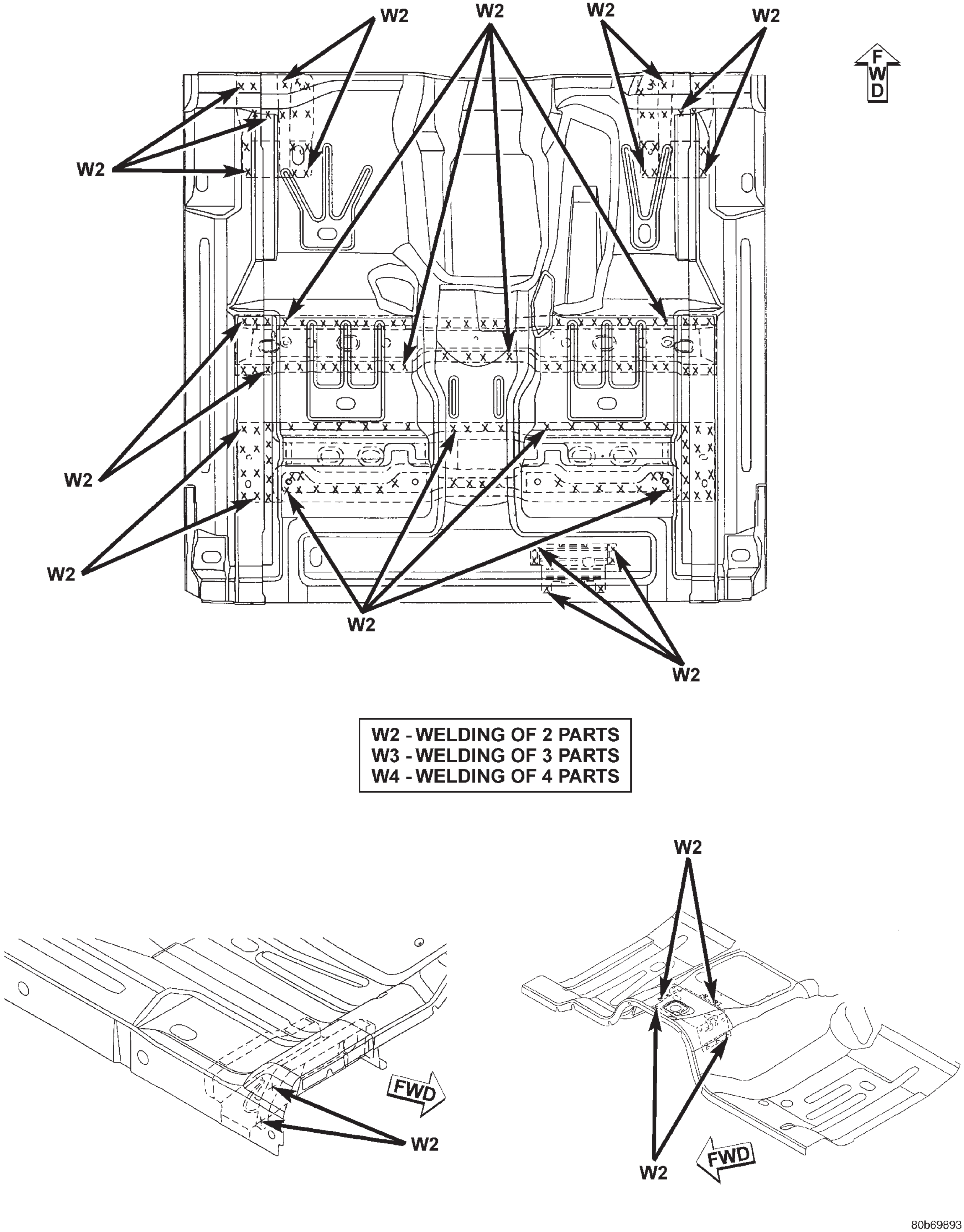
SPECIFICATIONS (Continued)

FLOOR PAN—REGULAR CAB



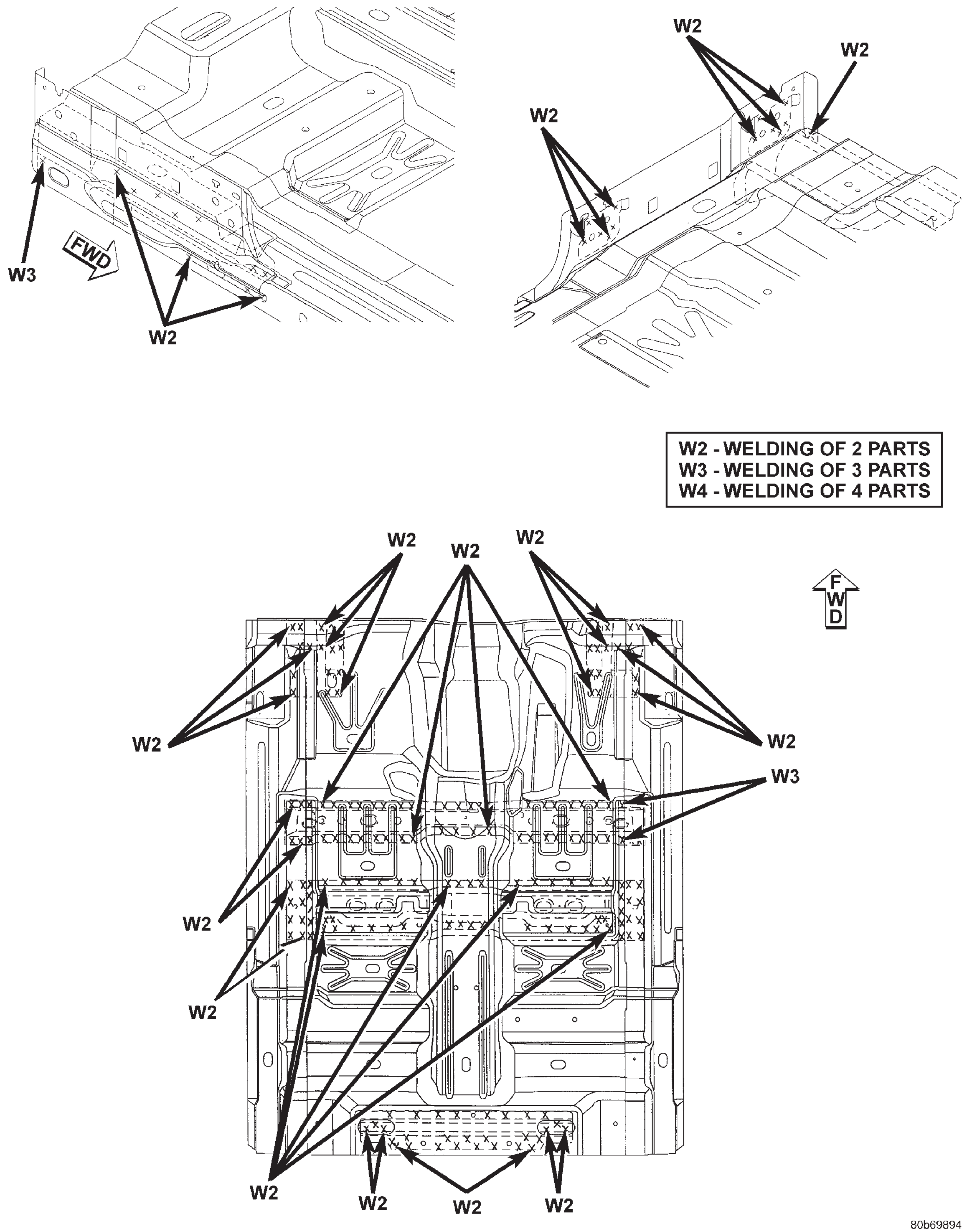
SPECIFICATIONS (Continued)

FLOOR PAN—CLUB CAB



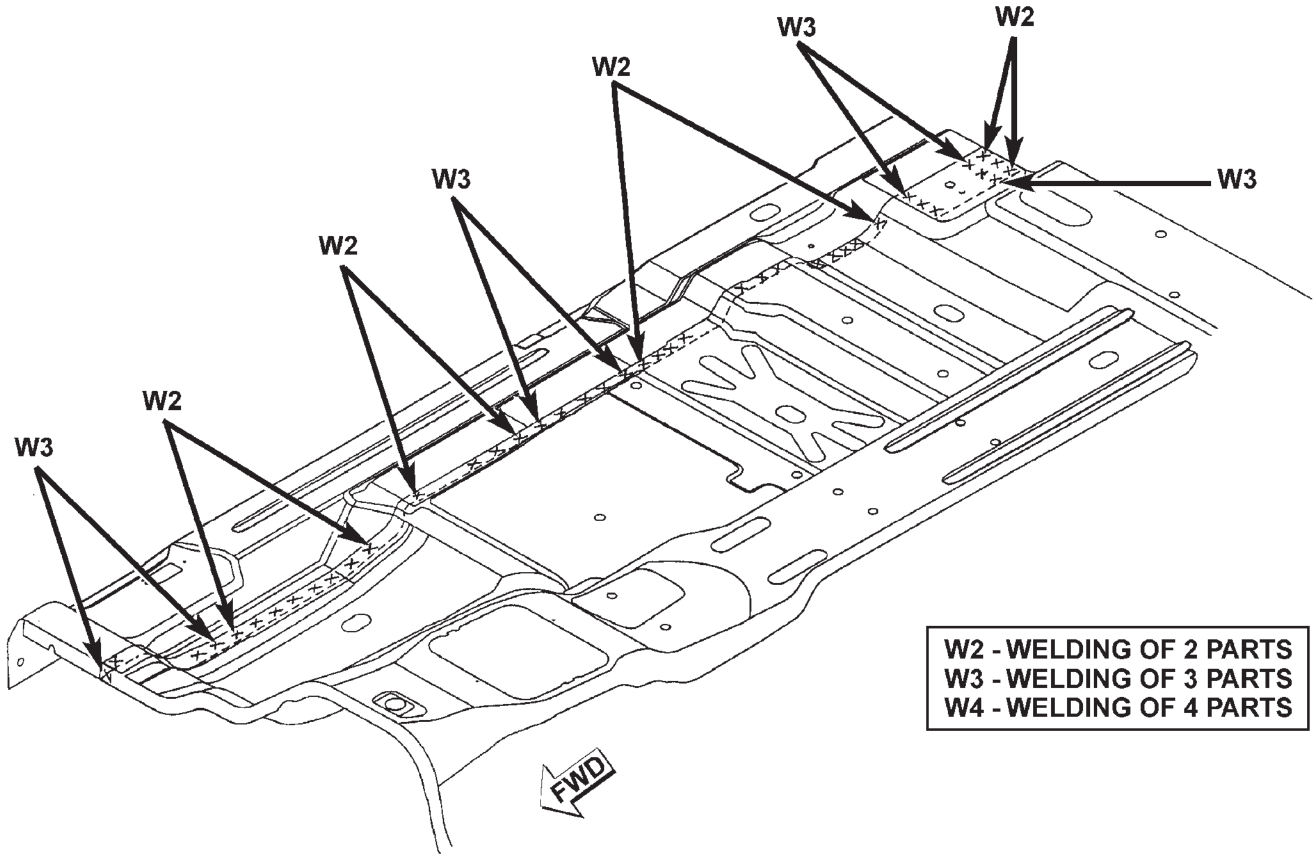
SPECIFICATIONS (Continued)

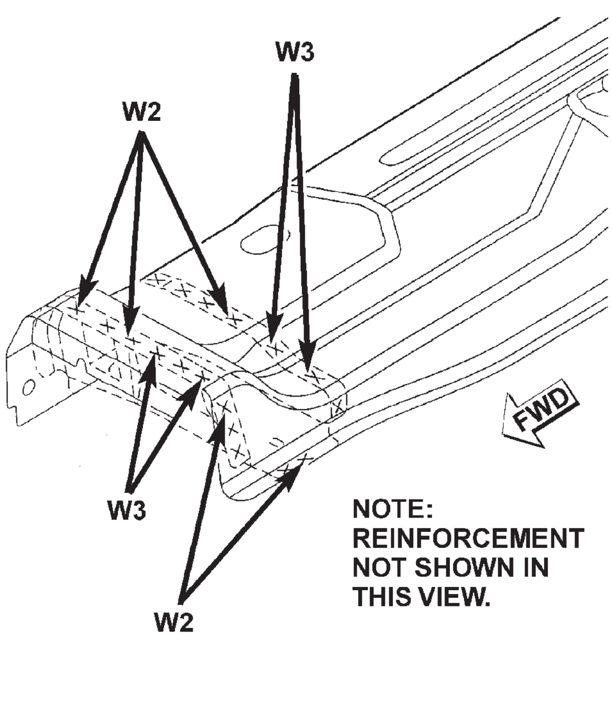
FLOOR PAN—CLUB CAB

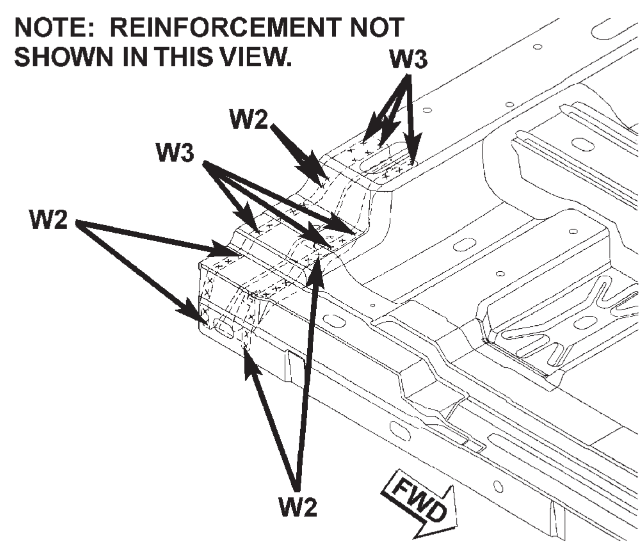


SPECIFICATIONS (Continued)

FLOOR PAN—CLUB CAB



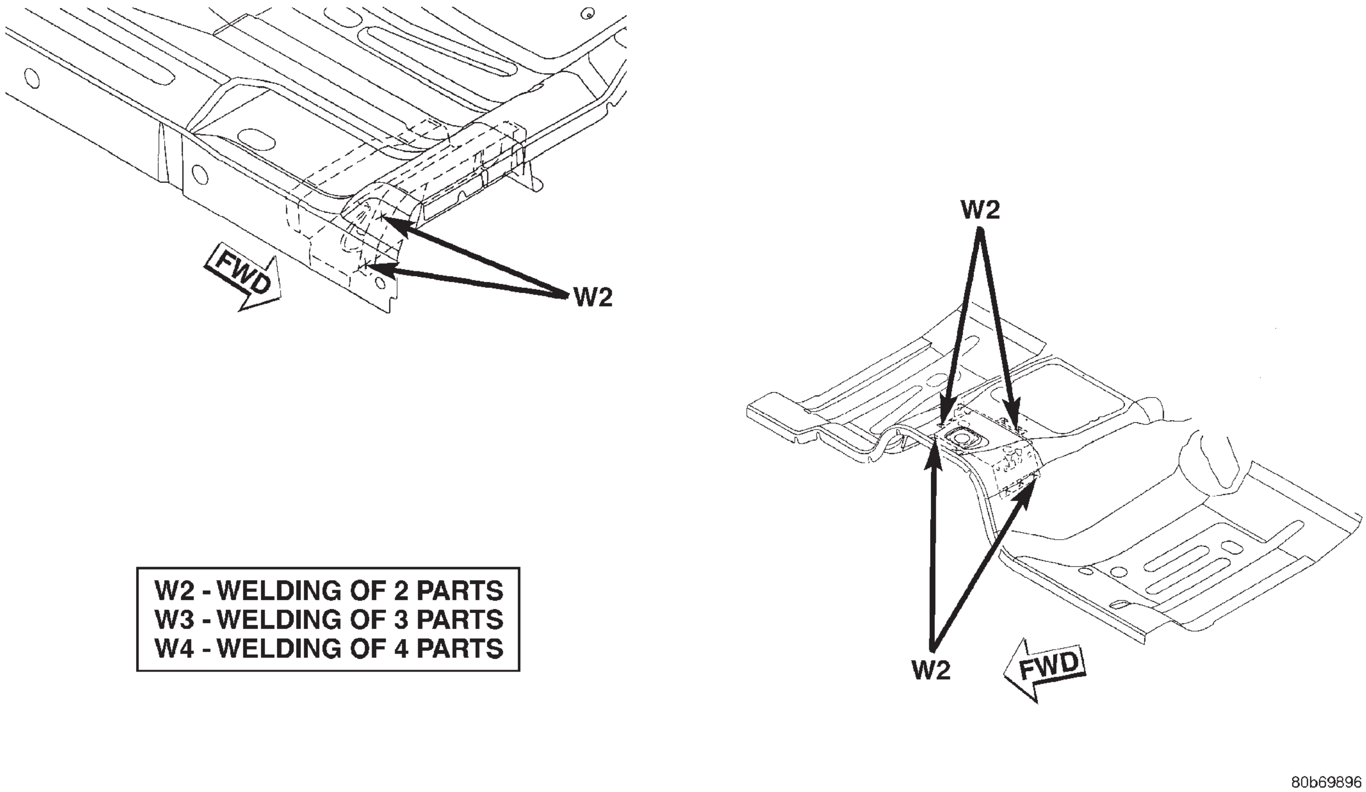




80b69895

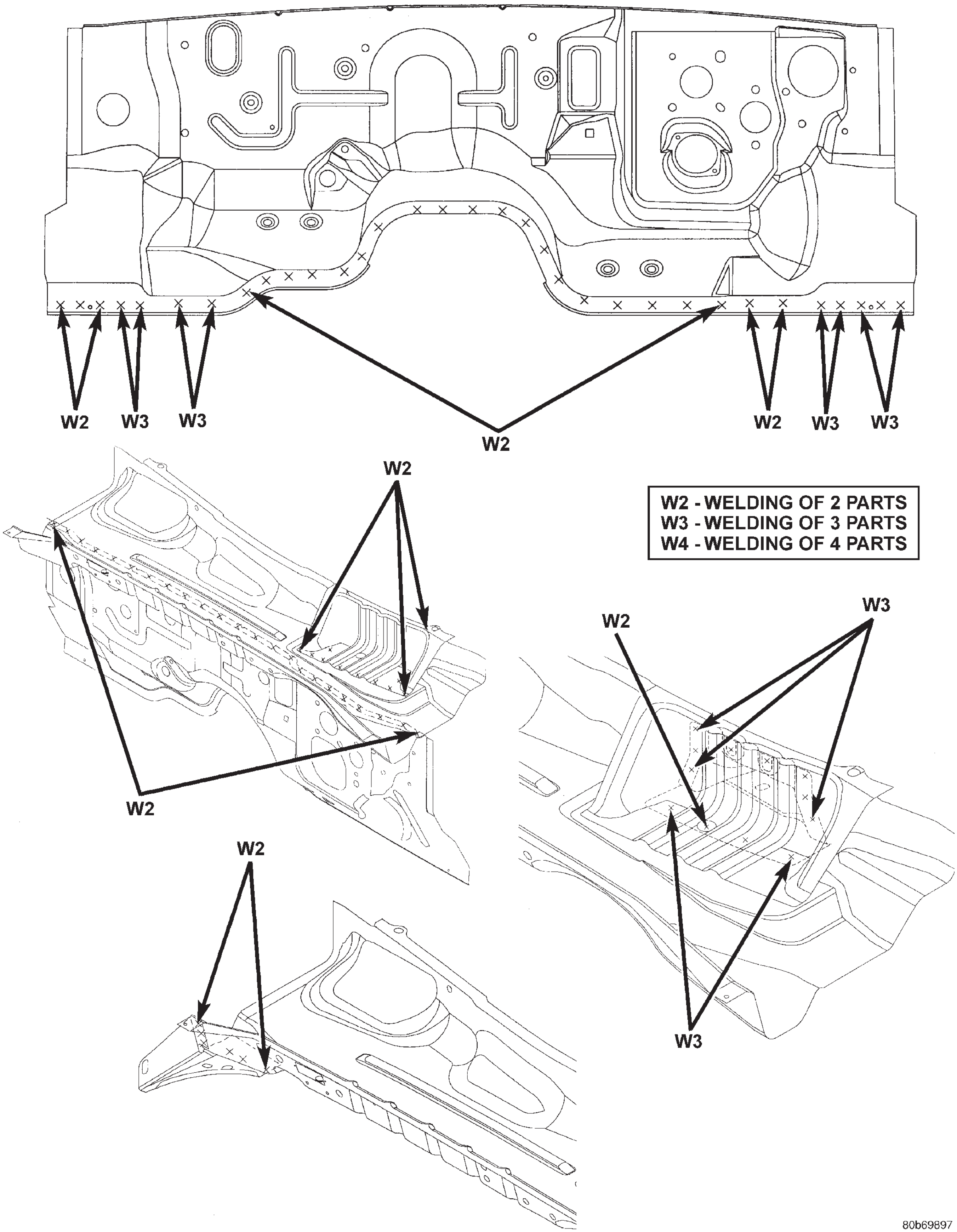
SPECIFICATIONS (Continued)

COWL AND DASH PANEL



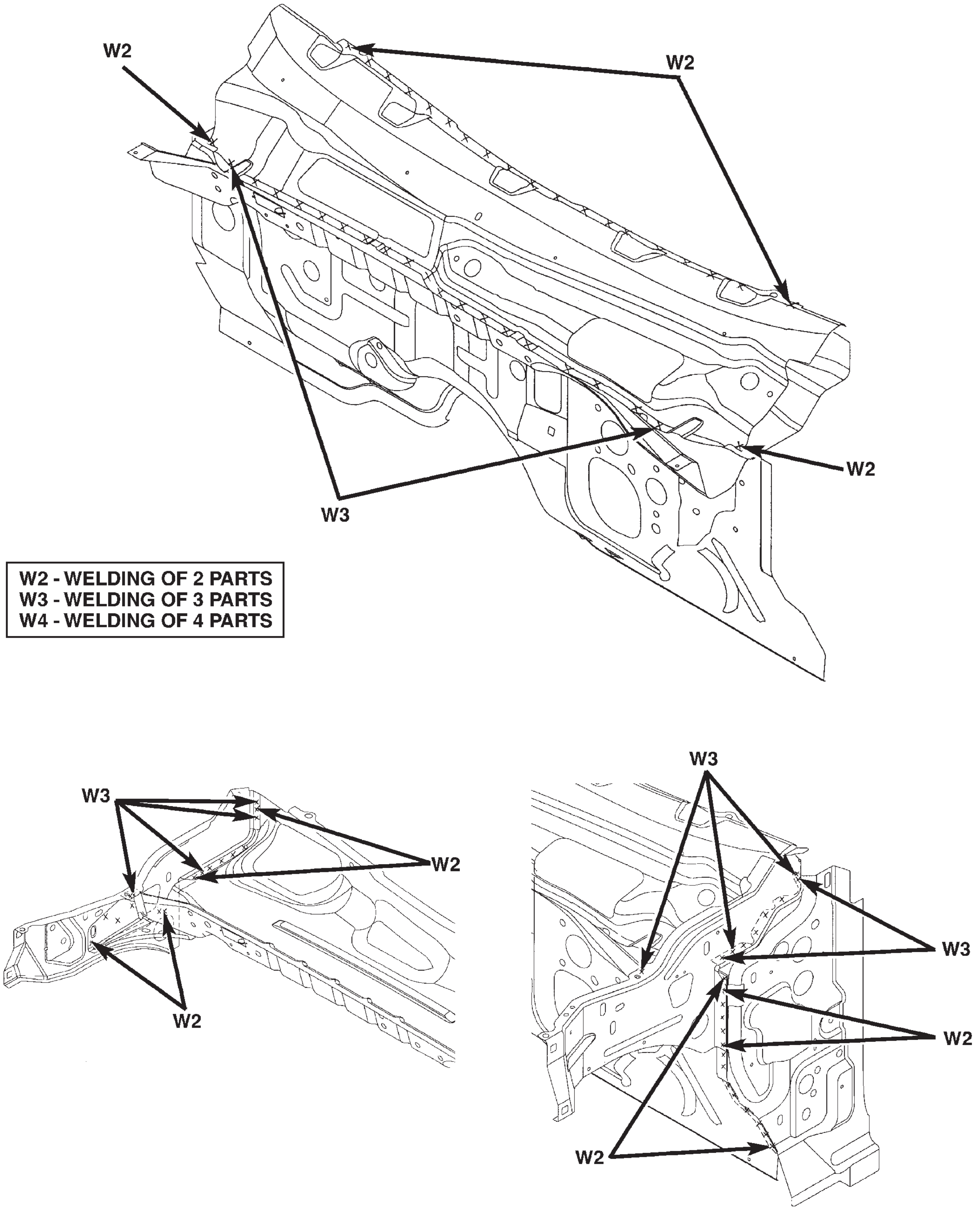
SPECIFICATIONS (Continued)

COWL AND DASH PANEL



SPECIFICATIONS (Continued)

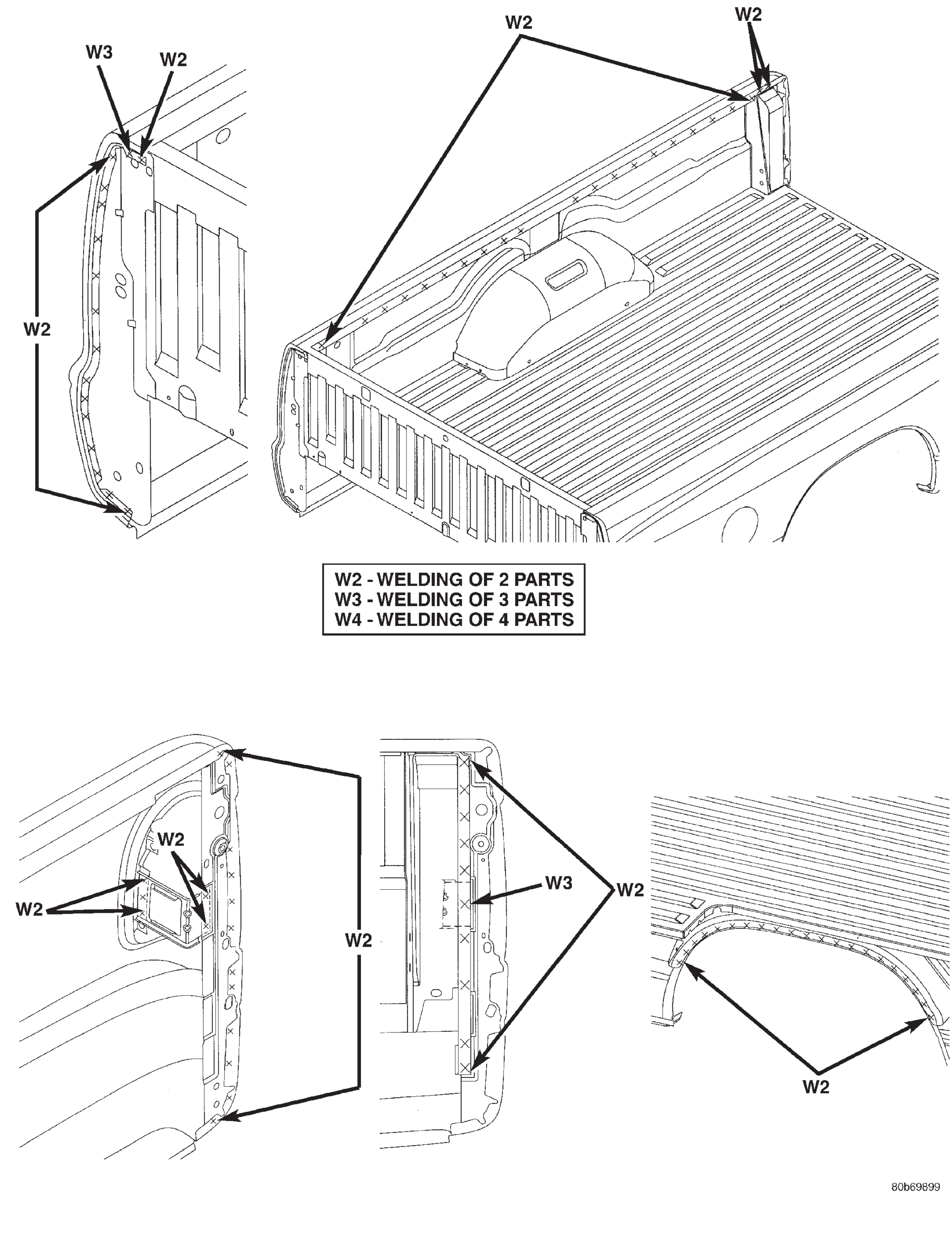
CARGO BOX OUTER SIDE PANEL



80b69898

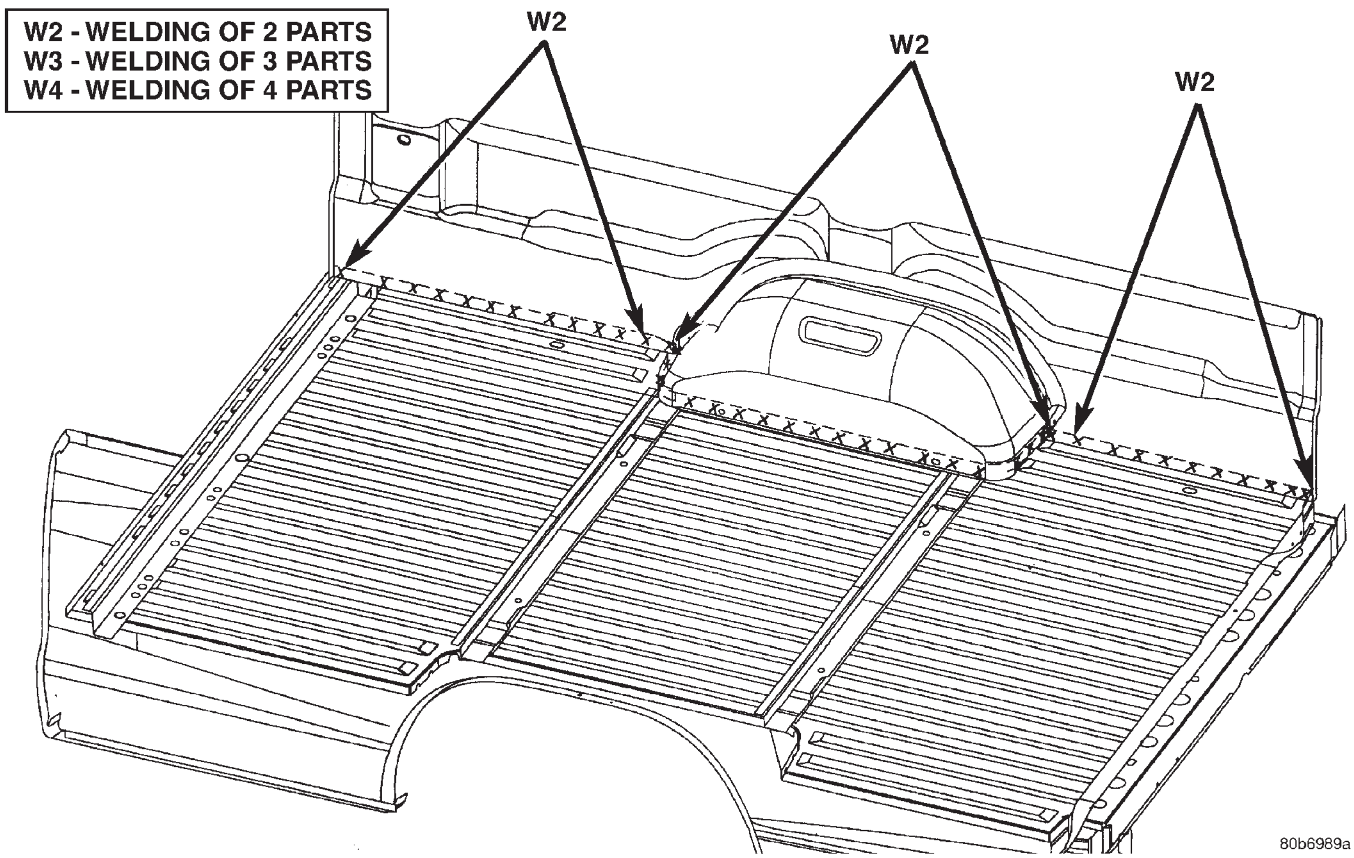
SPECIFICATIONS (Continued)

CARGO BOX INNER SIDE PANEL



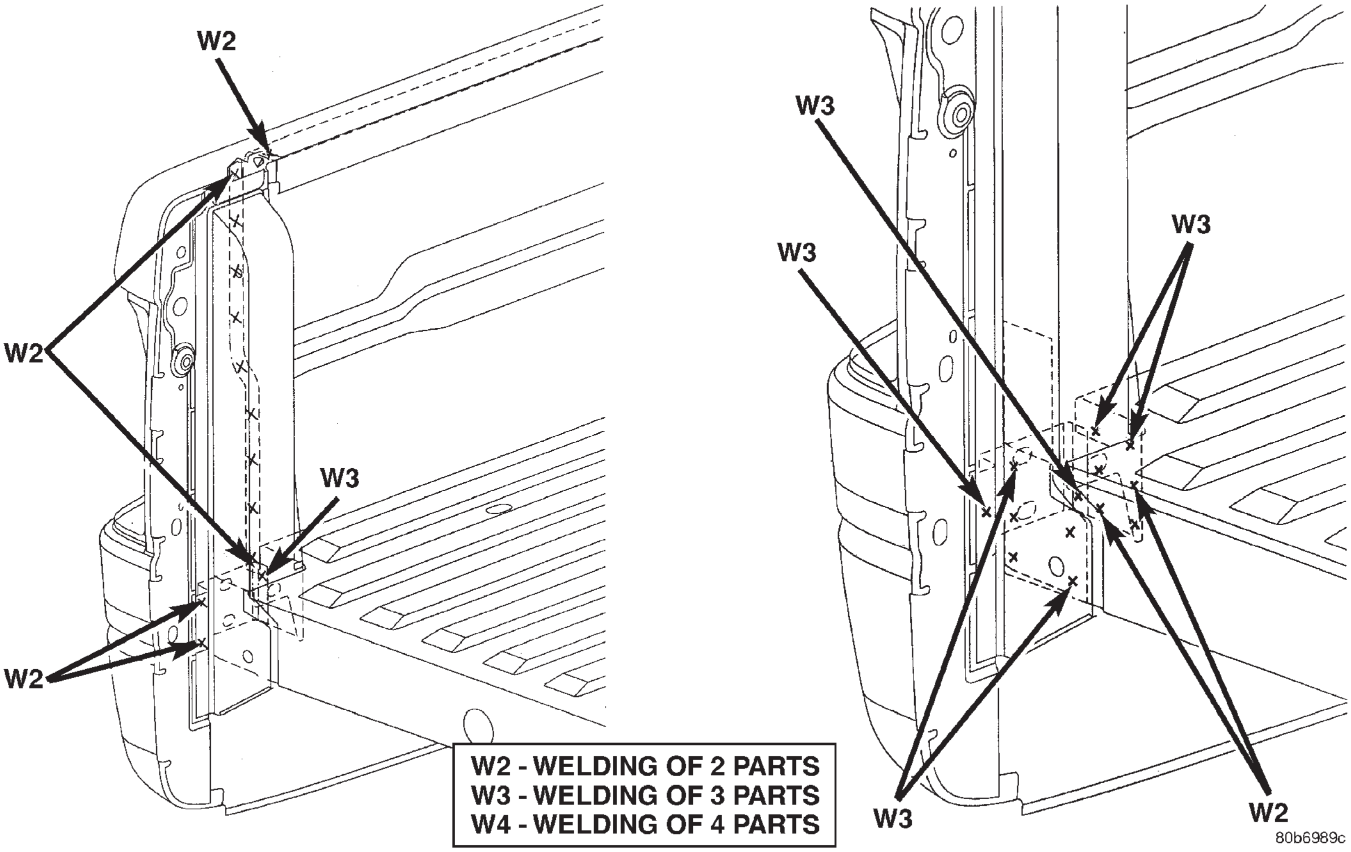
SPECIFICATIONS (Continued)

CARGO BOX INNER SIDE PANEL



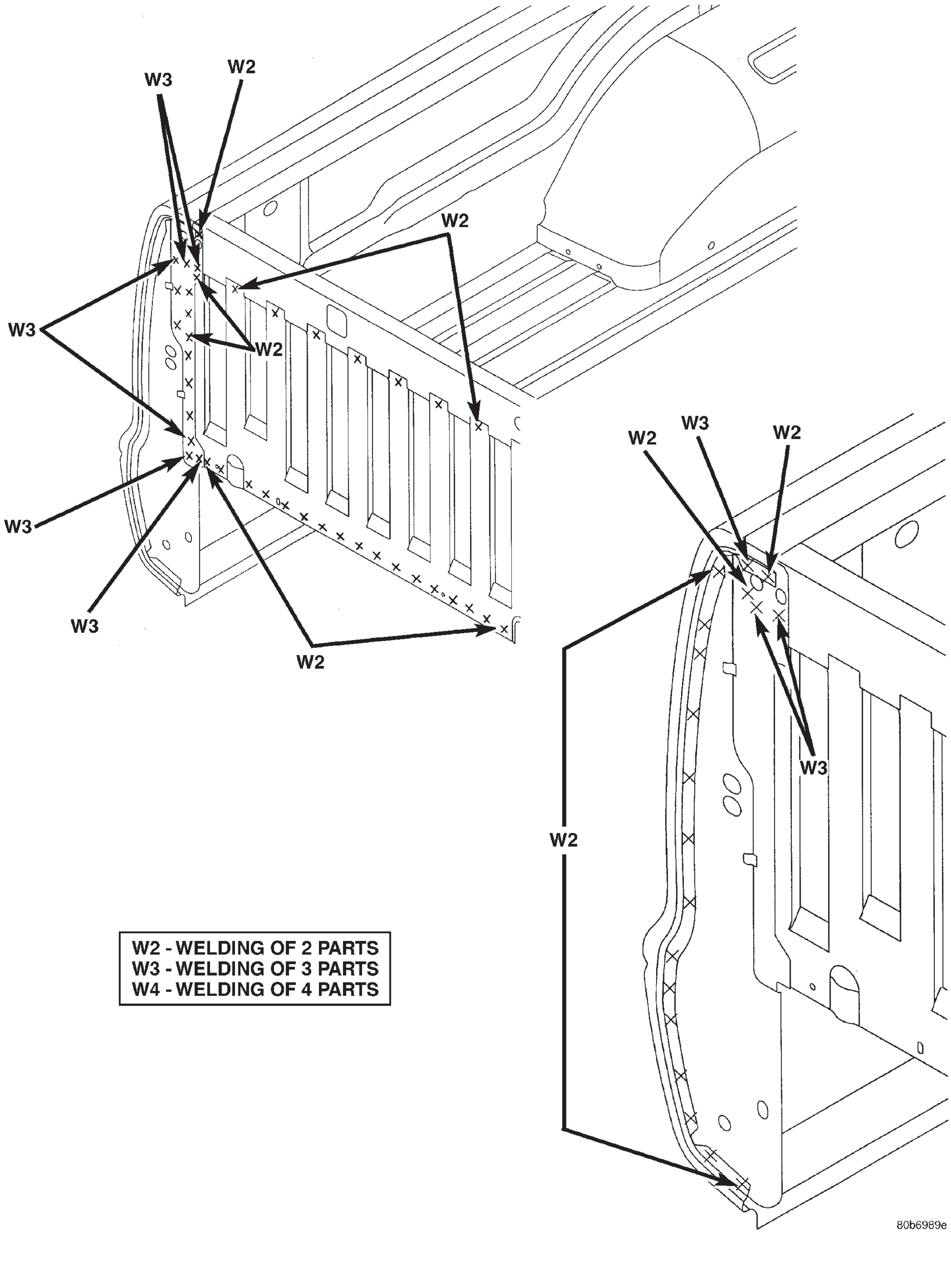
SPECIFICATIONS (Continued)

CARGO BOX INNER SIDE PANEL



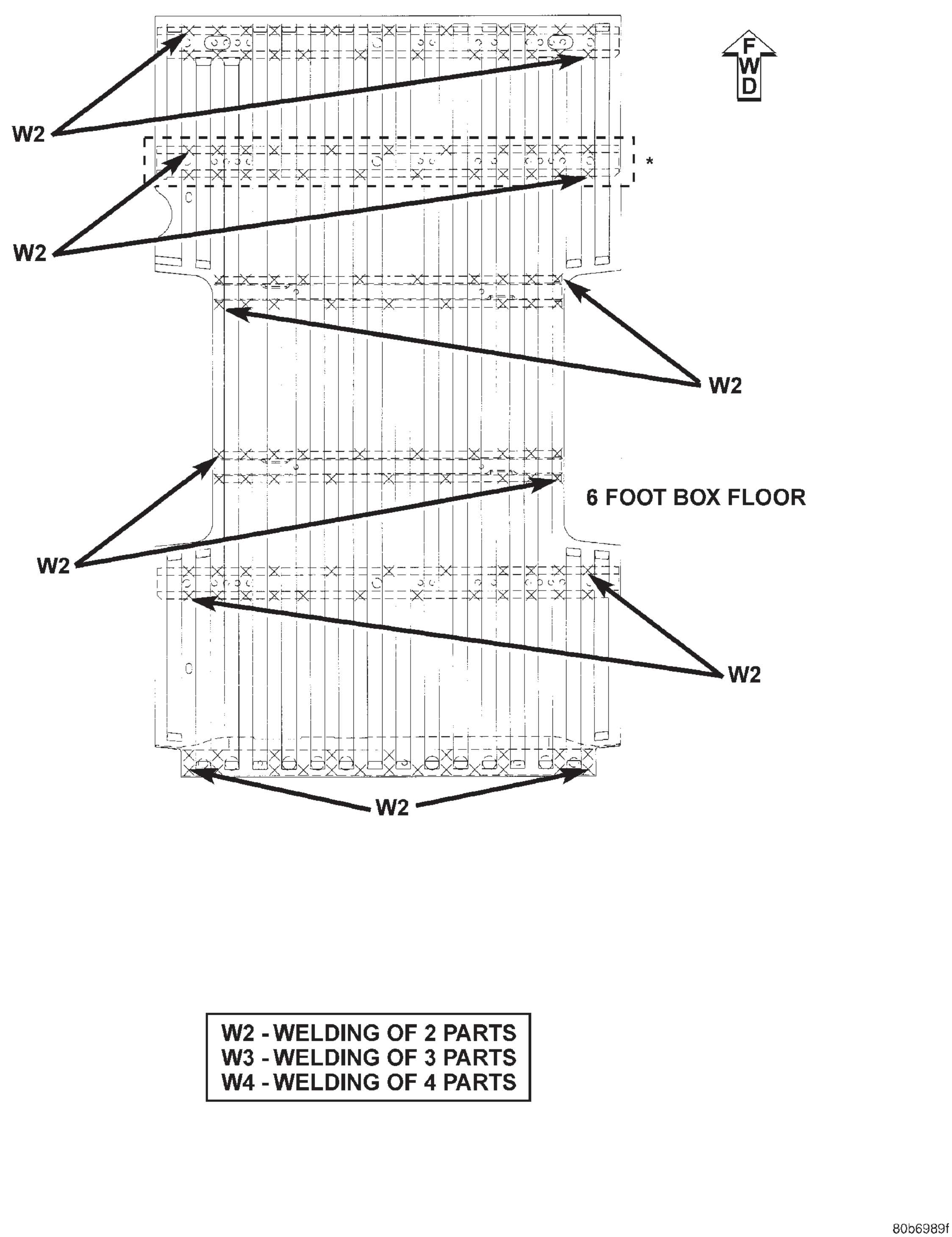
SPECIFICATIONS (Continued)

CARGO BOX FRONT PANELS



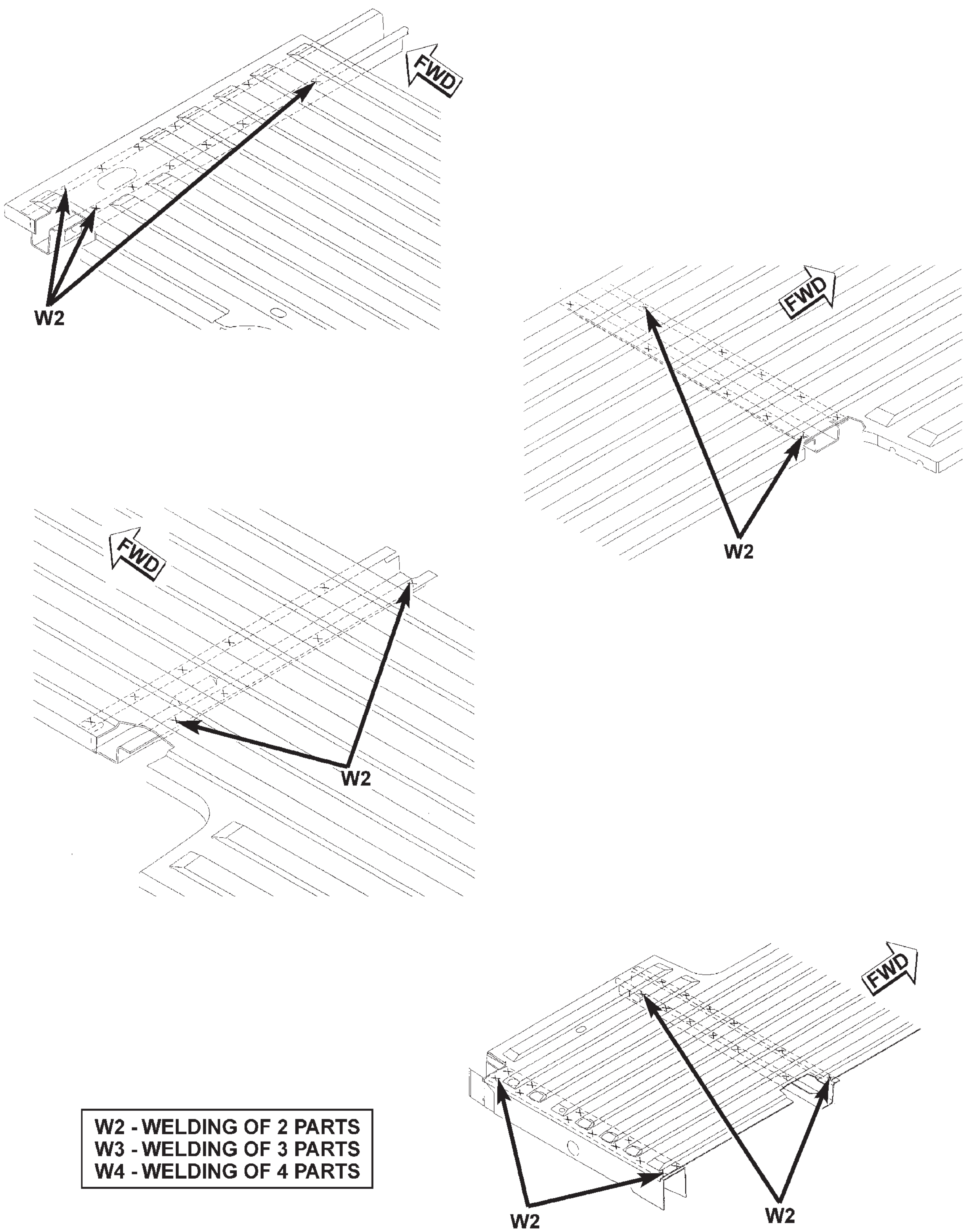
SPECIFICATIONS (Continued)

CARGO BOX FLOOR



SPECIFICATIONS (Continued)

CARGO BOX FLOOR

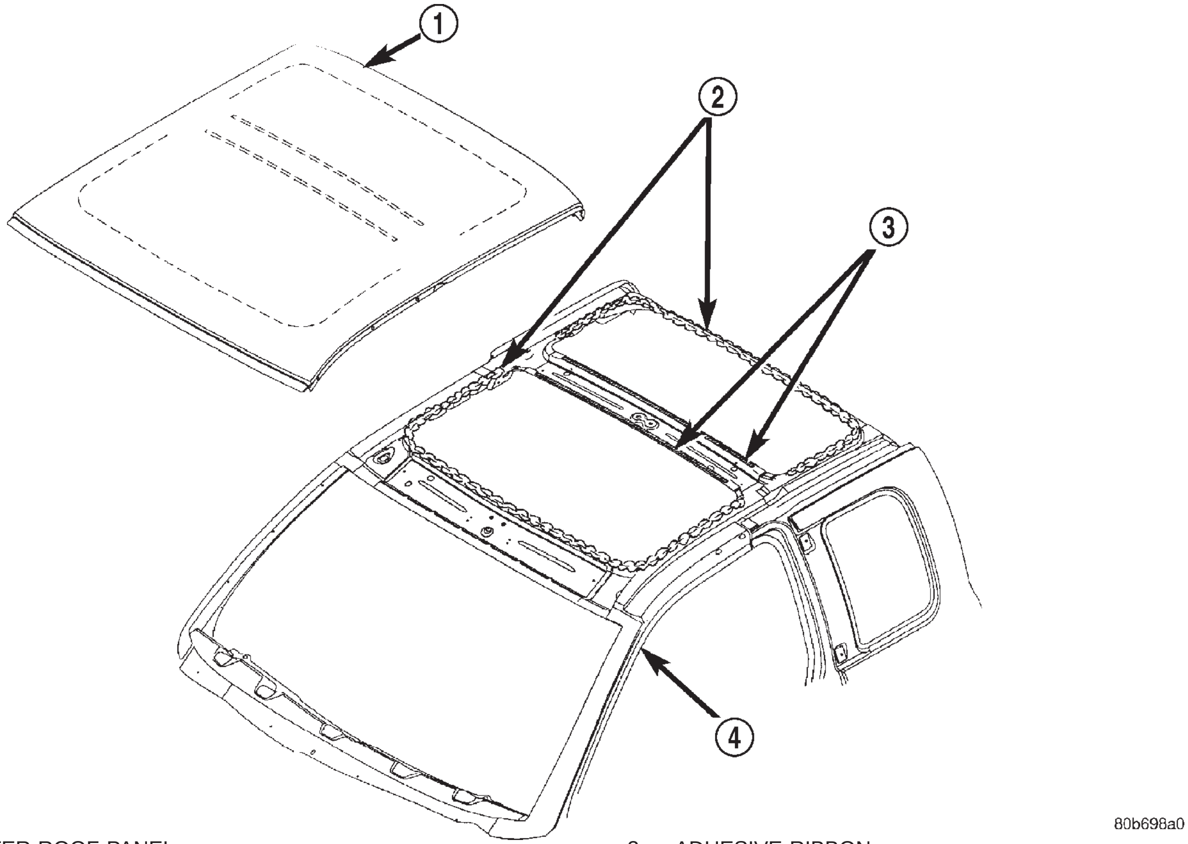


80b697a2

SPECIFICATIONS (Continued)

STRUCTURAL ADHESIVE LOCATIONS

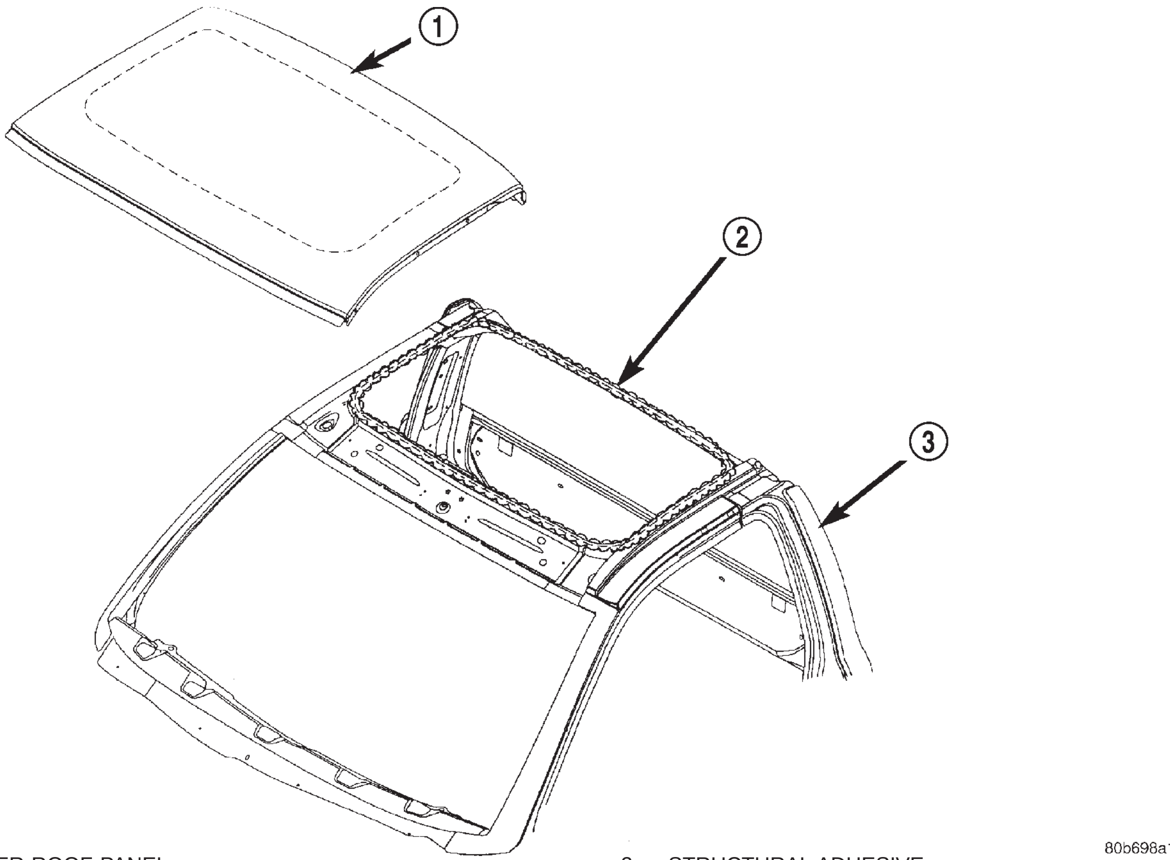
ROOF—EXTENDED CAB



1 – OUTER ROOF PANEL
2 – STRUCTURAL ADHESIVE
3 – ADHESIVE RIBBON
4 – EXTENDED CAB FRAMING

SPECIFICATIONS (Continued)

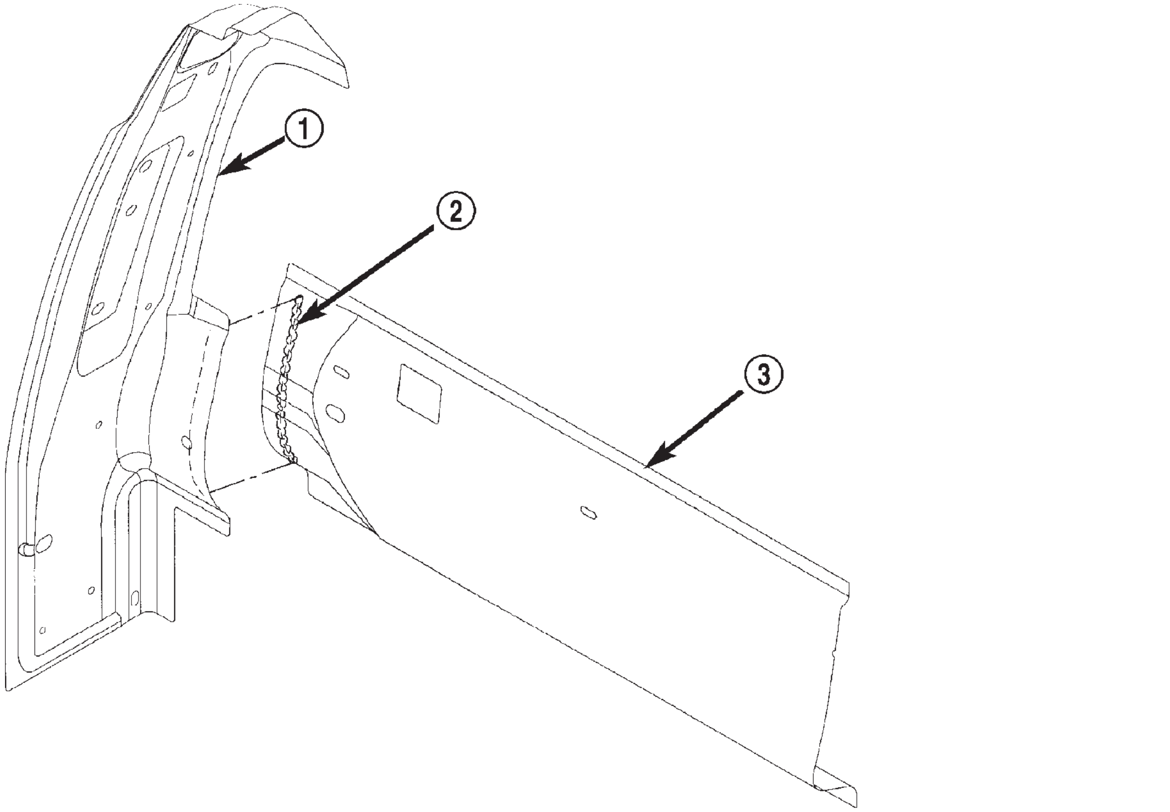
ROOF—REGULAR CAB



1 – OUTER ROOF PANEL
2 – STRUCTURAL ADHESIVE
3 – REGULAR CAB FRAMING

SPECIFICATIONS (Continued)

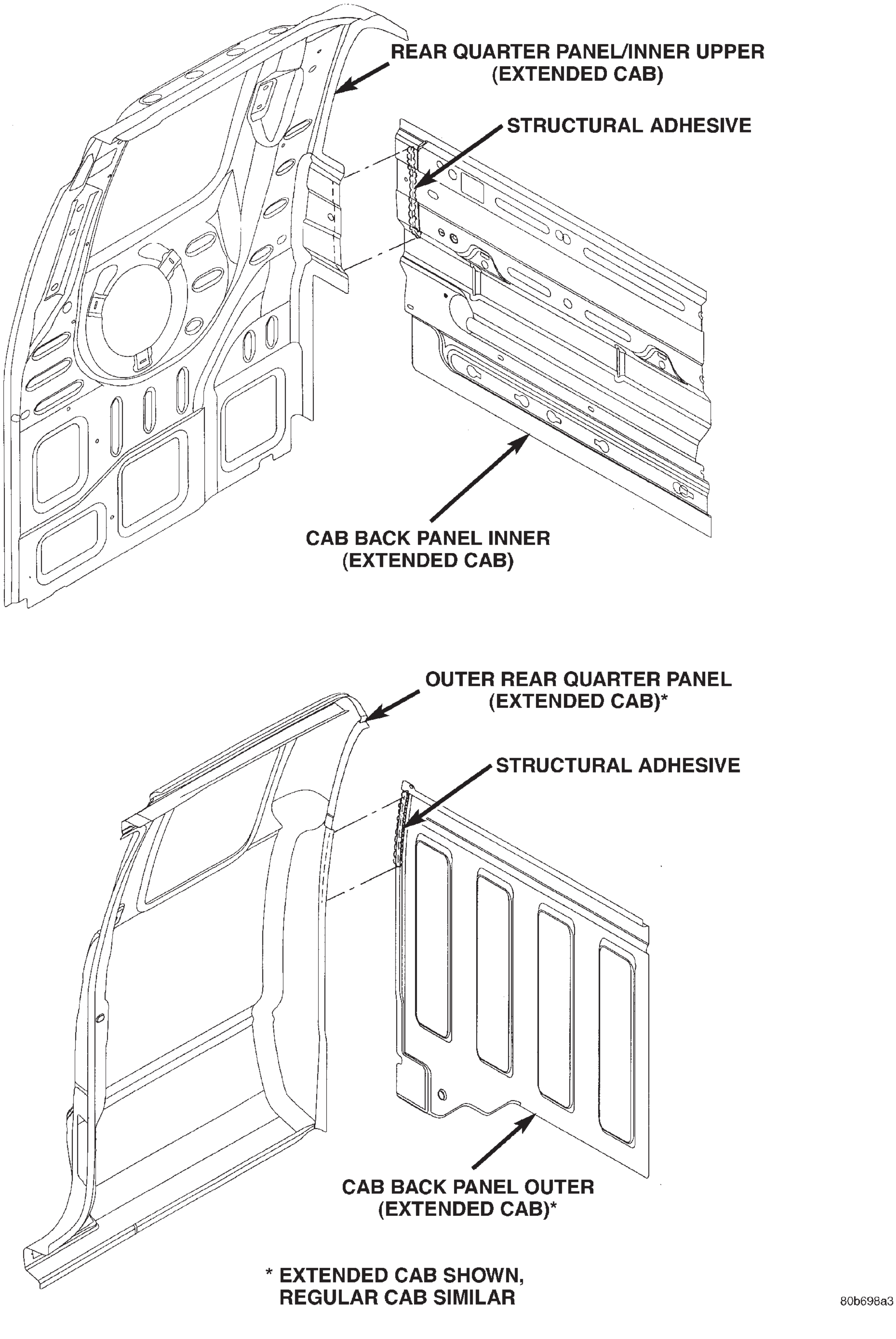
REAR QUARTER PANEL—REGULAR CAB



1 – REAR QUARTER PANEL/INNER UPPER (REGULAR CAB)
2 – STRUCTURAL ADHESIVE
3 – CAB BACK REINFORCEMENT (REGULAR CAB)

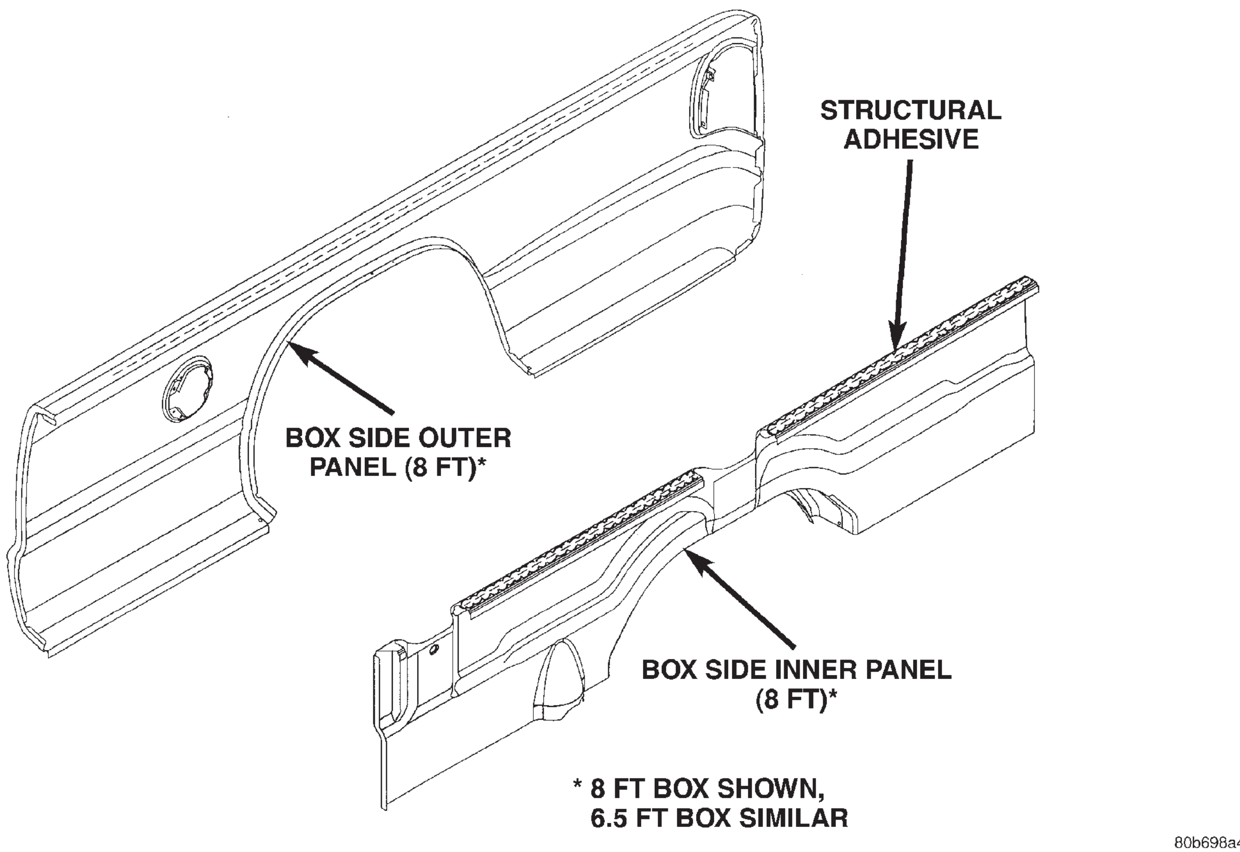
SPECIFICATIONS (Continued)

REAR QUARTER PANEL—EXTENDED CAB



SPECIFICATIONS (Continued)

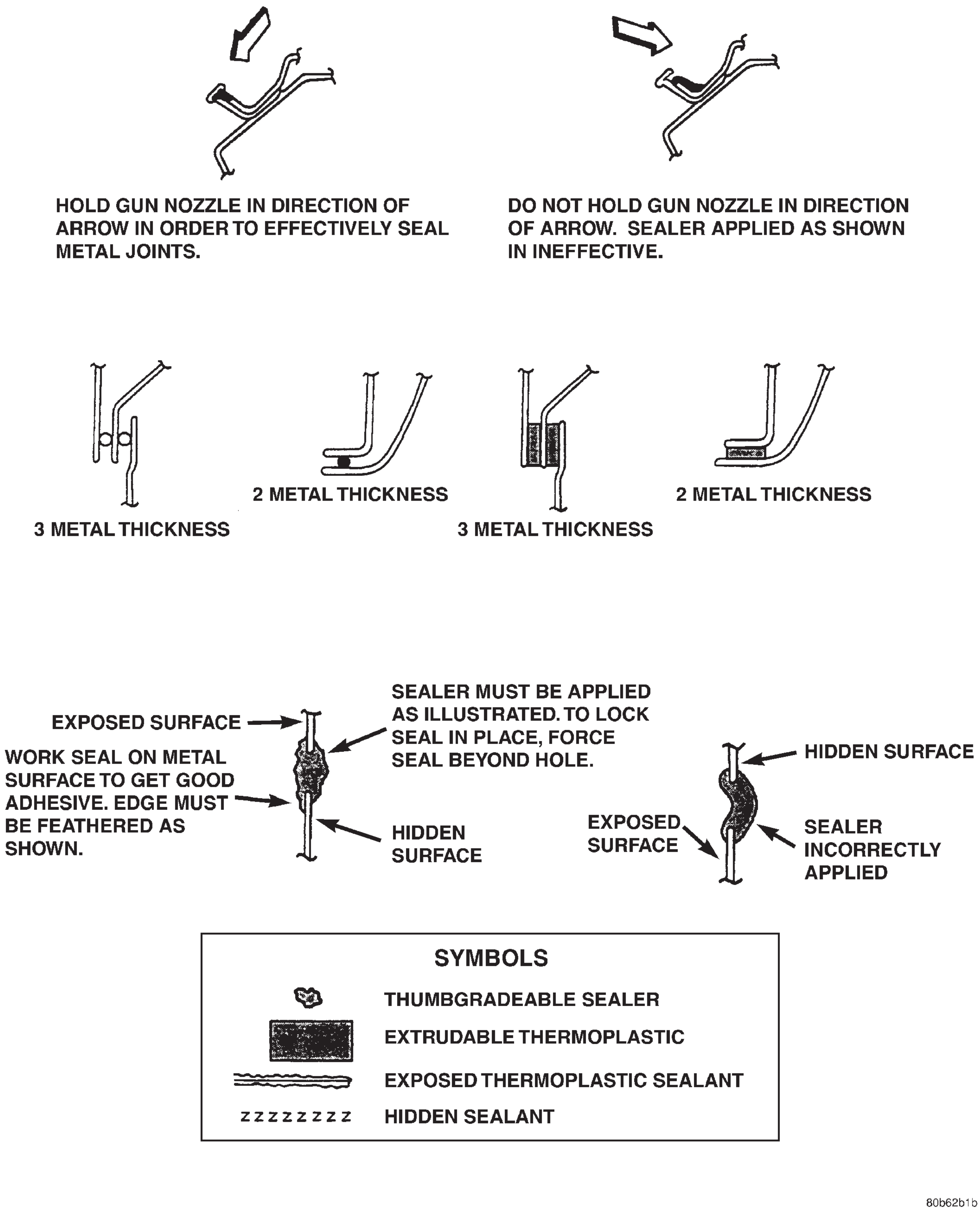
CARGO BOX INNER AND OUTER PANEL



SPECIFICATIONS (Continued)

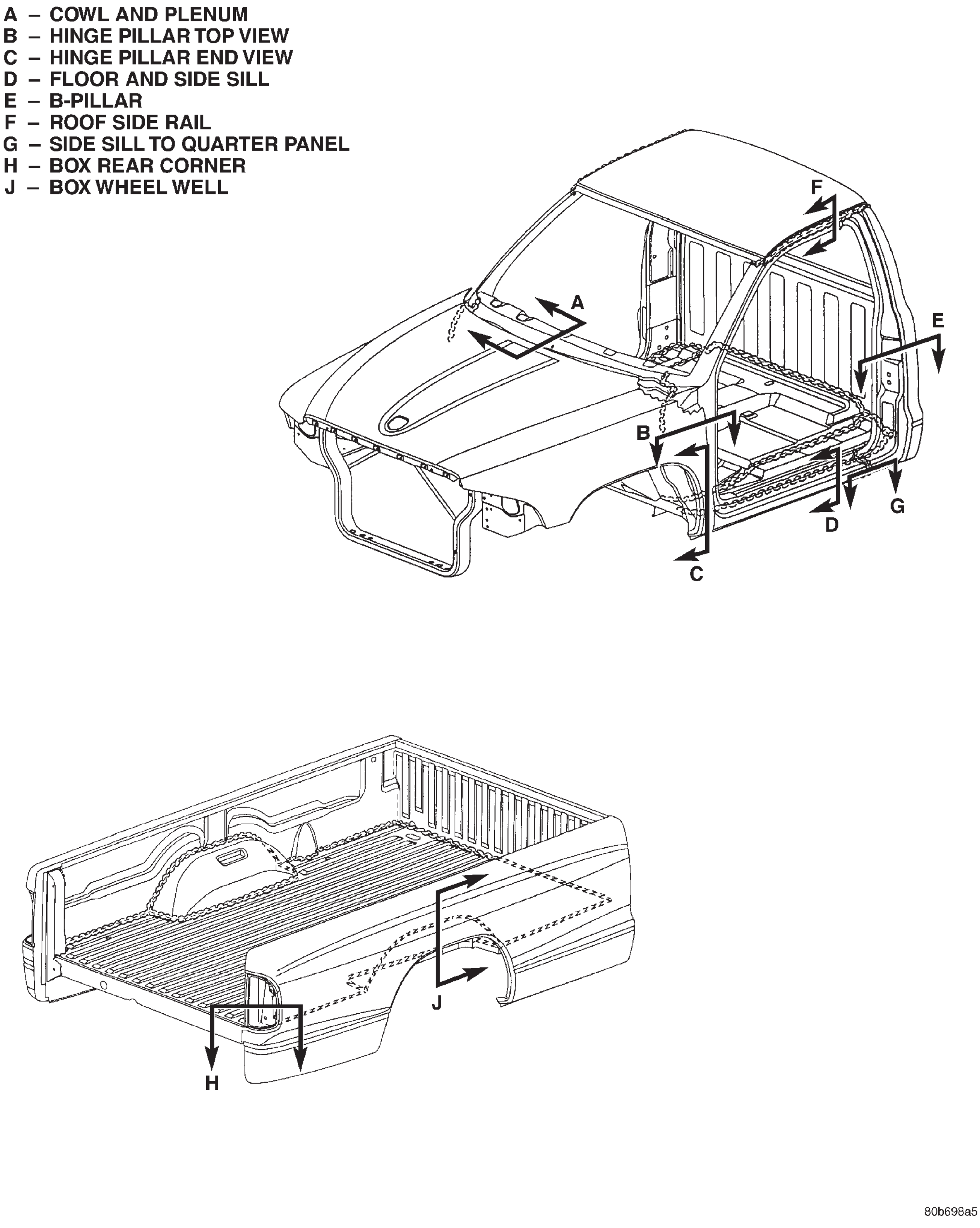
SEALER LOCATIONS

APPLICATION METHODS



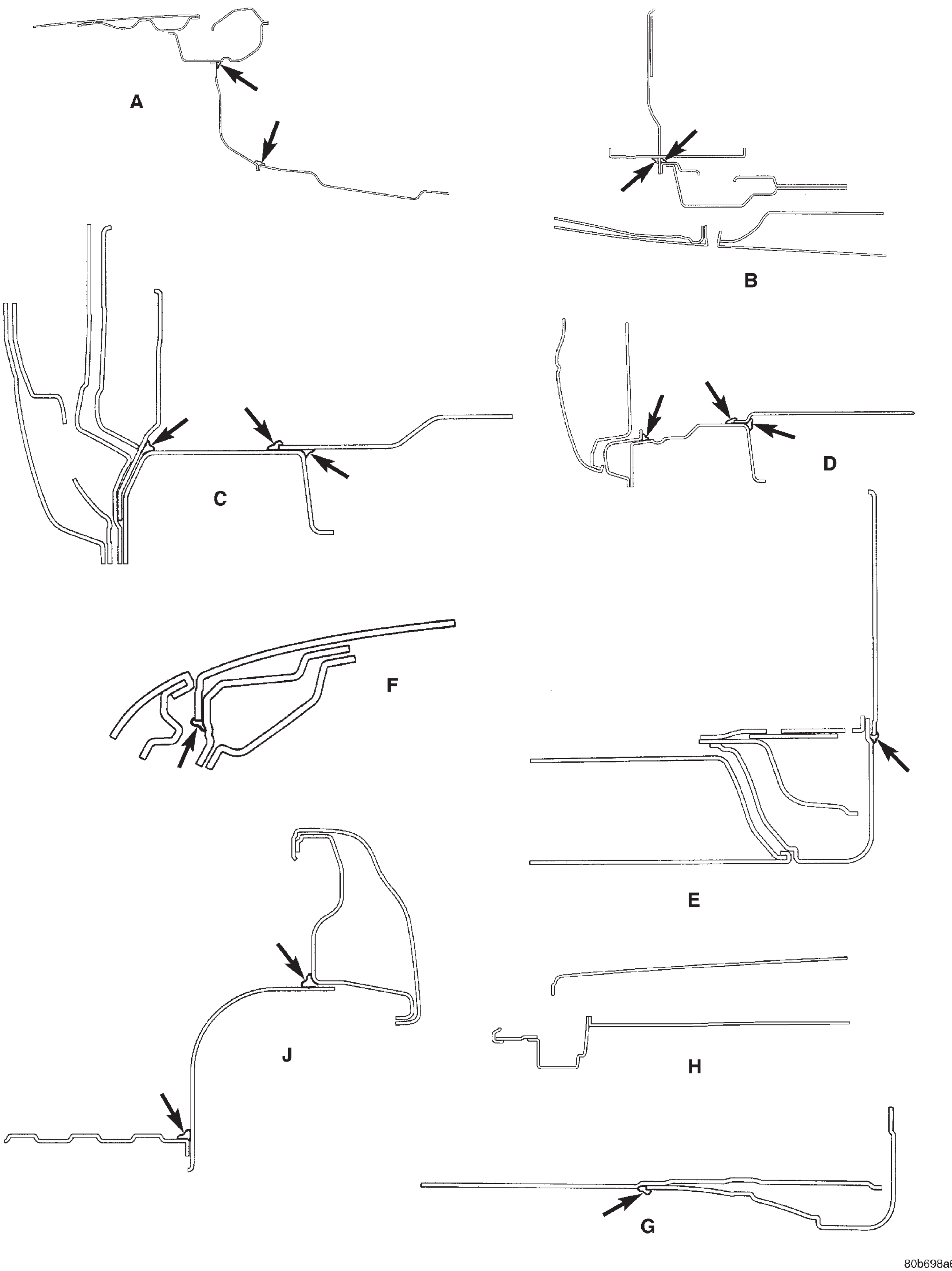
SPECIFICATIONS (Continued)

SEALER LOCATION



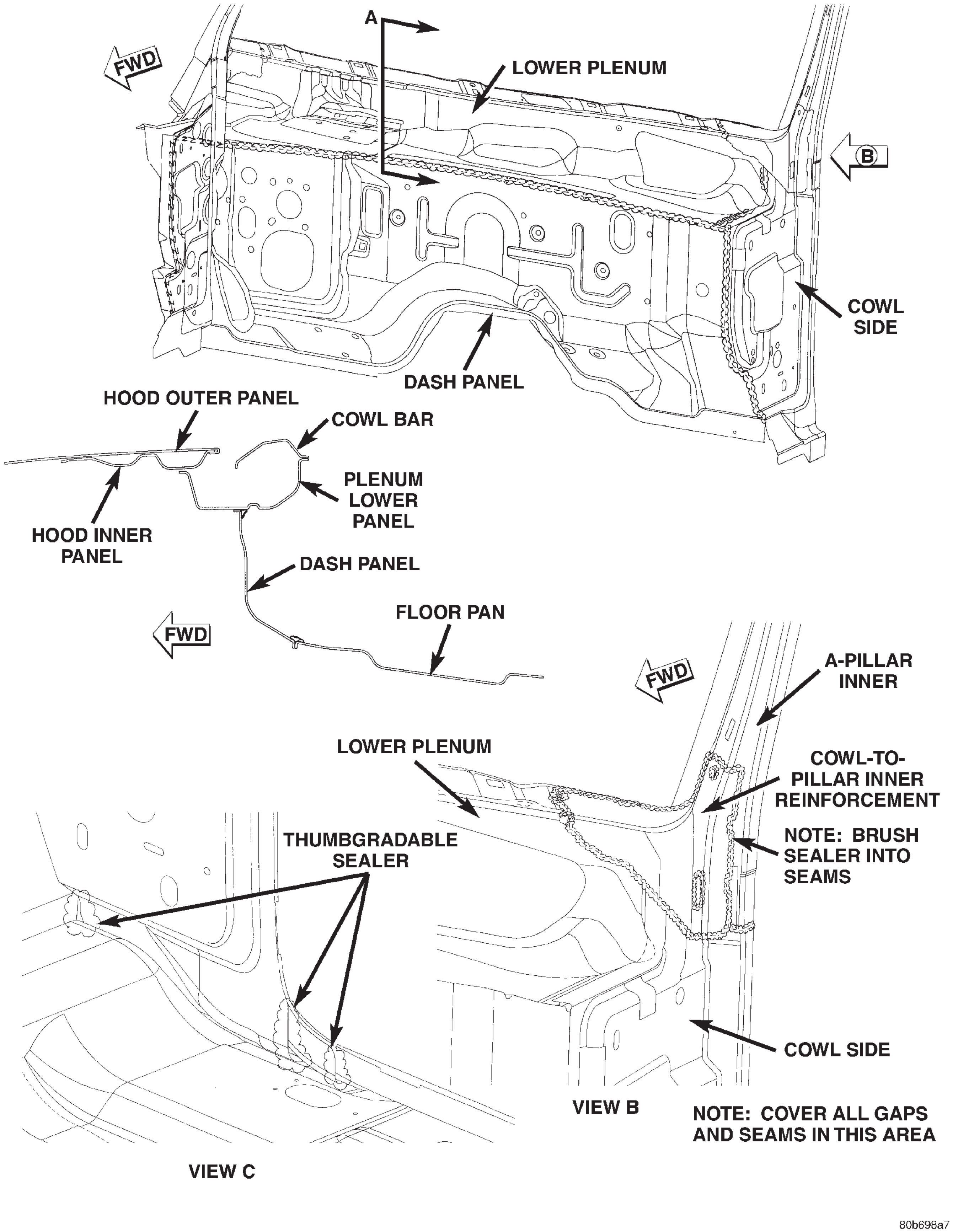
SPECIFICATIONS (Continued)

APPLICATION CUT-AWAY



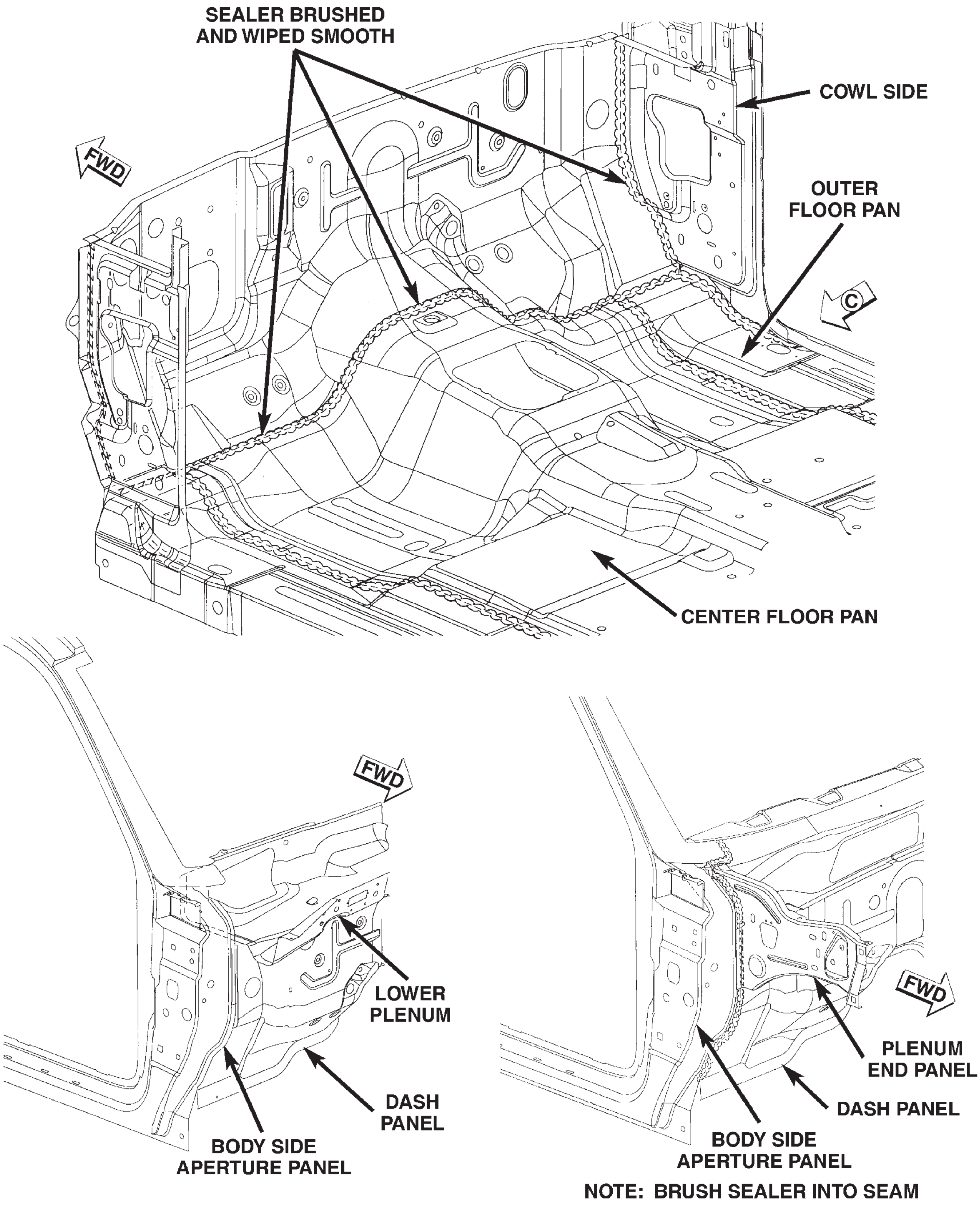
SPECIFICATIONS (Continued)

COWL AND DASH PANEL



SPECIFICATIONS (Continued)

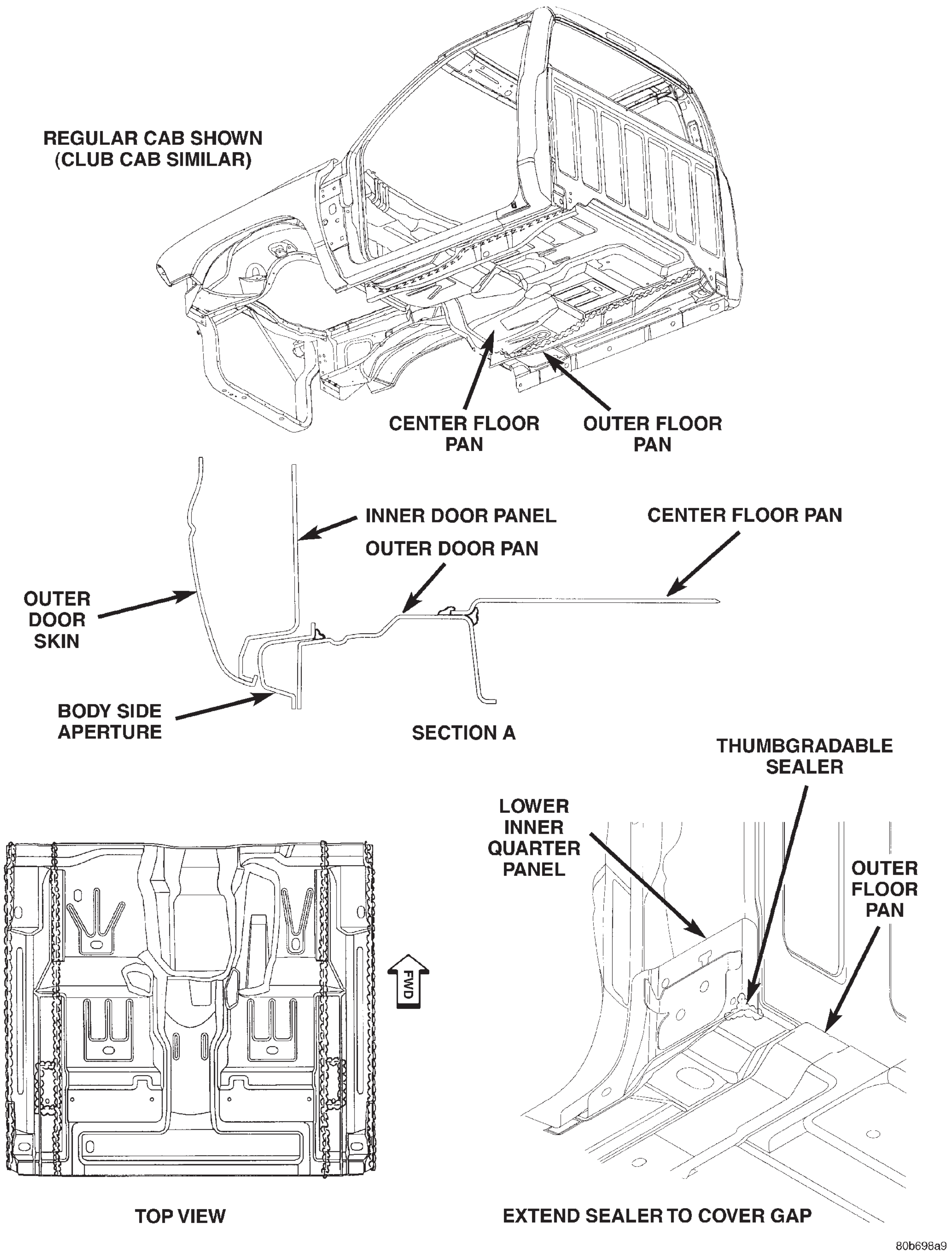
COWL AND DASH PANEL



80b698a8

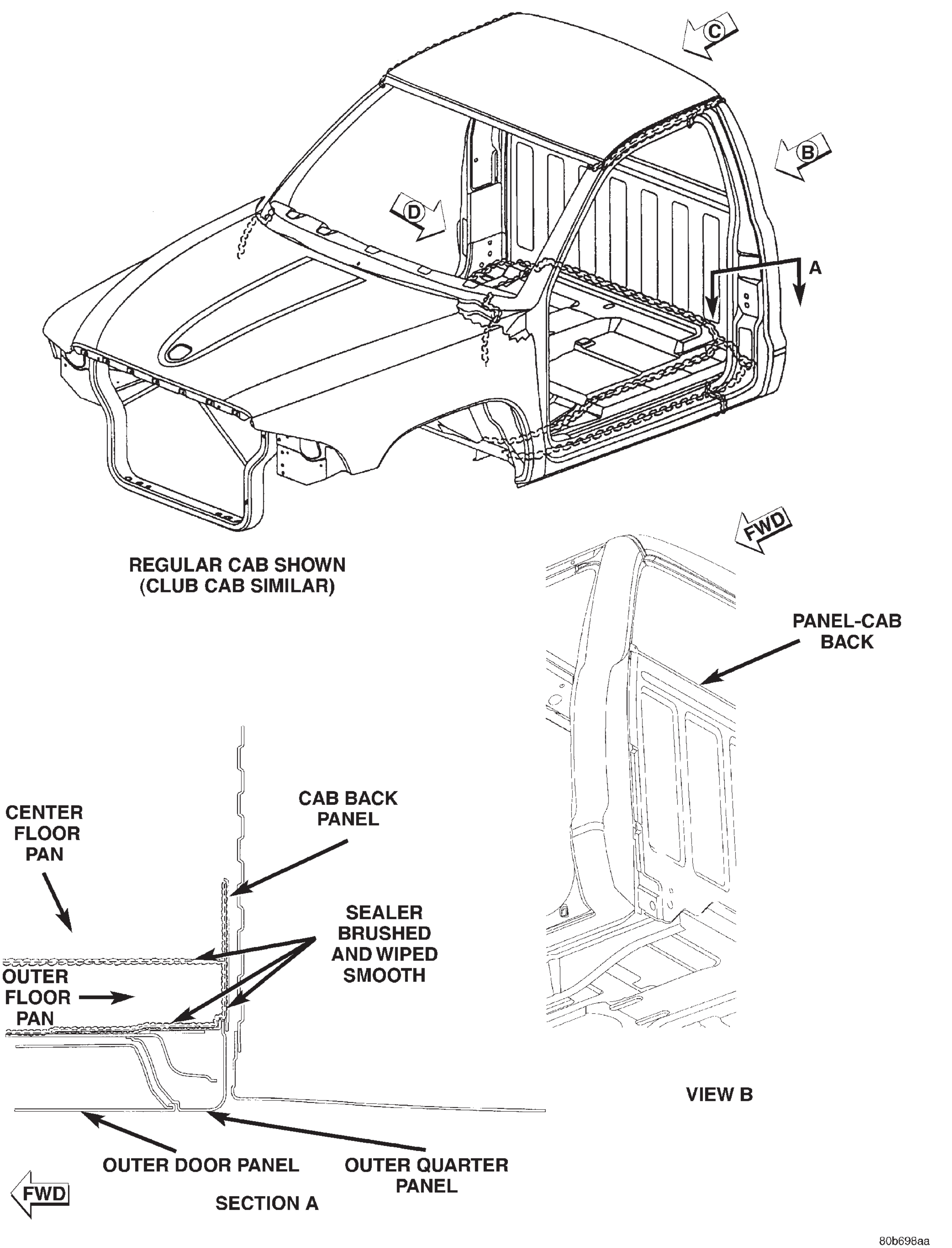
SPECIFICATIONS (Continued)

FLOOR PAN



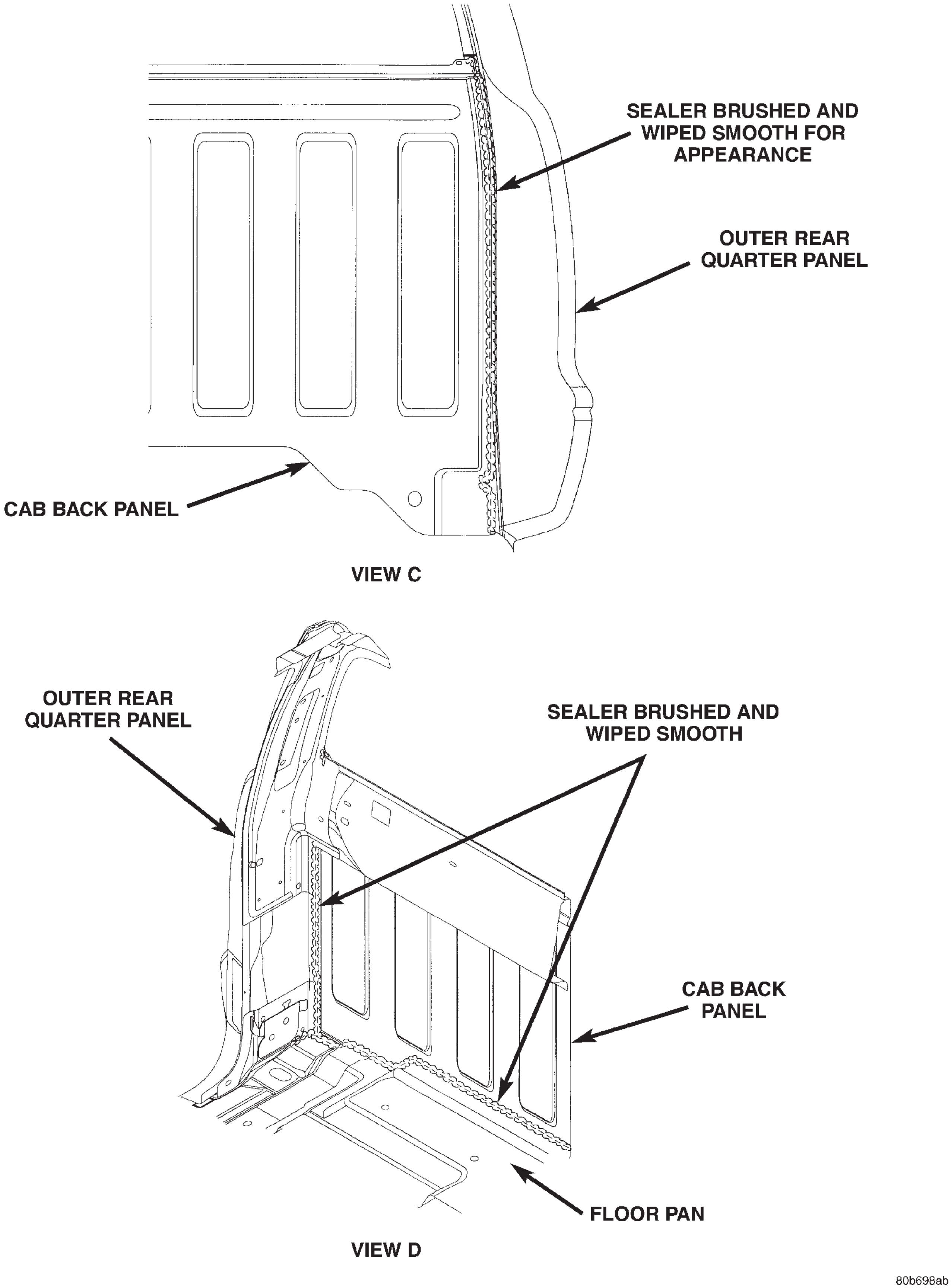
SPECIFICATIONS (Continued)

CAB REAR PANEL



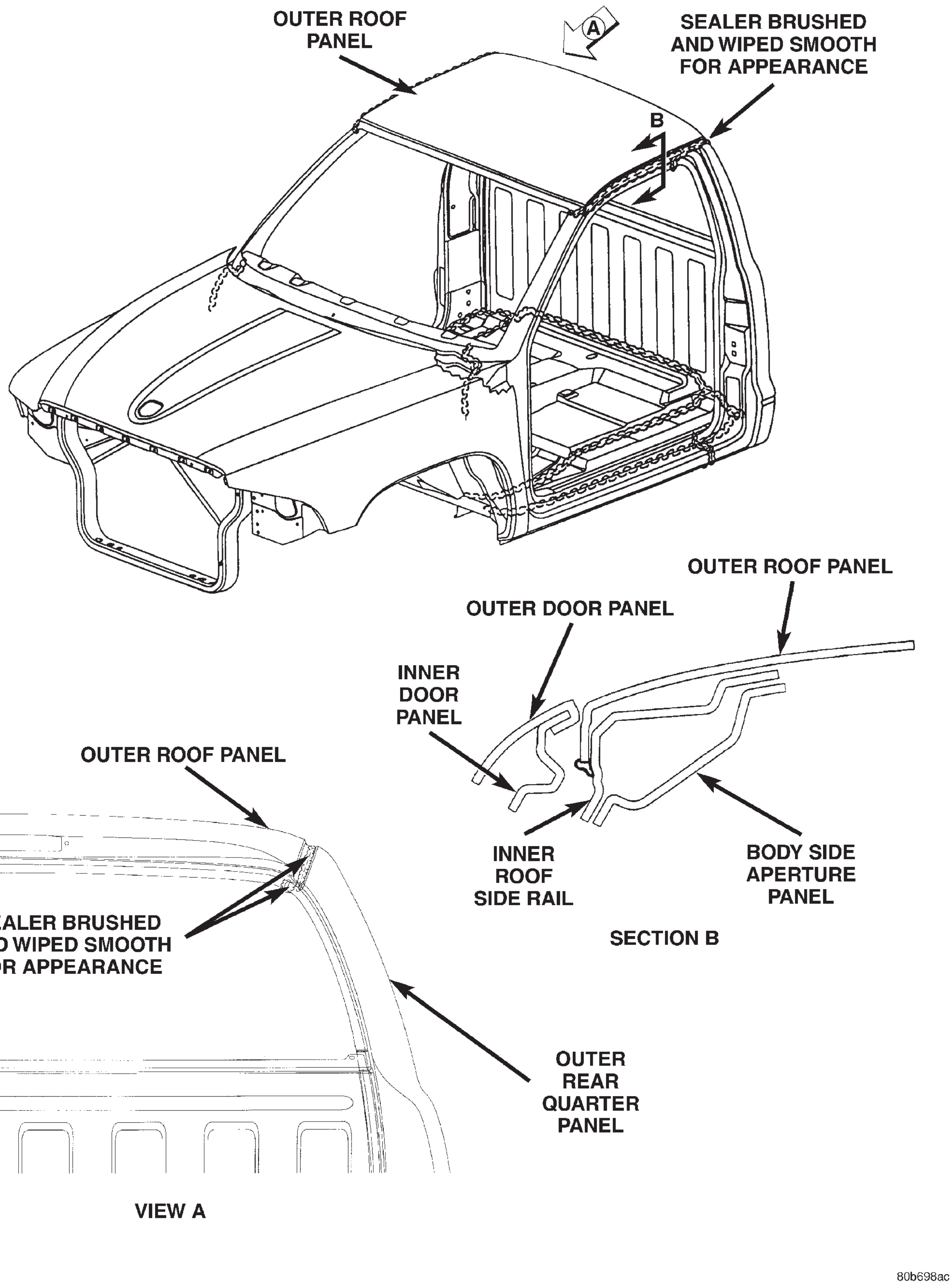
SPECIFICATIONS (Continued)

CAB REAR PANEL



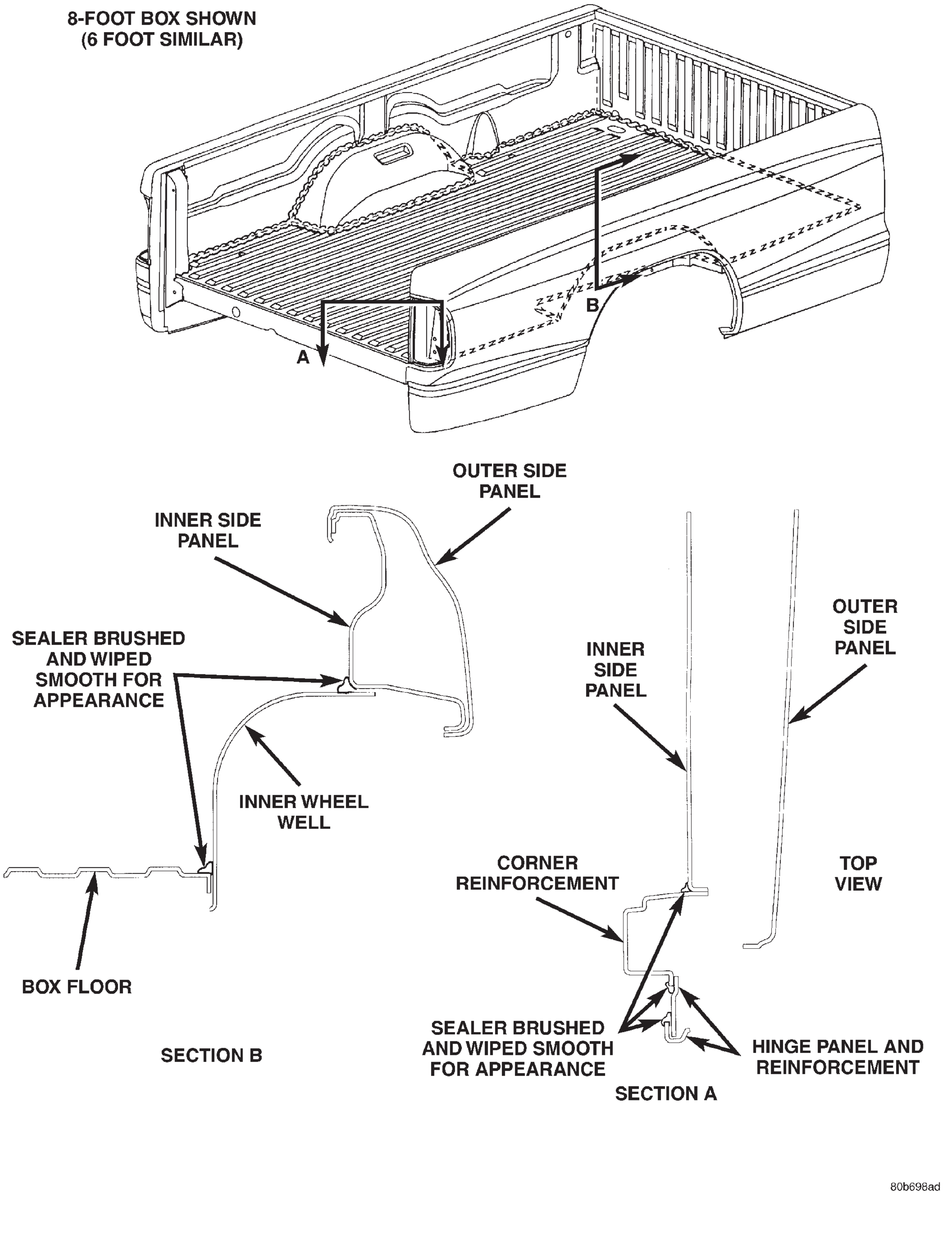
SPECIFICATIONS (Continued)

ROOF PANEL



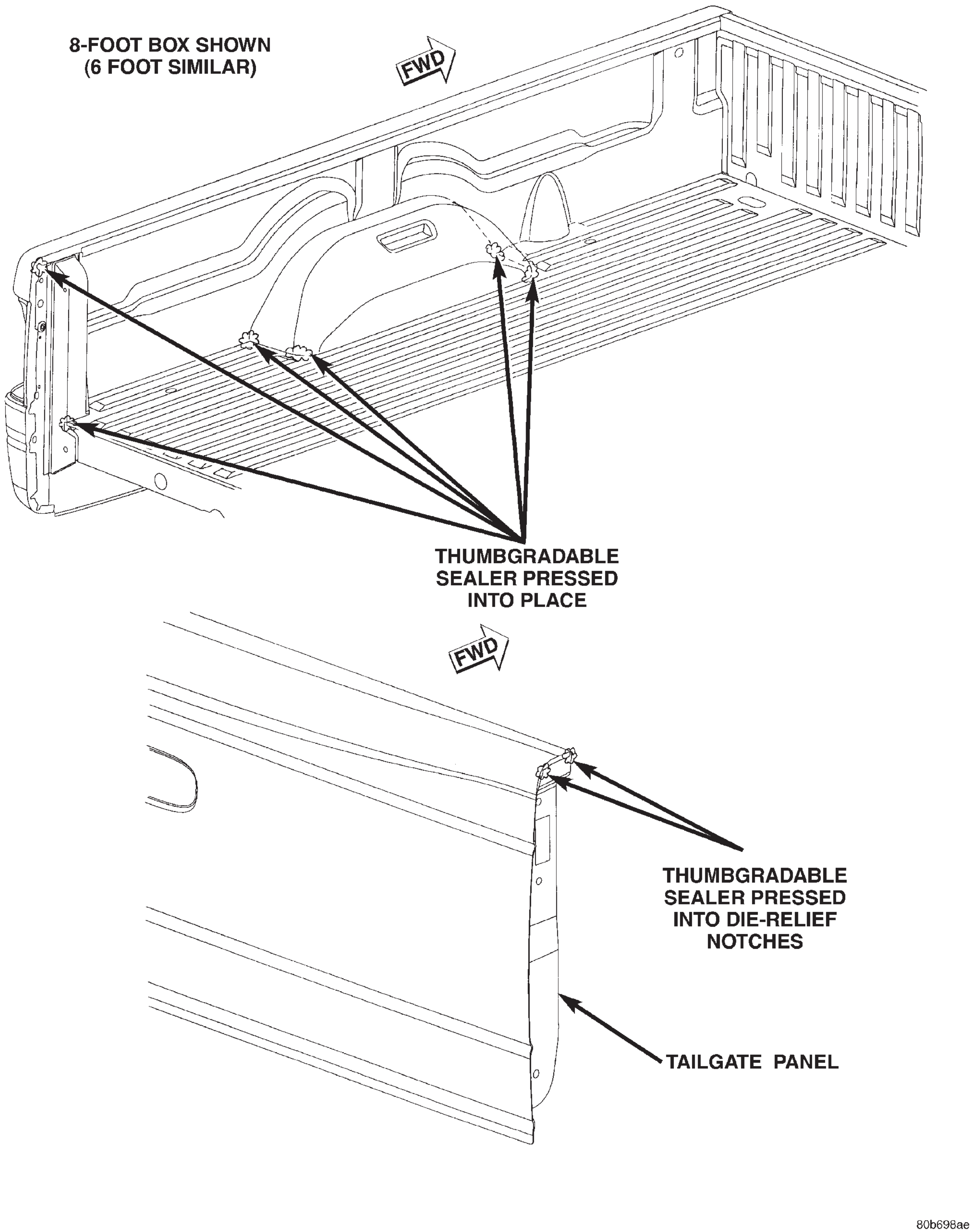
SPECIFICATIONS (Continued)

CARGO BOX



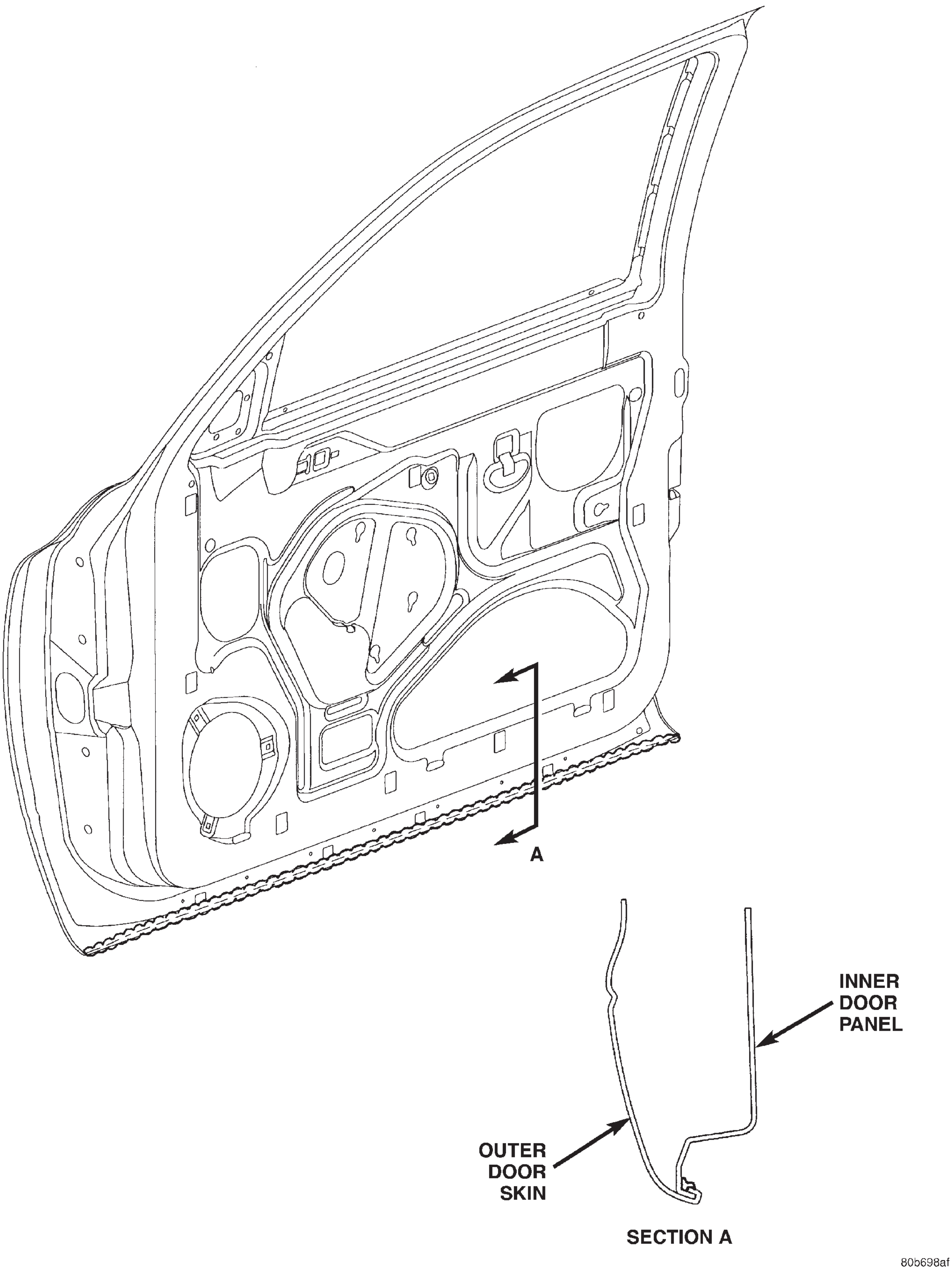
SPECIFICATIONS (Continued)

CARGO BOX



SPECIFICATIONS (Continued)

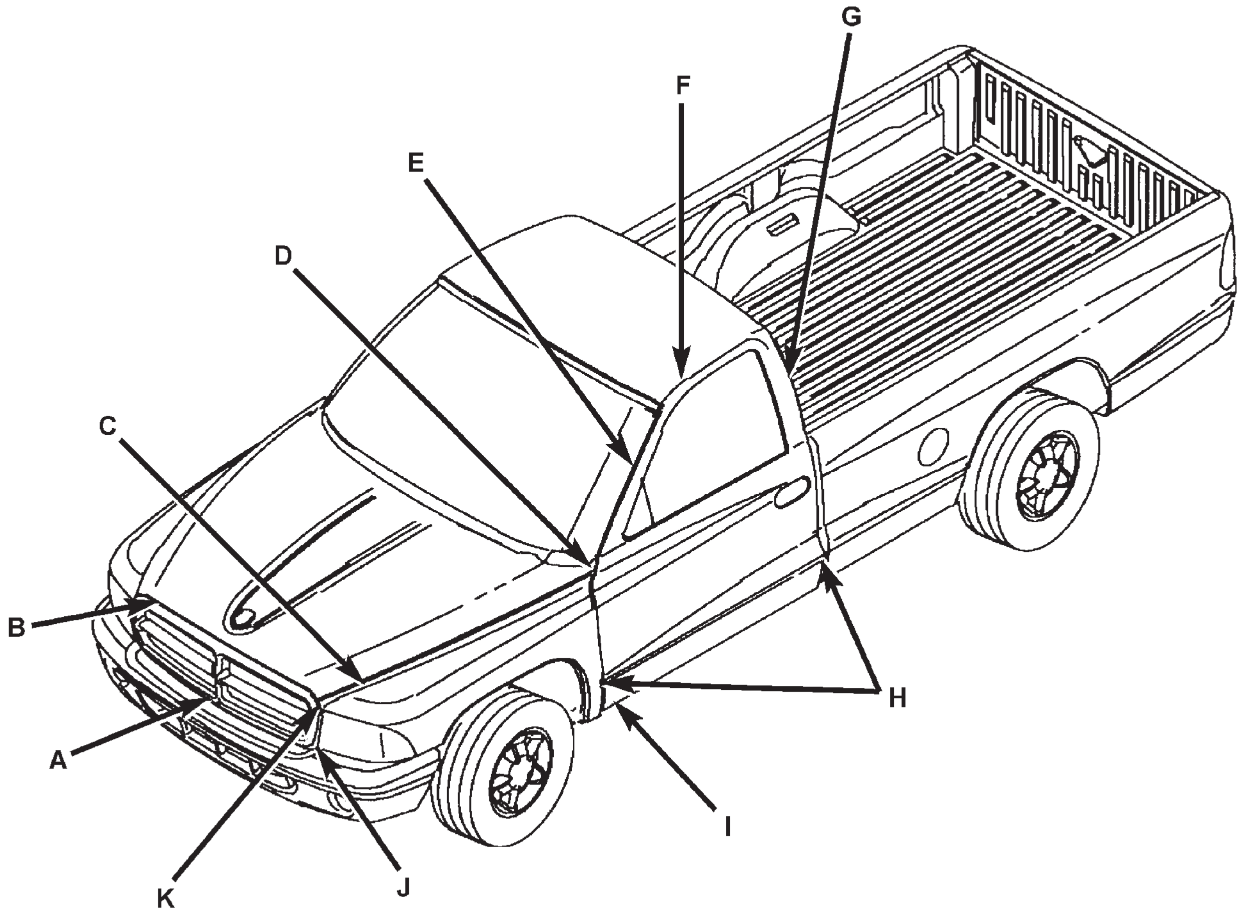
DOORS



SPECIFICATIONS (Continued)

BODY GAP AND FLUSH MEASUREMENTS

BODY GAP AND FLUSH — REGULAR CAB



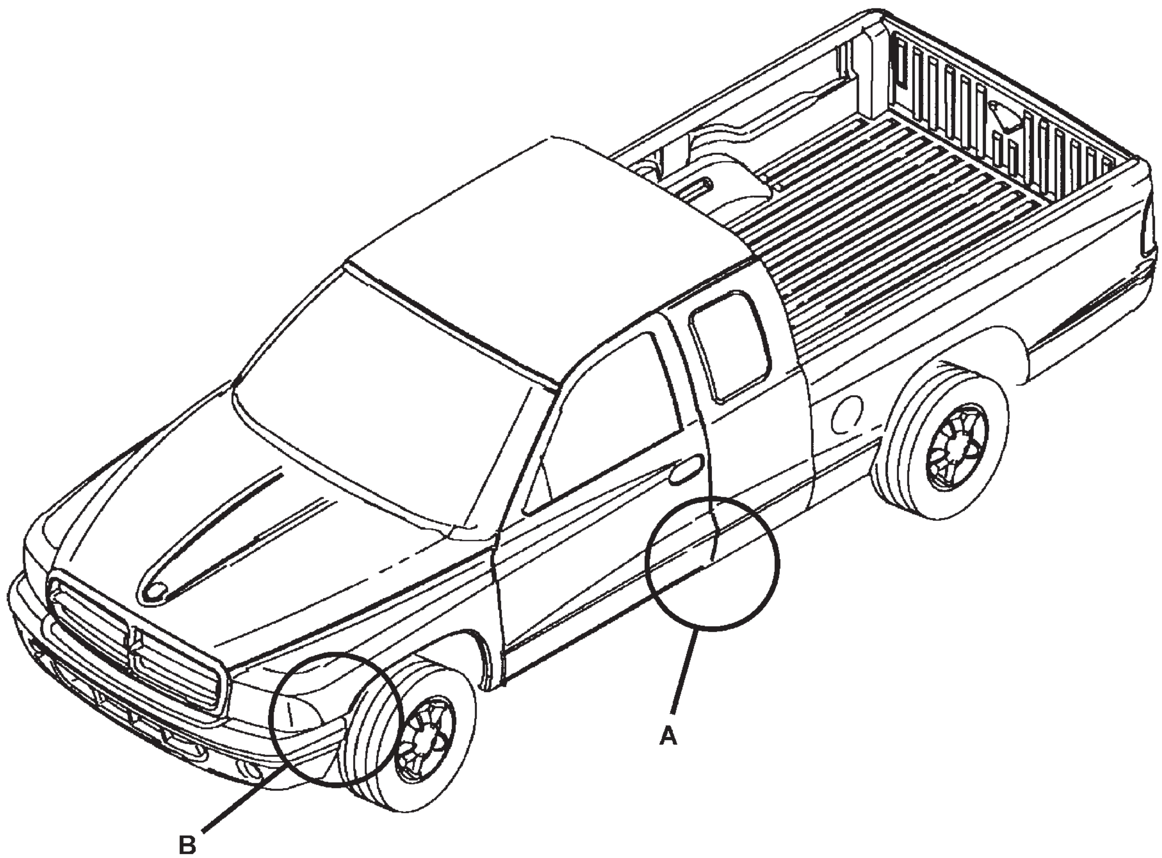
	DESCRIPTION	GAP	FLUSH
A	Grille to Fascia	17.1 +/- 3.0	N/A
B	Hood to Grille	1.5 +/- 0.8	0.7 +/- 0.5
C	Hood to Fender	2.8 +/- 1.5	0.3 +/- 1.5
D	Door to Hood / Fender	5.0 +/- 1.0	0.0 +/- 0.5
E	Door to Windshield Molding	5.1 +/- 1.5	N/A
F	Door to Roof	6.0 +/- 1.5	2.0 +/- 1.0
G	Door to Quarter	4.5 +/- 1.5	0.0 +/- 1.5
H	Fender / Door / Quarter Char Line U/D	4.5 +/- 1.5	0.0 +/- 1.5
I	Door to Sill	7.0 +/- 2.0	0.0 +/- 1.5
J	Grille to Headlamp	8.3 +/- 3.0	N/A
K	Grille to Fender	6.0 +/- 1.5	N/A

NOTE: ALL MEASUREMENTS ARE IN MM.

80b6fdf1

SPECIFICATIONS (Continued)

BODY GAP AND FLUSH



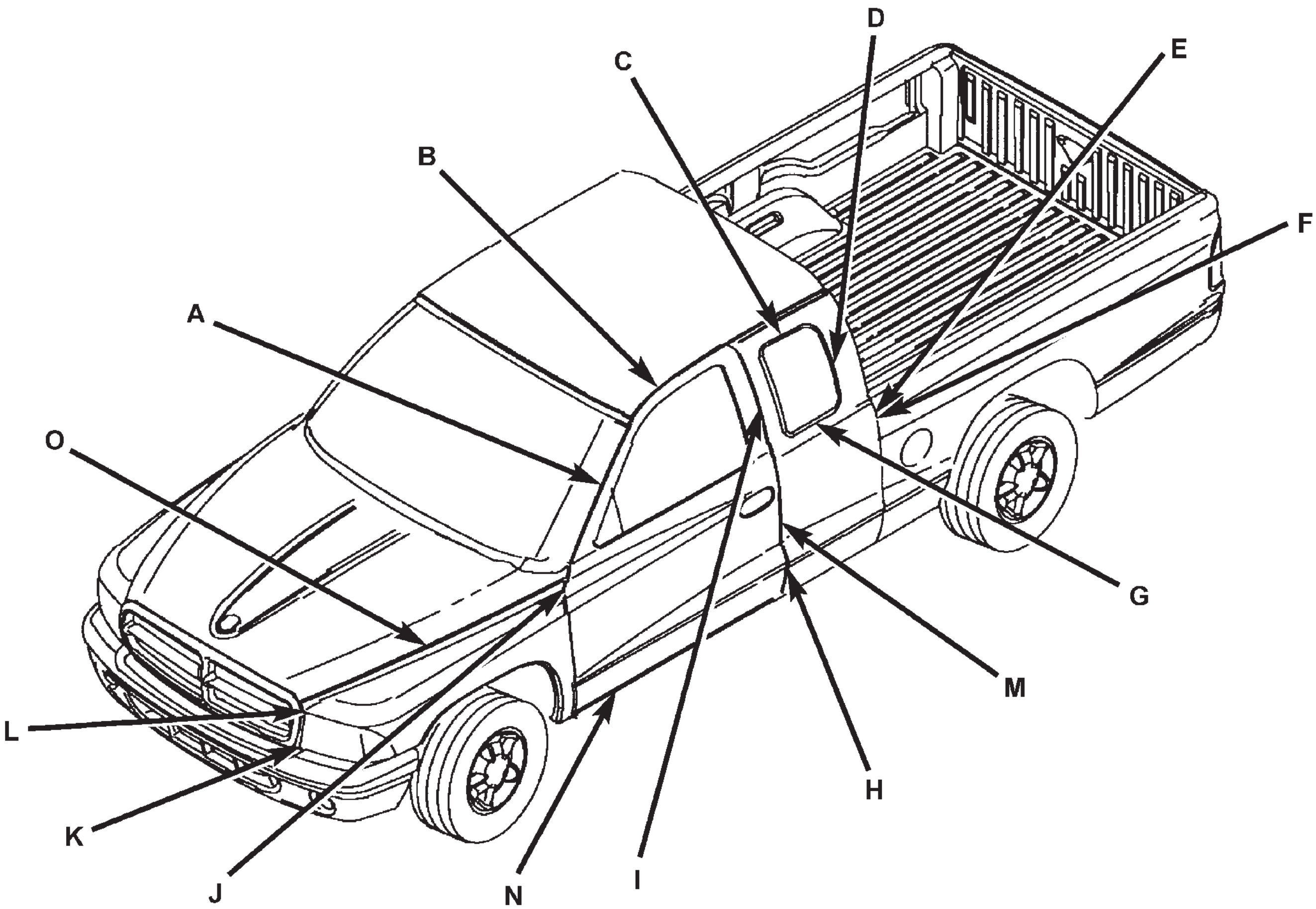
	DESCRIPTION	ALIGNMENT
A	Door to Quarter	0 +/- 2.5
B	Bumper to Fender	0 +/- 3.0

NOTE: ALL MEASUREMENTS ARE IN MM.

80b6fdf2

SPECIFICATIONS (Continued)

BODY GAP AND FLUSH — EXTENDED CAB



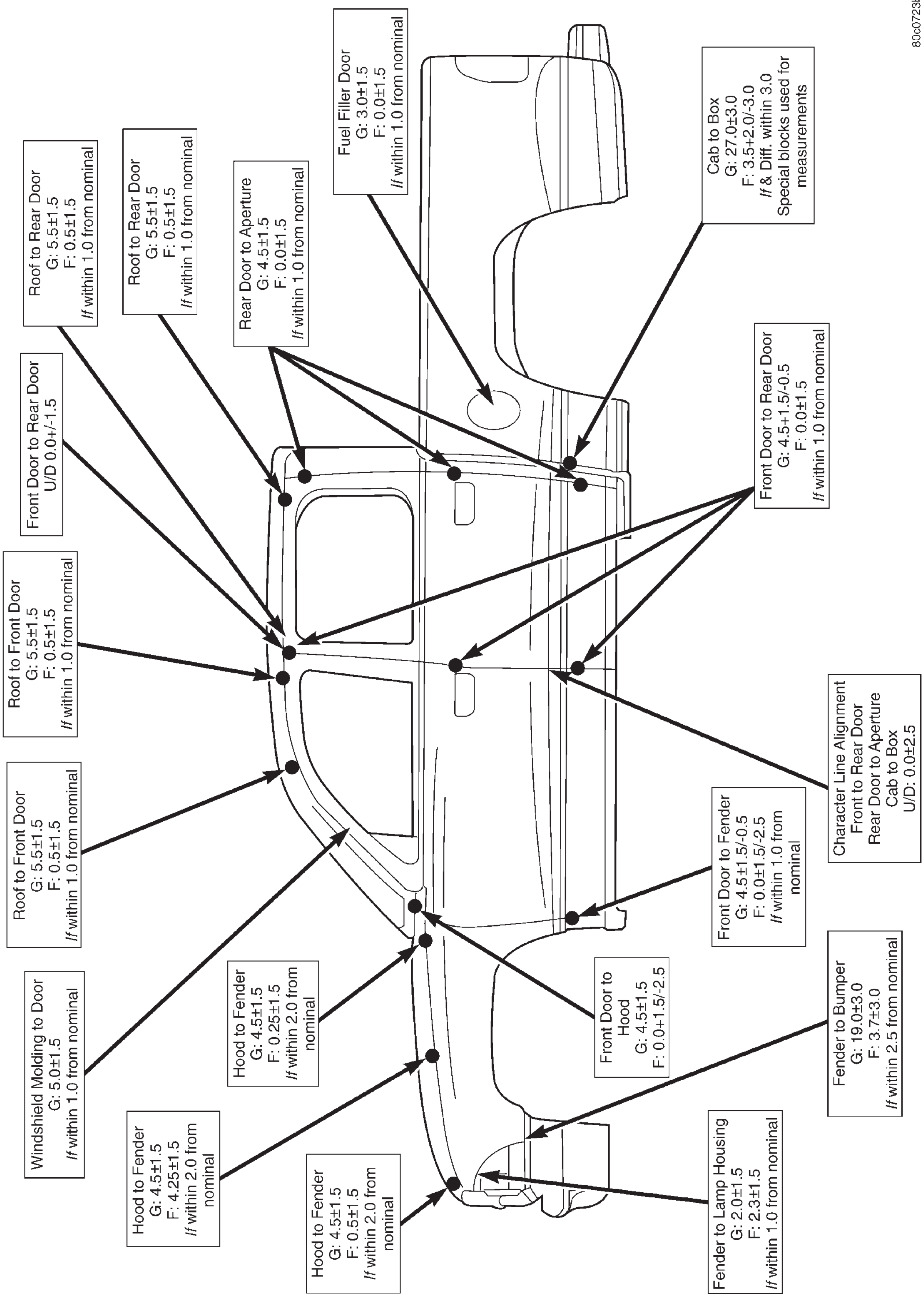
	DESCRIPTION	GAP	FLUSH
A	Door to Windshield Molding	5.1 +/- 1.5	N/A
B	Door to Roof	6.0 +/- 1.5	2.0 +/- 1.0
C	Quarter Glass to Quarter (top)	5.0 +/- 1.5	3.6 +/- 1.5
D	Quarter Glass to Quarter (rear)	5.0 +/- 1.5	3.6 +/- 1.5
E	Cab to Standard Box	18.7 +/- 3.0	-1.7 +/- 1.5
F	Cab to Extended Box	18.7 +/- 3.0	0.4 +/- 1.5
G	Quarter Glass to Quarter (bottom)	5.0 +/- 1.5	N/A
H	Door to Quarter	0.0 +/- 2.5	N/A
I	Quarter Glass to Door	5.0 +/- 1.5	3.6 +/- 1.5
J	Door to Hood / Fender	5.0 +/- 1.0	0.0 +/- 0.5
K	Grille to Headlamp	8.3 +/- 3.0	N/A
L	Grille to Fender	6.0 +/- 1.5	N/A
M	Door to Aperture	5.0 +/- 1.0	0.0 +/- 0.5
N	Door to Sill	7.0 +/- 2.0	0.0 +/- 1.5
O	Hood to Fender	6.0 +/- 1.0	1.5 +/- 1.0

NOTE: ALL MEASUREMENTS ARE IN MM.

80b6fdf3

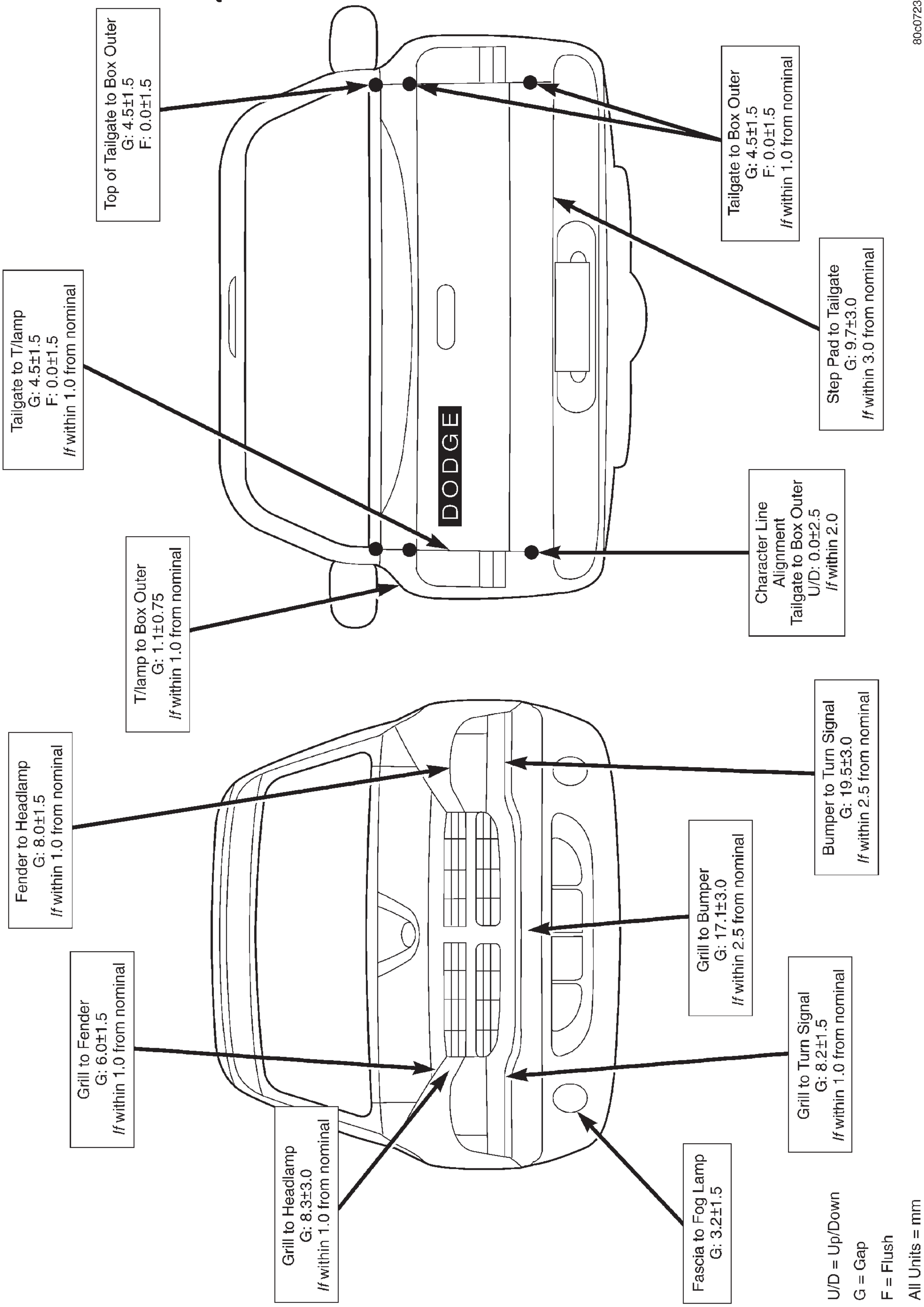
SPECIFICATIONS (Continued)

BODY GAP AND FLUSH— QUAD CAB



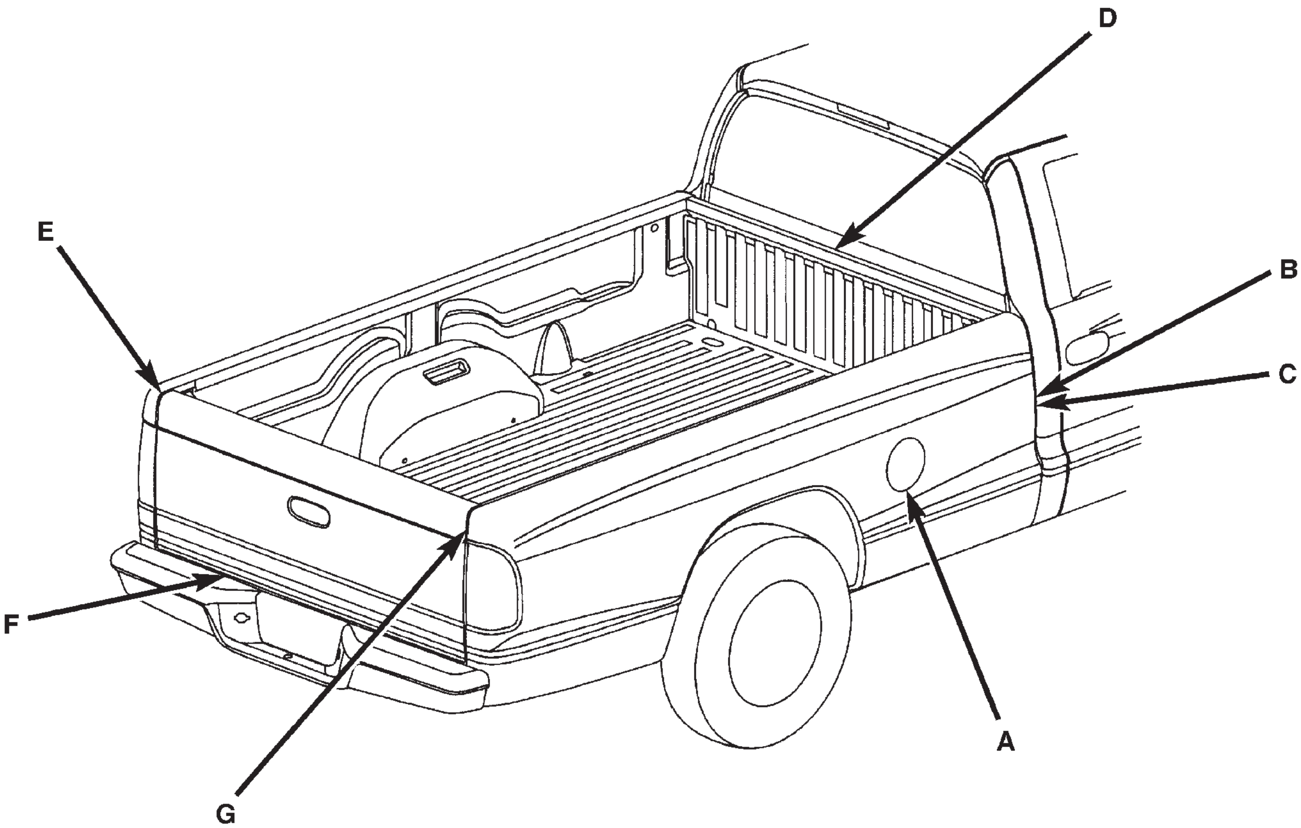
SPECIFICATIONS (Continued)

BODY GAP AND FLUSH— QUAD CAB



SPECIFICATIONS (Continued)

BODY GAP AND FLUSH — CARGO BOX



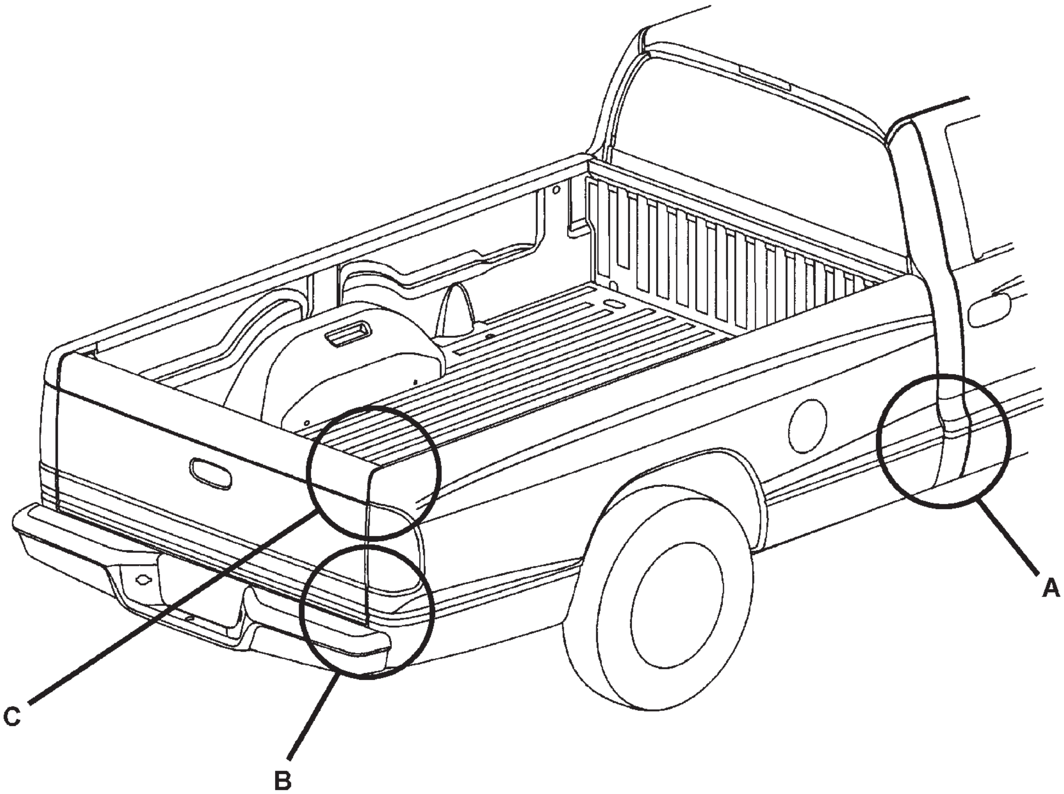
	DESCRIPTION	GAP	FLUSH
A	Fuel Filler Door to Box	3.0 +/- 0.75	0.0 +/- 0.5
B	Cargo to Standard Box	31.0 +/- 3.0	-1.7 +/- 1.5
C	Cargo to Extended Box	31.0 +/- 3.0	0.4 +/- 1.5
D	Cab to Box at Centerline	34.0 +/- 3.0	N/A
E	Box to Tailgate U/D	N/A	0.0 +/- 1.5
F	Tailgate to Bumper	9.7 +/- 3.0	N/A
G	Box to Tailgate	6.0 +/- 1.0	0.0 +/- 0.5

NOTE: ALL MEASUREMENTS ARE IN MM.

80b6fdf4

SPECIFICATIONS (Continued)

BODY GAP AND FLUSH — CARGO BOX



	DESCRIPTION	ALIGNMENT
A	Cab to Box Character Line	0 +/- 2.5
B	Box to Tailgate	0 +/- 2.5
C	Box to Tailgate	0 +/- 2.5

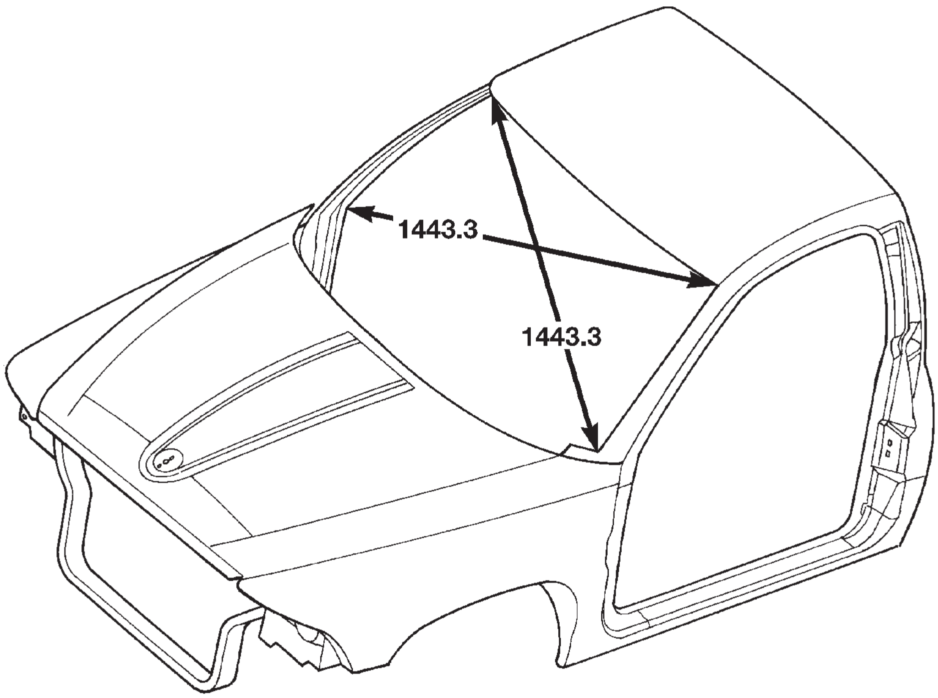
NOTE: ALL MEASUREMENTS ARE IN MM.

80b6fdf5

SPECIFICATIONS (Continued)

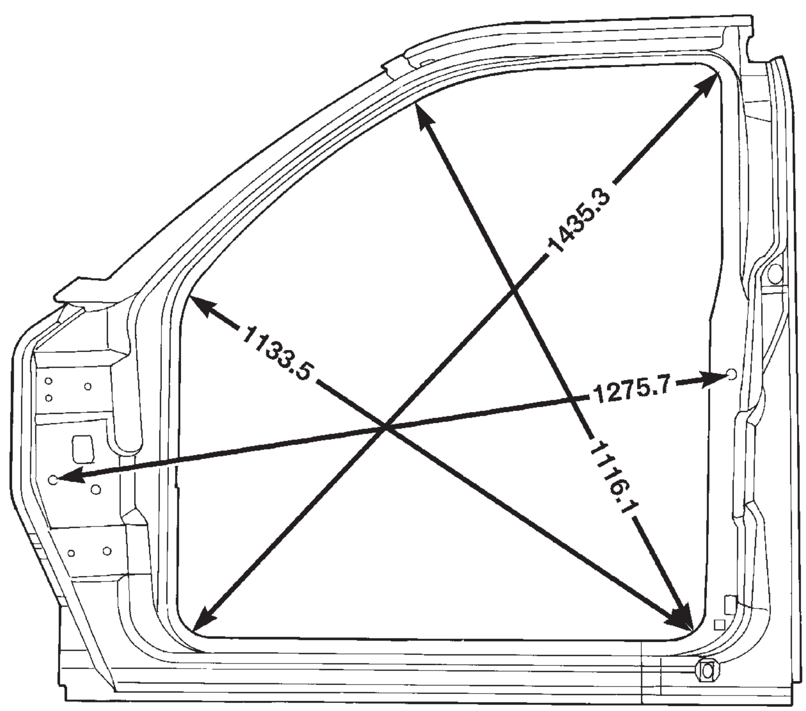
BODY OPENING DIMENSIONS

WINDSHIELD OPENING



80a53b46

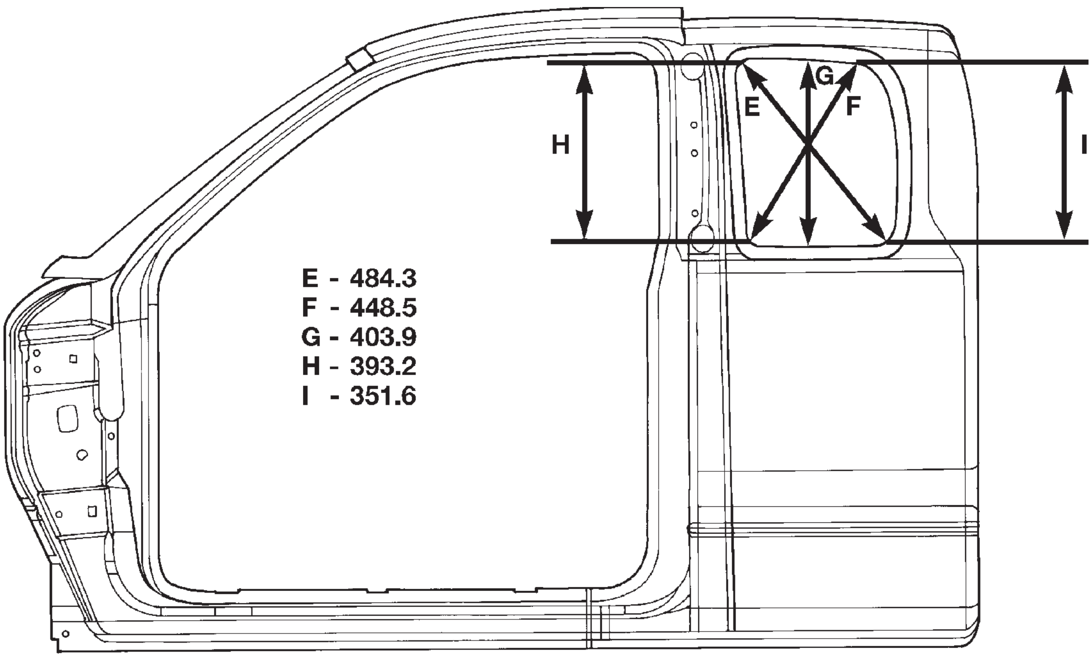
DOOR OPENING



80a53b43

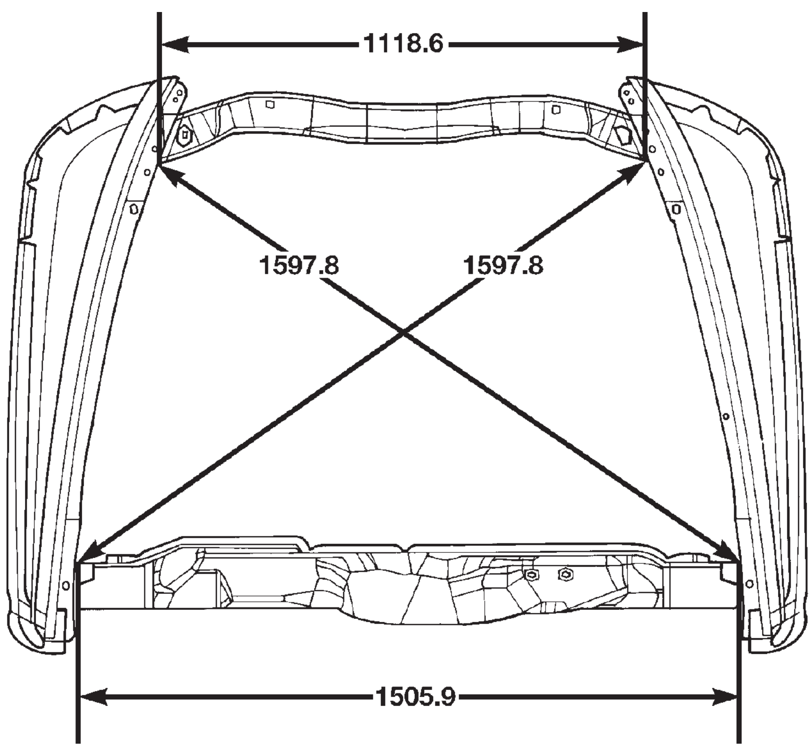
SPECIFICATIONS (Continued)

QUARTER WINDOW OPENING



80a53b49

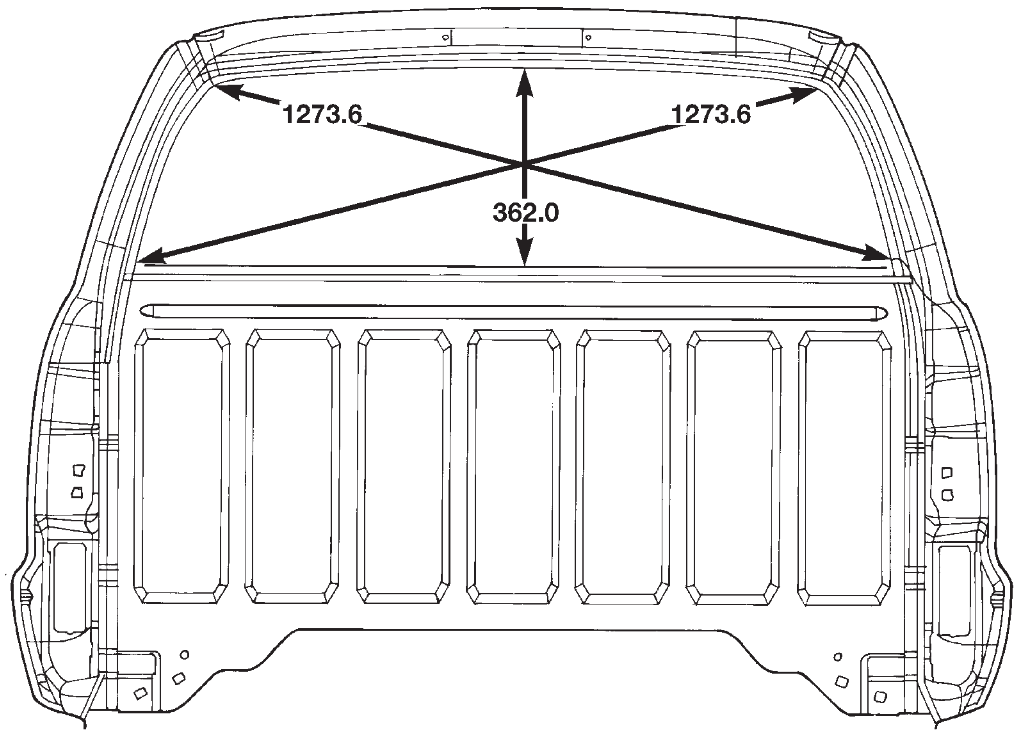
ENGINE COMPARTMENT OPENING



80a53b48

SPECIFICATIONS (Continued)

BACKLITE OPENING



80a53b47

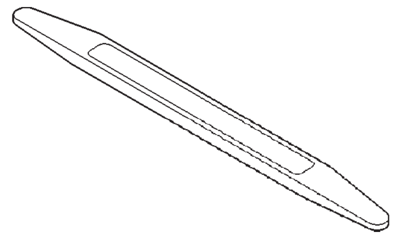
SPECIFICATIONS (Continued)

TORQUE SPECIFICATIONS

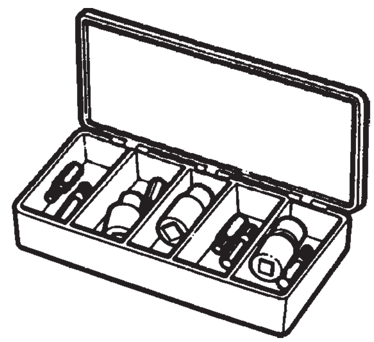
DESCRIPTION	TORQUE
Bench seat track to seat frame bolt	24 N·m (17 ft. lbs.)
Bench seat outer track to seat frame bolt	24 N·m (17 ft. lbs.)
Bench seat to floor pan front bolt	40 N·m (30 ft. lbs.)
Bench seat to floor pan rear bolt	28 N·m (20 ft. lbs.)
Bucket seat track to seat frame bolt	24 N·m (17 ft. lbs.)
Bucket seat track to floor pan front bolt	28 N·m (20 ft. lbs.)
Bucket seat track to floor pan rear inboard bolt	40 N·m (30 ft. lbs.)
Bucket seat track to floor pan rear outboard bolt	28 N·m (20 ft. lbs.)
Cab mounting bolt	81 N·m (60 ft. lbs.)
Cargo box bolt	27 N·m (20 ft. lbs.)
Center seat to bucket seat inboard track bolts	24 N·m (17 ft. lbs.)
Console lid/seat back pivot bolt	24 N·m (17 ft. lbs.)
Console lid/seat back to left hinge bracket torx screws	24 N·m (17 ft. lbs.)
Front bucket seat belt buckle anchor bolt	40 N·m (29 ft. lbs.)
Front door hinge to hinge pillar bolts	28 N·m (21 ft. lbs.)
Front door hinge to door nuts and bolts	28 N·m (21 ft. lbs.)
Front seat belt retractor bolt	44 N·m (32 ft. lbs.)
Front turning loop anchor bolt	44 N·m (32 ft. lbs.)
Front lower belt anchor bolt	44 N·m (32 ft. lbs.)
Front seat rear inboard seat track to floor pan bolts	40 N·m (30 ft. lbs.) torque.
Front seat rear outboard seat track to floor pan bolts	16 N·m (11 ft. lbs.)
Front seat front seat track to floor pan bolts	16 N·m (11 ft. lbs.)
Rear seat belt retractor bolt	44 N·m (32 ft. lbs.)
Rear turning loop anchor bolt	44 N·m (32 ft. lbs.)
Rear lower belt anchor bolt	44 N·m (32 ft. lbs.)
Rearview mirror set screw	1 N·m (9 in. lbs.)
Side view mirror nut	7 N·m (65 in. lbs.)
Rear seat belt/buckle anchor bolt	44 N·m (32 ft. lbs.)

SPECIAL TOOLS

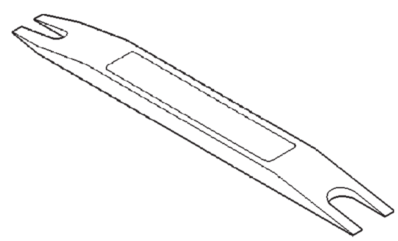
BODY



Trim Stick C-4755



Torx Bit Set C-4794-B



Molding Remover C-4829

HEATING AND AIR CONDITIONING

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
- ACCUMULATOR 2
- BLOWER MOTOR 2
- BLOWER MOTOR RELAY 2
- BLOWER MOTOR RESISTOR 3
- BLOWER MOTOR SWITCH 3
- COMPRESSOR 4
- COMPRESSOR CLUTCH 4
- COMPRESSOR CLUTCH RELAY 4
- CONDENSER 5
- EVAPORATOR COIL 5
- FIXED ORIFICE TUBE 5
- HEATER AND AIR CONDITIONER 5
- HEATER AND AIR CONDITIONER CONTROL 6
- HEATER CORE 7
- HIGH PRESSURE CUT-OFF SWITCH 7
- HIGH PRESSURE RELIEF VALVE 7
- LOW PRESSURE CYCLING CLUTCH SWITCH . . . 7
- REFRIGERANT 8
- REFRIGERANT LINE COUPLERS 8
- REFRIGERANT LINES 8
- REFRIGERANT OIL 8
- REFRIGERANT SYSTEM SERVICE PORTS 9
- VACUUM CHECK VALVE 9
- VACUUM RESERVOIR 9

DIAGNOSIS AND TESTING
- A/C PERFORMANCE 10
- BLOWER MOTOR 13
- BLOWER MOTOR RELAY 13
- BLOWER MOTOR RESISTOR 14
- BLOWER MOTOR SWITCH 15
- COMPRESSOR 15
- COMPRESSOR CLUTCH COIL 16
- COMPRESSOR CLUTCH RELAY 16
- DUAL FUNCTION HIGH PRESSURE SWITCH/HIGH PRESSURE CUT-OFF SWITCH 18
- HEATER PERFORMANCE 17
- HEATER-A/C CONTROL 17
- LOW PRESSURE CYCLING CLUTCH SWITCH . . 18

page

- REFRIGERANT SYSTEM LEAKS 19

SERVICE PROCEDURES
- REFRIGERANT OIL LEVEL 19
- REFRIGERANT RECOVERY 20
- REFRIGERANT SYSTEM CHARGE 20
- REFRIGERANT SYSTEM EVACUATE 20
- REFRIGERANT SYSTEM SERVICE EQUIPMENT 20

REMOVAL AND INSTALLATION
- ACCUMULATOR 23
- BLOWER MOTOR 24
- BLOWER MOTOR RELAY 25
- BLOWER MOTOR RESISTOR 25
- COMPRESSOR 26
- COMPRESSOR CLUTCH 27
- COMPRESSOR CLUTCH RELAY 30
- CONDENSER 31
- DUCTS AND OUTLETS 32
- EVAPORATOR COIL 34
- FIXED ORIFICE TUBE 35
- HEATER CORE 41
- HEATER-A/C CONTROL 35
- HEATER-A/C HOUSING 36
- HEATER-A/C HOUSING DOOR 40
- HIGH PRESSURE CUT-OFF SWITCH 42
- LIQUID LINE 43
- LOW PRESSURE CYCLING CLUTCH SWITCH . . 43
- MODE DOOR VACUUM ACTUATOR 44
- REFRIGERANT LINE COUPLER 45
- SERVICE WARNINGS AND PRECAUTIONS 22
- SUCTION AND DISCHARGE LINE 46
- TEMPERATURE CONTROL CABLE 47
- VACUUM CHECK VALVE 48
- VACUUM RESERVOIR 48
- VACUUM SYSTEM 50

ADJUSTMENTS
- TEMPERATURE CONTROL CABLE 55

SPECIFICATIONS
- A/C APPLICATION TABLE 55

DESCRIPTION AND OPERATION

ACCUMULATOR

DESCRIPTION

The accumulator is mounted in the engine compartment between the evaporator coil outlet tube and the compressor inlet.

OPERATION

Refrigerant enters the accumulator canister as a low pressure vapor through the inlet tube. Any liquid, oil-laden refrigerant falls to the bottom of the canister, which acts as a separator. A desiccant bag is mounted inside the accumulator canister to absorb any moisture which may have entered and become trapped within the refrigerant system (Fig. 1).

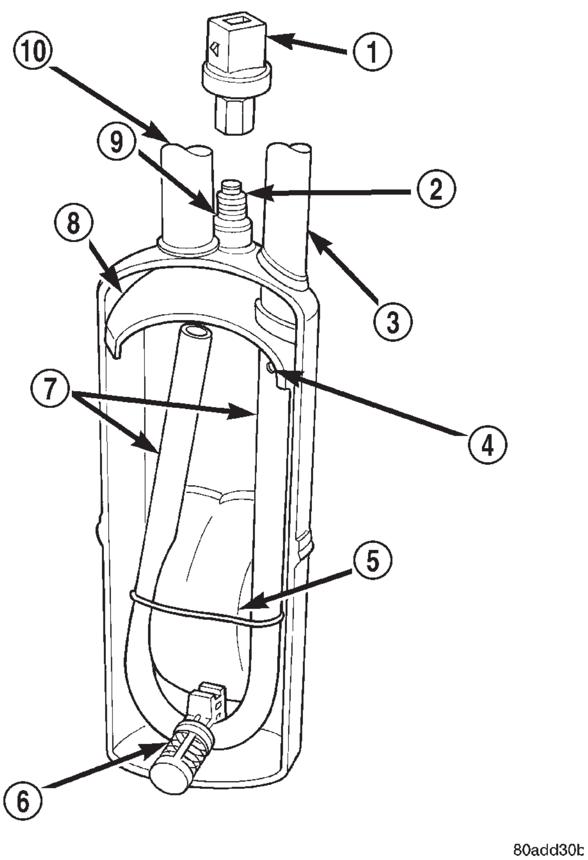


Fig. 1 Accumulator - Typical

1 – LOW PRESSURE CYCLING CLUTCH SWITCH
2 – PRESSURE SWITCH FITTING
3 – OUTLET TO COMPRESSOR
4 – ANTI-SIPHON HOLE
5 – DESICCANT BAG
6 – OIL RETURN ORIFICE FILTER
7 – VAPOR RETURN TUBE
8 – ACCUMULATOR DOME
9 – O-RING SEAL
10 – INLET FROM EVAPORATOR

BLOWER MOTOR

DESCRIPTION

The blower motor and blower wheel are located in the passenger side end of the heater-A/C housing, below the glove box. The blower motor controls the velocity of air flowing through the heater-A/C housing by spinning a squirrel cage-type blower wheel within the housing at the selected speed. The blower motor and blower wheel can only be serviced with the heater-A/C housing removed from the passenger compartment.

OPERATION

The blower motor will only operate when the ignition switch is in the On position, and the heater-A/C mode control switch knob is in any position, except Off. The blower motor receives a fused battery feed through the blower motor relay whenever the ignition switch is in the On position.

The blower motor battery feed circuit is protected by a fuse in the Power Distribution Center (PDC). The blower motor relay control circuit is protected by a fuse in the junction block. Blower motor speed is controlled by regulating the ground path through the heater-A/C mode control switch, the blower motor switch, the blower motor resistor, and the voltage reduction relay.

The blower motor and blower motor wheel cannot be repaired and, if faulty or damaged, they must be replaced. The blower motor and blower wheel are each serviced separately.

BLOWER MOTOR RELAY

DESCRIPTION

The blower motor relay (also referred to as Voltage Reduction Relay or VRR) is an International Standards Organization (ISO)-type relay. The relay is an electromechanical device that switches battery current from a fuse in the Power Distribution Center (PDC) directly to the blower motor. The relay is energized when the relay coil is provided a voltage signal by the ignition switch. This arrangement reduces the amount of battery current that must flow through the ignition switch.

OPERATION

The blower motor relay control circuit is protected by a fuse located in the junction block. When the relay is de-energized, the blower motor receives no battery current. The VRR is used to reduce blower speeds in Heat mode. In non-A/C modes, the relay is de-energized and switches the current flow through an added resistance in the resistor block. When an A/C mode is selected, the relay is energized and the

DESCRIPTION AND OPERATION (Continued)

normally open contact is used to bypass the added resistor. The fuse is located in the small relay fuse block that is attached to the Junction Block. The relay is energized by grounding the coil low side with the HVAC switch in any A/C mode. See Blower Motor Relay in the Diagnosis and Testing section of this group for more information.

The blower motor relay is mounted with a single screw directly to the instrument panel's structural plastic inside the glove box opening, next to the left-side energy-absorbing bracket (Fig. 2). Refer to the PDC label for blower motor relay identification and location.

The blower motor relay (VRR) cannot be repaired and, if faulty or damaged, it must be replaced.

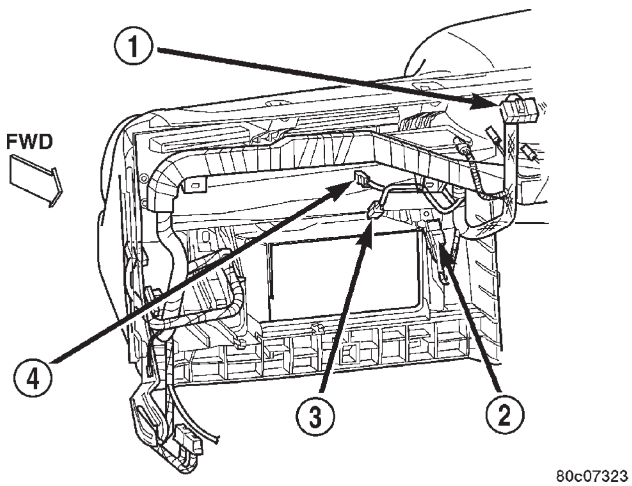


Fig. 2 Blower Motor Relay (VRR) Location

1 – BLOWER MOTOR RESISTOR CONNECTOR
2 – BLOWER MOTOR RELAY
3 – BLOWER MOTOR CONNECTOR
4 – GLOVE BOX LAMP CONNECTOR

BLOWER MOTOR RESISTOR

DESCRIPTION

During vehicle assembly, the blower motor resistor is mounted to the dash plenum panel inside the passenger compartment prior to instrument panel roll-up (Fig. 3). However, a resistor mounting plate has been designed so that the resistor can be removed through an access hole in the cowl plenum panel just below the windshield. It can be accessed by removing the cowl plenum cover/grille panel. See Blower Motor Resistor in the Removal and Installation section of this group for more information.

OPERATION

The resistor has multiple resistor wires, each of which will change the resistance in the blower motor ground path to change the blower motor speed. The blower motor switch directs the ground path through

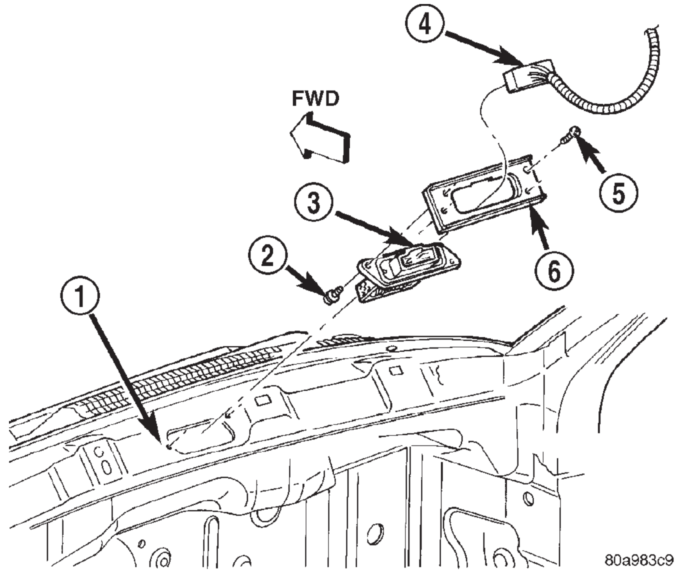


Fig. 3 Blower Motor Resistor - Factory Installation

1 – PLENUM PANEL
2 – SCREW
3 – RESISTOR
4 – CONNECTOR
5 – SCREW
6 – RESISTOR MOUNTING PLATE

the correct resistor wire to obtain the selected blower motor speed.

With the blower motor switch in the lowest speed position, the ground path for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed. When the blower motor switch is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR SWITCH

DESCRIPTION

The heater-only or heater-A/C blower motor is controlled by a four position rotary-type blower motor switch, mounted in the heater-A/C control panel. The switch allows the selection of one of four blower motor speeds, but can only be turned off by selecting the Off position with the heater-A/C mode control switch knob.

OPERATION

The blower motor switch directs the blower motor ground path through the mode control switch to the blower motor resistor, or directly to ground, as required to achieve the selected blower motor speed.

DESCRIPTION AND OPERATION (Continued)

The blower motor switch cannot be repaired and, if faulty or damaged, the entire heater-only or heater-A/C control unit must be replaced. The blower motor switch knob is serviced separately.

COMPRESSOR

DESCRIPTION

The air conditioning system uses a Sanden SD7H15 seven cylinder, reciprocating wobble plate-type compressor on all models. This compressor has a fixed displacement of 150 cubic centimeters (9.375 cubic inches), and has both the suction and discharge ports located on the cylinder head. A label identifying the use of R-134a refrigerant is located on the compressor.

OPERATION

The compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The compressor draws in low-pressure refrigerant vapor from the evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the condenser through the compressor discharge port.

The compressor cannot be repaired. If faulty or damaged, the entire compressor assembly must be replaced. The compressor clutch, pulley and clutch coil are available for service.

COMPRESSOR CLUTCH

DESCRIPTION

The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate (Fig. 4). The electromagnetic coil unit and the hub bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings. The clutch plate is mounted to the compressor shaft and secured with a nut.

OPERATION

The compressor clutch assembly provides the means to engage and disengage the compressor from the engine serpentine accessory drive belt. When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley. The compressor clutch and coil are the only serviced parts on the compressor.

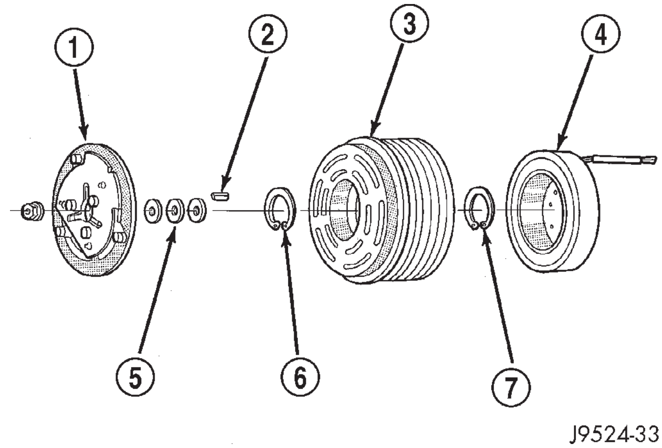


Fig. 4 Compressor Clutch - Typical

1 – CLUTCH PLATE
2 – SHAFT KEY
3 – PULLEY
4 – COIL
5 – CLUTCH SHIMS
6 – SNAP RING
7 – SNAP RING

The compressor clutch engagement is controlled by several components: the heater-A/C mode control switch, the low pressure cycling clutch switch, the high pressure cut-off switch, the compressor clutch relay, and the Powertrain Control Module (PCM). The PCM may delay compressor clutch engagement for up to thirty seconds. Refer to Group 14 - Fuel System for more information on the PCM controls.

COMPRESSOR CLUTCH RELAY

DESCRIPTION

The compressor clutch relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (footprint) is different, the current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

OPERATION

The compressor clutch relay is a electromechanical device that switches battery current to the compressor clutch coil when the Powertrain Control Module (PCM) grounds the coil side of the relay. The PCM responds to inputs from the heater-A/C mode control switch, the low pressure cycling clutch switch, and the high pressure cut-off switch. See Compressor Clutch Relay in the Diagnosis and Testing section of this group for more information.

The compressor clutch relay is located in the Power Distribution Center (PDC) in the engine compart-

DESCRIPTION AND OPERATION (Continued)

ment. Refer to the PDC label for relay identification and location.

The compressor clutch relay cannot be repaired and, if faulty or damaged, it must be replaced.

CONDENSER

DESCRIPTION

The condenser is located in the air flow in front of the engine cooling radiator. The condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the compressor to give up its heat to the air passing over the condenser fins.

OPERATION

When the refrigerant gas gives up its heat, it condenses. When the refrigerant leaves the condenser, it has become a high-pressure liquid refrigerant. The volume of air flowing over the condenser fins is critical to the proper cooling performance of the air conditioning system. Therefore, it is important that there are no objects placed in front of the radiator grille openings in the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or condenser service.

The condenser cannot be repaired and, if faulty or damaged, it must be replaced.

EVAPORATOR COIL

DESCRIPTION

The evaporator coil is located in the heater-A/C housing, under the instrument panel. The evaporator coil is positioned in the heater-A/C housing so that all air that enters the housing must pass over the fins of the evaporator before it is distributed through the system ducts and outlets. However, air passing over the evaporator coil fins will only be conditioned when the compressor is engaged and circulating refrigerant through the evaporator coil tubes.

OPERATION

Refrigerant enters the evaporator from the fixed orifice tube as a low-temperature, low-pressure liquid. As air flows over the fins of the evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas when it leaves the evaporator.

The evaporator coil cannot be repaired and, if faulty or damaged, it must be replaced.

FIXED ORIFICE TUBE

DESCRIPTION

The fixed orifice tube is installed in the liquid line between the outlet of the condenser and the inlet of the evaporator. The fixed orifice tube is located near the front end of the rear half of the two-piece liquid line. It is accessed for service by separating the tube fitting that joins the two halves of the liquid line.

OPERATION

The inlet end of the fixed orifice tube has a nylon mesh filter screen, which filters the refrigerant and helps to reduce the potential for blockage of the metering orifice by refrigerant system contaminants (Fig. 5). The outlet end of the tube has a nylon mesh diffuser screen. The O-rings on the plastic body of the fixed orifice tube seal the tube to the inside of the liquid line and prevent the refrigerant from bypassing the fixed metering orifice.

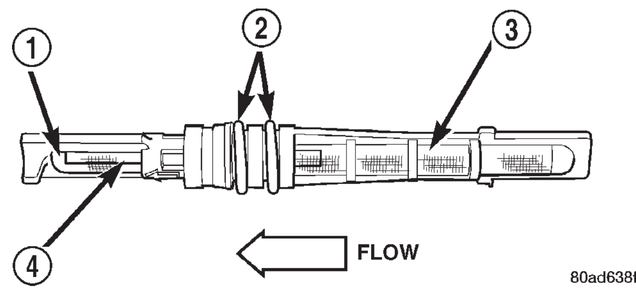


Fig. 5 Fixed Orifice Tube - Typical

1 – DIFFUSER SCREEN
2 – “O” RINGS
3 – INLET FILTER SCREEN
4 – ORIFICE

The fixed orifice tube is used to meter the flow of liquid refrigerant into the evaporator coil. The high-pressure liquid refrigerant from the condenser expands into a low-pressure liquid as it passes through the metering orifice and diffuser screen of the fixed orifice tube.

The fixed orifice tube cannot be repaired and, if faulty or plugged, it must be replaced.

HEATER AND AIR CONDITIONER

DESCRIPTION

All vehicles are equipped with a common heater-A/C housing assembly (Fig. 6). The system combines air conditioning, heating, and ventilating capabilities in a single unit housing mounted under the instrument panel. On heater-only systems, the evaporator coil and recirculation air door are omitted from the housing.

DESCRIPTION AND OPERATION (Continued)

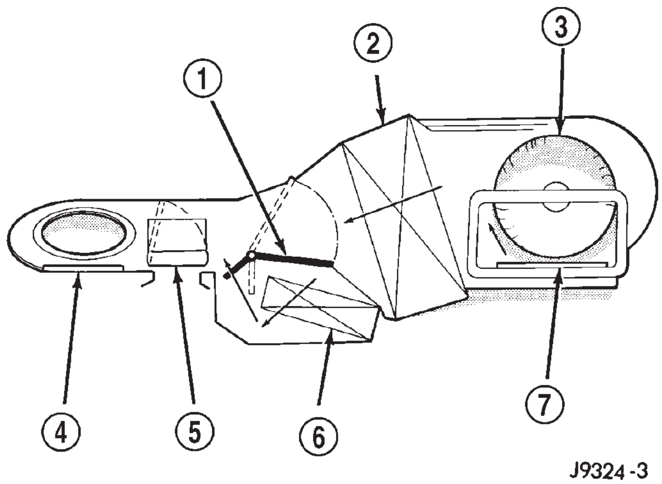


Fig. 6 Common Blend-Air Heater-Air Conditioner System - Typical

1 – TEMPERATURE BLEND/AIR DOOR
2 – EVAPORATOR CORE
3 – BLOWER
4 – PANEL DEFROST DOOR
5 – HEAT DEFROST DOOR
6 – HEATER CORE
7 – RECIRCULATING AIR DOOR

OPERATION

Outside fresh air enters the vehicle through the cowl top opening at the base of the windshield, and passes through a plenum chamber to the heater-A/C system blower housing. Air flow velocity can then be adjusted with the blower motor speed selector switch on the heater-A/C control panel. The air intake openings must be kept free of snow, ice, leaves, and other obstructions for the heater-A/C system to receive a sufficient volume of outside air.

It is also important to keep the air intake openings clear of debris because leaf particles and other debris that is small enough to pass through the cowl plenum screen can accumulate within the heater-A/C housing. The closed, warm, damp and dark environment created within the heater-A/C housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during heater-A/C system operation.

The heater and optional air conditioner are blend-air type systems. In a blend-air system, a blend-air door controls the amount of unconditioned air (or cooled air from the evaporator on models with air conditioning) that is allowed to flow through, or around, the heater core. A temperature control knob on the heater-A/C control panel determines the discharge air temperature by moving a cable, which operates the blend-air door. This allows an almost immediate manual control of the output air temperature of the system.

The mode control knob on the heater-only or heater-A/C control panel is used to direct the conditioned air to the selected system outlets. Both mode control switches use engine vacuum to control the mode doors, which are operated by vacuum actuator motors.

On air conditioned vehicles, the outside air intake can be shut off by selecting the recirculation mode (Max A/C) with the mode control knob. This will operate a vacuum actuated recirculating air door that closes off the outside fresh air intake and recirculates the air that is already inside the vehicle.

The optional air conditioner for all models is designed for the use of non-CFC, R-134a refrigerant. The air conditioning system has an evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. This air conditioning system uses a fixed orifice tube in the liquid line between the condenser and the evaporator coil to meter refrigerant flow to the evaporator coil. To maintain minimum evaporator temperature and prevent evaporator freezing, a fixed pressure setting switch on the accumulator cycles the compressor clutch.

HEATER AND AIR CONDITIONER CONTROL

DESCRIPTION

Both the heater-only and heater-A/C systems use a combination of mechanical, electrical, and vacuum controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle. Refer to the owner's manual in the vehicle glove box for more information on the features, use, and suggested operation of these controls.

OPERATION

The heater-only or heater-A/C control panel is located to the right of the instrument cluster on the instrument panel. The control panel contains a rotary-type temperature control knob, a rotary-type mode control switch knob, and a rotary-type blower motor speed switch knob.

The heater-only or heater-A/C control panel cannot be repaired. If faulty or damaged, the entire unit must be replaced. The illumination lamps are available for service replacement.

DESCRIPTION AND OPERATION (Continued)

HEATER CORE

DESCRIPTION

The heater core is located in the heater-A/C housing, under the instrument panel. It is a heat exchanger made of rows of tubes and fins.

OPERATION

Engine coolant is circulated through heater hoses to the heater core at all times. As the coolant flows through the heater core, heat removed from the engine is transferred to the heater core fins and tubes. Air directed through the heater core picks up the heat from the heater core fins. The blend air door allows control of the heater output air temperature by controlling how much of the air flowing through the heater-A/C housing is directed through the heater core. The blower motor speed controls the volume of air flowing through the heater-A/C housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced. Refer to Cooling System for more information on the engine cooling system, the engine coolant and the heater hoses.

HIGH PRESSURE CUT-OFF SWITCH

DESCRIPTION

The high pressure cut-off switch is located on the discharge line near the compressor. The switch is screwed onto a fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system. The discharge line fitting is equipped with an O-ring to seal the switch connection.

OPERATION

The high pressure cut-off switch is connected in series electrically with the low pressure cycling clutch switch between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This prevents compressor operation when the discharge line pressure approaches high levels.

The high pressure cut-off switch contacts are open when the discharge line pressure rises above about 3100 to 3375 kPa (450 to 490 psi). The switch contacts will close when the discharge line pressure drops to about 1860 to 2275 kPa (270 to 330 psi).

The high pressure cut-off switch is a factory-calibrated unit. The switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

HIGH PRESSURE RELIEF VALVE

DESCRIPTION

A high pressure relief valve is located on the compressor cylinder head, which is at the rear of the compressor. This mechanical valve is designed to vent refrigerant from the system to protect against damage to the compressor and other system components, caused by condenser air flow restriction or an overcharge of refrigerant.

OPERATION

The high pressure relief valve vents the system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The valve closes with a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the system. If the valve vents refrigerant, it does not mean the valve is faulty.

The high pressure relief valve is a factory-calibrated unit. The valve cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the compressor assembly.

LOW PRESSURE CYCLING CLUTCH SWITCH

DESCRIPTION

The low pressure cycling clutch switch is located on the side of the accumulator near the top. The switch is screwed onto an accumulator fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system. The accumulator fitting is equipped with an O-ring to seal the switch connection.

OPERATION

The low pressure cycling clutch switch is connected in series electrically with the high pressure cut-off switch and the heater-A/C controls, between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This regulates the refrigerant system pressure and controls evaporator temperature. Controlling evaporator temperature prevents condensate water on the evaporator fins from freezing and obstructing air conditioning system air flow.

The low pressure cycling clutch switch contacts are open when the suction pressure is about 165 kPa (24± 1 psi) or lower. The switch contacts will close when the suction pressure rises to about 269 kPa (39± 2 psi) or above. Lower ambient temperatures,

DESCRIPTION AND OPERATION (Continued)

below about -1° C (30° F), will also cause the switch contacts to open. This is due to the pressure/temperature relationship of the refrigerant in the system.

The low pressure cycling clutch switch is a factory-calibrated unit. It cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REFRIGERANT

DESCRIPTION

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

OPERATION

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 added to an R-134a refrigerant system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance. In addition, the PolyAlkylene Glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the compressor identifying to service technicians that the air conditioning system is equipped with R-134a.

REFRIGERANT LINES

DESCRIPTION

The refrigerant lines and hoses are used to carry the refrigerant between the various air conditioning system components. A barrier hose design with a nylon tube, which is sandwiched between rubber layers, is used for the R-134a air conditioning system on this vehicle. This nylon tube helps to further contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant hoses are made from lightweight aluminum or steel, and commonly use braze-less fittings.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

OPERATION

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

The refrigerant lines and hoses are coupled with other components of the HVAC system with peanut-block style fittings. A stat-O seal type flat steel gasket with a captured compressible O-ring, is used to mate plumbing lines with A/C components to ensure the integrity of the refrigerant system.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

REFRIGERANT LINE COUPLERS

DESCRIPTION

Spring-lock type refrigerant line couplers are used to connect many of the refrigerant lines and other components to the refrigerant system. These couplers require a special tool for disengaging the two coupler halves.

OPERATION

The spring-lock coupler is held together by a garter spring inside a circular cage on the male half of the fitting (Fig. 7). When the two coupler halves are connected, the flared end of the female fitting slips behind the garter spring inside the cage on the male fitting. The garter spring and cage prevent the flared end of the female fitting from pulling out of the cage.

Two O-rings on the male half of the fitting are used to seal the connection. These O-rings are compatible with R-134a refrigerant and must be replaced with O-rings made of the same material.

Secondary clips are installed over the two connected coupler halves at the factory for added blowoff protection.

REFRIGERANT OIL

DESCRIPTION

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, PolyAlkylene Glycol (PAG),

DESCRIPTION AND OPERATION (Continued)

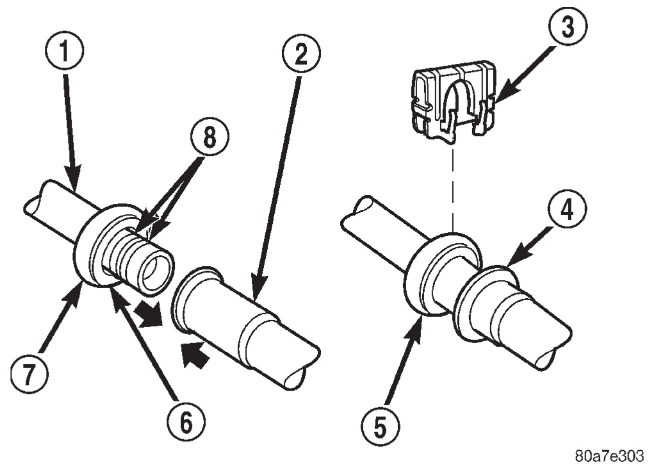


Fig. 7 Spring-Lock Coupler - Typical

1 – MALE HALF SPRING-LOCK COUPLER
2 – FEMALE HALF SPRING-LOCK COUPLER
3 – SECONDARY CLIP
4 – CONNECTION INDICATOR RING
5 – COUPLER CAGE
6 – GARTER SPRING
7 – COUPLER CAGE
8 – “O” RINGS

wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The SD7H15 compressor used in this vehicle is designed to use an SP-20 PAG refrigerant oil. Use only refrigerant oil of this same type to service the refrigerant system.

OPERATION

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause compressor damage, and too much can reduce air conditioning system performance.

PAG refrigerant oil is much more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

REFRIGERANT SYSTEM SERVICE PORTS

DESCRIPTION

The two refrigerant system service ports are used to charge, recover/recycle, evacuate, and test the air conditioning refrigerant system. Unique service port coupler sizes are used on the R-134a system, to ensure that the refrigerant system is not accidentally contaminated by the use of the wrong refrigerant (R-12), or refrigerant system service equipment.

OPERATION

The high pressure service port is located on the liquid line between the condenser and the evaporator, near the front of the engine compartment. The low pressure service port is located on the compressor manifold, directly over the suction port of the compressor.

Each of the service ports has a threaded plastic protective cap installed over it from the factory. After servicing the refrigerant system, always reinstall both of the service port caps.

VACUUM CHECK VALVE

DESCRIPTION

A vacuum check valve is installed in the accessory vacuum supply line in the engine compartment, near the vacuum fitting on the power brake booster. The vacuum check valve is designed to allow vacuum to flow in only one direction through the accessory vacuum supply circuits.

OPERATION

The use of a vacuum check valve helps to maintain the system vacuum needed to retain the selected heater-A/C mode settings. The check valve will prevent the engine from bleeding down system vacuum through the intake manifold during extended heavy engine load (low engine vacuum) operation.

The vacuum check valve cannot be repaired and, if faulty or damaged, it must be replaced.

VACUUM RESERVOIR

DESCRIPTION

The vacuum reservoir is mounted to the underside of the cowl plenum cover/grille panel in the right cowl plenum area. The cowl plenum cover/grille panel must be removed from the vehicle to access the vacuum reservoir for service.

OPERATION

Engine vacuum is stored in the vacuum reservoir. The stored vacuum is used to operate the vacuum-controlled vehicle accessories during periods of low engine vacuum such as when the vehicle is climbing a steep grade, or under other high engine load operating conditions.

The vacuum reservoir cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

A/C PERFORMANCE

The air conditioning system is designed to provide the passenger compartment with low temperature and low humidity air. The evaporator, located in the heater-A/C housing on the dash panel below the instrument panel, is cooled to temperatures near the freezing point. As warm damp air passes through the cooled evaporator, the air transfers its heat to the refrigerant in the evaporator tubes and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an air conditioning system will be more effective in the recirculation mode (Max-A/C). With the system in the recirculation mode, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, the air conditioning system performance levels improve.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity has on the performance of the air conditioning system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. High humidity greatly reduces the ability of the evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their air conditioning system on humid days. A performance test is the best way to determine whether the system is performing up to standard. This test also provides valuable clues as to the possible cause of trouble with the air conditioning system.

Review the Service Warnings and Precautions in the front of this group before performing this procedure. The air temperature in the test room and in the vehicle must be a minimum of 21° C (70° F) for this test.

(1) Connect a tachometer and a manifold gauge set.

(2) Set the heater-A/C mode control switch knob in the recirculation mode (Max-A/C) position, the temperature control knob in the full cool position, and the blower motor switch knob in the highest speed position.

(3) Start the engine and hold the idle at 1,000 rpm with the compressor clutch engaged.

(4) The engine should be at operating temperature. The doors and windows must be closed.

(5) Insert a thermometer in the driver side center A/C (panel) outlet. Operate the engine for five minutes.

(6) The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, unplug the low pressure cycling clutch switch wire harness connector from the switch located on the accumulator (Fig. 8). Place a jumper wire between the two cavities of the low pressure cycling clutch switch wire harness connector.

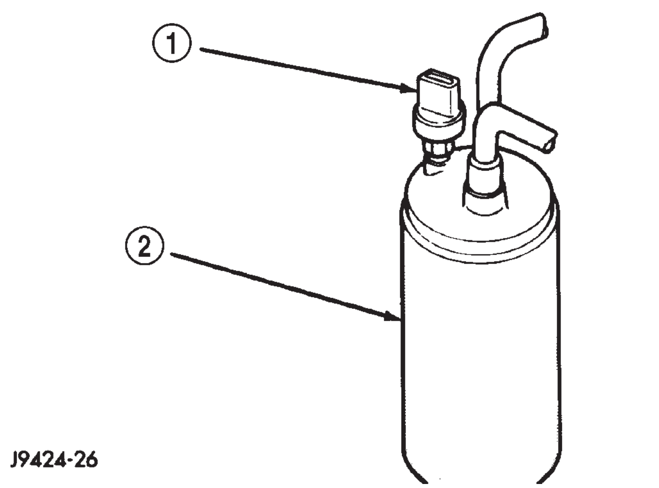


Fig. 8 Low Pressure Cycling Clutch Switch - Typical

1 – CLUTCH CYCLING PRESSURE SWITCH
2 – ACCUMULATOR

(7) With the compressor clutch engaged, record the discharge air temperature, the compressor discharge pressure, and the evaporator inlet pressure.

(8) Compare the discharge air temperature to the Performance Temperature and Pressure chart. If the discharge air temperature is high, see Refrigerant System Leaks in the Diagnosis and Testing section of this group, and Refrigerant System Charge in the Service Procedures section of this group.

DIAGNOSIS AND TESTING (Continued)

Performance Temperature and Pressure					
Ambient Air Temperature	21°C (70°F)	27°C (80°F)	32°C (90°F)	38°C (100°F)	43°C (110°F)
Maximum Allowable Air Temperature at Center Panel Outlet	3°C (38°F)	7°C (44°F)	9°C (48°F)	13°C (55°F)	18°C (64°F)
Evaporator Inlet Pressure at Charge Port	172 to 241 kPa (25 to 35 psi)	221 to 276 kPa (32 to 40 psi)	255 to 310 kPa (37 to 45 psi)	269 to 345 kPa (39 to 50 psi)	310 to 379 kPa (45 to 55 psi)
Compressor Discharge Pressure	1102 to 1378 kPa (160 to 200 psi)	1309 to 1516 kPa (190 to 220 psi)	1378 to 1654 kPa (200 to 240 psi)	1516 to 1791 kPa (220 to 260 psi)	1723 to 2067 kPa (250 to 300 psi)

(9) Compare the compressor discharge and suction (evaporator inlet) pressure readings to the Performance Temperature and Pressure chart. If the compressor discharge pressure or suction pressure is not normal, see the Pressure Diagnosis chart.

Pressure Diagnosis		
Condition	Possible Causes	Correction
Rapid compressor clutch cycling (ten or more cycles per minute).	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
Equal pressures, but the compressor clutch does not engage.	1. No refrigerant in the refrigerant system. 2. Faulty fuse. 3. Faulty compressor clutch coil. 4. Faulty compressor clutch relay. 5. Improperly installed or faulty low pressure cycling clutch switch. 6. Faulty high pressure cut-off switch. 7. Faulty Powertrain Control Module (PCM).	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. Check the fuses in the Power Distribution Center and the junction block. Repair the shorted circuit or component and replace the fuses, if required. 3. See Compressor Clutch Coil in this group. Test the compressor clutch coil and replace, if required. 4. See Compressor Clutch Relay in this group. Test the compressor clutch relay and relay circuits. Repair the circuits or replace the relay, if required. 5. See Low Pressure Cycling Clutch Switch in this group. Test the low pressure cycling clutch switch and tighten or replace, if required. 6. See High Pressure Cut-Off Switch in this group. Test the high pressure cut-off switch and replace, if required. 7. Refer to the proper Diagnostic Procedures manual for testing of the PCM. Test the PCM and replace, if required.

DIAGNOSIS AND TESTING (Continued)

Pressure Diagnosis		
Condition	Possible Causes	Correction
Normal pressures, but A/C Performance Test air temperatures at center panel outlet are too high.	1. Excessive refrigerant oil in system. 2. Temperature control cable improperly installed or faulty. 3. Blend-air door inoperative or sealing improperly.	1. See Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required. 2. See Temperature Control Cable in this group. Inspect the temperature control cable for proper routing and operation and correct, if required. 3. See Blend-Air Door under Heater-A/C Housing Door in this group. Inspect the blend-air door for proper operation and sealing and correct, if required.
The low side pressure is normal or slightly low, and the high side pressure is too low.	1. Low refrigerant system charge. 2. Refrigerant flow through the accumulator is restricted. 3. Refrigerant flow through the evaporator coil is restricted. 4. Faulty compressor.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. See Accumulator in this group. Replace the restricted accumulator, if required. 3. See Evaporator Coil in this group. Replace the restricted evaporator coil, if required. 4. See Compressor in this group. Replace the compressor, if required.
The low side pressure is normal or slightly high, and the high side pressure is too high.	1. Condenser air flow restricted. 2. Inoperative cooling fan. 3. Refrigerant system overcharged. 4. Air in the refrigerant system. 5. Engine overheating.	1. Check the condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Refer to Group 7 - Cooling System for more information on air seals. Clean, repair, or replace components as required. 2. Refer to Group 7 - Cooling System for more information. Test the cooling fan and replace, if required. 3. See Refrigerant System Charge in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required. 4. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 5. Refer to Group 7 - Cooling System for more information. Test the cooling system and repair, if required.
The low side pressure is too high, and the high side pressure is too low.	1. Accessory drive belt slipping. 2. Fixed orifice tube not installed. 3. Faulty compressor.	1. Refer to Group 7 - Cooling System for more information. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required. 2. See Fixed Orifice Tube in this group. Install the missing fixed orifice tube, if required. 3. See Compressor in this group. Replace the compressor, if required.

DIAGNOSIS AND TESTING (Continued)

Pressure Diagnosis		
Condition	Possible Causes	Correction
The low side pressure is too low, and the high side pressure is too high.	1. Restricted refrigerant flow through the refrigerant lines. 2. Restricted refrigerant flow through the fixed orifice tube. 3. Restricted refrigerant flow through the condenser.	1. See Liquid Line and Suction and Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line, if required. 2. See Fixed Orifice Tube in this group. Replace the restricted fixed orifice tube, if required. 3. See Condenser in this group. Replace the restricted condenser, if required.

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For circuit descriptions and diagrams, refer to Air Conditioning/Heater in Wiring Diagrams. Possible causes of an inoperative blower motor include:

- Faulty fuse
- Faulty blower motor circuit wiring or wire harness connectors
- Faulty blower motor resistor
- Faulty blower motor relay
- Faulty voltage reduction relay
- Faulty blower motor switch
- Faulty heater-A/C mode control switch
- Faulty blower motor.

Possible causes of the blower motor not operating in all speeds include:

- Faulty fuse
- Faulty blower motor switch
- Faulty blower motor resistor
- Faulty blower motor relay
- Faulty blower motor circuit wiring or wire harness connectors.

VIBRATION

Possible causes of blower motor vibration include:

- Improper blower motor mounting
- Improper blower wheel mounting
- Blower wheel out of balance or deformed
- Blower motor faulty.

NOISE

To verify that the blower is the source of the noise, unplug the blower motor wire harness connector and operate the heater-A/C system. If the noise goes away, possible causes include:

- Foreign material in the heater-A/C housing
- Improper blower motor mounting
- Improper blower wheel mounting
- Blower motor faulty.

BLOWER MOTOR RELAY

RELAY TEST

The blower motor relay (Voltage Reduction Relay or VRR) (Fig. 9) is mounted with a single screw directly to the instrument panel's structural plastic inside the glove box opening, next to the left-side energy-absorbing bracket (Fig. 10). Remove the blower motor relay to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, see Relay Circuit Test in the Diagnosis and Testing section of this group. If not OK, replace the faulty relay.

RELAY CIRCUIT TEST

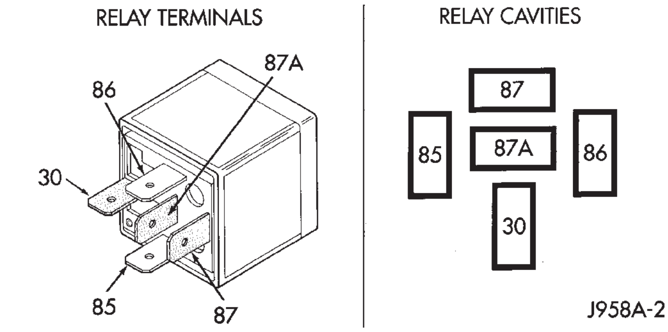
For circuit descriptions and diagrams, refer to Air Conditioning/Heater in Wiring Diagrams.

(1) The relay common feed terminal cavity (30) is connected to fused battery feed directly from a fuse in the Power Distribution Center (PDC), and should be hot at all times. Check for battery voltage at the PDC cavity for relay terminal 30. If OK, go to Step 2. If not OK, repair the open circuit to the PDC fuse as required.

(2) The relay normally closed terminal cavity (87A) is not used for this application. Go to Step 3.

(3) The relay normally open terminal cavity (87) is connected to the blower motor. When the relay is

DIAGNOSIS AND TESTING (Continued)



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 9 Blower Motor Relay

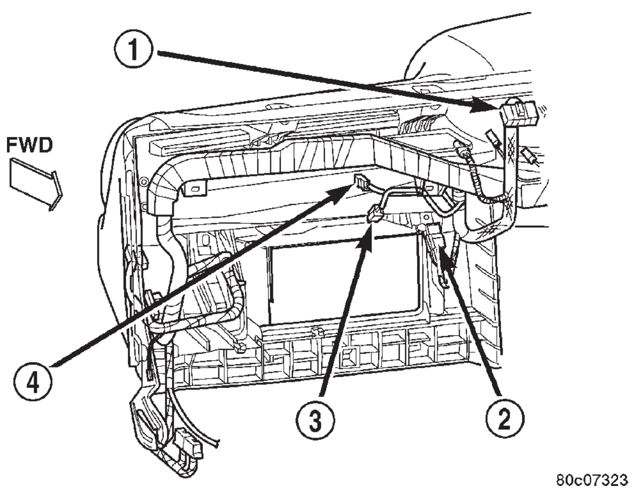


Fig. 10 Blower Motor Relay (VRR) Location

1 – BLOWER MOTOR RESISTOR CONNECTOR
2 – BLOWER MOTOR RELAY
3 – BLOWER MOTOR CONNECTOR
4 – GLOVE BOX LAMP CONNECTOR

energized, terminal 87 is connected to terminal 30 and provides full battery current to the blower motor feed circuit. There should be continuity between the PDC cavity for terminal 87 and the blower motor relay output circuit cavity of the blower motor wire harness connector at all times. If OK, go to Step 4. If not OK, repair the open circuit to the blower motor as required.

(4) The coil battery terminal cavity (86) is connected to the ignition switch. When the ignition switch is placed in the On position, fused ignition switch output is directed from a fuse in the junction block to the relay electromagnetic coil to energize the relay. There should be battery voltage at the PDC cavity for relay terminal 86 with the ignition switch in the On position. If OK, go to Step 5. If not OK, repair the open circuit to the junction block fuse as required.

(5) The coil ground terminal cavity (85) is connected to ground. This terminal supplies the ground for the relay electromagnetic coil. There should be continuity between the PDC cavity for relay terminal 85 and a good ground at all times. If not OK, repair the open circuit as required.

ADDITIONAL RELAY CIRCUIT TESTING

- The relay common feed terminal cavity 30 is connected to the low side of the blower motor. When the blower switch is Off and the ignition is On, there should be battery voltage present on this circuit. When the ignition switch is On, the voltage at that point should vary based on blower switch position.
- The normally closed contact cavity 87A is connected to the resistor block cavity 3. Check this circuit by turning the blower switch to High and cycling between Heat and A/C modes. The voltage in the Heat mode should be approximately 2 volts. The blower switch must be in High blower speed position during this check.
- The normally open contact on cavity 87 is tied to both the resistor block cavity 6 and the HVAC blower switch cavity 6. Check for continuity on this circuit.
- The coil B+ contact cavity 86 is connected to an ignition run start feed. Battery voltage should be present on this circuit when the ignition switch is in the Run position.
- The coil ground (–) cavity 85 is connected to the HVAC switch cavity 2 as well as the JTEC and A/C high pressure switch. Battery voltage should be present on this circuit when the ignition switch is in the Run position and a Heat mode is selected on the control head. When an A/C mode is selected, the voltage at this point should be less than 1 volt.
- If the blower motor does not operate, or only operates in some modes, check for a faulty connection at the VRR, or defective blower motor relay (VRR).

BLOWER MOTOR RESISTOR

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the blower motor resistor.

(3) Check for continuity between each of the blower motor switch input terminals of the resistor and the resistor output terminal. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor switch and the blower motor resistor or blower motor as required. If not OK, replace the faulty blower motor resistor.

BLOWER MOTOR SWITCH

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check for battery voltage at the fuse in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the heater-A/C control from the instrument panel. Check for continuity between the ground circuit cavity of the heater-A/C control wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) With the heater-A/C control wire harness connector unplugged, place the heater-A/C mode control switch knob in any position except the Off position. Check for continuity between the ground circuit terminal and each of the blower motor driver circuit terminals of the heater-A/C control as you move the blower motor switch knob to each of the four speed positions. There should be continuity at each driver circuit terminal in only one blower motor switch speed position. If OK, test and repair the blower driver circuits between the heater-A/C control connector and the blower motor resistor as required. If not OK, replace the faulty heater-A/C control unit.

COMPRESSOR

When investigating an air conditioning related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during air conditioning operation can often be misleading. For example: What sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon belt tension, belts can develop noises that are mistaken for a compressor noise. Improper belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the serpentine drive belt condition and tension as described in Group 7 - Cooling System before beginning this procedure.

(1) Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Switch the compressor on and off several times to clearly identify the compressor noise. Listen to the compressor while the clutch is engaged and disengaged. Probe the compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.

(2) Loosen all of the compressor mounting hardware and retighten. Tighten the compressor clutch mounting nut. Be certain that the clutch coil is mounted securely to the compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap. See Compressor and Compressor Clutch in the Removal and Installation section of this group for the procedures.

(3) To duplicate a high-ambient temperature condition (high head pressure), restrict the air flow through the condenser. Install a manifold gauge set to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).

(4) Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines for kinks or sharp bends that will restrict refrigerant flow, which can cause noises. See Suction and Discharge Line in the Removal and Installation section of this group for more information.

DIAGNOSIS AND TESTING (Continued)

(5) If the noise is from opening and closing of the high pressure relief valve, evacuate and recharge the refrigerant system. See Refrigerant System Evacuate and Refrigerant System Charge in the Service Procedures section of this group. If the high pressure relief valve still does not seat properly, replace the compressor.

(6) If the noise is from liquid slugging on the suction line, replace the accumulator. See Accumulator in the Removal and Installation section of this group for the procedures. Check the refrigerant oil level and the refrigerant system charge. See Refrigerant Oil Level and Refrigerant System Charge in the Service Procedures section of this group. If the liquid slugging condition continues following accumulator replacement, replace the compressor.

(7) If the noise continues, replace the compressor and repeat Step 1.

COMPRESSOR CLUTCH COIL

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. The battery must be fully-charged before performing the following tests. Refer to Group 8A - Battery for more information.

(1) Connect an ammeter (0 to 10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0 to 20 volt scale) with clip-type leads for measuring the voltage across the battery and the compressor clutch coil.

(2) With the heater-A/C mode control switch in any A/C mode, and the blower motor switch in the lowest speed position, start the engine and run it at normal idle.

(3) The compressor clutch coil voltage should read within two volts of the battery voltage. If there is voltage at the clutch coil, but the reading is not within two volts of the battery voltage, test the clutch coil feed circuit for excessive voltage drop and repair as required. If there is no voltage reading at the clutch coil, use a DRB scan tool and the proper Diagnostic Procedures manual for testing of the compressor clutch circuit. The following components must be checked and repaired as required before you can complete testing of the clutch coil:

- Fuses in the junction block and the Power Distribution Center (PDC)
- Heater-A/C mode control switch
- Compressor clutch relay
- High pressure cut-off switch
- Low pressure cycling clutch switch
- Powertrain Control Module (PCM).

(4) The compressor clutch coil is acceptable if the current draw measured at the clutch coil is 2.0 to 3.9 amperes with the electrical system voltage at 11.5 to 12.5 volts. This should only be checked with the work area temperature at 21° C (70° F). If system voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until the system voltage drops below 12.5 volts.

(a) If the clutch coil current reading is four amperes or more, the coil is shorted and should be replaced.

(b) If the clutch coil current reading is zero, the coil is open and should be replaced.

COMPRESSOR CLUTCH RELAY

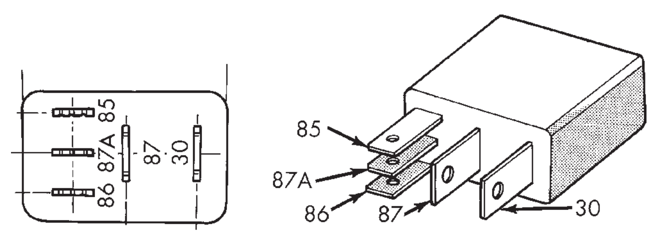
RELAY TEST

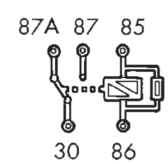
The compressor clutch relay (Fig. 11) is located in the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location. Remove the relay from the PDC to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, see Relay Circuit Test in the Diagnosis and Testing section of this group. If not OK, replace the faulty relay.





TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 11 Compressor Clutch Relay

RELAY CIRCUIT TEST

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) The relay common feed terminal cavity (30) is connected to fused battery feed. There should be battery voltage at the cavity for relay terminal 30 at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

DIAGNOSIS AND TESTING (Continued)

(2) The relay normally closed terminal (87A) is not used in this application. Go to Step 3.

(3) The relay normally open terminal cavity (87) is connected to the compressor clutch coil. There should be continuity between this cavity and the A/C compressor clutch relay output circuit cavity of the compressor clutch coil wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit as required.

(4) The relay coil battery terminal (86) is connected to the fused ignition switch output (run/start) circuit. There should be battery voltage at the cavity for relay terminal 86 with the ignition switch in the On position. If OK, go to Step 5. If not OK, repair the open circuit to the fuse in the junction block as required.

(5) The coil ground terminal cavity (85) is switched to ground through the Powertrain Control Module (PCM). There should be continuity between this cavity and the A/C compressor clutch relay control circuit cavity of the PCM wire harness connector C (gray) at all times. If not OK, repair the open circuit as required.

HEATER-A/C CONTROL

Satisfactory heater and air conditioner performance depends upon proper operation and adjustment of all operating controls and refrigeration system components. For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. These inspections, tests, and adjustments should be used to locate the cause of a malfunction.

Operation must be tested as described in the following sequence:

(1) Move the temperature control knob quickly to the full hot and the full cold positions. There should be a distinct sound of the blend-air door hitting its stops within the heater-A/C housing at the end of knob travel in each direction, with no spring-back of the knob. If not OK, inspect the condition, routing, installation and adjustment of the temperature control cable. See Temperature Control Cable in the Removal and Installation section and in the Adjustments section of this group for more information.

(2) Inspect and adjust the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(3) Start the engine and hold the idle speed at 1,300 rpm.

(4) On vehicles with air conditioning, turn the temperature control knob to the extreme counterclockwise (Cool) position, and set the mode control switch knob in the Bi-Level (A/C) position. The outside (recirculation) air door should be open to outside air. If not OK, see Vacuum System in the Diagnosis and Testing section of this group.

(5) Open the vehicle windows. Test the blower motor operation in all speeds. If not OK, see Blower Motor in the Diagnosis and Testing section of this group. Leave the blower motor switch knob in the highest speed position.

(6) On vehicles with air conditioning, the compressor should be running and the air conditioning system in operation unless the ambient air temperature is below about -1° C (30° F). If not OK, see A/C Performance in the Diagnosis and Testing section of this group.

(7) Check the mode control switch operation. The heater and air conditioner systems should respond as described in the owner's manual in the vehicle glove box to each mode selected. Reduce the engine speed to normal idle. The vacuum will be high at low idle and the vacuum actuators should respond quickly. If not OK, see Vacuum System in the Diagnosis and Testing section of this group.

(8) If the vacuum tests, and the electrical component and circuit tests reveal no problems, disassemble the heater-A/C housing to inspect for mechanical misalignment or binding of the mode doors.

HEATER PERFORMANCE

Before performing the following tests, refer to Group 7 - Cooling System for the procedures to check the radiator coolant level, serpentine drive belt tension, radiator air flow and the radiator fan operation. Also be certain that the accessory vacuum supply line is connected at the power brake booster.

MAXIMUM HEATER OUTPUT

Engine coolant is delivered to the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control knob in the full hot position, the mode control switch knob in the floor position, and the blower motor switch knob in the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the heater-A/C housing floor outlets. Compare the test thermometer reading to the Temperature Reference chart.

DIAGNOSIS AND TESTING (Continued)

Temperature Reference				
Ambient Air Temperature	15.5° C (60° F)	21.1° C (70° F)	26.6° C (80° F)	32.2° C (90° F)
Minimum Air Temperature at Floor Outlet	62.2° C (144° F)	63.8° C (147° F)	65.5° C (150° F)	67.2° C (153° F)

If the floor outlet air temperature is too low, refer to Group 7 - Cooling System to check the engine coolant temperature specifications. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Group 7 - Cooling System for the procedures.

OBSTRUCTED COOLANT FLOW

Possible locations or causes of obstructed coolant flow:

- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- A plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is still low, a mechanical problem may exist.

MECHANICAL PROBLEMS

Possible locations or causes of insufficient heat:

- An obstructed cowl air intake.
- Obstructed heater system outlets.
- A blend-air door not functioning properly.

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control knob on the heater-A/C control panel, the following could require service:

- The heater-A/C control.
- The temperature control cable (not connected, not routed, or not adjusted properly).
- The blend-air door.
- Improper engine coolant temperature.

DUAL FUNCTION HIGH PRESSURE SWITCH/ HIGH PRESSURE CUT-OFF SWITCH

Before performing diagnosis of the dual function high pressure switch, or the high pressure cut-off switch, verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in the Service Procedures section of this group for more information.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the high pressure switch wire harness connector from the switch on the refrigerant system fitting.

(3) On the dual function high pressure switch, check for continuity between terminals C and D. On the two terminal switch, check for continuity between both terminals of the high pressure cut-off switch. There should be continuity. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

LOW PRESSURE CYCLING CLUTCH SWITCH

Before performing diagnosis of the low pressure cycling clutch switch, be certain that the switch is properly installed on the accumulator fitting. If the switch is too loose it may not open the Schrader-type valve in the accumulator fitting, which will prevent the switch from correctly monitoring the refrigerant system pressure. Remember that lower ambient temperatures, below about -1° C (30° F), during cold weather will open the switch contacts and prevent compressor operation due to the pressure/temperature relationship of the refrigerant.

Also verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in the Service Procedures section of this group for more information.

For circuit descriptions and diagrams, refer to Air Conditioning/Heater in Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the low pressure cycling clutch switch wire harness connector from the switch on the accumulator fitting.

(3) Install a jumper wire between the two cavities of the low pressure cycling clutch switch wire harness connector.

(4) Connect a manifold gauge set to the refrigerant system service ports. See Refrigerant System Service Equipment and Refrigerant System Service Ports in the Description and Operation section of this group for more information.

(5) Connect the battery negative cable.

DIAGNOSIS AND TESTING (Continued)

(6) Place the heater-A/C mode control switch knob in any A/C position and start the engine.

(7) Check for continuity between the two terminals of the low pressure cycling clutch switch. There should be continuity with a suction pressure reading of 283 kPa (41 psi) or above, and no continuity with a suction pressure reading of 159 kPa (23 psi) or below. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

REFRIGERANT SYSTEM LEAKS

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE LEAK TESTING THE SYSTEM.

If the air conditioning system does not cool properly, the A/C system performance should be tested. See A/C Performance in the Diagnosis and Testing section of this group for the procedures. If the A/C system refrigerant fill is found to be low or if the system is empty; a leak at a refrigerant line, connector fitting, component, or component seal is likely.

An electronic leak detector designed for R-134a refrigerant, or a fluorescent R-134a leak detection dye and a black light are recommended for locating and confirming refrigerant system leaks. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

An oily residue on or near refrigerant system lines, connector fittings, components, or component seals can indicate the general location of a possible refrigerant leak. However, the exact leak location should be confirmed with an electronic leak detector prior to component repair or replacement.

To detect a leak in the refrigerant system with an electronic leak detector, perform one of the following procedures:

SYSTEM EMPTY

(1) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(2) Connect and dispense 0.283 kilograms (0.625 pounds or 10 ounces) of R-134a refrigerant into the evacuated refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

(3) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(4) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(5) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet and the floor duct outlet. Set the blower motor switch to the lowest speed position, and the mode control switch in the recirculation mode (Max-A/C).

SYSTEM LOW

(1) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(2) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run with the air conditioning system turned on for five minutes.

(3) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(4) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet and the floor duct outlet. Set the blower motor switch to the lowest speed position, and the mode control switch in the recirculation mode (Max-A/C).

SERVICE PROCEDURES

REFRIGERANT OIL LEVEL

When an air conditioning system is assembled at the factory, all components except the compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the compressor is dispersed throughout the refrigerant system. The accumulator, evaporator, condenser, and compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of oil in the refrigerant system. This ensures proper lubrication of the compressor. Too little oil will result in damage to the compressor. Too much oil will reduce the cooling capacity of the air conditioning system.

It will not be necessary to check the oil level in the compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when a accumulator, evaporator coil, or condenser are replaced. See the Refrigerant Oil Capacities chart. When a compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

Refrigerant Oil Capacities		
Component	ml	fl oz
A/C System	180	6.1
Accumulator	90	3
Condenser	22	.75
Evaporator	45	1.5
Compressor	drain and measure the oil from the old compressor as noted	

REFRIGERANT RECOVERY

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE RECOVERING REFRIGERANT.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to recover the refrigerant from an R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT SYSTEM CHARGE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

After the refrigerant system has been tested for leaks and evacuated, a refrigerant charge can be injected into the system. See Refrigerant Charge Capacity in the Service Procedures section of this group for the proper amount of the refrigerant charge.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT CHARGE CAPACITY

The R-134a refrigerant system charge capacity for this vehicle is: 0.907 kilograms (32 ounces).

REFRIGERANT SYSTEM EVACUATE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE EVACUATING THE SYSTEM.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be charged. If moisture and air enters the system and becomes mixed with the refrigerant, the compressor head pressure will rise above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Evacuating the refrigerant system will remove the air and boil the moisture out of the system at near room temperature. To evacuate the refrigerant system, use the following procedure:

(1) Connect a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 and a manifold gauge set to the refrigerant system of the vehicle.

(2) Open the low and high side valves and start the charging station vacuum pump. When the suction gauge reads 88 kPa (26 in. Hg.) vacuum or greater, close all of the valves and turn off the vacuum pump.

(a) If the refrigerant system fails to reach the specified vacuum, the system has a leak that must be corrected. See Refrigerant System Leaks in the Diagnosis and Testing section of this group for the procedures.

(b) If the refrigerant system maintains the specified vacuum for five minutes, restart the vacuum pump, open the suction and discharge valves and evacuate the system for an additional ten minutes.

(3) Close all of the valves, and turn off the charging station vacuum pump.

(4) The refrigerant system is now ready to be charged with R-134a refrigerant. See Refrigerant System Charge in the Service Procedures section of this group.

REFRIGERANT SYSTEM SERVICE EQUIPMENT

WARNING: EYE PROTECTION MUST BE WORN WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED, BEFORE CONNECTING TO OR DISCONNECTING FROM THE REFRIGERANT SYSTEM. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY.

SERVICE PROCEDURES (Continued)

When servicing the air conditioning system, a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used. Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

A manifold gauge set may be needed with some recovery/recycling/charging equipment (Fig. 12). The service hoses on the gauge set being used should have manual (turn wheel), or automatic back-flow valves at the service port connector ends. This will prevent refrigerant from being released into the atmosphere.

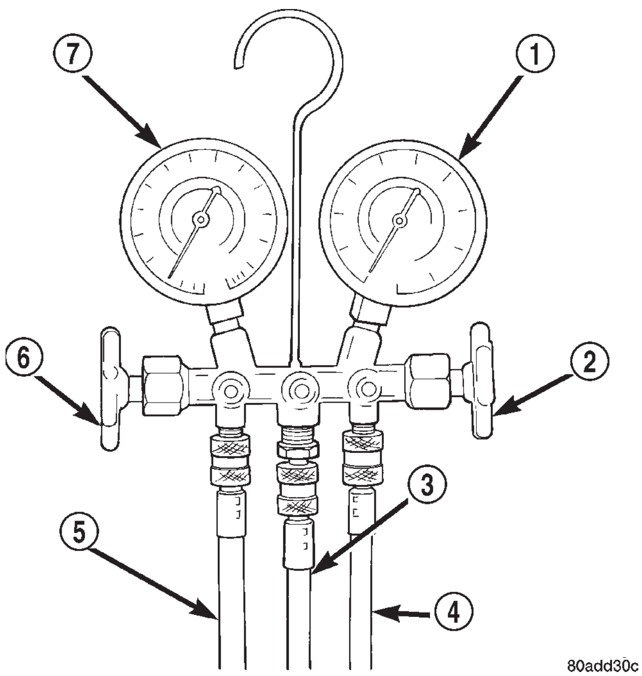


Fig. 12 Manifold Gauge Set - Typical

1 – HIGH PRESSURE GAUGE
2 – VALVE
3 – VACUUM/REFRIGERANT HOSE (YELLOW W/BLACK STRIPE)
4 – HIGH PRESSURE HOSE (RED W/BLACK STRIPE)
5 – LOW PRESSURE HOSE (BLUE W/BLACK STRIPE)
6 – VALVE
7 – LOW PRESSURE GAUGE

MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

LOW PRESSURE GAUGE HOSE

The low pressure hose (Blue with Black stripe) attaches to the suction service port. This port is located on the compressor manifold, directly over the suction port of the compressor.

HIGH PRESSURE GAUGE HOSE

The high pressure hose (Red with Black stripe) attaches to the discharge service port. This port is located on the liquid line between the condenser and the evaporator, near the front of the engine compartment.

RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE

The center manifold hose (Yellow, or White, with Black stripe) is used to recover, evacuate, and charge the refrigerant system. When the low or high pressure valves on the manifold gauge set are opened, the refrigerant in the system will escape through this hose.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND PRECAUTIONS

WARNING:

• THE AIR CONDITIONING SYSTEM CONTAINS REFRIGERANT UNDER HIGH PRESSURE. SEVERE PERSONAL INJURY MAY RESULT FROM IMPROPER SERVICE PROCEDURES. REPAIRS SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL.

• AVOID BREATHING THE REFRIGERANT AND REFRIGERANT OIL VAPOR OR MIST. EXPOSURE MAY IRRITATE THE EYES, NOSE, AND/OR THROAT. WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM DIRECT CONTACT WITH THE REFRIGERANT. IF EYE CONTACT OCCURS, SEEK MEDICAL ATTENTION IMMEDIATELY.

• DO NOT EXPOSE THE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC LEAK DETECTOR IS RECOMMENDED.

• IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE THE WORK AREA BEFORE RESUMING SERVICE. LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

• THE EVAPORATION RATE OF R-134a REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT THE SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH THE REFRIGERANT.

• THE R-134a SERVICE EQUIPMENT OR THE VEHICLE REFRIGERANT SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR AND R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS, AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

CAUTION:

• Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with the service equipment being used.

• Never add R-12 to a refrigerant system designed to use R-134a. Damage to the system will result.

• R-12 refrigerant oil must not be mixed with R-134a refrigerant oil. They are not compatible.

• Do not use R-12 equipment or parts on the R-134a system. Damage to the system will result.

• Do not overcharge the refrigerant system. This will cause excessive compressor head pressure and can cause noise and system failure.

• Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

• Do not remove the secondary retention clip from any spring-lock coupler connection while the refrigerant system is under pressure. Recover the refrigerant before removing the secondary retention clip. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.

• The refrigerant system must always be evacuated before charging.

• Do not open the refrigerant system or uncap a replacement component until you are ready to service the system. This will prevent contamination in the system.

• Before disconnecting a component, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system.

• Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug.

• Before connecting an open refrigerant fitting, always install a new seal or gasket. Coat the fitting and seal with clean refrigerant oil before connecting.

• Do not remove the sealing caps from a replacement component until it is to be installed.

• When installing a refrigerant line, avoid sharp bends that may restrict refrigerant flow. Position the refrigerant lines away from exhaust system components or any sharp edges, which may damage the line.

• Tighten refrigerant fittings only to the specified torque. The aluminum fittings used in the refrigerant system will not tolerate overtightening.

• Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.

• Keep service tools and the work area clean. Contamination of the refrigerant system through careless work habits must be avoided.

COOLING SYSTEM REQUIREMENTS

To maintain the performance level of the heating-air conditioning system, the engine cooling system

REMOVAL AND INSTALLATION (Continued)

must be properly maintained. The use of a bug screen is not recommended. Any obstructions in front of the radiator or condenser will reduce the performance of the air conditioning and engine cooling systems.

The engine cooling system includes the heater core and the heater hoses. Refer to Group 7 - Cooling System for more information before the opening of, or attempting any service to the engine cooling system.

REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS

Kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all refrigerant system connections are pressure tight.

A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. Sharp bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold. It is a good practice to inspect all flexible refrigerant system hose lines at least once a year to make sure they are in good condition and properly routed.

There are two types of refrigerant fittings:

- All fittings with O-rings need to be coated with refrigerant oil before installation. Use only O-rings that are the correct size and approved for use with R-134a refrigerant. Failure to do so may result in a leak.
- Unified plumbing connections with gaskets cannot be serviced with O-rings. The gaskets are not reusable and new gaskets do not require lubrication before installing.

Using the proper tools when making a refrigerant plumbing connection is very important. Improper tools or improper use of the tools can damage the refrigerant fittings.

The refrigerant must be recovered completely from the system before opening any fitting or connection. Open the fittings with caution, even after the refrigerant has been recovered. If any pressure is noticed as a fitting is loosened, tighten the fitting and recover the refrigerant from the system again.

Do not discharge refrigerant into the atmosphere. Use an R-134a refrigerant recovery/recycling device that meets SAE Standard J2210.

The refrigerant system will remain chemically stable as long as pure, moisture-free R-134a refrigerant and refrigerant oil is used. Dirt, moisture, or air can upset this chemical stability. Operational troubles or serious damage can occur if foreign material is present in the refrigerant system.

When it is necessary to open the refrigerant system, have everything needed to service the system ready. The refrigerant system should not be left open to the atmosphere any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture. All lines and components in parts stock should be capped or sealed until they are to be installed.

All tools, including the refrigerant recycling equipment, the manifold gauge set, and test hoses should be kept clean and dry. All tools and equipment must be designed for R-134a refrigerant.

ACCUMULATOR

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Unplug the wire harness connector from the low pressure cycling clutch switch.

(4) If the vehicle is so equipped, remove the nuts that secure the vehicle speed control servo mounting bracket to the studs on the cowl plenum panel and move the servo far enough to access the accumulator refrigerant line couplers. Refer to Vehicle Speed Control System for the procedures.

(5) Loosen the screw that secures the accumulator retaining band to the support bracket on the dash panel (Fig. 13).

(6) Disconnect the suction line refrigerant line fastener from the accumulator. Install plugs in, or tape over all of the opened refrigerant line fittings.

(7) Disconnect the accumulator inlet tube refrigerant line fastener from the accumulator. Install plugs in, or tape over all of the opened refrigerant line fittings.

(8) Pull the accumulator and retaining band unit forward until the screw in the band is clear of the slotted hole in the support bracket on the dash panel.

(9) Remove the accumulator from the vehicle.

INSTALLATION

(1) Install the accumulator and retaining band as a unit by sliding the screw in the band into the slotted hole in the support bracket on the dash panel.

(2) Remove the tape or plugs from the refrigerant line fittings on the accumulator inlet tube and the evaporator outlet tube. Connect both refrigerant lines

REMOVAL AND INSTALLATION (Continued)

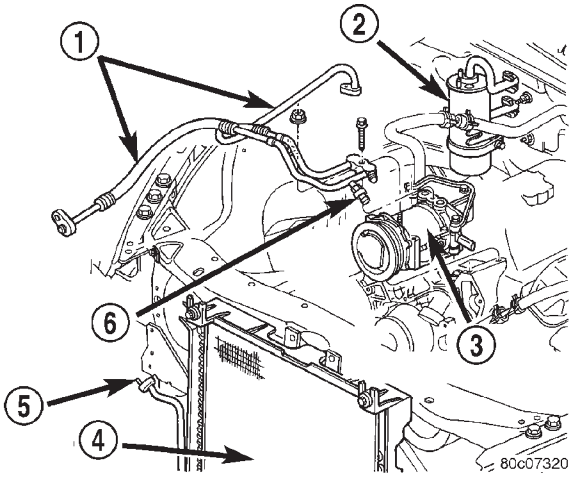


Fig. 13 Accumulator And Lines

1 – SUCTION AND DISCHARGE LINE ASSEMBLY
2 – ACCUMULATOR
3 – A/C COMPRESSOR
4 – CONDENSER
5 – TO LIQUID LINE
6 – HIGH PRESSURE CUT-OFF SWITCH

to the accumulator. Tighten the fasteners to 25.99 ±3.39 N·m (230 ±30 in. lbs.).

(3) Tighten the accumulator retaining band screw to 4.5 N·m (40 in. lbs.).

(4) Plug the wire harness connector into the low pressure cycling clutch switch.

(5) Connect the battery negative cable.

(6) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(7) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

NOTE: If the accumulator is replaced, add 120 milliliters (4 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove and disassemble the heater-A/C housing. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Remove the three screws that secure the blower motor and blower wheel assembly to the heater-A/C housing (Fig. 14).

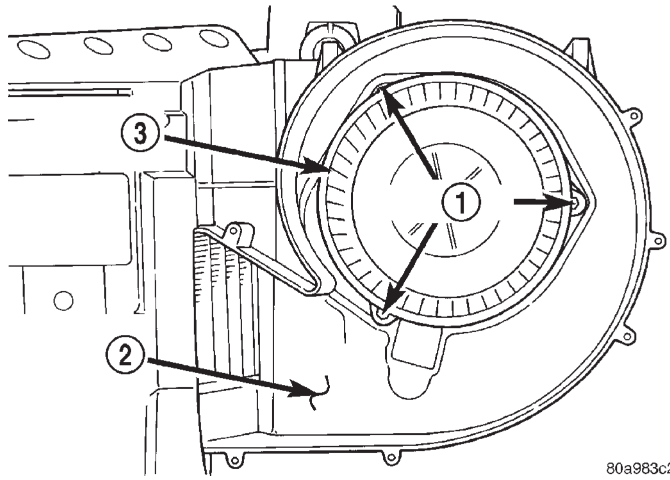


Fig. 14 Blower Motor Remove/Install

1 – SCREWS
2 – BLOWER MOTOR HOUSING
3 – BLOWER WHEEL

(3) Pull the blower motor and wheel assembly out of the passenger compartment side of the heater-A/C housing while feeding the blower motor wire harness, grommet and connector through the hole on the dash panel side of the housing.

(4) Remove the blower wheel retainer clip and remove the wheel from the blower motor shaft (Fig. 15).

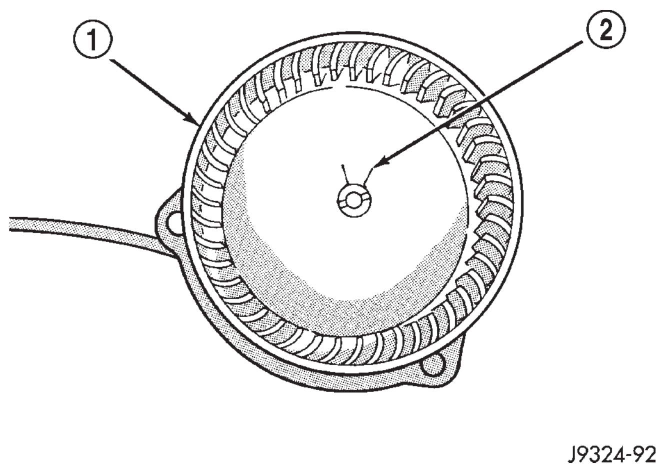


Fig. 15 Blower Motor Wheel Remove/Install

1 – BLOWER MOTOR WHEEL
2 – RETAINER CLIP

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Press the blower wheel hub onto the blower motor shaft. Be sure the flat on the blower motor shaft is indexed to the flat on the inside of the blower wheel hub.

(2) Install the retainer clip over the blower wheel hub. The ears of the retainer clip must be indexed over the flats on the blower motor shaft and blower wheel hub.

(3) Place the blower motor and wheel assembly inside the heater-A/C housing and feed the blower motor wire harness connector through the grommet hole in the dash panel side of the housing.

(4) Pull the blower motor wiring through the hole from the dash panel side of the heater-A/C housing until the grommet is seated, while positioning the blower motor and blower wheel assembly inside the housing.

(5) Install the three screws that secure the blower motor and wheel assembly to the heater-A/C housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Assemble and install the heater-A/C housing. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

BLOWER MOTOR RELAY

REMOVAL

The blower motor relay (Voltage Reduction Relay or VRR) is mounted with a single screw directly to the instrument panel's structural plastic inside the glove box opening, next to the left-side energy-absorbing bracket (Fig. 16).

(1) Disconnect and isolate the battery negative cable.

(2) Roll down the glove box as described in the Glove Box section of Instrument Panel Systems.

(3) Using a short or 90 degree screwdriver, remove the screw that secures the blower motor relay (VRR) to the steel clip in the instrument panel plastic flange.

(4) Maneuver the VRR into the glove box opening far enough for access, and disengage the wiring harness from the relay.

(5) Remove the relay through the glove box opening.

INSTALLATION

(1) Position the relay into the instrument panel inside the glove box opening.

(2) Align the VRR with the connector and engage the wiring harness to the relay.

(3) Align the relay with the steel clip in the instrument panel, and insert and tighten the single screw to 2.2 N·m (20 in. lbs.).

(4) Roll up the glove box as described in the Glove Box Installation section of Instrument Panel Systems.

(5) Reconnect the battery negative cable.

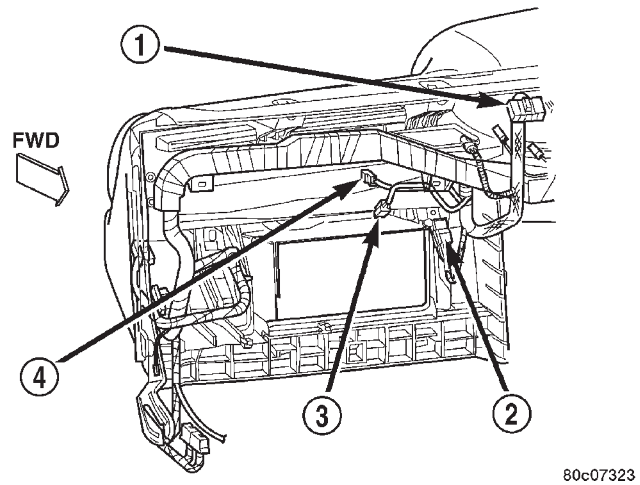


Fig. 16 Blower Motor Relay (VRR) Location

1 – BLOWER MOTOR RESISTOR CONNECTOR
2 – BLOWER MOTOR RELAY
3 – BLOWER MOTOR CONNECTOR
4 – GLOVE BOX LAMP CONNECTOR

BLOWER MOTOR RESISTOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cowl plenum cover/grille panel from the cowl top. See Vacuum Reservoir in the Removal and Installation section of this group for the procedures.

(3) Reach through the cowl plenum access hole (Fig. 17) to remove the two hex screws that secure the blower motor resistor to the cowl plenum panel.

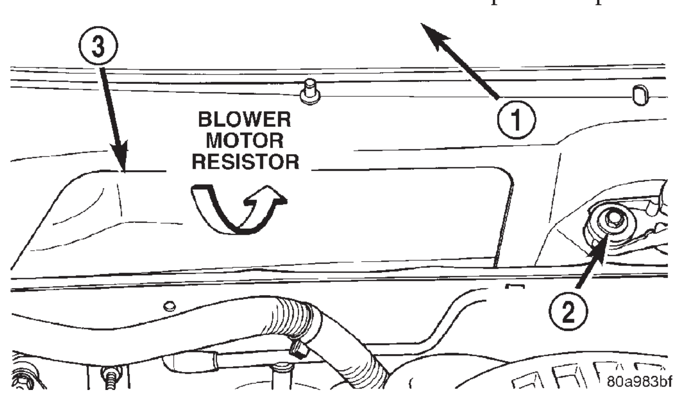


Fig. 17 Blower Motor Resistor Remove/Install

1 – WINDSHIELD
2 – RIGHT WIPER PIVOT
3 – COWL PLENUM ACCESS HOLE

REMOVAL AND INSTALLATION (Continued)

(4) Pull the blower motor resistor and its wire harness out of the plenum panel and through the cowl plenum access hole far enough to access the wire harness connector.

(5) Unplug the blower motor resistor from the wire harness connector.

(6) Remove the blower motor resistor from the cowl plenum.

INSTALLATION

(1) Plug the blower motor resistor into the wire harness connector.

(2) Install the blower motor resistor to the cowl plenum panel by feeding the resistor and wire harness back through the cowl plenum access hole.

(3) Install and tighten the two screws that secure the resistor to the cowl plenum panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Reinstall the cowl plenum cover/grille panel to the cowl top. See Vacuum Reservoir in the Removal and Installation section of this group for the procedures.

(5) Connect the battery negative cable.

COMPRESSOR

The compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the compressor clutch or clutch coil, the engine, the cylinder head, or the generator.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(2) Disconnect and isolate the battery negative cable.

(3) Remove the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(4) Unplug the compressor clutch coil wire harness connector.

(5) Remove the suction and discharge refrigerant line manifold from the compressor. See Suction and Discharge Line in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant fittings.

(6) Remove the four screws that secure the compressor to the mounting bracket (Fig. 18) or (Fig. 19).

(7) Remove the compressor from the mounting bracket.

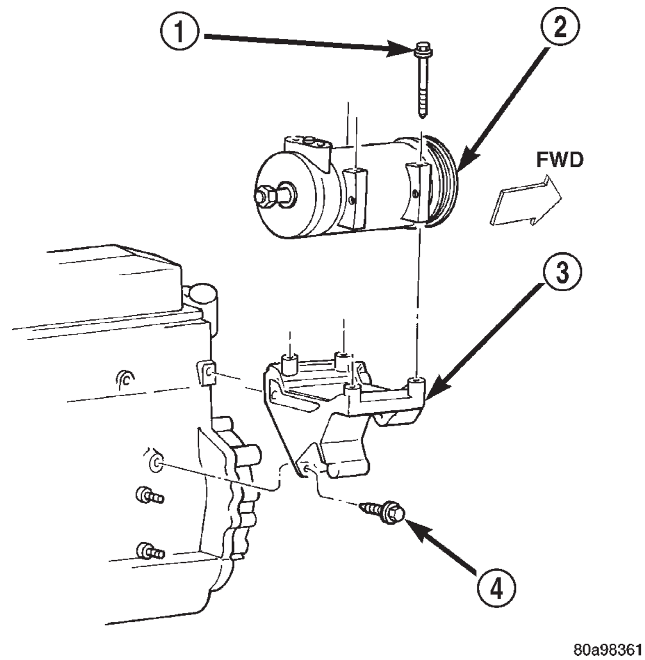


Fig. 18 Compressor Remove/Install - 2.5L Engine

1 – SCREW AND WASHER
2 – COMPRESSOR
3 – BRACKET
4 – SCREW AND WASHER

INSTALLATION

NOTE: If a replacement compressor is being installed, be certain to check the refrigerant oil level. See Refrigerant Oil Level in the Service Procedures section of this group. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(1) Install the compressor to the mounting bracket. Tighten the four mounting screws to 27 N·m (20 ft. lbs.).

(2) Remove the tape or plugs from all of the opened refrigerant line fittings. Install the suction and discharge line manifold to the compressor. See Suction and Discharge Line in the Removal and Installation section of this group for the procedures.

(3) Install the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(4) Plug in the compressor clutch coil wire harness connector.

(5) Connect the battery negative cable.

(6) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(7) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

REMOVAL AND INSTALLATION (Continued)

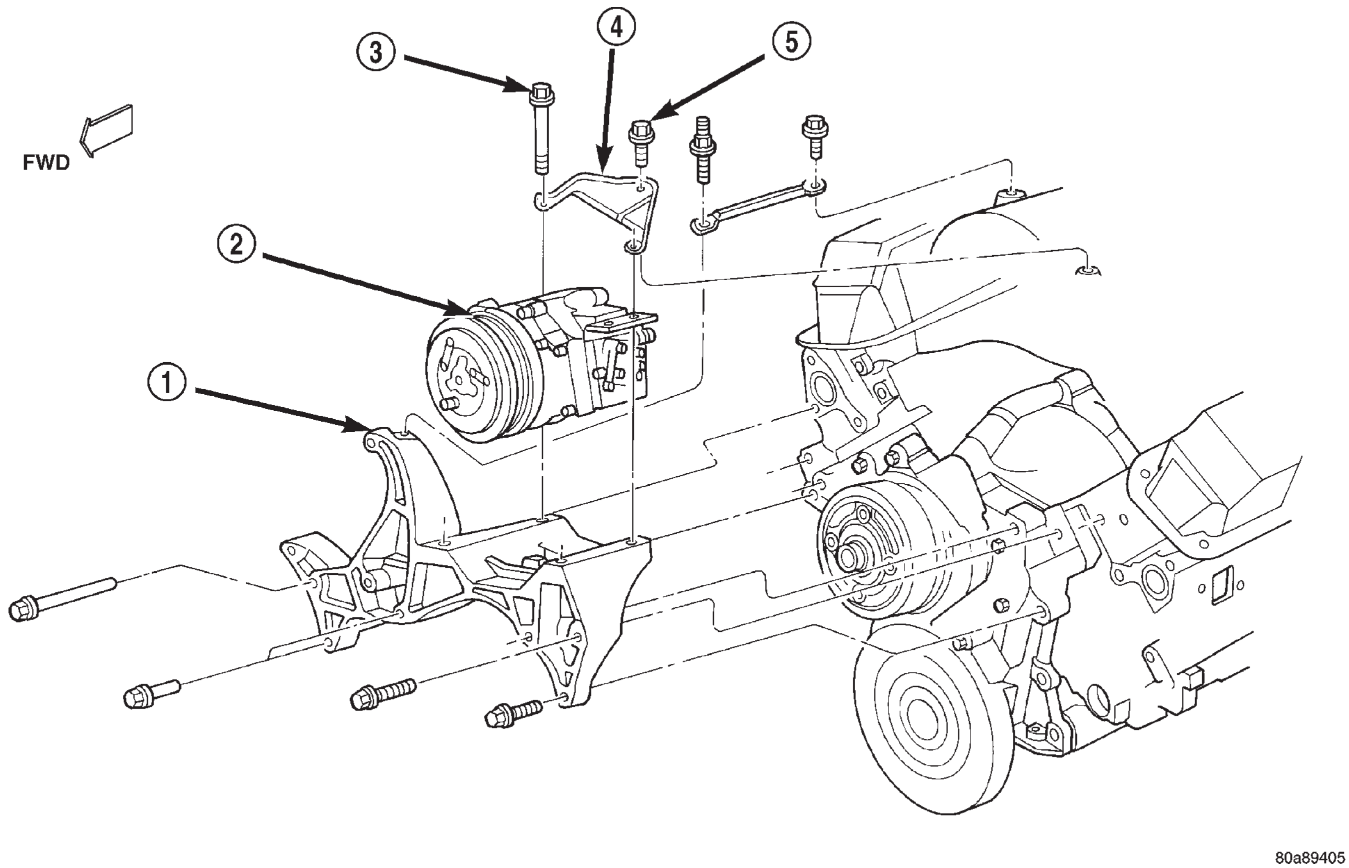


Fig. 19 Compressor Remove/Install - 3.9L and 5.2L Engine

1 – BRACKET
2 – COMPRESSOR
3 – SCREW & WASHER
4 – BRACE
5 – BOLT

COMPRESSOR CLUTCH

The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement. The compressor clutch can be serviced in the vehicle.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(3) Unplug the compressor clutch coil wire harness connector.

(4) Insert the two pins of the spanner wrench (Special Tool 6462 in Kit 6460) into the holes of the clutch plate. Hold the clutch plate stationary and remove the hex nut (Fig. 20).

(5) Remove the clutch plate and the clutch shims.

(6) Remove the external front housing snap ring with snap ring pliers (Fig. 21).

(7) Install the lip of the rotor puller (Special Tool C-6141-1 in Kit 6460) into the snap ring groove exposed in Step 6, and install the shaft protector (Special Tool C-6141-2 in Kit 6460) (Fig. 22).

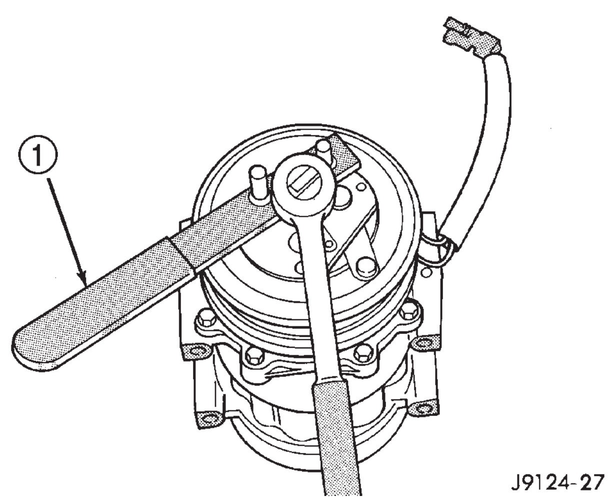


Fig. 20 Clutch Nut Remove

1 – FRONT PLATE SPANNER

REMOVAL AND INSTALLATION (Continued)

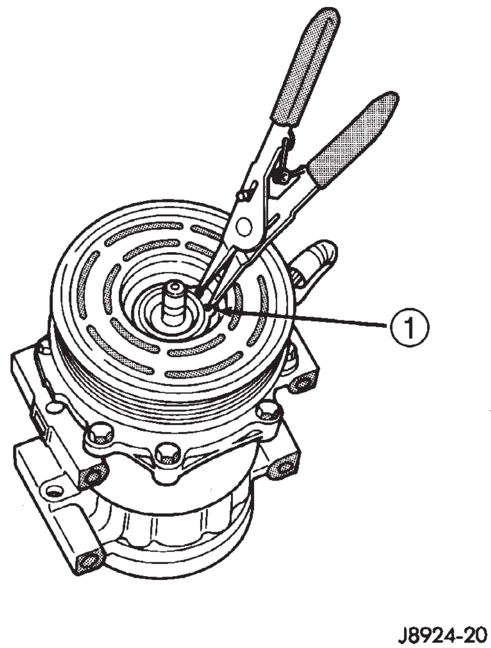


Fig. 21 External Snap Ring Remove

1 – EXTERNAL SNAP RING

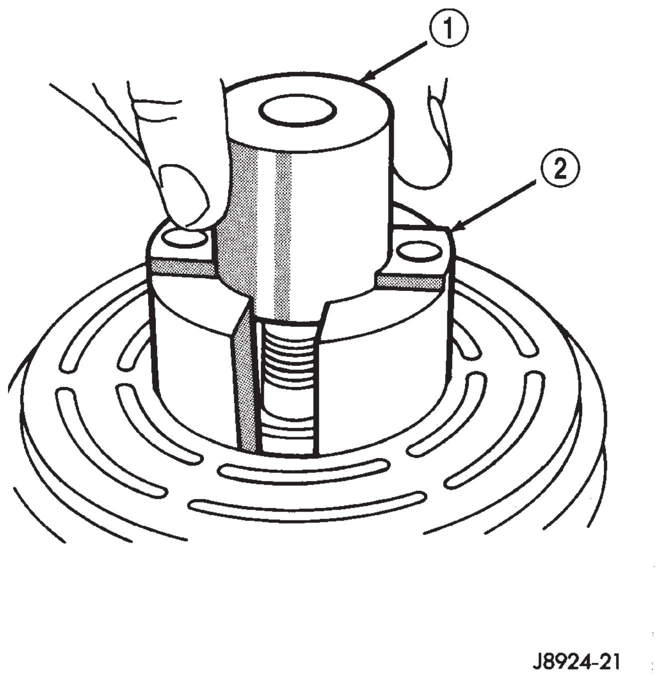


Fig. 22 Shaft Protector and Puller

1 – PULLER SHAFT PROTECTOR
2 – JAWS

(8) Install the puller through-bolts (Special Tool C-6461) through the puller flange and into the jaws of the rotor puller and tighten (Fig. 23). Turn the puller center bolt clockwise until the rotor pulley is free.

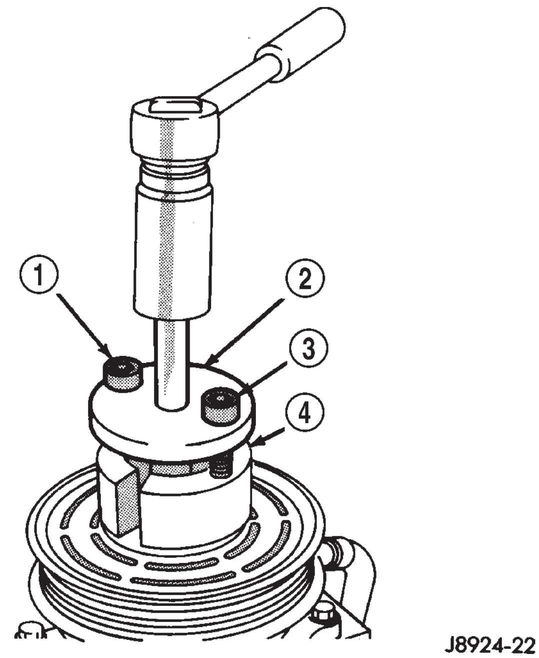


Fig. 23 Install Puller Plate

1 – BOLT
2 – PULLER PLATE AND BOLT
3 – BOLT
4 – JAWS

(9) Remove the screw and retainer from the clutch coil lead wire harness on the compressor front housing (Fig. 24).

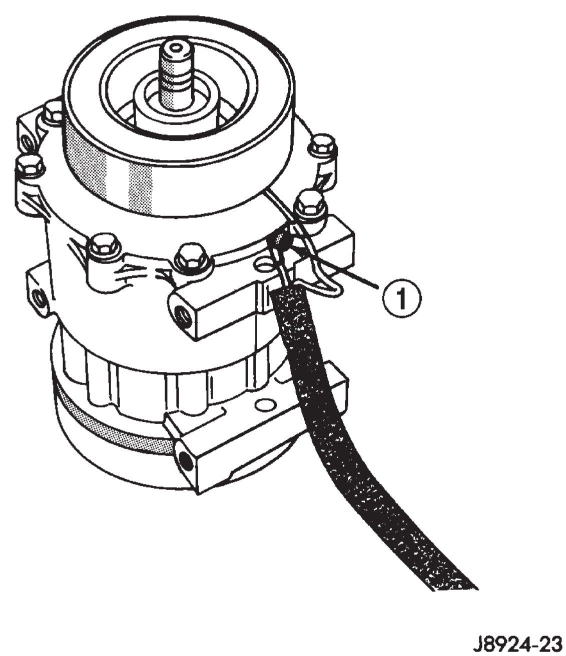


Fig. 24 Clutch Coil Lead Wire Harness

1 – CLIP

REMOVAL AND INSTALLATION (Continued)

(10) Remove the snap ring from the compressor hub and remove the clutch field coil (Fig. 25). Slide the clutch field coil off of the compressor hub.

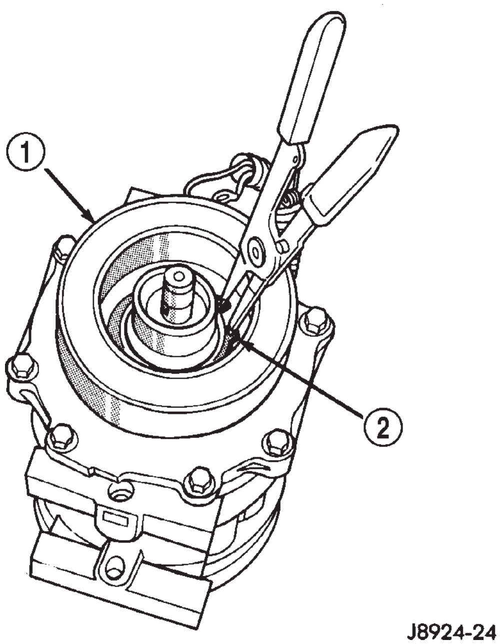


Fig. 25 Clutch Field Coil Snap Ring Remove

1 – FIELD COIL
2 – SNAP RING

INSPECTION

Examine the friction surfaces of the clutch pulley and the front plate for wear. The pulley and front plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the compressor for oil. Remove the felt from the front cover. If the felt is saturated with oil, the shaft seal is leaking and the compressor must be replaced.

Check the clutch pulley bearing for roughness or excessive leakage of grease. Replace the bearing, if required.

INSTALLATION

(1) Install the clutch field coil and snap ring.

(2) Install the clutch coil lead wire harness retaining clip on the compressor front housing and tighten the retaining screw.

(3) Align the rotor assembly squarely on the front compressor housing hub.

(4) Thread the handle (Special Tool 6464 in Kit 6460) into the driver (Special Tool 6143 in Kit 6460) (Fig. 26).

(5) Place the driver tool assembly into the bearing cavity on the rotor. Make certain the outer edge of the tool rests firmly on the rotor bearing inner race (Fig. 27).

Fig. 26 Rotor Installer Set

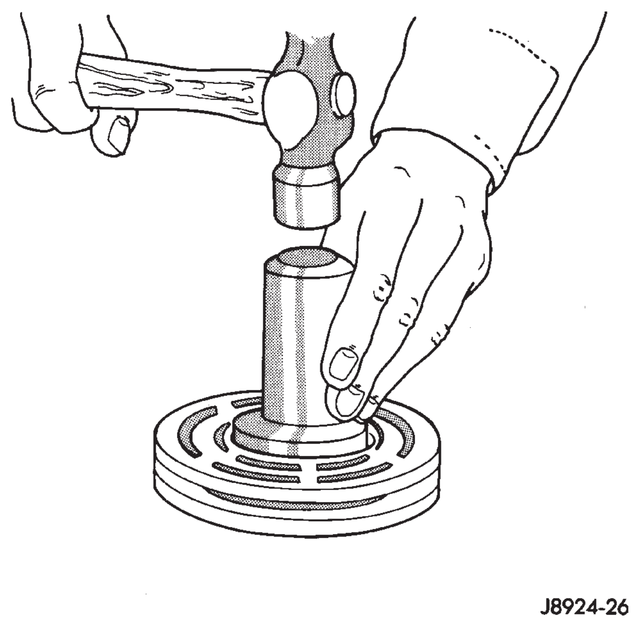


Fig. 27 Rotor Install

(6) Tap the end of the driver while guiding the rotor to prevent binding. Tap until the rotor bottoms against the compressor front housing hub. Listen for a distinct change of sound during the tapping process, to indicate the bottoming of the rotor.

(7) Install the external front rotor snap ring with snap ring pliers. The bevel side of the snap ring must be facing outward. Press the snap ring to make sure it is properly seated in the groove.

REMOVAL AND INSTALLATION (Continued)

CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in a clutch failure and severe damage to the front housing of the compressor.

(8) Install the original clutch shims on the compressor shaft.

(9) Install the clutch plate. Use the shaft protector (Special Tool 6141-2 in Kit 6460) to install the clutch plate on the compressor shaft (Fig. 28). Tap the clutch plate over the compressor shaft until it has bottomed against the clutch shims. Listen for a distinct change of sound during the tapping process, to indicate the bottoming of the clutch plate.

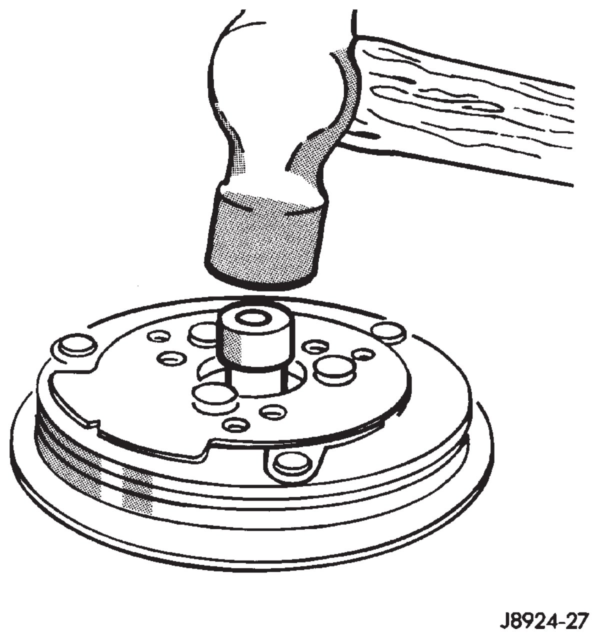


Fig. 28 Clutch Plate Install

(10) Replace the compressor shaft hex nut. Tighten the nut to 14.4 N·m (10.5 ft. lbs.).

(11) Check the clutch air gap with a feeler gauge (Fig. 29). If the air gap does not meet the specification, add or subtract shims as required. The air gap specification is 0.41 to 0.79 millimeter (0.016 to 0.031 inch). If the air gap is not consistent around the circumference of the clutch, lightly pry up at the minimum variations. Lightly tap down at the points of maximum variation.

NOTE: The air gap is determined by the spacer shims. When installing an original, or a new clutch assembly, try the original shims first. When installing a new clutch onto a compressor that previously did not have a clutch, use 1.0, 0.50, and 0.13 millimeter (0.040, 0.020, and 0.005 inch) shims from the clutch hardware package that is provided with the new clutch.

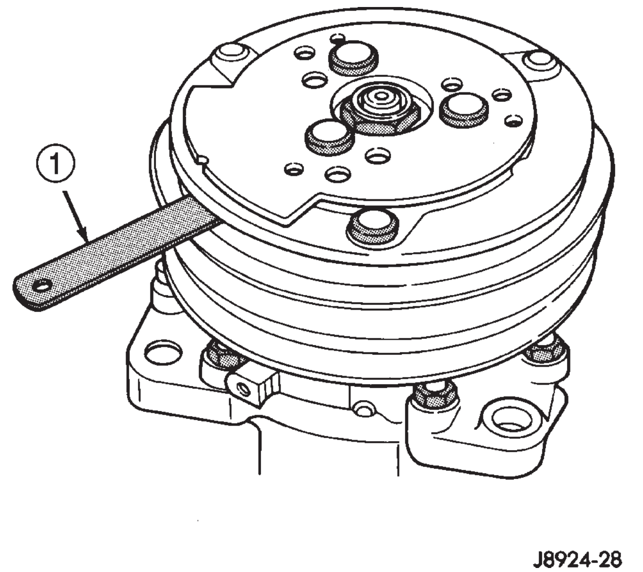


Fig. 29 Check Clutch Air Gap

1 – FEELER GAUGE

(12) Reverse the remaining removal procedures to complete the installation.

CLUTCH BREAK-IN

After a new compressor clutch has been installed, cycle the compressor clutch approximately twenty times (five seconds on, then five seconds off). During this procedure, set the heater-A/C control to the recirculation mode (Max-A/C), the blower motor switch to the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

COMPRESSOR CLUTCH RELAY

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 30).

(3) Refer to the label on the PDC for compressor clutch relay identification and location.

(4) Unplug the compressor clutch relay from the PDC.

(5) Install the compressor clutch relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.

(7) Connect the battery negative cable.

(8) Test the relay operation.

REMOVAL AND INSTALLATION (Continued)

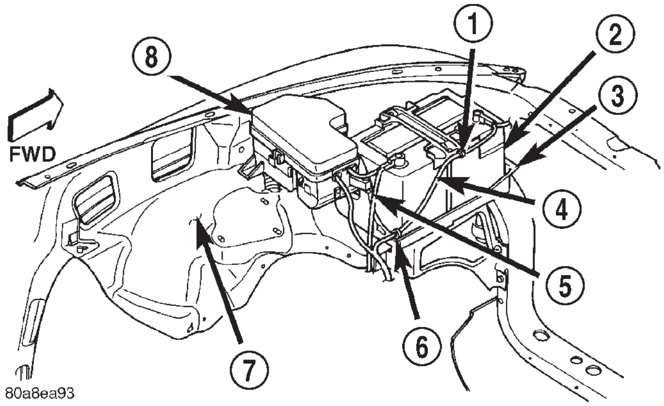


Fig. 30 Power Distribution Center

1 – CLIP
2 – BATTERY
3 – TRAY
4 – NEGATIVE CABLE
5 – POSITIVE CABLE
6 – CLIP
7 – FENDER INNER SHIELD
8 – POWER DISTRIBUTION CENTER

CONDENSER

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

CAUTION: Before removing the condenser, note the location of each of the radiator and condenser air seals. These seals are used to direct air through the condenser and radiator. The air seals must be reinstalled in their proper locations in order for the air conditioning and engine cooling systems to perform as designed.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Disconnect the refrigerant line fitting that secures the discharge line to the condenser inlet (Fig. 31). Install plugs in, or tape over all of the opened refrigerant line fittings.

(4) Disconnect the refrigerant line fitting that secures the liquid line to the condenser outlet. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Remove the two screws that secure the radiator and fan shroud module to the inside of the upper radiator crossmember.

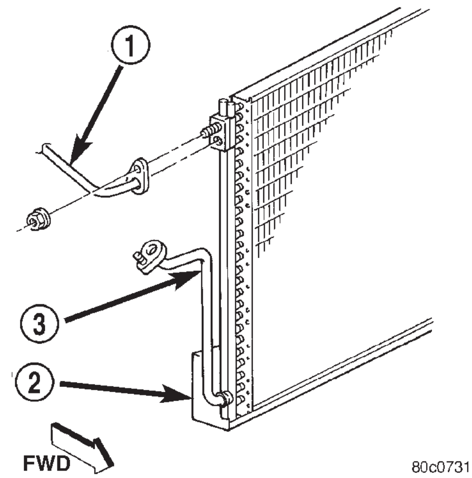


Fig. 31 Condenser Line Fittings

1 – DISCHARGE LINE
2 – CONDENSER
3 – TO LIQUID LINE

(6) On models equipped with a V-8 engine, remove the radiator from the engine compartment. Refer to Cooling Systems for the procedures.

(7) Remove the two screws that secure the condenser to the outside of the upper radiator crossmember (Fig. 32).

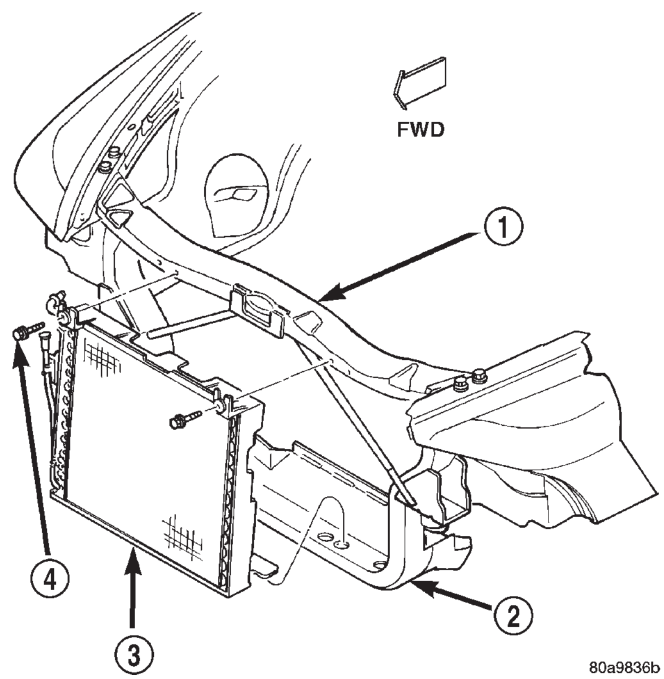


Fig. 32 Condenser Remove/Install - Typical

1 – UPPER CROSSMEMBER
2 – LOWER CROSSMEMBER
3 – CONDENSER
4 – SCREW

REMOVAL AND INSTALLATION (Continued)

(8) Tilt the top of the radiator and fan shroud module towards the engine, using care not to damage the radiator fins on the engine cooling fan.

(9) With the radiator and fan shroud module tilted, carefully lift the condenser upwards until the lower condenser mounts are clear of the isolators in the lower crossmember.

(10) Remove the condenser from the vehicle.

INSTALLATION

(1) With the radiator and fan shroud module tilted towards the engine, carefully position the lower condenser mounts in the lower crossmember isolators.

(2) Reinstall the two screws that secure the condenser to the outside of the upper radiator crossmember and tighten to 10.7 N·m (95 in. lbs.).

(3) On models equipped with a V-8 engine, reinstall the radiator to the engine compartment. Refer to Cooling Systems for the procedures.

(4) Reinstall the two screws that secure the radiator and fan shroud module to the inside of the upper radiator crossmember.

(5) Remove the plugs or tape from the refrigerant line fittings on the liquid line and the condenser outlet. Connect the liquid line to the condenser outlet. Tighten the fitting to 25.99 ±3.39 N·m (230 ±30 in. lbs.).

(6) Remove the plugs or tape from the refrigerant line fittings on the discharge line and the condenser inlet. Connect the discharge line to the condenser inlet. Tighten the fitting to 25.99 ±3.39 N·m (230 ±30 in. lbs.).

(7) Check that all of the condenser and radiator air seals are in their proper locations.

(8) Connect the battery negative cable.

(9) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(10) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

NOTE: If the condenser is replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

DUCTS AND OUTLETS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

PANEL AND DEFROSTER DUCTS

The panel and defroster ducts are integral to the instrument panel assembly. The defroster outlets are integral to the instrument panel top cover. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

PANEL OUTLET BARRELS

(1) Using a trim stick or another suitable wide-bladed flat tool, gently pry at the sides of the panel outlet barrels to release the snap-fit pivots on the barrel from the pivot pins in the outlet housing of the instrument panel top cover or the instrument cluster bezel (Fig. 33).

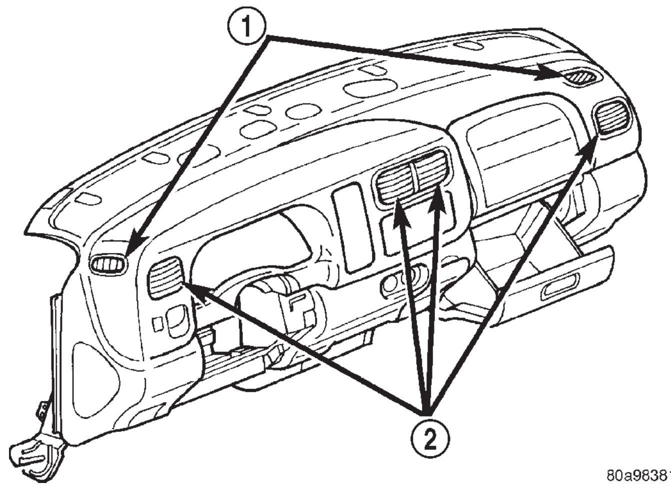


Fig. 33 Panel Outlet Barrels

1 – DEMISTER OUTLETS
2 – PANEL OUTLETS

(2) To install the panel outlet barrel, position the barrel in the panel outlet housing and press inwards firmly and evenly until the barrel snaps into place.

FLOOR DUCT

(1) Remove the four screws that secure the floor duct to the bottom of the heater-A/C housing (Fig. 34).

(2) Remove the floor duct from the heater-A/C housing.

(3) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

DEMISTER DUCT ADAPTER

(1) Roll the instrument panel assembly down, but do not remove it from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.

REMOVAL AND INSTALLATION (Continued)

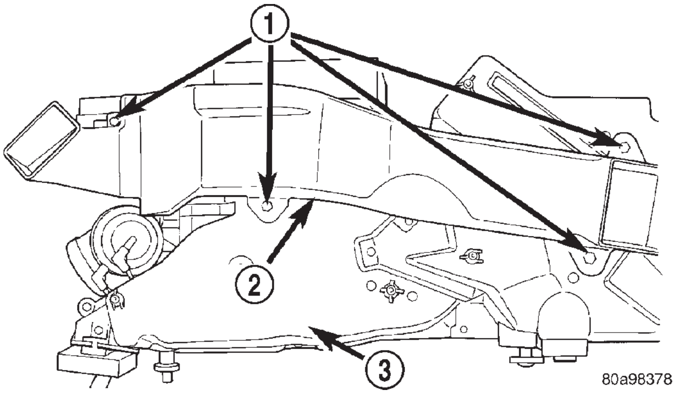


Fig. 34 Floor Duct Remove/Install

1 – SCREWS
2 – FLOOR DUCT
3 – HEATER-A/C HOUSING

tion section of Group 8E - Instrument Panel Systems for the procedures.

(2) Disconnect the flexible demister duct hose from the demister duct adapter on the top of the heater-A/C housing.

(3) Remove the two screws that secure the demister duct adapter to the top of the heater-A/C housing (Fig. 35).

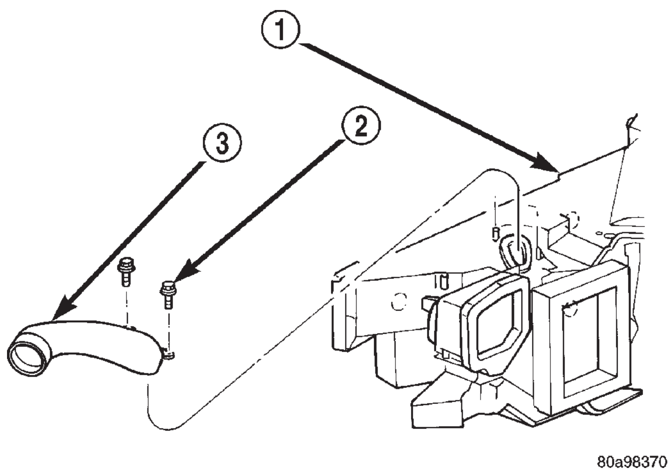


Fig. 35 Demister Duct Adapter Remove/Install

1 – HEATER-A/C HOUSING
2 – SCREW
3 – ADAPTER

(4) Remove the demister duct adapter from the heater-A/C housing.

(5) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

DEMISTER HOSE

(1) Remove the heater-A/C control from the instrument panel. See Heater-A/C Control in the Removal and Installation section of this group for the procedures.

(2) Reach through the heater-A/C control opening in the instrument panel to access and remove the screw that secures the flexible demister duct hose to the demister duct tee.

(3) Roll the instrument panel assembly down, but do not remove it from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(4) Disconnect the flexible demister duct hose from the demister duct adapter on the top of the heater-A/C housing.

(5) Remove the demister duct hose from the demister duct tee near the underside of the instrument panel top cover.

(6) Reverse the removal procedures to install. Tighten the hose mounting screw to 2.2 N·m (20 in. lbs.).

DEMISTER DUCTS AND OUTLETS

(1) Remove the instrument panel top cover from the instrument panel. Refer to Instrument Panel Top Cover in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(2) Remove the screws (two - left side, three - right side) that secure the demister ducts to the instrument panel top cover (Fig. 36).

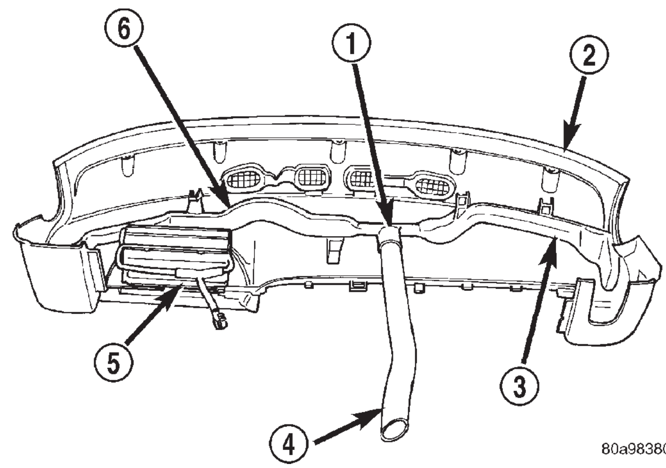


Fig. 36 Demister Ducts Remove/Install

1 – DEMISTER DUCT TEE
2 – INSTRUMENT PANEL TOP COVER
3 – LEFT DEMISTER DUCT
4 – DEMISTER HOSE
5 – PASSENGER SIDE AIRBAG MODULE
6 – RIGHT DEMISTER DUCT

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry between the end of the

demister duct and the demister outlet flange to release the duct from the outlet.

(4) Remove the demister ducts and the tee from the instrument panel top cover.

(5) Squeeze the demister outlet flange from the underside of the instrument panel top cover and push it out through the top.

(6) Using a trim stick or another suitable wide flat-bladed tool, gently pry between the end of the demister duct and the demister outlet flange to release the duct from the outlet.

(7) Remove the demister ducts and the tee from the instrument panel top cover.

(8) Squeeze the demister outlet flange from the underside of the instrument panel top cover and push it out through the top.

(9) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

HEATER-A/C HOUSING PLENUM ADAPTER

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Slide the heater-A/C housing plenum adapter (Fig. 37) all the way to one side of the plenum opening.

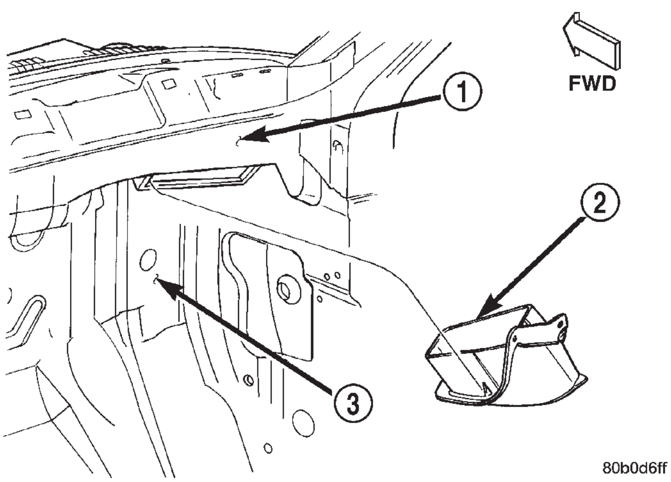


Fig. 37 Heater-A/C Housing Plenum Adapter Remove/Install

1 – PLENUM PANEL
2 – PLENUM ADAPTER
3 – DASH PANEL

(3) Pull downwards sharply and firmly on the opposite side of the plenum adapter to disengage the snap feature from the plenum opening.

(4) Remove the plenum adapter from the plenum panel.

(5) When reinstalling the heater-A/C housing plenum adapter to the plenum panel opening, be certain that the snap features on each side of the adapter are fully engaged with the sides of the plenum panel opening. This must be a water tight connection to prevent leaks.

(6) Reverse the remaining removal procedures to complete the installation.

EVAPORATOR COIL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle, and remove the housing cover. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Lift the evaporator coil out of the heater-A/C housing (Fig. 38).

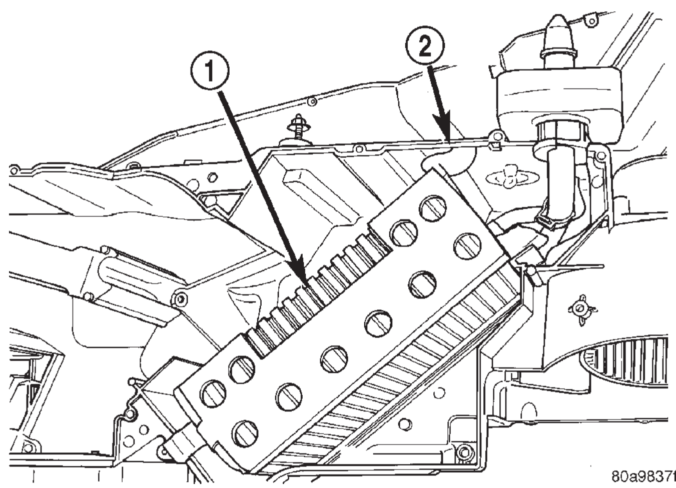


Fig. 38 Evaporator Coil Remove/Install

1 – EVAPORATOR COIL
2 – HEATER-A/C HOUSING

INSTALLATION

(1) Insert the evaporator coil into the bottom of the heater-A/C housing.

(2) Reassemble and reinstall the heater-A/C housing in the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

NOTE: If the evaporator is replaced, add 60 millili-ters (2 fluid ounces) of refrigerant oil to the refrig-erant system.

FIXED ORIFICE TUBE

WARNING: REVIEW THE WARNINGS AND CAU-TIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Disconnect the liquid line refrigerant line fastener at the condenser outlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

CAUTION: Always use two wrenches when loosen-ing or tightening tube fittings. Use one wrench to hold one side of the connection stationary, while loosening or tightening the other side of the con-nection with a second wrench.

(4) Remove the front half of the liquid line from the rear half by disconnecting it at the tube fitting (Fig. 39). Install plugs in, or tape over all of the opened refrigerant line tube fittings.

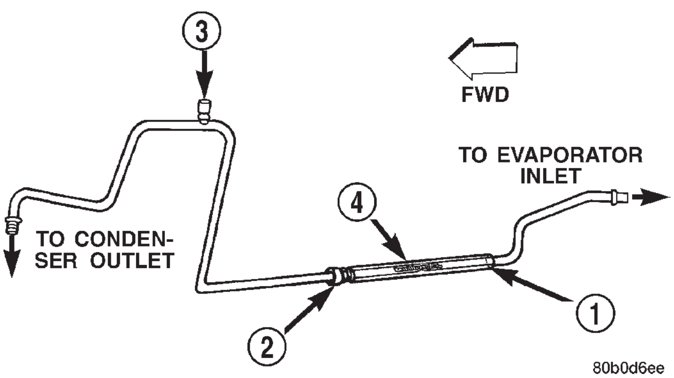


Fig. 39 Fixed Orifice Tube - Typical

1 – INSULATOR
2 – TUBE FITTING
3 – HIGH PRESSURE SERVICE PORT
4 – FIXED ORIFICE TUBE

(5) Remove the fixed orifice tube from the rear half of the liquid line using a pair of needle nose pliers. Note the orientation of the fixed orifice tube for correct reinstallation.

INSTALLATION

(1) Insert the fixed orifice tube into the rear half of the liquid line. Be certain that it is properly oriented (Fig. 40).

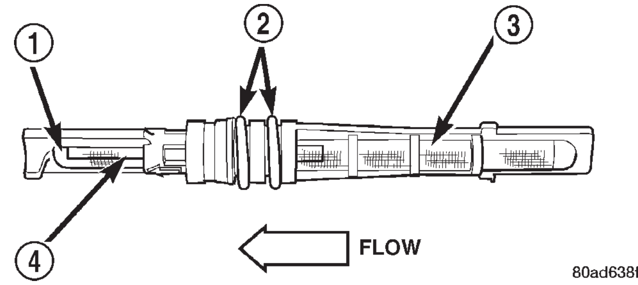


Fig. 40 Fixed Orifice Tube - Typical

1 – DIFFUSER SCREEN
2 – “O” RINGS
3 – INLET FILTER SCREEN
4 – ORIFICE

(2) Remove the tape or plugs from all of the refrigerant line tube fittings. Install a new O-ring on the liquid line tube fitting. Connect and tighten the tube fitting on the front half of the liquid line to the tube fitting on the rear half of the liquid line.

(3) Remove the tape or plugs from all of the refrigerant line fittings. Install the front half of the liquid line to the condenser outlet tube. Tighten the fastener to 22.6 ±3.39 N·m (200 ±30 in. lbs.).

(4) Connect the battery negative cable.

(5) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(6) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

HEATER-A/C CONTROL

WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRE-CAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. Refer to Cluster Bezel in the Removal and

Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the four screws that secure the heater-A/C control to the instrument panel (Fig. 41).

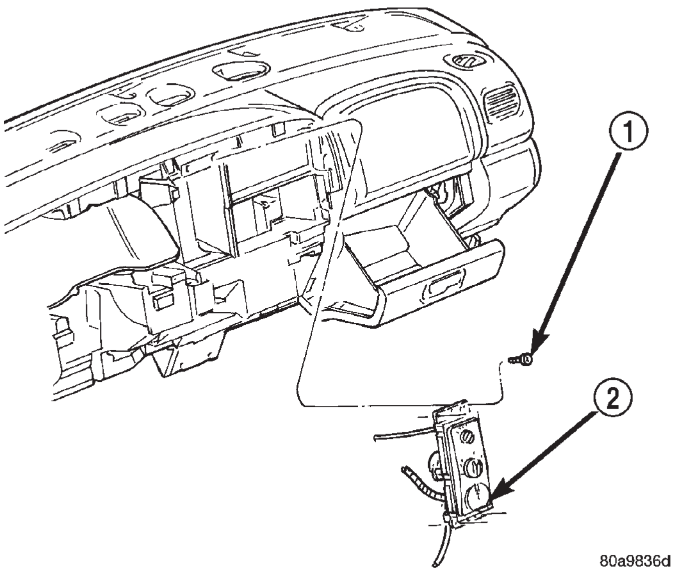


Fig. 41 Heater-A/C Control Remove/Install

1 – SCREW
2 – CONTROL

(4) Pull the heater-A/C control assembly away from the instrument panel far enough to access the connections on the back of the control.

(5) Unplug the wire harness connector from the back of the heater-A/C control (Fig. 42).

(6) Disconnect the wire harness retainer from the side of the heater-A/C control assembly.

(7) Remove the two stamped nuts that secure the vacuum harness connector and unplug the connector from the back of the heater-A/C control.

(8) Release the temperature control cable housing flag retainer latch in the receptacle on the back of the heater-A/C control and disengage the flag retainer from the receptacle.

(9) Rotate the heater-A/C control assembly to align the cable core with the slot on the end of the temperature control lever and disengage the cable end from the lever.

(10) Remove the heater-A/C control from the instrument panel.

INSTALLATION

(1) Connect the temperature control cable core end to the temperature control lever on the back of the heater-A/C control.

(2) Connect the temperature control cable housing flag retainer to the receptacle on the back of the heater-A/C control.

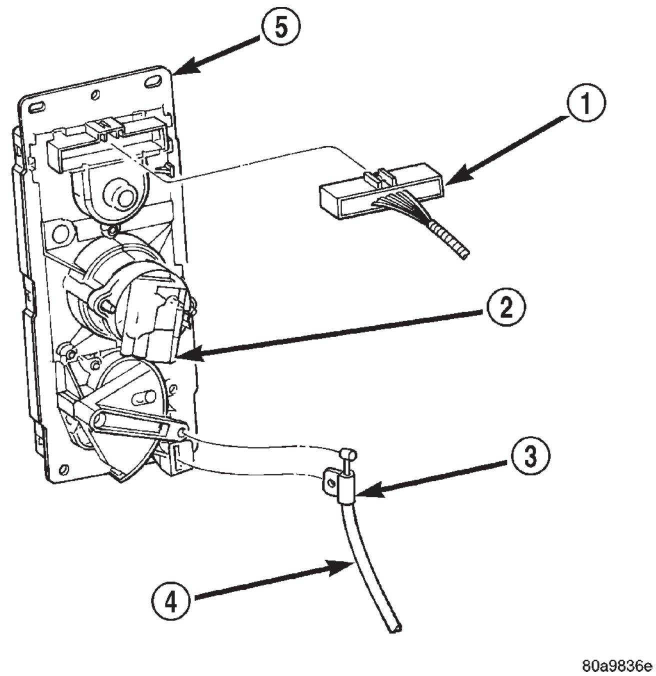


Fig. 42 Heater-A/C Control Connections

1 – WIRE HARNESS CONNECTOR
2 – VACUUM HARNESS CONNECTOR
3 – FLAG RETAINER
4 – TEMPERATURE CONTROL CABLE
5 – CONTROL

(3) Plug in the vacuum harness connector and install the two stamped nuts to secure the connector to the back of the heater-A/C control.

(4) Plug the wire harness connector into the back of the heater-A/C control.

(5) Reinstall the wire harness retainer to the side of the heater-A/C control.

(6) Position the heater-A/C control in the instrument panel and secure it with four screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(7) Reinstall the cluster bezel to the instrument panel. Refer to Cluster Bezel in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(8) Connect the battery negative cable.

(9) Adjust the temperature control cable. See Temperature Control Cable in the Adjustments section of this group for the procedures.

HEATER-A/C HOUSING

The heater-A/C housing assembly must be removed from the vehicle and disassembled for service access of the blower motor, blower motor wheel, heater core, evaporator coil, blend-air door, and each of the various mode control doors.

REMOVAL AND INSTALLATION (Continued)

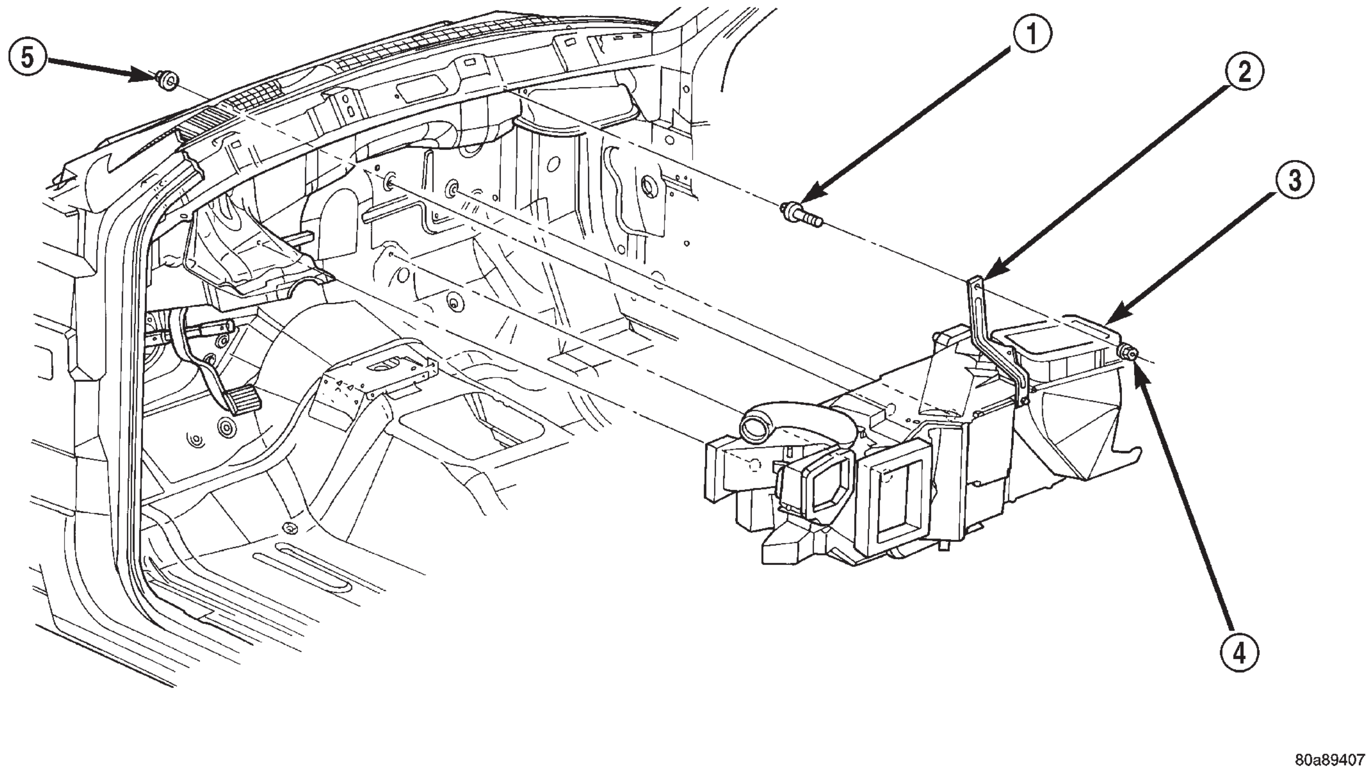


Fig. 43 Heater-A/C Housing Remove/Install

1 – STUD
2 – BRACE
3 – HEATER-A/C HOUSING
4 – NUT
5 – NUT

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) If the vehicle is not equipped with air conditioning, go to Step 6. If the vehicle is equipped with air conditioning, recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(4) Disconnect the liquid line refrigerant line fitting from the evaporator inlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Disconnect the accumulator inlet tube refrigerant line fitting from the evaporator outlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Drain the engine cooling system. Refer to Group 7 - Cooling System for the procedures.

(7) Disconnect the heater hoses from the heater core tubes. Refer to Group 7 - Cooling System for the procedures. Install plugs in, or tape over the opened heater core tubes.

(8) Remove the four nuts from the heater-A/C housing mounting studs on the engine compartment side of the dash panel (Fig. 43).

(9) Remove the nut that secures the heater-A/C housing mounting brace to the stud on the passenger compartment side of the dash panel.

(10) Pull the heater-A/C housing rearward far enough for the mounting studs and the evaporator condensate drain tube to clear the dash panel holes.

(11) Remove the heater-A/C housing from the vehicle.

REMOVAL AND INSTALLATION (Continued)

DISASSEMBLY

(1) Place the heater-A/C housing on a work bench, with the heater-A/C housing cover facing down.

(2) Remove the two screws that secure the heater-A/C housing cover to the top of the blower motor housing cover.

(3) If the vehicle is so equipped, unplug the two vacuum harness connectors from the recirculation air door actuator.

(4) Unplug the vacuum harness connector from the panel-defrost door actuator.

(5) Remove the four screws that secure the floor duct to the bottom of the heater-A/C housing and remove the duct from the housing.

(6) Remove the two screws that secure the heater-A/C housing cover to the lower housing near the floor outlet (Fig. 44).

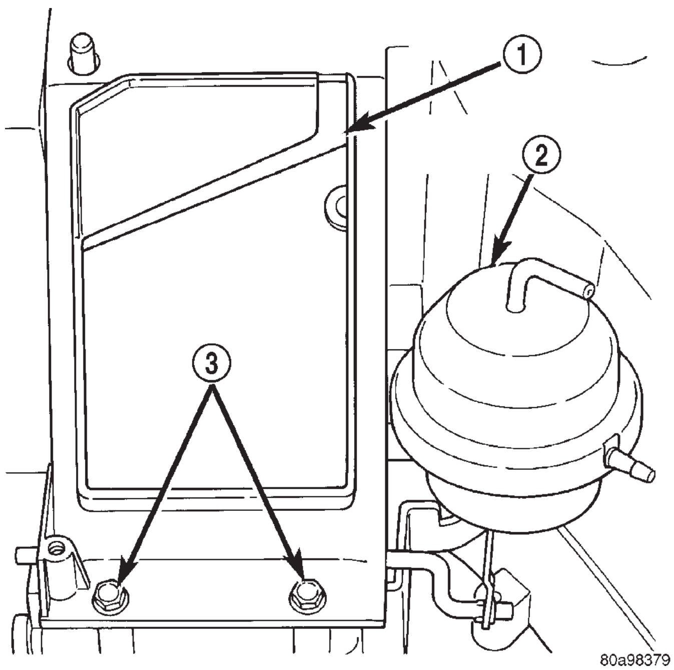


Fig. 44 Heater-A/C Housing Floor Outlet Screws

1 – HEATER-A/C HOUSING FLOOR OUTLET
2 – FLOOR-DEFROST DOOR ACTUATOR
3 – SCREWS

(7) Turn the heater-A/C housing over on the work bench, with the heater-A/C housing cover facing up.

(8) Disengage the vacuum harness retainer from the hole near the left end of the heater-A/C housing cover.

(9) Remove the vacuum harness from the molded clips on the heater-A/C housing cover (Fig. 45).

(10) Remove the thirteen screws that secure the perimeter of the housing cover to the heater-A/C housing.

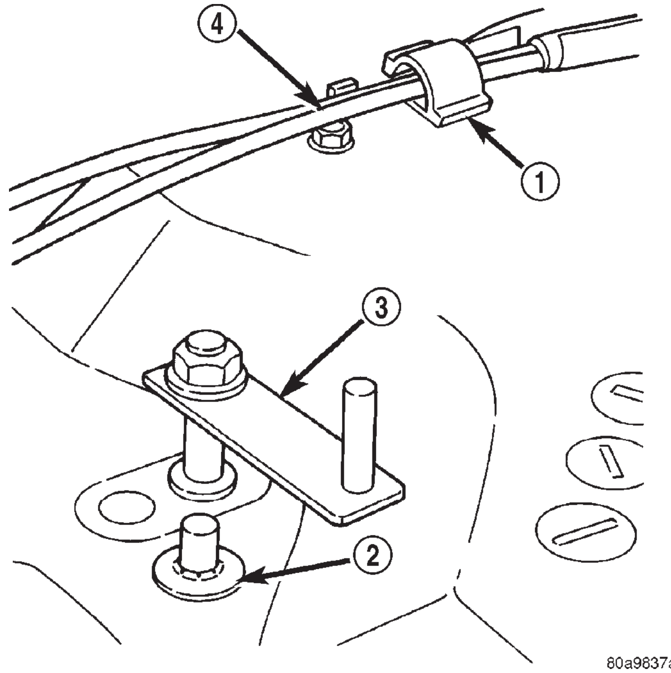


Fig. 45 Blend-Air Door Lever Remove/Install

1 – CLIP
2 – PUSH NUT
3 – BLEND-AIR DOOR LEVER
4 – VACUUM HARNESS

(11) Remove the nut that secures the blend-air door lever to the blend-air door pivot shaft and remove the lever.

(12) Gently pry off the push nut that secures the heater-A/C housing cover to the heater-A/C housing post.

(13) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel-defrost door lever off of the panel-defrost door pivot shaft (Fig. 46).

(14) Pull up the perimeter edges of the heater-A/C housing cover far enough to separate the cover sealant from the heater-A/C housing.

(15) Remove the housing cover from the heater-A/C housing.

(16) If the vehicle is so equipped, remove the recirculation air door actuator from the blower motor housing cover. See Mode Door Vacuum Actuators in the Removal and Installation section of this group for the procedures.

(17) Remove the six screws that secure the blower motor housing cover to the heater-A/C housing (Fig. 47).

(18) Remove the blower motor housing cover from the heater-A/C housing.

REMOVAL AND INSTALLATION (Continued)

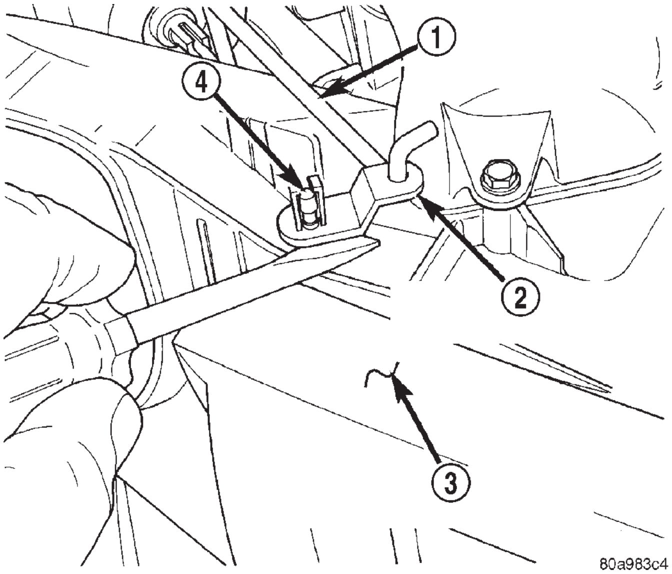


Fig. 46 Panel-Defrost Door Lever Remove

1 – PANEL-DEFROST DOOR ACTUATOR LINK
2 – PANEL-DEFROST DOOR LEVER
3 – HEATER-A/C HOUSING TOP COVER
4 – DOOR PIVOT SHAFT

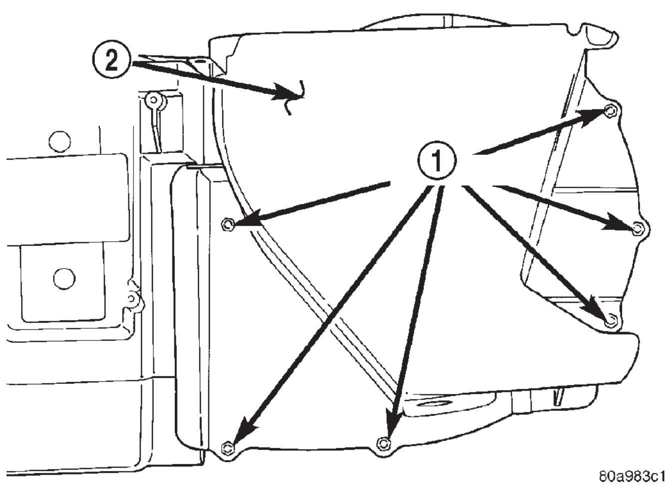


Fig. 47 Blower Motor Housing Cover Remove/Install

1 – SCREWS
2 – BLOWER MOTOR HOUSING COVER

ASSEMBLY

(1) Before installing the blower motor housing cover, be certain that the cover sealant is in place and in good condition (Fig. 48).

(2) Position the blower motor housing cover to the heater-A/C housing.

(3) Install the six screws that secure the blower motor housing cover to the heater-A/C housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) If the vehicle is so equipped, reinstall the recirculation air door actuator. See Mode Door Vacuum

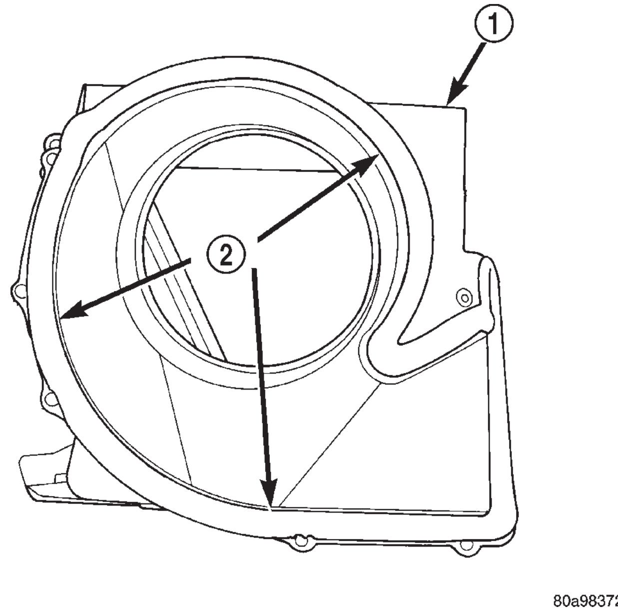


Fig. 48 Blower Motor Housing Cover Sealant

1 – BLOWER MOTOR HOUSING COVER
2 – SEALANT

Actuators in the Removal and Installation section of this group for the procedures.

(5) Before installing the heater-A/C housing cover, be certain that the cover sealant is in place and in good condition (Fig. 49).

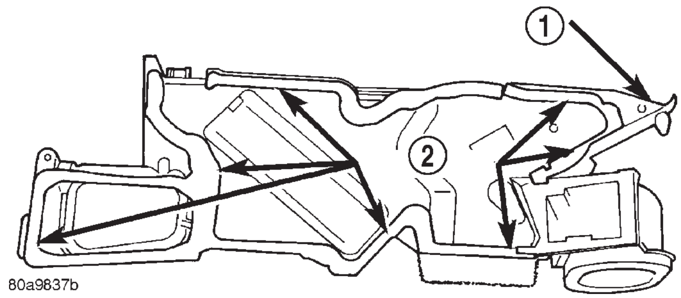


Fig. 49 Heater-A/C Housing Cover Sealant

1 – HEATER-A/C HOUSING COVER
2 – SEALANT

(6) Position the heater-A/C housing cover on the heater-A/C housing. Be certain that the pivots for the floor-defrost, the panel-defrost, the blend-air, and the recirculation air (if the vehicle is so equipped) doors are properly positioned.

(7) Reinstall the push nut that secures the heater-A/C housing cover to the heater-A/C housing post.

(8) Install the thirteen screws that secure the perimeter of the housing cover to the heater-A/C housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(9) Snap the panel-defrost door lever onto the panel-defrost door pivot shaft.

REMOVAL AND INSTALLATION (Continued)

(10) Install the blend-air door lever to the blend-air door pivot shaft and secure it to the shaft with the nut.

(11) Install the vacuum harness retainer into the hole near the left end of the heater-A/C housing cover.

(12) Route the vacuum harness through the molded clips on the heater-A/C housing cover.

(13) Turn the heater-A/C housing over on the work bench, with the heater-A/C housing cover facing down.

(14) Install the two screws that secure the heater-A/C housing cover to the lower housing near the floor outlet. Tighten the screws to 2.2 N·m (20 in. lbs.).

(15) Position the floor duct to the bottom of the heater-A/C housing and secure with four screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(16) Plug in the vacuum harness connector to the panel-defrost door actuator.

(17) If the vehicle is so equipped, plug in the two vacuum harness connectors to the recirculation air door actuator.

(18) Install the two screws that secure the heater-A/C housing cover to the top of the blower motor housing cover. Tighten the screws to 2.2 N·m (20 in. lbs.).

(19) Reinstall the heater-A/C housing in the vehicle.

INSTALLATION

(1) Position the heater-A/C housing to the dash panel. Be certain that the evaporator condensate drain tube and the housing mounting studs are inserted into their correct mounting holes.

(2) Install the nut that secures the heater-A/C housing mounting brace to the stud on the passenger compartment side of the dash panel. Tighten the nut to 11 N·m (95 in. lbs.).

(3) Install and tighten the four nuts onto the heater-A/C housing mounting studs on the engine compartment side of the dash panel. Tighten the nuts to 7 N·m (60 in. lbs.).

(4) Unplug or remove the tape from the heater core tubes. Connect the heater hoses to the heater core tubes and fill the engine cooling system. Refer to Group 7 - Cooling System for the procedures.

(5) If the vehicle is not equipped with air conditioning, go to Step 9. If the vehicle is equipped with air conditioning, unplug or remove the tape from the accumulator inlet tube and the evaporator outlet tube fittings. Connect the accumulator inlet tube coupler to the evaporator outlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(6) Unplug or remove the tape from the liquid line and the evaporator inlet tube fittings. Connect the liquid line coupler to the evaporator inlet tube. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures.

(7) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(8) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

(9) Reinstall the instrument panel in the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(10) Connect the battery negative cable.

(11) Start the engine and check for proper operation of the heating and air conditioning systems.

HEATER-A/C HOUSING DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

BLEND-AIR DOOR

(1) Remove the heater-A/C housing from the vehicle, and remove the housing cover. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Lift the blend-air door pivot shaft out of the pivot hole in the bottom of the heater-A/C housing (Fig. 50).

(3) Reverse the removal procedures to install.

FLOOR-DEFROST DOOR

(1) Remove the heater-A/C housing from the vehicle, and remove the housing cover. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Remove the push nut retainer that secures the floor-defrost door actuator link to the floor-defrost door crank arm (Fig. 51).

(3) Disengage the floor-defrost door actuator link from the floor-defrost door crank arm.

(4) Remove the floor-defrost door from the heater-A/C housing.

(5) Reverse the removal procedures to install.

PANEL-DEFROST DOOR

(1) Remove the heater-A/C housing from the vehicle, and remove the housing cover. See Heater-A/C

REMOVAL AND INSTALLATION (Continued)

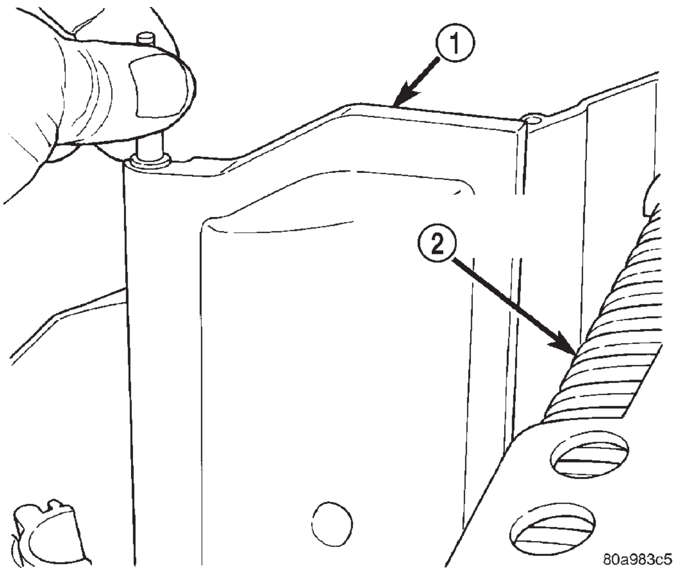


Fig. 50 Blend-Air Door Remove/Install

1 – BLEND-AIR DOOR
2 – EVAPORATOR COIL

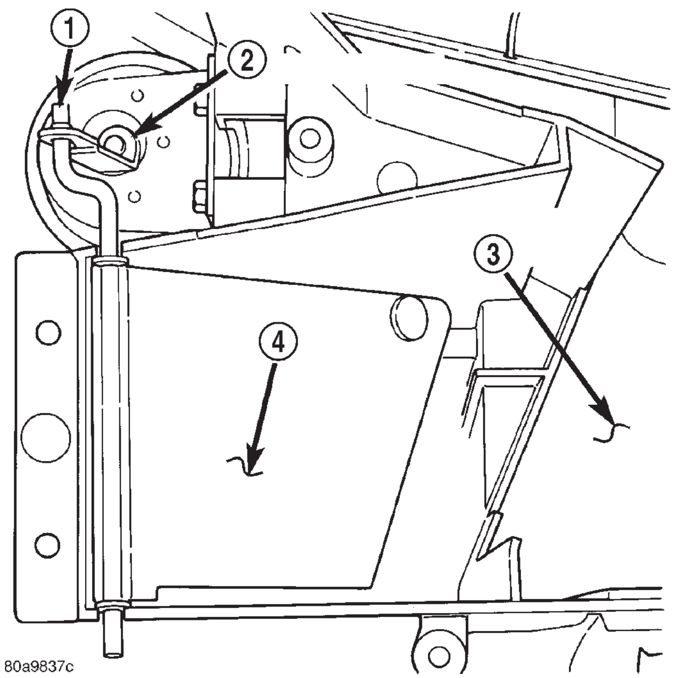


Fig. 51 Floor-Defrost Door Remove/Install

1 – PUSH-NUT
2 – ACTUATOR LINK
3 – HEATER-A/C HOUSING
4 – FLOOR-DEFROST DOOR

Housing in the Removal and Installation section of this group for the procedures.

(2) Lift the panel-defrost door out of the heater-A/C housing. **Assure that the chute assembly on the panel-defrost door is properly positioned.**

(3) Reverse the removal procedures to install.

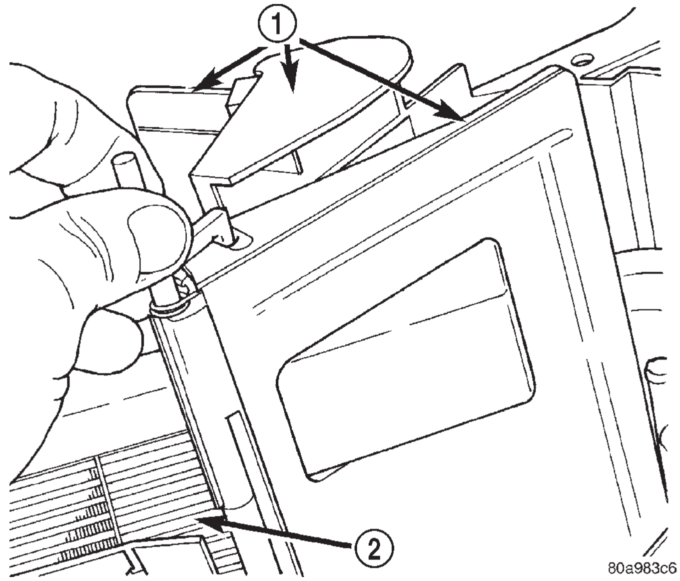


Fig. 52 Panel-Defrost Door Remove/Install

1 – PANEL-DEFROST DOOR
2 – HEATER CORE

RECIRCULATION AIR DOOR

A recirculation air door and vacuum actuator are used only on models with the optional air conditioning system.

(1) Remove the heater-A/C housing from the vehicle, and remove the housing cover. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Remove the recirculation air door actuator from the blower motor housing cover. See Mode Door Vacuum Actuators in the Removal and Installation section of this group for the procedures.

(3) Lift the lower end of the recirculation air door up far enough so that the door lever is clear of the recirculation air intake grille, then twist the door to remove the door pivots from the pivot holes in the blower motor housing cover (Fig. 53).

(4) Remove the recirculation air door from the blower motor housing cover.

(5) Reverse the removal procedures to install.

HEATER CORE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL AND INSTALLATION (Continued)

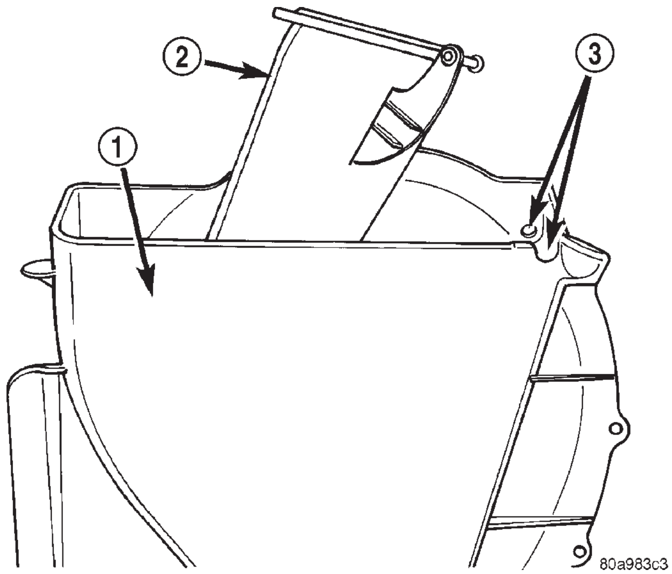


Fig. 53 Recirculation Air Door Remove/Install

1 – BLOWER MOTOR HOUSING COVER
2 – RECIRCULATION AIR DOOR
3 – DOOR PIVOT HOLES

REMOVAL

(1) Remove the heater-A/C housing from the vehicle, and remove the housing cover. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

(2) Lift the heater core out of the heater-A/C housing (Fig. 54).

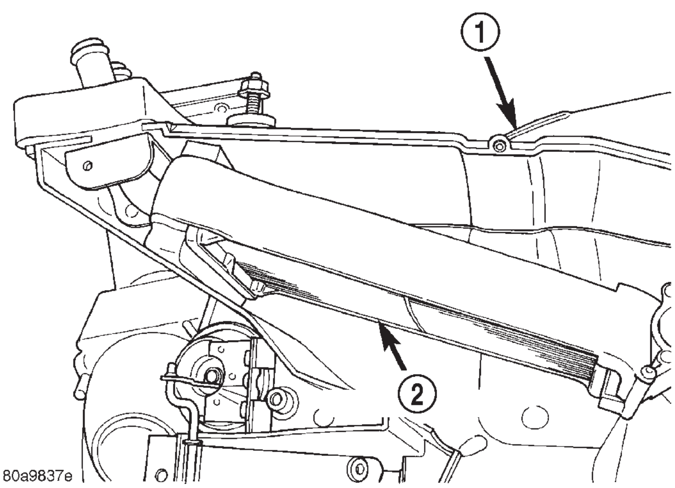


Fig. 54 Heater Core Remove/Install

1 – HEATER-A/C HOUSING
2 – HEATER CORE

INSTALLATION

(1) Insert the heater core into the bottom of the heater-A/C housing.

(2) Reassemble and reinstall the heater-A/C housing in the vehicle. See Heater-A/C Housing in the Removal and Installation section of this group for the procedures.

HIGH PRESSURE CUT-OFF SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the high pressure cut-off switch, which is mounted to a fitting on the discharge line between the compressor and the condenser inlet (Fig. 55).

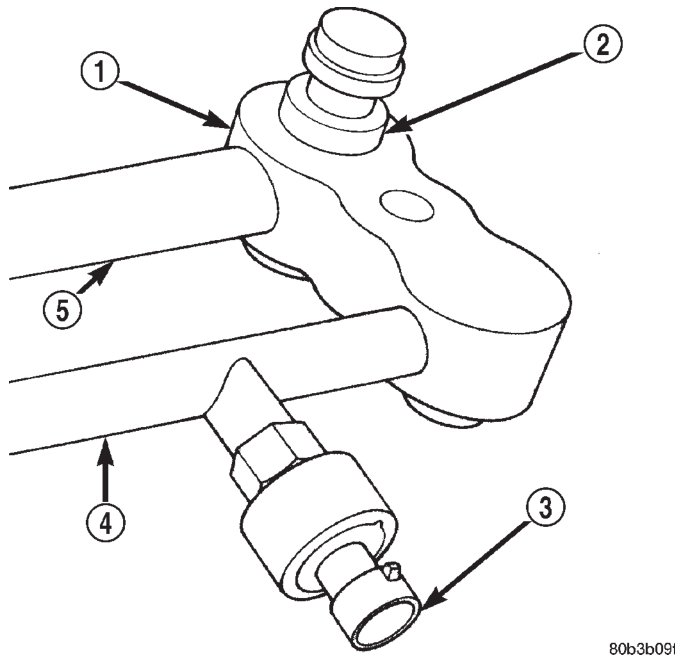


Fig. 55 High Pressure Cut-Off Switch Remove/Install

1 – MANIFOLD
2 – LOW PRESSURE SERVICE PORT
3 – HIGH PRESSURE CUT-OFF SWITCH
4 – DISCHARGE LINE
5 – SUCTION LINE

(3) Unscrew the high pressure cut-off switch from the discharge line fitting.

(4) Remove the high pressure cut-off switch from the vehicle.

(5) Remove the O-ring seal from the discharge line fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Install and tighten the high pressure cut-off switch on the discharge line fitting.

REMOVAL AND INSTALLATION (Continued)

(3) Plug the wire harness connector into the high pressure cut-off switch.

(4) Connect the battery negative cable.

LIQUID LINE

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Remove the engine air filter housing. Refer to Fuel System for the procedures.

(4) If the vehicle is so equipped, remove the nuts that secure the vehicle speed control servo mounting bracket to the studs on the cowl plenum panel and move the servo far enough to access the liquid line to evaporator coupler. Refer to Vehicle Speed Control System for the procedures.

(5) Disconnect the liquid line fastener at the condenser, and refrigerant line coupler at the evaporator. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Disengage the two clips that secure the liquid line to the inner fender shield (Fig. 56).

(7) Remove the liquid line from the vehicle.

INSTALLATION

(1) Install the liquid line in the two clips on the inner fender shield.

(2) Remove the tape or plugs from the refrigerant line fittings on the liquid line, the condenser outlet, and the evaporator inlet. Connect the liquid line to the condenser and the evaporator. See Refrigerant Line Coupler in the Removal and Installation section of this group for the procedures. Tighten the fastener at the condenser to 22.6 ±3.38 N·m (200 ±30 in. lbs.).

(3) If the vehicle is so equipped, reinstall the vehicle speed control servo mounting bracket to the studs

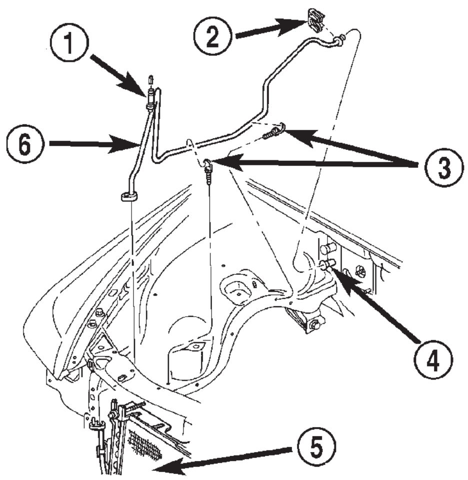


Fig. 56 Liquid Line

1 – HIGH PRESSURE SERVICE PORT
2 – CLIP
3 – LINE MOUNTING CLIPS
4 – EVAPORATOR TUBES
5 – CONDENSER
6 – LIQUID LINE

on the cowl plenum panel. Refer to Vehicle Speed Control System for the procedures.

(4) Reinstall the engine air filter housing. Refer to Fuel System for the procedures.

(5) Connect the battery negative cable.

(6) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(7) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

LOW PRESSURE CYCLING CLUTCH SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the low pressure cycling clutch switch near the top of the accumulator (Fig. 57).

(3) Unscrew the low pressure cycling clutch switch from the fitting on the side of the accumulator.

(4) Remove the O-ring seal from the accumulator fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the accumulator fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

REMOVAL AND INSTALLATION (Continued)

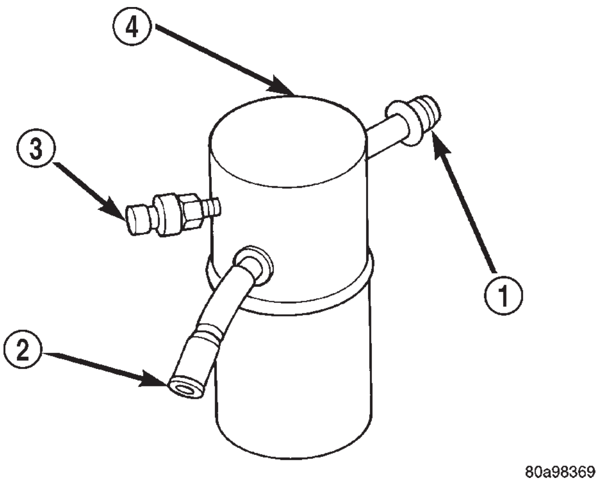


Fig. 57 Low Pressure Cycling Clutch Switch - Typical

1 – FROM EVAPORATOR
2 – TO COMPRESSOR
3 – LOW PRESSURE CYCLING CLUTCH SWITCH
4 – ACCUMULATOR

(2) Install and tighten the low pressure cycling clutch switch on the accumulator fitting. The switch should be hand-tightened onto the accumulator fitting.

(3) Plug the wire harness connector into the low pressure cycling clutch switch.

(4) Connect the battery negative cable.

MODE DOOR VACUUM ACTUATOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FLOOR-DEFROST DOOR ACTUATOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel assembly from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Unplug the two vacuum harness connectors from the floor-defrost door actuator (Fig. 58).

(4) Remove the push nut retainer that secures the floor-defrost door actuator link to the floor-defrost door crank arm.

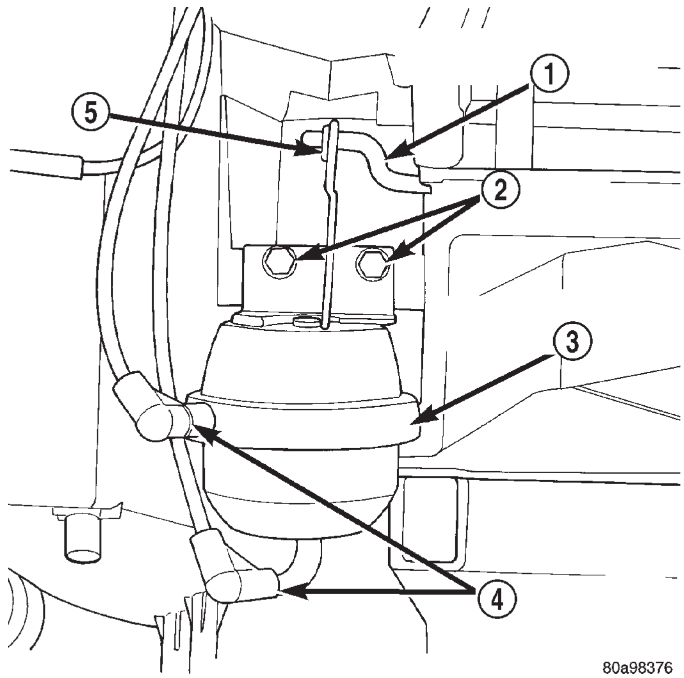


Fig. 58 Floor-Defrost Door Actuator Remove/Install

1 – FLOOR-DEFROST DOOR CRANK ARM
2 – SCREWS
3 – FLOOR-DEFROST DOOR ACTUATOR
4 – VACUUM CONNECTORS
5 – PUSH NUT

(5) Remove the two screws that secure the floor-defrost door actuator to the heater-A/C housing.

(6) Disengage the floor-defrost door actuator link from the floor-defrost door crank arm and remove the actuator from the heater-A/C housing.

(7) Reverse the removal procedures to install. Tighten the floor-defrost door actuator mounting screws to 2.2 N·m (20 in. lbs.).

PANEL-DEFROST DOOR ACTUATOR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel assembly from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Unplug the vacuum harness connector from the panel-defrost door actuator (Fig. 59).

(4) Remove the two screws that secure the panel-defrost door actuator to the heater-A/C housing.

(5) Rotate the panel-defrost door actuator clockwise about one-quarter turn to disengage the hooked end of the actuator link from the hole on the end of the panel-defrost door lever.

(6) Remove the panel-defrost door actuator from the heater-A/C housing.

REMOVAL AND INSTALLATION (Continued)

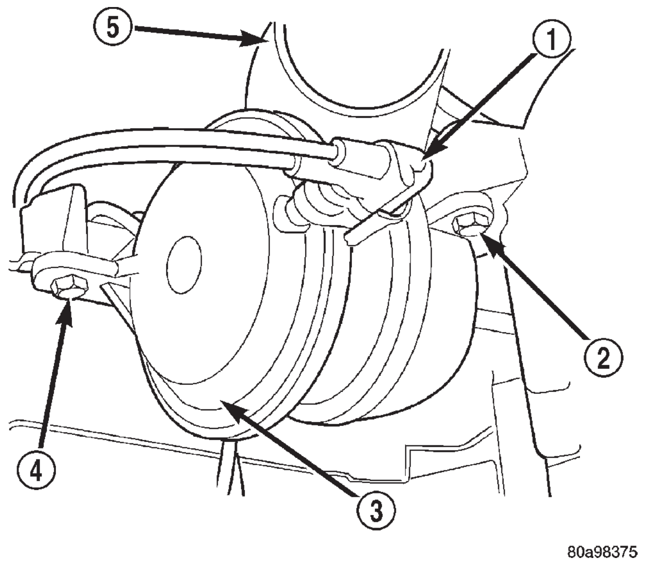


Fig. 59 Panel-Defrost Door Actuator

1 – VACUUM CONNECTOR
2 – SCREW
3 – PANEL-DEFROST DOOR ACTUATOR
4 – SCREW
5 – DEMISTER DUCT ADAPTER

(7) Reverse the removal procedures to install. Tighten the panel-defrost door actuator mounting screws to 2.2 N·m (20 in. lbs.).

RECIRCULATION AIR DOOR ACTUATOR

A recirculation air door and vacuum actuator are used only on models with the optional air conditioning system.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel assembly from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) If the vehicle is so equipped, and the heater-A/C housing is in its installed position in the vehicle, remove the Infinity speaker system amplifier. Refer to Amplifier in the Removal and Installation section of Group 8F - Audio Systems for the procedures.

(4) Unplug the two vacuum harness connectors from the recirculation air door actuator (Fig. 60).

(5) Remove the two stamped nuts that secure the recirculation air door actuator to the blower motor housing cover.

(6) Unhook the actuator link from the recirculation air door lever.

(7) Remove the actuator from the blower motor housing cover.

(8) Reverse the removal procedures to install. Tighten the mounting nuts until the recirculation air door actuator is seated to the blower motor housing cover.

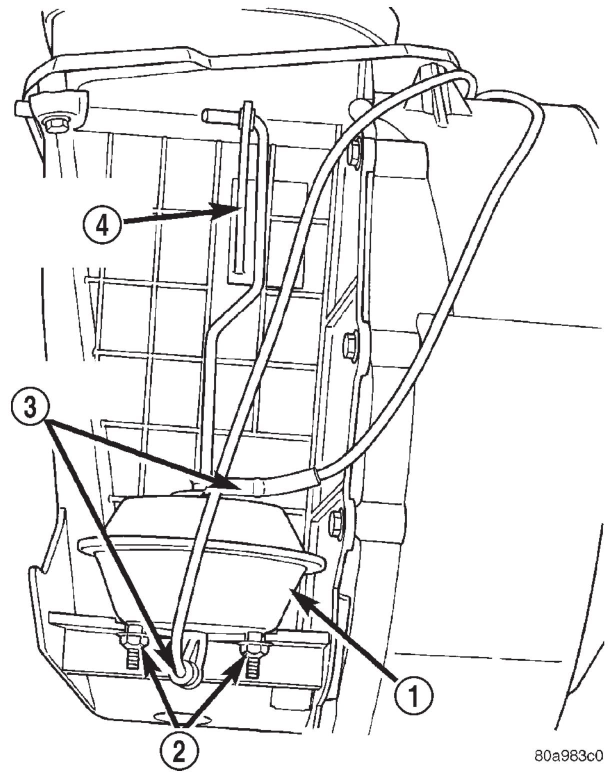


Fig. 60 Recirculation Air Door Actuator Remove/ Install

1 – ACTUATOR
2 – NUTS
3 – VACUUM CONNECTORS
4 – RECIRCULATION AIR DOOR LEVER

REFRIGERANT LINE COUPLER

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(2) Remove the secondary clip from the spring-lock coupler.

(3) Fit the proper size A/C line disconnect tool (Special Tool Kit 7193) over the spring-lock coupler cage (Fig. 61).

(4) Close the two halves of the A/C line disconnect tool around the spring-lock coupler.

(5) Push the A/C line disconnect tool into the open side of the coupler cage to expand the garter spring. Once the garter spring is expanded and while still

REMOVAL AND INSTALLATION (Continued)

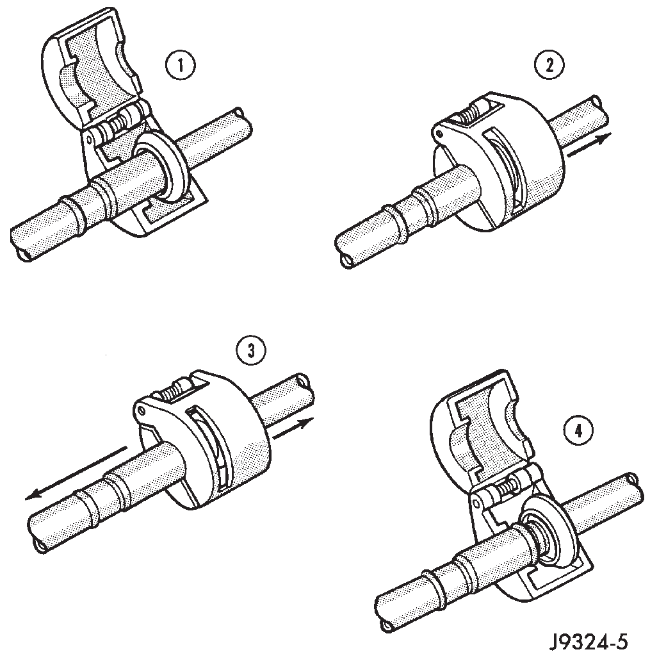


Fig. 61 Refrigerant Line Spring-Lock Coupler Disconnect

pushing the disconnect tool into the open side of the coupler cage, pull on the refrigerant line attached to the female half of the coupler fitting until the flange on the female fitting is separated from the garter spring and cage on the male fitting within the disconnect tool.

NOTE: The garter spring may not release if the A/C line disconnect tool is cocked while pushing it into the coupler cage opening.

(6) Open and remove the A/C line disconnect tool from the disconnected spring-lock coupler.

(7) Complete the separation of the two halves of the coupler fitting.

INSTALLATION

(1) Check to ensure that the garter spring is located within the cage of the male coupler fitting, and that the garter spring is not damaged.

(a) If the garter spring is missing, install a new spring by pushing it into the coupler cage opening.

(b) If the garter spring is damaged, remove it from the coupler cage with a small wire hook (DO NOT use a screwdriver) and install a new garter spring.

(2) Clean any dirt or foreign material from both halves of the coupler fitting.

(3) Install new O-rings on the male half of the coupler fitting.

CAUTION: Use only the specified O-rings as they are made of a special material for the R-134a system. The use of any other O-rings may allow the connection to leak intermittently during vehicle operation.

(4) Lubricate the male fitting and O-rings, and the inside of the female fitting with clean R-134a refrigerant oil. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(5) Fit the female half of the coupler fitting over the male half of the fitting.

(6) Push together firmly on the two halves of the coupler fitting until the garter spring in the cage on the male half of the fitting snaps over the flanged end on the female half of the fitting.

(7) Ensure that the spring-lock coupler is fully engaged by trying to separate the two coupler halves. This is done by pulling the refrigerant lines on either side of the coupler away from each other.

(8) Reinstall the secondary clip over the spring-lock coupler cage.

SUCTION AND DISCHARGE LINE

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in the Service Procedures section of this group.

(3) Unplug the wire harness connector from the high pressure cut-off switch.

(4) Remove the fasteners and disconnect the refrigerant line couplers at the condenser and the accumulator. Install plugs in, or tape over all of the opened refrigerant line fittings.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the fastener that secures the refrigerant line support bracket near the compressor.

(6) Remove the screw that secures the refrigerant line manifold to the compressor (Fig. 63) and (Fig. 62). Install plugs in, or tape over all of the opened refrigerant line fittings.

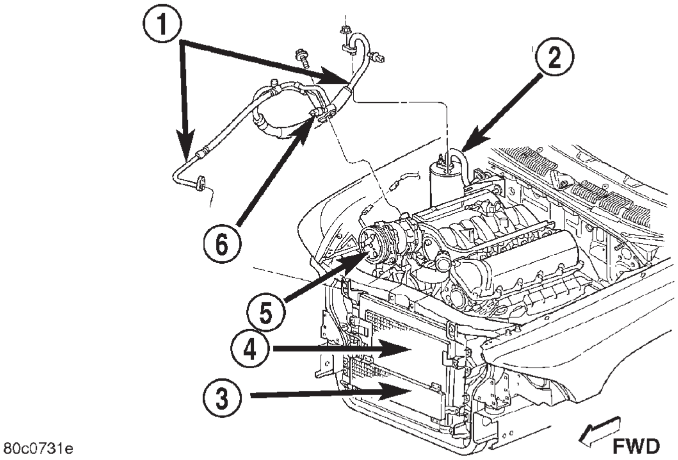


Fig. 62 Section and Discharge Line 4.7L

1 – SUCTION AND DISCHARGE LINE ASSEMBLY
2 – ACCUMULATOR
3 – AUXILIARY TRANSMISSION COOLER
4 – CONDENSER
5 – A/C COMPRESSOR
6 – HIGH PRESSURE CUT-OFF SWITCH

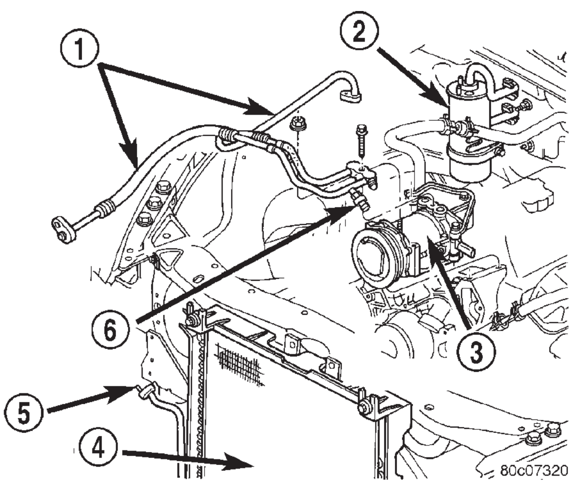


Fig. 63 Suction and Discharge Line 3.9L/5.2L/5.9L

1 – SUCTION AND DISCHARGE LINE ASSEMBLY
2 – ACCUMULATOR
3 – A/C COMPRESSOR
4 – CONDENSER
5 – TO LIQUID LINE
6 – HIGH PRESSURE CUT-OFF SWITCH

(7) Remove the suction and discharge line assembly from the vehicle.

INSTALLATION

(1) Remove the tape or plugs from all of the refrigerant line fittings. Install the refrigerant line couplers to the condenser and the accumulator. Tighten the fasteners to 22 ±3.38 N·m (200 ±30 in. lbs.).

(2) Install the refrigerant line manifold to the compressor. Tighten the mounting screw to 22 N·m (200 in. lbs.).

(3) Install the fastener that secures the refrigerant line support bracket near the compressor. Tighten the mounting screw to 6.77 ±1.7 N·m (60 ±15 in. lbs.).

(4) Plug in the wire harness connector to the high pressure cut-off switch.

(5) Connect the battery negative cable.

(6) Evacuate the refrigerant system. See Refrigerant System Evacuate in the Service Procedures section of this group.

(7) Charge the refrigerant system. See Refrigerant System Charge in the Service Procedures section of this group.

TEMPERATURE CONTROL CABLE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Roll down the instrument panel assembly, but do not remove it from the vehicle. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Disconnect the temperature control cable from the heater-A/C control. See Heater-A/C Control in the Removal and Installation section of this group for the procedures.

(4) Disconnect the temperature control cable housing flag retainer from the receptacle on the top of the heater-A/C housing (Fig. 64).

(5) Pull the temperature control cable core self-adjuster clip off of the pin on the end of the blend-air door lever.

(6) Remove the temperature control cable from the vehicle.

REMOVAL AND INSTALLATION (Continued)

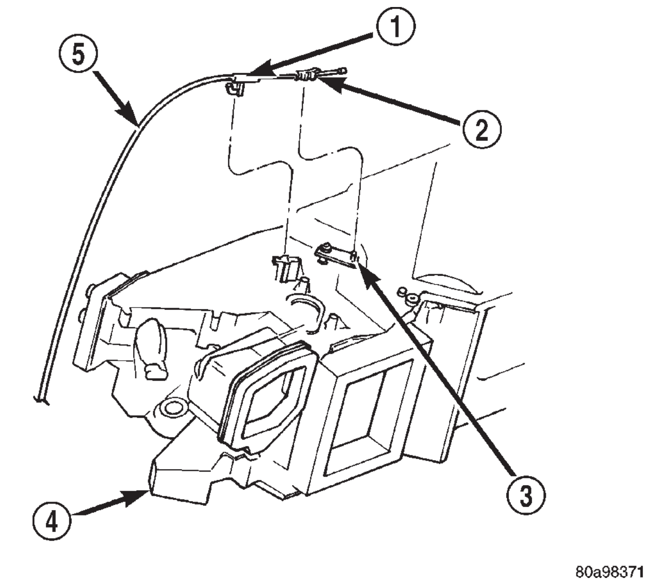


Fig. 64 Temperature Control Cable Remove/Install

1 – FLAG RETAINER
2 – ADJUSTER CLIP
3 – BLEND-AIR DOOR LEVER
4 – HEATER-A/C HOUSING
5 – TEMPERATURE CONTROL CABLE

INSTALLATION

Before installing the temperature control cable, be certain that the self-adjuster clip is properly positioned (Fig. 65). This measurement must be made with the cable end bottomed against the flag retainer on the heater-A/C control end of the cable housing. The measurement is taken from the end of the flag retainer on the heater-A/C housing end of the cable to the center of the self-adjuster clip. If the self-adjuster clip is not properly positioned, slide the clip up or down the cable core as required to achieve the specified dimension.

(1) Connect the temperature control cable to the heater-A/C control. See Heater-A/C Control in the Removal and Installation section of this group for the procedures.

(2) Route the cable through the instrument panel. Position the cable end near the connection points on the HVAC unit assembly, making sure not to kink or distort the cable.

(3) Push the temperature control cable core self-adjuster clip onto the pin on the end of the blend-air door lever.

(4) Snap the temperature control cable housing flag retainer into the receiver on the top of the heater-A/C housing.

(5) Reinstall the instrument panel assembly. Refer to Instrument Panel Assembly in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(6) Connect the battery negative cable.

(7) Adjust the temperature control cable. See Temperature Control Cable in the Adjustments section of this group for the procedures.

VACUUM CHECK VALVE

(1) Unplug the vacuum supply line connector at the power brake booster (Fig. 66).

(2) Note the orientation of the check valve in the vacuum supply line for correct reinstallation.

(3) Unplug the vacuum check valve from the vacuum supply line fittings.

(4) Reverse the removal procedures to install.

VACUUM RESERVOIR

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. Refer to Wiper Arm in the Removal and Installation

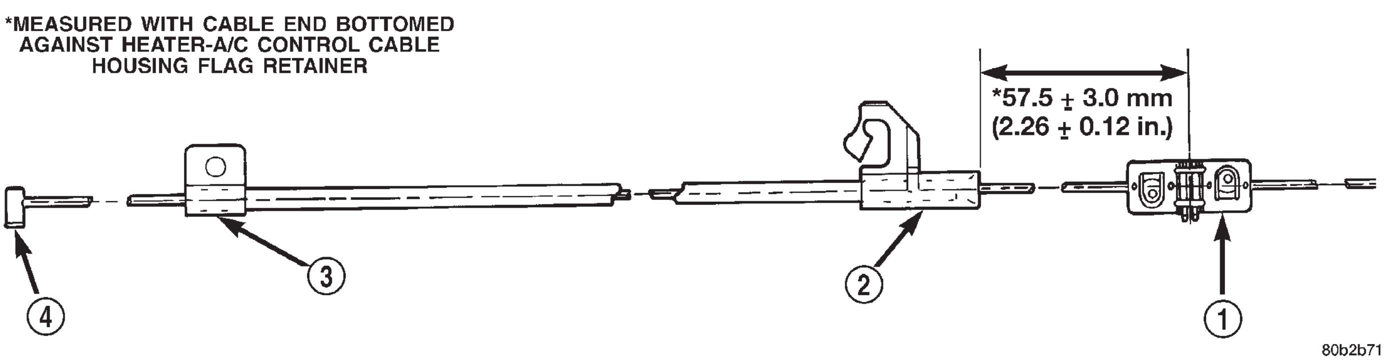


Fig. 65 Temperature Control Cable Self-Adjuster Clip

1 – SELF-ADJUSTER CLIP
2 – HEATER-A/C CONTROL CABLE HOUSING FLAG RETAINER-HOUSING END
3 – HEATER-A/C CONTROL CABLE HOUSING FLAG RETAINER-CONTROL END
4 – CABLE END

REMOVAL AND INSTALLATION (Continued)

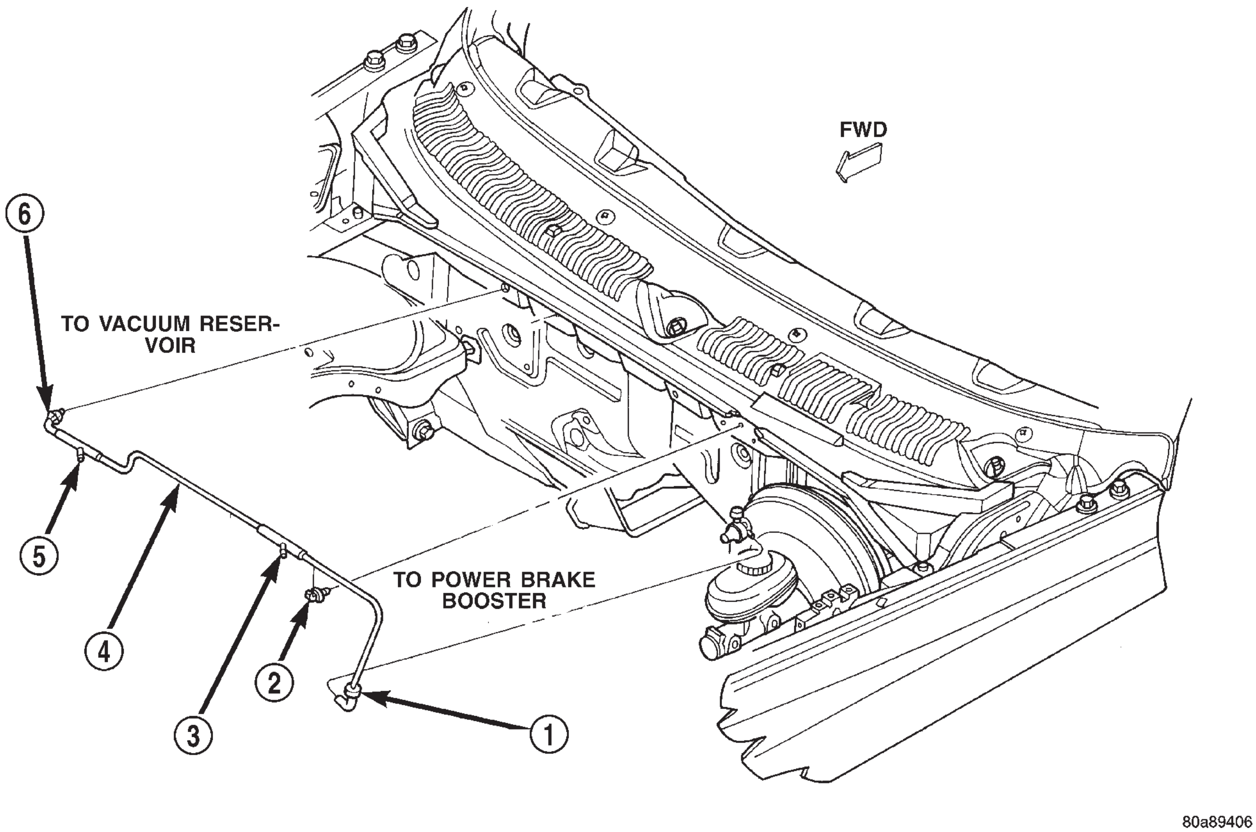


Fig. 66 Vacuum Supply

1 – VACUUM CHECK VALVE
2 – CLIP
3 – TO HEATER-AC CONTROLS
4 – VACUUM SUPPLY LINE
5 – TO SPEED CONTROL SERVO
6 – GROMMET

section of Group 8K - Wiper and Washer Systems for the procedures.

(3) Remove the weatherstrip along the front edge of the cowl plenum cover/grille panel and the cowl plenum panel (Fig. 67).

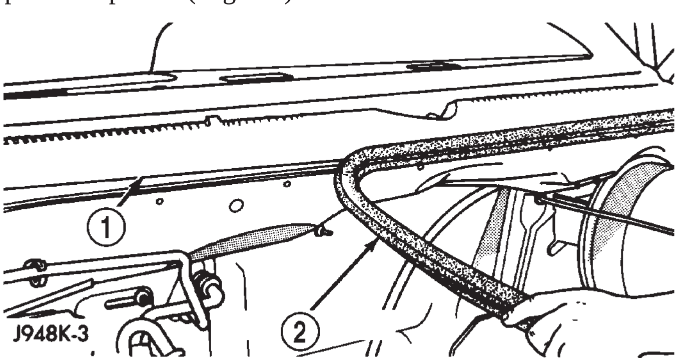


Fig. 67 Cowl Plenum Cover/Grille Panel Weatherstrip

1 – COWL GRILLE
2 – WEATHERSTRIP

(4) Remove the four plastic nuts that secure the cowl plenum cover/grille panel to the studs on the cowl top panel near the base of the windshield (Fig. 68).

(5) Remove the one plastic rivet that secures the front corner on each side of the cowl plenum cover/grille panel to the cowl plenum panel.

(6) Remove the one plastic push-in retainer that secures the rear corner on each side of the cowl plenum cover/grille panel to the windshield reveal molding.

(7) Unsnap the slotted center hole on each side of the cowl plenum cover/grille panel from the adhesive-backed snap fastener. **(If equipped: This feature may not be on all models).**

(8) Lift the cowl plenum cover/grille panel from the cowl top far enough to access the windshield washer nozzle and vacuum plumbing near the right end of the cowl plenum.

(9) Disconnect the windshield washer supply hose at the in-line connector.

(10) Disconnect the vacuum supply hose from the vacuum reservoir, which is secured to the underside

REMOVAL AND INSTALLATION (Continued)

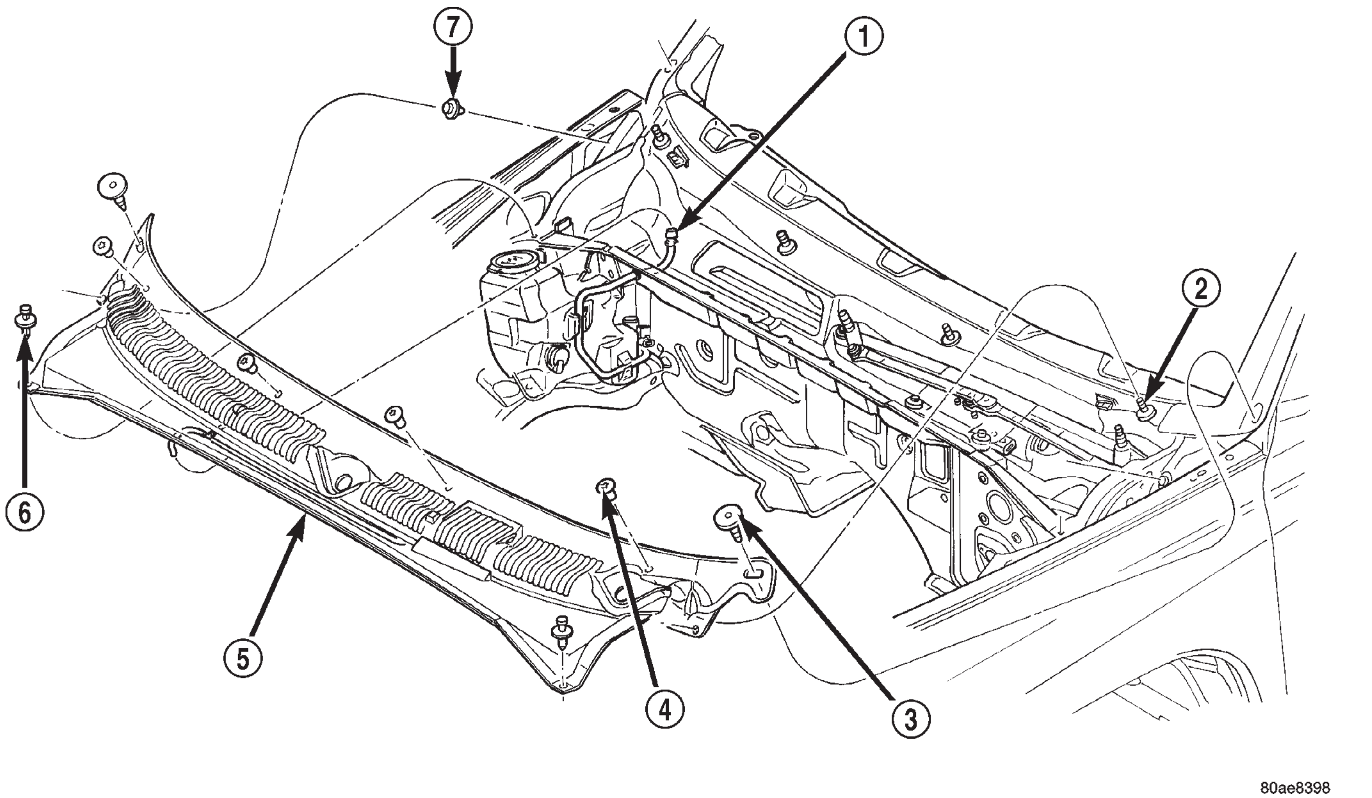


Fig. 68 Cowl Plenum Cover/Grille Panel Remove/Install

1 – IN-LINE WASHER SUPPLY HOSE CONNECTOR
2 – STUD
3 – PUSH-IN PLASTIC RETAINER
4 – PLASTIC NUT
5 – COWL PLENUM COVER/GRILLE PANEL
6 – PLASTIC RIVET
7 – ADHESIVE-BACKED SNAP FASTENER

of the right end of the cowl plenum cover/grille panel (Fig. 69).

(11) Remove the cowl plenum cover/grille panel from the vehicle.

(12) Remove the three screws that secure the vacuum reservoir to the underside of the cowl plenum cover/grille panel.

(13) Remove the vacuum reservoir from the cowl plenum cover/grille panel.

(14) Reverse the removal procedures to install. Tighten the vacuum reservoir mounting screws to 2.2 N·m (20 in. lbs.).

VACUUM SYSTEM

Vacuum control is used to operate the mode doors in the heater-only and heater-A/C housings. Testing of the heater-only and heater-A/C mode control switch operation will determine if the vacuum, electrical, and mechanical controls are functioning. However, it is possible that a vacuum control system that operates perfectly at engine idle (high engine vacuum) may not function properly at high engine speeds or loads (low engine vacuum). This can be

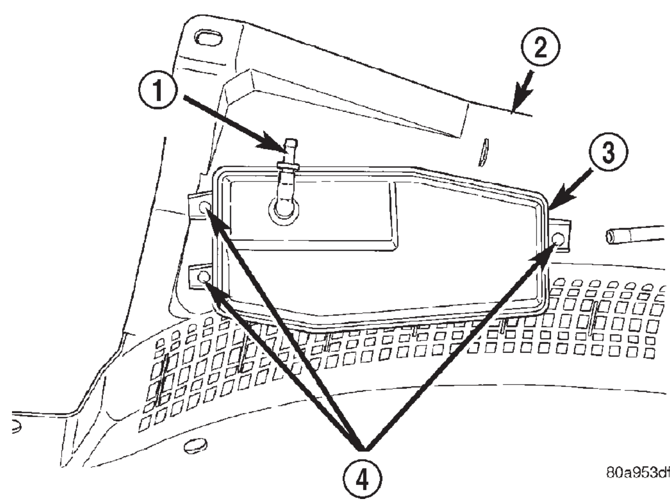


Fig. 69 Vacuum Reservoir

1 – VACUUM SUPPLY CONNECTOR
2 – COWL PLENUM COVER/GRILLE PANEL
3 – VACUUM RESERVOIR
4 – SCREWS

REMOVAL AND INSTALLATION (Continued)

caused by leaks in the vacuum system, or a faulty vacuum check valve.

A vacuum system test will help to identify the source of poor vacuum system performance or vacuum system leaks. Before starting this test, stop the engine and make certain that the problem is not a disconnected vacuum supply tube at the power brake booster vacuum tap or at the vacuum reservoir.

Use an adjustable vacuum test set (Special Tool C-3707) and a suitable vacuum pump to test the heater-A/C vacuum control system. With a finger placed over the end of the vacuum test hose probe (Fig. 70), adjust the bleed valve on the test set gauge to obtain a vacuum of exactly 27 kPa (8 in. Hg.). Release and block the end of the probe several times to verify that the vacuum reading returns to the exact 27 kPa (8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

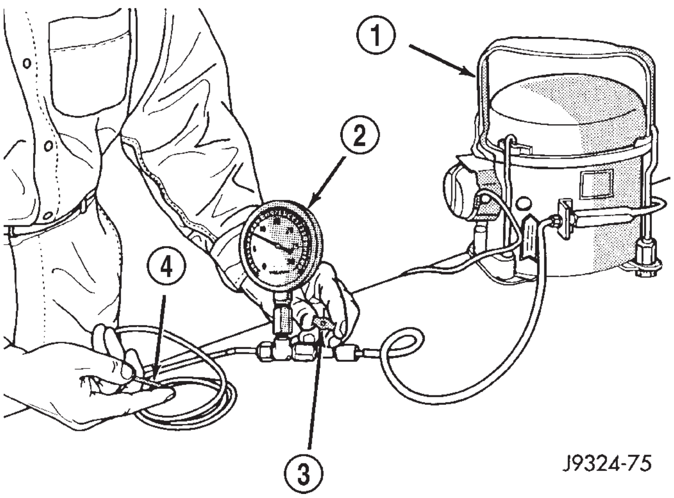


Fig. 70 Adjust Vacuum Test Bleed Valve

1 – VACUUM PUMP TOOL C-4289
2 – VACUUM TEST SET C-3707
3 – BLEED VALVE
4 – PROBE

VACUUM CHECK VALVE

(1) Remove the vacuum check valve. The valve is located in the vacuum supply tube (black) at the power brake booster on the left side of the engine compartment.

(2) Connect the test set vacuum supply hose to the heater-A/C control side of the valve. When connected to this side of the check valve, no vacuum should pass and the test set gauge should return to the 27 kPa (8 in. Hg.) setting. If OK, go to step Step 3. If not OK, replace the faulty valve.

(3) Connect the test set vacuum supply hose to the engine vacuum side of the valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty valve.

HEATER-A/C CONTROLS

(1) Connect the test set vacuum probe to the heater-A/C vacuum supply (black) tube at the tee near the power brake booster in the engine compartment. Position the test set gauge so that it can be viewed from the passenger compartment.

(2) Place the heater-A/C mode control switch knob in each mode position, one position at a time, and pause after each selection. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each selection is made. If not OK, a component or vacuum line in the vacuum circuit of the selected mode has a leak. See Locating Vacuum Leaks in the Diagnosis and Testing section of this group.

CAUTION: Do not use lubricant on the switch ports or in the holes in the plug, as lubricant will ruin the vacuum valve in the switch. A drop of clean water in the connector plug holes will help the connector slide onto the switch ports.

LOCATING VACUUM LEAKS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the vacuum connector from the back of the heater-A/C mode control switch on the instrument panel.

(2) Connect the test set vacuum hose probe to each port in the vacuum harness connector, one port at a time, and pause after each connection (Fig. 71). The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty heater-A/C control. If not OK, go to step Step 3.

(3) Determine the vacuum line color of the vacuum circuit that is leaking. To determine the vacuum line colors, see the Vacuum Circuits chart (Fig. 72) or (Fig. 73).

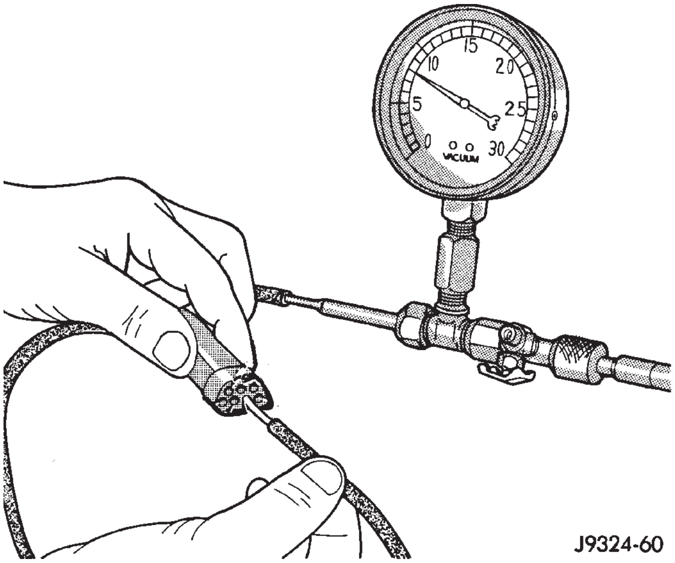


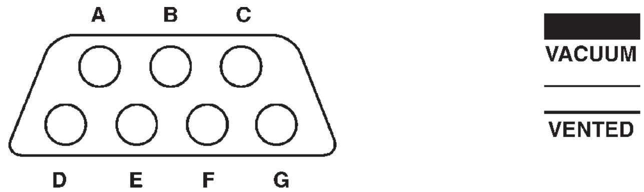
Fig. 71 Vacuum Circuit Test

(4) Disconnect and plug the vacuum line from the component (fitting, actuator, valve, switch, or reservoir) on the other end of the leaking circuit. Instrument panel disassembly or removal may be necessary to gain access to some components. See the Removal and Installation section of this group for more information.

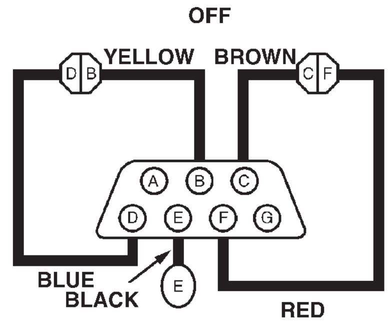
(5) Connect the test set hose or probe to the open end of the leaking circuit. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty disconnected component. If not OK, go to Step 6.

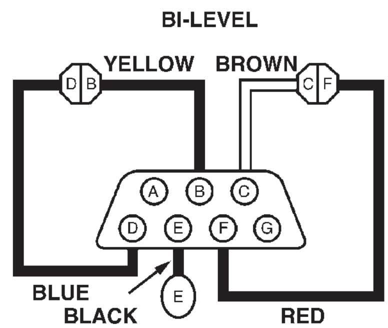
(6) To locate a leak in a vacuum line, leave one end of the line plugged and connect the test set hose or probe to the other end of the line. Run your fingers slowly along the line while watching the test set gauge. The vacuum reading will fluctuate when your fingers contact the source of the leak. To repair the vacuum line, cut out the leaking section of the line. Then, insert the loose ends of the line into a suitable length of 3 millimeter (0.125 inch) inside diameter rubber hose.

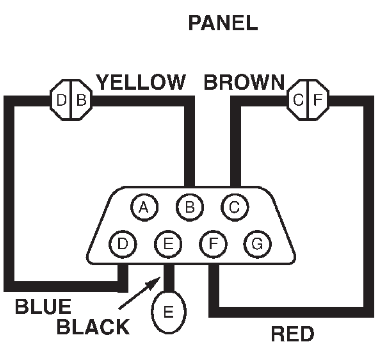
REMOVAL AND INSTALLATION (Continued)

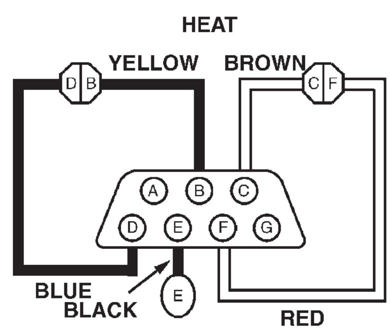


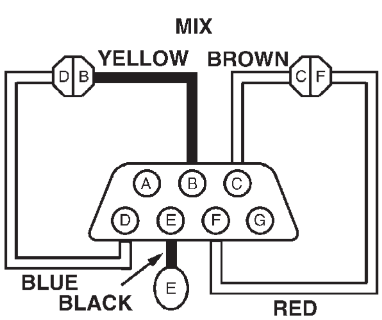
VACUUM CIRCUIT LEGEND		
I. D.	**FUNCTION**	**COLOR**
A	Not Used	N/A
B	Floor-Defrost Actuator (Mid Position)	Yellow
C	Panel-Defrost Actuator (Full Position)	Brown
D	Floor-Defrost Actuator (Full Position)	Blue
E	Vacuum Supply (Reservoir)	Black
F	Panel-Defrost Actuator (Mid Position)	Red
G	Not Used	N/A

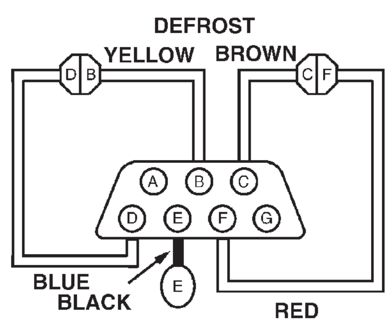








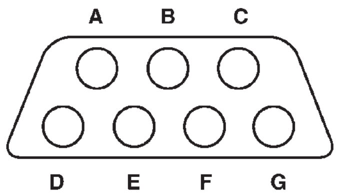




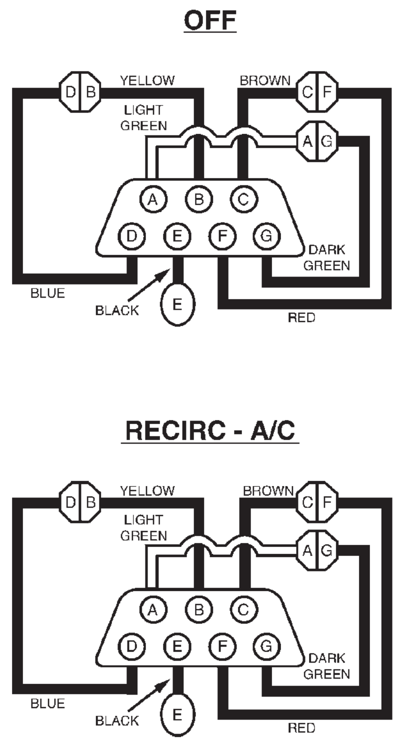
80a89427

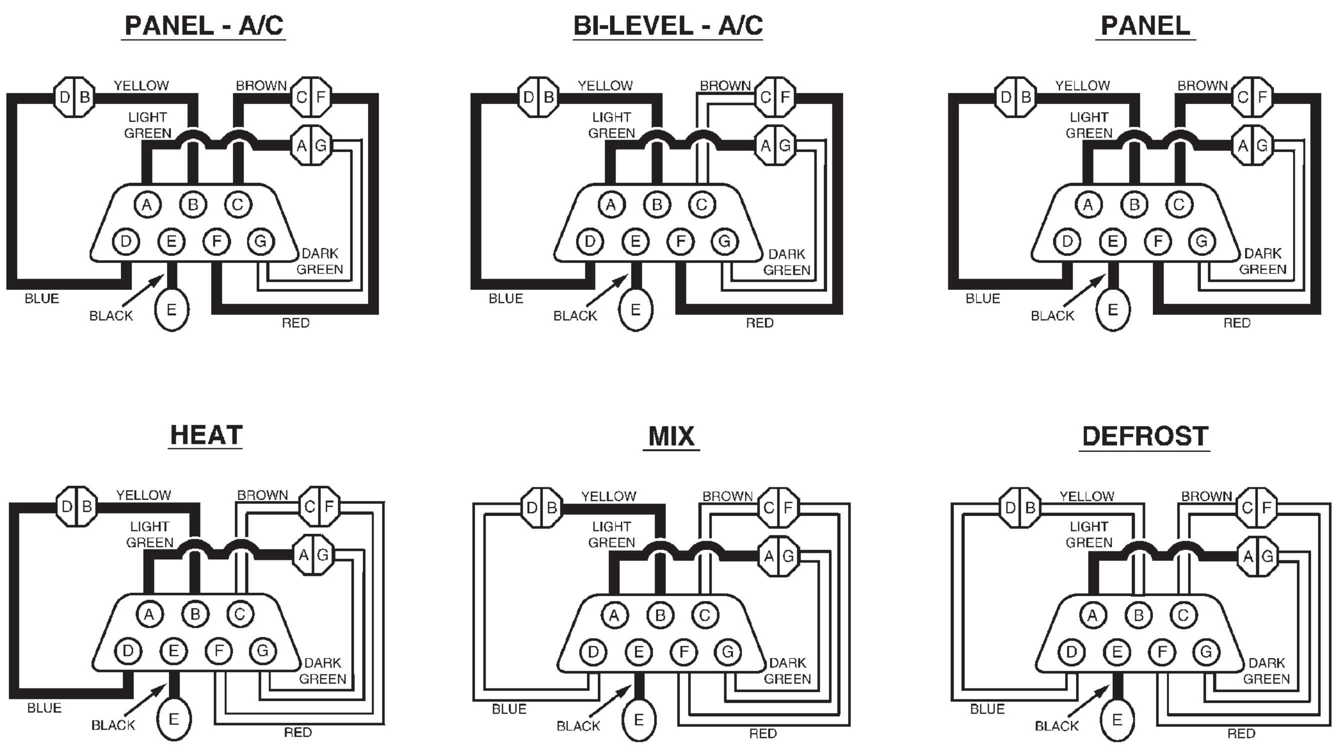
Fig. 72 Vacuum Circuits - Heater Only

REMOVAL AND INSTALLATION (Continued)



VACUUM CIRCUIT LEGEND		
I.D.	FUNCTION	COLOR
A	Recirculation Actuator (Door Closed)	Light Green
B	Floor-Defrost Actuator (Mid Position)	Yellow
C	Panel-Defrost Actuator (Full Position)	Brown
D	Floor-Defrost Actuator (Full Position)	Blue
E	Vacuum Supply (Reservoir)	Black
F	Panel-Defrost Actuator (Mid Position)	Red
G	Recirculation Actuator (Door Open)	Dark Green





80a8943a

Fig. 73 Vacuum Circuits - Heater-A/C

ADJUSTMENTS

TEMPERATURE CONTROL CABLE

Any time the heater-A/C control or the temperature control cable are removed and/or replaced, the following procedure must be performed.

(1) The temperature control cable housing and core must be installed at both the heater-A/C control and the heater-A/C housing ends, and the heater-A/C control must be installed in the instrument panel. See Heater-A/C Control and Temperature Control Cable in the Removal and Installation section of this group for the procedures.

(2) Rotate the temperature control knob on the heater-A/C control so that the knob pointer is in the 12 o'clock position.

(3) Pull the temperature control knob straight out from the heater-A/C control base until the perimeter of the knob (not the knob pointer) protrudes about 6 millimeters (0.25 inch) from the face of the control base.

(4) Rotate the temperature control knob to the 1 o'clock position. Push in on the knob slightly and continue rotating the knob to its full clockwise stop. The knob pointer should be aimed at a position about 8 millimeters (0.315 inch) beyond the end of the graduated red strobe temperature control graphic on the face of the heater-A/C control base. If the knob is not pointed to the correct position, go back to Step 2 and repeat the adjustment procedure.

(5) Rotate the temperature control knob counterclockwise until the knob pointer is in the 12 o'clock position again.

(6) Push the temperature control knob straight in towards the heater-A/C control base until the perimeter of the knob (not the knob pointer) is flush with the face of the heater-A/C control base.

(7) Rotate the knob to its full clockwise stop again. The knob pointer should be aimed at the end of the graduated red strobe temperature control graphic on the face of the heater-A/C control base. If OK, go to Step 8. If not OK, go back to Step 2.

(8) Rotate the knob to its full counterclockwise stop and release the knob. If the knob springs back from the counterclockwise stop, the self-adjuster clip that secures the temperature control cable to the blend-air door lever is improperly installed. See Temperature Control Cable in the Removal and Installation section of this group for the procedures. If the knob does not spring back, the temperature control cable adjustment is complete.

SPECIFICATIONS

A/C APPLICATION TABLE

Item	Description	Notes
VEHICLE	AN Dakota	
SYSTEM	R134a w/orifice tube	
COMPRESSOR	Sanden SD7H15	SP-20 PAG oil
Freeze–up Control	Low Pressure cycling cutout switch	accumulator mounted
Low psi Control	opens < 24± 1 psi - resets > 39± 2 psi	
High psi Control	opens > 450-490 psi - resets < 270-330 psi	line mounted
CONTROL HEAD	manual type	
Mode Door	vacuum	
Blend Air Door	cable	
Fresh/Recirc door	vacuum	
Blower Motor	hardwired to control head	resistor block
COOLING FAN	V-6 & V-8 electrical/ mechanical cooling fan module, I-4 (2.5) electric fan	PCM output
CLUTCH		
Control	relay	PCM
Draw	2.0 - 3.9 amps @ 12 V	± 0.5V @ 70° F
Gap	0.016” - 0.031″	
DRB III®		
Reads	TPS, RPM, A/C switch test	
Actuators	clutch relay (fan relay 2.5 only)	

EMISSION CONTROL SYSTEMS

TABLE OF CONTENTS

	page
ON-BOARD DIAGNOSTICS	1
EVAPORATIVE EMISSION CONTROLS	23

ON-BOARD DIAGNOSTICS

TABLE OF CONTENTS

	page
DESCRIPTION AND OPERATION	
EMISSION SYSTEM	1
MALFUNCTION INDICATOR LAMP (MIL)	2
STATE DISPLAY TEST MODE	2
CIRCUIT ACTUATION TEST MODE	2
DIAGNOSTIC TROUBLE CODES	2
DIAGNOSTIC TROUBLE CODE DESCRIPTIONS	3
TASK MANAGER—GASOLINE POWERED ENGINES ONLY	16
MONITORED SYSTEMS	19
TRIP DEFINITION	21
COMPONENT MONITORS	21
NON-MONITORED CIRCUITS	22
HIGH AND LOW LIMITS	22
LOAD VALUE	22

DESCRIPTION AND OPERATION

EMISSION SYSTEM

OPERATION

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warm-up cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator (check engine) Lamp. Refer to Malfunction Indicator Lamp in this section.

Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example**, assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

Technicians must retrieve stored DTC's by connecting the DRB scan tool (or an equivalent scan tool) to the 16–way data link connector (Fig. 1).

NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, connect the DRB scan tool to the 16–way data link connector to erase all DTC's and extinguish the MIL (check engine lamp).

DESCRIPTION AND OPERATION (Continued)

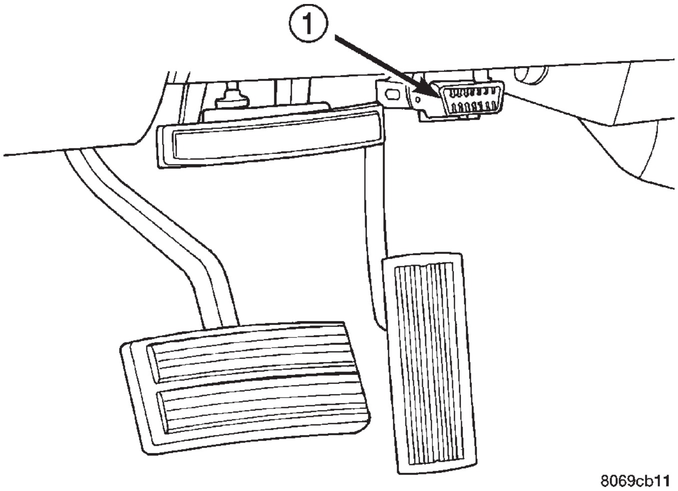


Fig. 1 Data Link (Diagnostic) Connector Location

1 – 16–WAY DATA LINK CONNECTOR

MALFUNCTION INDICATOR LAMP (MIL)

DESCRIPTION

The Malfunction Indicator Lamp (MIL) is located on the instrument panel. It is displayed as an engine icon (graphic).

OPERATION

As a functional test, the MIL illuminates at key-on before engine cranking. Whenever the Powertrain Control Module (PCM) sets a Diagnostic Trouble Code (DTC) that affects vehicle emissions, it illuminates the MIL. If a problem is detected, the PCM sends a message to the instrument cluster to illuminate the lamp. The PCM illuminates the MIL only for DTC's that affect vehicle emissions. There are some monitors that may take two consecutive trips, with a detected fault, before the MIL is illuminated. The MIL stays on continuously when the PCM has entered a Limp-In mode or identified a failed emission component. Refer to the Diagnostic Trouble Code charts in this group for emission related codes.

Also, the MIL either flashes or illuminates continuously when the PCM detects active engine misfire. Refer to Misfire Monitoring in this section.

Additionally, the PCM may reset (turn off) the MIL when one of the following occur:

- PCM does not detect the malfunction for 3 consecutive trips (except misfire and Fuel system Monitors).
- PCM does not detect a malfunction while performing three successive engine misfire or fuel system tests. The PCM performs these tests while the engine is operating within ± 375 RPM of and within 10 % of the load of the operating condition at which the malfunction was first detected.

STATE DISPLAY TEST MODE

OPERATION

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. Connect the DRB scan tool to the data link connector and access the state display screen. Then access either State Display Inputs and Outputs or State Display Sensors.

CIRCUIT ACTUATION TEST MODE

OPERATION

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly. Connect the DRB scan tool to the data link connector and access the Actuators screen.

DIAGNOSTIC TROUBLE CODES

OPERATION

A Diagnostic Trouble Code (DTC) indicates that the Powertrain Control Module (PCM) has recognized an abnormal condition in the system.

DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

Technicians must retrieve stored DTC's by connecting the DRB III scan tool (or an equivalent scan tool) to the 16–way data link connector. This connector is located on the lower edge of the instrument panel near the steering column.

OBTAINING DTC's

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST ON AN OPERATING ENGINE.

(1) Connect the DRB scan tool to data link (diagnostic) connector.

(2) Turn the ignition switch on, access Read Fault Screen. Record all the DTC's shown on the DRB scan tool.

(3) To erase DTC's, use the Erase Trouble Code data screen on the DRB scan tool.

NOTE: For a list of DTC's, refer to the following charts.

DESCRIPTION AND OPERATION (Continued)

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
(G) Generator lamp illuminated		
Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0030 (M)	1/1 O2 Sensor Heater Relay Circuit	Problem detected in oxygen sensor heater relay circuit.
P0036 (M)	1/2 O2 Sensor Heater Relay Circuit	Problem detected in oxygen sensor heater relay circuit.
P0106	Barometric Pressure Out of Range	MAP sensor input voltage out of an acceptable range detected during reading of barometric pressure at key-on.
P0107 (M)	Map Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
P0108 (M)	Map Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
P0112 (M)	Intake Air Temp Sensor Voltage Low	Intake air (charge) temperature sensor input below the minimum acceptable voltage.
P0113 (M)	Intake Air Temp Sensor Voltage High	Intake air (charge) temperature sensor input above the maximum acceptable voltage.
P0116		A rationatilty error has been detected in the coolant temp sensor.
P0117 (M)	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below the minimum acceptable voltage.
P0118 (M)	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above the maximum acceptable voltage.
P0121 (M)	TPS Voltage Does Not Agree With MAP	TPS signal does not correlate to MAP sensor signal.
P0121 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too Low	APPS voltage input below the minimum acceptable voltage.
P0122 (M)	Throttle Position Sensor Voltage Low	Throttle position sensor input below the acceptable voltage range.
P0122 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too Low	APPS voltage input below the minimum acceptable voltage.
P0123 (M)	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
P0123 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too High	APPS voltage input above the maximum acceptable voltage.
P0125 (M)	Closed Loop Temp Not Reached	Time to enter Closed Loop Operation (Fuel Control) is excessive.
P0125 (M)	Engine is Cold Too Long	Engine does not reach operating temperature.
P0130 (M)	1/1 O2 Sensor Heater Circuit Malfunction	Oxygen sensor heater element malfunction.
P0131 (M)	1/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0132 (M)	1/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0133 (M)	1/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.

DESCRIPTION AND OPERATION (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
P0134 (M)	1/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor input.
P0135 (M)	1/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0136 (M)	1/2 O2 Sensor Heater Circuit Malfunction	Oxygen sensor heater element malfunction.
P0137 (M)	1/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0138 (M)	1/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0139 (M)	1/2 O2 Sensor Slow Response	Oxygen sensor response not as expected.
P0140 (M)	1/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0141 (M)	1/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0143 (M)	1/3 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0144 (M)	1/3 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0145 (M)	1/3 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0146 (M)	1/3 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0147 (M)	1/3 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0151 (M)	2/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0152 (M)	2/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage sustained above normal operating range.
P0153 (M)	2/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0154 (M)	2/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0155 (M)	2/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0157 (M)	2/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0158 (M)	2/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0159	2/2 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0160 (M)	2/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0161 (M)	2/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0168 (M)	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.
P0171 (M)	1/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P0172 (M)	1/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0174 (M)	2/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
P0175 (M)	2/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0176	Loss of Flex Fuel Calibration Signal	No calibration voltage present from flex fuel sensor.
P0177	Water In Fuel Light	Excess water found in fuel by water-in-fuel sensor.
P0178	Flex Fuel Sensor Volts Too Low	Flex fuel sensor input below minimum acceptable voltage.
P0178	Water in Fuel Light—Water In Fuel Sensor Voltage Too Low	Loss of water-in-fuel circuit or sensor.
P0179	Flex Fuel Sensor Volts Too High	Flex fuel sensor input above maximum acceptable voltage.
P0180	Fuel Temperature in range error	ECM detects problem with fuel temperature circuits/ sensor
P0181	Fuel Temperature in range error	ECM detects high fuel temperature with low engine coolant temperature.
P0182 (M)	CNG Temp Sensor Voltage Too Low	Compressed natural gas temperature sensor voltage below acceptable voltage.
P0183 (M)	CNG Temp Sensor Voltage Too High	Compressed natural gas temperature sensor voltage above acceptable voltage.
P0201 (M)	Injector #1 Control Circuit	An open or shorted condition detected in control circuit for injector #1 or the INJ 1 injector bank.
P0202 (M)	Injector #2 Control Circuit	An open or shorted condition detected in control circuit for injector #2 or the INJ 2 injector bank.
P0203 (M)	Injector #3 Control Circuit	An open or shorted condition detected in control circuit for injector #3 or the INJ 3 injector bank.
P0204 (M)	Injector #4 Control Circuit	Injector #4 or INJ 4 injector bank output driver stage does not respond properly to the control signal.
P0205 (M)	Injector #5 Control Circuit	Injector #5 output driver stage does not respond properly to the control signal.
P0206 (M)	Injector #6 Control Circuit	Injector #6 output driver stage does not respond properly to the control signal.
P0207 (M)	Injector #7 Control Circuit	Injector #7 output driver stage does not respond properly to the control signal.
P0208 (M)	Injector #8 Control Circuit	Injector #8 output driver stage does not respond properly to the control signal.
P0209 (M)	Injector #9 Control Circuit	Injector #9 output driver stage does not respond properly to the control signal.
P0210 (M)	Injector #10 Control Circuit	Injector #10 output driver stage does not respond properly to the control signal.
P0215	Fuel Injection Pump Control Circuit	Failure in fuel pump relay control circuit.
P0216 (M)	Fuel Injection Pump Timing Failure	High fuel supply restriction, low fuel pressure or possible wrong or incorrectly installed pump keyway.

DESCRIPTION AND OPERATION (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
P0217 Check Gauges Lamp	Decreased Engine Performance Due To Engine Overheat Condition	Engine overheating. ECM will derate engine performance.
P0219	Crankshaft Position Sensor Overspeed Signal	Engine has exceeded rpm limits.
P0222 (M)	Idle Validation Signals Both Low	Problem detected with idle validation circuits within APPS.
P0223 (M)	Idle Validation Signals Both High (Above 5 Volts)	Problem detected with idle validation circuits within APPS.
P0230	Transfer Pump (Lift Pump) Circuit Out of Range	Problem detected in fuel transfer pump circuits.
P0232	Fuel Shutoff Signal Voltage Too High	Fuel shut-off signal voltage too high from ECM to fuel injection pump.
P0234 (M)	Turbo Boost Limit Exceeded	Problem detected in turbocharger wastegate.
P0236 (M)	Map Sensor Too High Too Long	Problem detected in turbocharger wastegate.
P0237 (M)	Map Sensor Voltage Too Low	MAP sensor voltage input below the minimum acceptable voltage.
P0238 (M)	Map Sensor Voltage Too High	MAP sensor voltage input above the maximum acceptable voltage.
P0251 (M)	Fuel Inj. Pump Mech. Failure Fuel Valve Feedback Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0252 (M)	VP44 stuck fuel valve error	Fuel solenoid circuit not detecting solenoid valve movement
P0253 (M)	Fuel Injection Pump Fuel Valve Open Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0254	Fuel Injection Pump Fuel Valve Current Too High	Problem caused by internal fuel injection pump failure.
P0300 (M)	Multiple Cylinder Mis-fire	Misfire detected in multiple cylinders.
P0301 (M)	CYLINDER #1 MISFIRE	Misfire detected in cylinder #1.
P0302 (M)	CYLINDER #2 MISFIRE	Misfire detected in cylinder #2.
P0303 (M)	CYLINDER #3 MISFIRE	Misfire detected in cylinder #3.
P0304 (M)	CYLINDER #4 MISFIRE	Misfire detected in cylinder #4.
P0305 (M)	CYLINDER #5 MISFIRE	Misfire detected in cylinder #5.
P0306 (M)	CYLINDER #6 MISFIRE	Misfire detected in cylinder #6.
P0307 (M)	CYLINDER #7 MISFIRE	Misfire detected in cylinder #7
P0308 (M)	CYLINDER #8 MISFIRE	Misfire detected in cylinder #8.
P0309 (M)	CYLINDER #9 MISFIRE	Misfire detected in cylinder #9.
P0310 (M)	CYLINDER #10 MISFIRE	Misfire detected in cylinder #10.
P0320 (M)	No Crank Referance Signal at PCM	No reference signal (crankshaft position sensor) detected during engine cranking.
P0320 (M)	No RPM Signal to PCM (Crankshaft Position Sensor Signal to JTEC)	A CKP signal has not been detected at the PCM.
P0325	Knock Sensor #1 Circuit	Knock sensor (#1) signal above or below minimum acceptable threshold voltage at particular engine speeds.

DESCRIPTION AND OPERATION (Continued)

(M) Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.		
P0330	Knock Sensor #2 Circuit	Knock sensor (#2) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0336 (M)	Crankshaft Position (CKP) Sensor Signal	Problem with voltage signal from CKP.
P0340 (M)	No Cam Signal At PCM	No fuel sync
P0341 (M)	Camshaft Position (CMP) Sensor Signal	Problem with voltage signal from CMP.
P0350	Ignition Coil Draws Too Much Current	A coil (1-5) is drawing too much current.
P0351 (M)	Ignition Coil # 1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0352 (M)	Ignition Coil # 2 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0353 (M)	Ignition Coil # 3 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0354 (M)	Ignition Coil # 4 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0355 (M)	Ignition Coil # 5 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0356 (M)	Ignition Coil # 6 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0357 (M)	Ignition Coil # 7 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0358 (M)	Ignition Coil # 8 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0370	Fuel Injection Pump Speed/Position Sensor Sig Lost	Problem caused by internal fuel injection pump failure.
P0380 (M)	Intake Air Heater Relay #1 Control Circuit	Problem detected in #1 air heater solenoid/relay circuit (not heater element)
P0381 (M)	Wait To Start Lamp Inoperative	Problem detected in wait-to-start bulb circuit.
P0382 (M)	Intake Air Heater Relay #2 Control Circuit	Problem detected in #2 air heater solenoid/relay circuit (not heater element)
P0387	Crankshaft Position Sensor Supply Voltage Too Low	CKP sensor voltage input below the minimum acceptable voltage.
P0388	Crankshaft Position Sensor Supply Voltage Too High	CKP sensor voltage input above the maximum acceptable voltage.
P0401	EGR System Failure	Required change in air/fuel ration not detected during diagnostic test.
P0403	EGR Solenoid Circuit	An open or shorted condition detected in the EGR solenoid control circuit.
P0404	EGR Position Sensor Rationality	EGR position sensor signal does not correlate to EGR duty cycle.
P0405	EGR Position Sensor Volts Too Low	EGR position sensor input below the acceptable voltage range.

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P0406	EGR Position Sensor Volts Too High	EGR position sensor input above the acceptable voltage range.
P0412	Secondary Air Solenoid Circuit	An open or shorted condition detected in the secondary air (air switching/aspirator) solenoid control circuit.
P0420 (M)	1/1 Catalytic Converter Efficiency	Catalyst 1/1 efficiency below required level.
P0432 (M)	1/2 Catalytic Converter Efficiency	Catalyst 2/1 efficiency below required level.
P0441 (M)	Evap Purge Flow Monitor	Insufficient or excessive vapor flow detected during evaporative emission system operation.
P0442 (M)	Evap Leak Monitor Medium Leak Detected	A small leak has been detected in the evaporative system.
P0443 (M)	Evap Purge Solenoid Circuit	An open or shorted condition detected in the EVAP purge solenoid control circuit.
P0455 (M)	Evap Leak Monitor Large Leak Detected	A large leak has been detected in the evaporative system.
P0456 (M)	Evap Leak Monitor Small Leak Detected	Leak has been detected in the evaporative system.
P0460	Fuel Level Unit No Change Over Miles	During low fuel
P0460	Fuel Level Unit No Change Over Miles	Fuel level sending unit voltage does not change for more than 40 miles.
P0462	Fuel Level Sending Unit Volts Too Low	Fuel level sensor input below acceptable voltage.
P0462 (M)	Fuel Level Sending Unit Volts Too Low	Open circuit between PCM and fuel gauge sending unit.
P0463	Fuel Level Sending Unit Volts Too High	Fuel level sensor input above acceptable voltage.
P0463 (M)	Fuel Level Sending Unit Volts Too High	Circuit shorted to voltage between PCM and fuel gauge sending unit.
P0500 (M)	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
P0500 (M)	No Vehicle Speed Sensor Signal	A vehicle speed signal was not detected.
P0505 (M)	Idle Air Control Motor Circuits	SBEC II
P0522 Check Gauges Light	Oil Pressure Voltage Too Low	Oil pressure sending unit (sensor) voltage input below the minimum acceptable voltage.
P0523 Check Gauges Light	Oil Pressure Voltage Too High	Oil pressure sending unit (sensor) voltage input above the maximum acceptable voltage.
P0524 Check Gauges Light	Oil Pressure Too Low	Engine oil pressure is low. Engine power derated.
P0545	A/C Clutch Relay Circuit	Problem detected in air conditioning clutch relay control circuit.
P0551	Power Steering Switch Failure	Incorrect input state detected for the power steering switch circuit. PL: High pressure seen at high speed.
P0562 Check Gauges Light	Charging System Voltage Too Low	Supply voltage sensed at ECM too low.

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P0563 Check Gauges Light	Charging System Voltage Too High	Supply voltage sensed at ECM too high.
P0600	PCM Failure SPI Communications	No communication detected between co-processors in the control module.
P0601 (M)	Internal Controller Failure	Internal control module fault condition (check sum) detected.
P0602 (M)	ECM Fueling Calibration Error	ECM Internal fault condition detected.
P0604	RAM Check Failure	Transmission control module RAM self test fault detected. -Aisin transmission
P0605	ROM Check Falure	Transmission control module ROM self test fault detected -Aisin transmission
P0606 (M)	ECM Failure	ECM Internal fault condition detected.
P0615	Starter Relay Control Circuit	An open or shorted condition detected in the starter relay control circuit.
P0622 (G)	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
P0645	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay control circuit.
P0700	EATX Controller DTC Present	This SBEC III or JTEC DTC indicates that the EATX or Aisin controller has an active fault and has illuminated the MIL via a CCD (EATX) or SCI (Aisin) message. The specific fault must be acquired from the EATX via CCD or from the Aisin via ISO-9141.
P0703	Brake Switch Stuck Pressed or Released	Incorrect input state detected in the brake switch circuit. (Changed from P1595)
P0711 (M)	Trans Temp Sensor, No Temp Rise After Start	Relationship between the transmission temperature and overdrive operation and/or TCC operation indicates a failure of the Transmission Temperature Sensor. OBD II Rationality. Was MIL code 37.
P0712	Trans Temp Sensor Voltage Too Low	Transmission fluid temperature sensor input below acceptable voltage. Was MIL code 37.
P0712 (M)	Trans Temp Sensor Voltage Too Low	Voltage less than 1.55 volts (4-speed auto. trans. only).
P0713	Trans Temp Sensor Voltage Too High	Transmission fluid temperature sensor input above acceptable voltage. Was MIL code 37.
P0713 (M)	Trans Temp Sensor Voltage Too High	Voltage greater than 3.76 volts (4-speed auto. trans. only).
P0720 (M)	Low Output SPD Sensor RPM, Above 15 MPH	The relationship between the Output Shaft Speed Sensor and vehicle speed is not within acceptable limits.
P0720 (M)	Low Output Spd Sensor RPM Above 15 mph	Output shaft speed is less than 60 rpm with vehicle speed above 15 mph (4-speed auto. trans. only).
P0740 (M)	Torq Con Clu, No RPM Drop at Lockup	Relationship between engine and vehicle speeds indicated failure of torque convertor clutch lock-up system (TCC/PTU solenoid)
P0743 (M)	Torque Converter Clutch Solenoid/ Trans Relay Circuits	An open or shorted condition detected in the torque converter clutch (part throttle unlock) solenoid control circuit. Shift solenoid C electrical fault - Aisin transmission

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P0743 (M)	Torque Converter Clutch Solenoid/ Trans Relay Circuits	An open or shorted condition detected in the torque converter part throttle unlock solenoid control circuit (3 or 4-speed auto. trans. only).
P0748 (M)	Governor Pressur Sol Control/Trans Relay Circuits	An open or shorted condition detected in the Governor Pressure Solenoid circuit or Trans Relay Circuit in JTEC RE transmissions.
P0748 (M)	Governor Pressure Sol Control/Trans Relay Circuits	An open or shorted condition detected in the governor pressure solenoid or relay circuits (4-speed auto. trans. only).
P0751 (M)	O/D Switch Pressed (Lo) More Than 5 Minutes	Overdrive override switch input is in a prolonged depressed state.
P0751 (M)	O/D Switch Pressed (LO) More Than 5 Min	Overdrive Off switch input too low for more than 5 minutes (4-speed auto. trans. only).
P0753 (M)	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the overdrive solenoid control circuit or Trans Relay Circuit in JTEC RE transmissions. Was MIL code 45.
P0753 (M)	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the transmission 2-4 shift solenoid circuit (4-speed auto. trans. only).
P0756	AW4 Shift Sol B (2-3) Functional Failure	Shift solenoid B (2-3) functional fault - Aisin transmission
P0783 (M)	3-4 Shift Sol, No RPM Drop at Lockup	The overdrive solenoid is unable to engage the gear change from 3rd gear to the overdrive gear.
P0801	Reverse Gear Lockout Circuit Open or Short	An open or shorted condition detected in the transmission reverse gear lock-out solenoid control circuit.
P0830	Clutch Depressed Switch Circuit	Problem detected in clutch switch circuit.
P0833	Clutch Released Switch Circuit	Problem detected in clutch switch circuit.
P1110	Decrease Engine Performance Due To High Intake Air Temperature	Intake manifold air temperature is above the engine protection limit. Engine power will be derated.
P1180	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.
P1195 (M)	1/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/1 during catalyst monitor test. (Also see SCI DTC $66) (was P0133)
P1196 (M)	2/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 2/1 during catalyst monitor test. (Also see SCI DTC $7A) (was P0153)
P1197	1/2 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/2 during catalyst monitor test. (Also see SCI DTC $68) (was P0139)
P1198	Radiator Temperature Sensor Volts Too High	Radiator coolant temperature sensor input above the maximum acceptable voltage.
P1199	Radiator Temperature Sensor Volts Too Low	Radiator coolant temperature sensor input below the minimum acceptable voltage.
P1281	Engine is Cold Too Long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (Thermostat).

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P1282	Fuel Pump Relay Control Circuit	An open or shorted condition detected in the fuel pump relay control circuit.
P1283	Idle Select Signal Invalid	ECM or fuel injection pump module internal fault condition detected.
P1284 (M)	Fuel Injection Pump Battery Voltage Out-Of-Range	Fuel injection pump module internal fault condition detected. Engine power will be derated.
P1285 (M)	Fuel Injection Pump Controller Always On	Fuel injection pump module relay circuit failure detected. Engine power will be derated.
P1286	Accelerator Position Sensor (APPS) Supply Voltage Too High	High voltage detected at APPS.
P1287 (M)	Fuel Injection Pump Controller Supply Voltage Low	ECM or fuel injection pump module internal fault condition detected. Engine power will be derated.
P1288	Intake Manifold Short Runner Solenoid Circuit	An open or shorted condition detected in the short runner tuning valve circuit.
P1289	Manifold Tune Valve Solenoid Circuit	An open or shorted condition detected in the manifold tuning valve solenoid control circuit.
P1290	CNG Fuel System Pressure Too High	Compressed natural gas system pressure above normal operating range.
P1291 (M)	No Temp Rise Seen From Intake Heaters	Energizing Heated Air Intake does not change intake air temperature sensor an acceptable amount.
P1291 (M)	No Temperature Rise Seen From Intake Air Heaters	Problem detected in intake manifold air heating system.
P1292	CNG Pressure Sensor Voltage Too High	Compressed natural gas pressure sensor reading above acceptable voltage.
P1293	CNG Pressure Sensor Voltage Too Low	Compressed natural gas pressure sensor reading below acceptable voltage.
P1294 (M)	Target Idle Not Reached	Target RPM not achieved during drive idle condition. Possible vacuum leak or IAC (AIS) lost steps.
P1295 (M)	No 5 Volts to TP Sensor	Loss of a 5 volt feed to the Throttle Position Sensor has been detected.
P1295 (M)	Accelerator Position Sensor (APPS) Supply Voltage Too Low	APPS supply voltage input below the minimum acceptable voltage.
P1296	No 5 Volts to MAP Sensor	Loss of a 5 volt feed to the MAP Sensor has been detected.
P1297 (M)	No Change in MAP From Start To Run	No difference is recognized between the MAP reading at engine idle and the stored barometric pressure reading.
P1298	Lean Operation at Wide Open Throttle	A prolonged lean condition is detected during Wide Open Throttle
P1299	Vacuum Leak Found (IAC Fully Seated)	MAP Sensor signal does not correlate to Throttle Position Sensor signal. Possible vacuum leak.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the ASD or CNG shutoff relay control ckt.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P1389	No ASD Relay Output Voltage At PCM	No Z1 or Z2 voltage sensed when the auto shutdown relay is energized.
P1389 (M)	No ASD Relay Output Voltage at PCM	An open condition detected In the ASD relay output circuit.
P1390	Timing Belt Skipped 1 Tooth or More	Relationship between Cam and Crank signals not correct
P1391 (M)	Intermittent Loss of CMP or CKP	Loss of the Cam Position Sensor or Crank Position sensor has occurred. For PL 2.0L
P1398 (M)	Mis-Fire Adaptive Numerator at Limit	PCM is unable to learn the Crank Sensor's signal in preparation for Misfire Diagnostics. Probable defective Crank Sensor
P1399	Wait To Start Lamp Cicuit	An open or shorted condition detected in the Wait to Start Lamp circuit.
P1403	No 5V to EGR Sens	Loss of 5v feed to the EGR position sensor.
P01475	Aux 5 Volt Supply Voltage High	Sensor supply voltage for ECM sensors is too high.
P1476	Too Little Secondary Air	Insufficient flow of secondary air injection detected during aspirator test (was P0411)
P1477	Too Much Secondary Air	Excessive flow of secondary air injection detected during aspirator test (was P0411).
P1478	Battery Temp Sensor Volts Out of Limit	Internal temperature sensor input voltage out of an acceptable range.
P1479	Transmission Fan Relay Circuit	An open or shorted condition detected in the transmission fan relay circuit.
P1480	PCV Solenoid Circuit	An open or shorted condition detected in the PCV solenoid circuit.
P1481	EATX RPM Pulse Perf	EATX RPM pulse generator signal for misfire detection does not correlate with expected value.
P1482	Catalyst Temperature Sensor Circuit Shorted Low	Catalyst temperature sensor circuit shorted low.
P1483	Catalyst Temperature Sensor Circuit Shorted High.	Catalyst temperature sensor circuit shorted high.
P1484	Catalytic Converter Overheat Detected	A catalyst overheat condition has been detected by the catalyst temperature sensor.
P1485	Air Injection Solenoid Circuit	An open or shorted condition detected in the air assist solenoid circuit.
P1486	Evap Leak Monitor Pinched Hose Found	LDP has detected a pinched hose in the evaporative hose system.
P1487	Hi Speed Rad Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the #2 high speed radiator fan control relay.
P1488	Auxiliary 5 Volt Supply Output Too Low	Auxiliary 5 volt sensor feed is sensed to be below an acceptable limit.
P1488	5 Volt Supply Voltage Low	Sensor supply voltage for ECM sensors is too low.
P1489	High Speed Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the high speed radiator fan control relay.
P1490	Low Speed Fan CTRL Relay Circuit	An open or shorted condition detected in control circuit of the low speed radiator fan control relay.

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P1491	Rad Fan Control Relay Circuit	An open or shorted condition detected in the radiator fan control relay control circuit. This includes PWM solid state relays.
P1492	Ambient/Batt Temp Sen Volts Too High	External temperature sensor input above acceptable voltage.
P1492 (M)	Ambient/Batt Temp Sensor Volts Too High	Battery temperature sensor input voltage above an acceptable range.
P1493 (M)	Ambient/Batt Temp Sen Volts Too Low	External temperature sensor input below acceptable voltage.
P1493 (M)	Ambient/Batt Temp Sen Volts Too Low	Battery temperature sensor input voltage below an acceptable range.
P1494 (M)	Leak Detection Pump Sw or Mechanical Fault	Incorrect input state detected for the Leak Detection Pump (LDP) pressure switch.
P1495	Leak Detection Pump Solenoid Circuit	An open or shorted condition detected in the Leak Detection Pump (LDP) solenoid circuit.
P1496	5 Volt Supply, Output Too Low	5 volt sensor feed is sensed to be below an acceptable limit. (less than 4v for 4 sec)
P1498	High Speed Rad Fan Ground CTRL Rly Circuit	An open or shorted condition detected in the control circuit of the #3 high speed radiator fan control relay.
P1594 (G)	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1594 (G)	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in either of the speed control vacuum or vent solenoid control circuits.
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.
P1596	Speed Control Switch Always High	Speed control switch input above maximum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below minimum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below the minimum acceptable voltage.
P1598	A/C Pressure Sensor Volts Too High	A/C pressure sensor input above maximum acceptable voltage.
P1598	A/C Sensor Input Hi	Problem detected in air conditioning electrical circuit.
P1599	A/C Pressure Sensor Volts Too Low	A/C pressure sensor input below minimum acceptable voltage.
P1599	A/C Sensor Input Lo	Problem detected in air conditioning electrical circuit.
P1680	Clutch Released Switch Circuit	Problem detected in clutch switch electrical circuit.
P1681	No I/P Cluster CCD/J1850 Messages Received	No CCD/J1850 messages received from the cluster control module.

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P1682 (G)	Charging System Voltage Too Low	Battery voltage sense input below target charging voltage during engine operation and no significant change in voltage detected during active test of generator output circuit.
P1682	Charging System Voltage Too Low	Charging system output voltage low.
P1683	SPD CTRL PWR Relay; or S/C 12v Driver CKT	An open or shorted condition detected in the speed control servo power control circuit.
P1683	Spd ctrl pwr rly, or s/c 12v driver circuit	An open or shorted condition detected in the speed control servo power control circuit.
P1684	Batt Loss in 50 Star	The battery has been disconnected within the last 50 starts
P1685	SKIM Invalid Key	The engine controler has received an invalid key from the SKIM.
P1686	No SKIM BUS Messages Received	No CCD/J1850 messages received from the Smart Key Immobilizer Module (SKIM).
P1687	No MIC BUS Message	No CCD/J1850 messages received from the Mechanical Instrument Cluster (MIC) module.
P1688 (M)	Internal Fuel Injection Pump Controller Failure	Internal problem within the fuel injection pump. Low power, engine derated, or engine stops.
P1689 (M)	No Communication Between ECM and Injection Pump Module	Data link circuit failure between ECM and fuel injection pump. Low power, engine derated, or engine stops.
P1690 (M)	Fuel Injection Pump CKP Sensor Does Not Agree With ECM CKP Sensor	Problem in fuel sync signal. Possible injection pump timing problem. Low power, engine derated, or engine stops.
P1691	Fuel Injection Pump Controller Calibration Error	Internal fuel injection pump failure. Low power, engine derated, or engine stops.
P1692	DTC Set In ECM	A “Companion DTC” was set in both the ECM and PCM.
P1693 (M)	DTC Detected in Companion Module	A fault has been generated in the companion engine control module.
P1693 (M)	DTC Detected in PCM/ECM or DTC Detected in ECM	A “Companion DTC” was set in both the ECM and PCM.
P1694	Fault In Companion Module	No CCD/J1850 messages received from the powertrain control module-Aisin transmission
P1694 (M)	No CCD Messages received from ECM	Bus communication failure to PCM.
P1695	No CCD/J1850 Message From Body Control Module	No CCD/J1850 messages received from the body control module.
P1696	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the control module.
P1697	PCM Failure SRI Mile Not Stored	Unsuccessful attempt to update Service Reminder Indicator (SRI or EMR) mileage in the control module EEPROM.
P1698	No CCD/J1850 Message From TCM	No CCD/J1850 messages received from the electronic transmission control module (EATX) or the Aisin transmission controller.

DESCRIPTION AND OPERATION (Continued)

(M) **Malfunction Indicator Lamp (MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA). MIL is displayed as an engine icon on instrument panel.**		
P1698	No CCD Messages received from PCM	Bus communication failure to PCM. A “Companion DTC” was set in both the ECM and PCM.
P1719	Skip Shift Solenoid Circuit	An open or shorted condition detected in the transmission 2-3 gear lock-out solenoid control circuit.
P1740	TCC or OD Sol Perf	A rationality error has been detected in either the TCC solenoid or overdrive solenoid systems.
P1740 (M)	TCC OR O/D Solenoid Performance	Problem detected in transmission convertor clutch and/or overdrive circuits (diesel engine with 4-speed auto. trans. only).
P1756 (M)	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear. (Mid Pressure Malfunction)
P1756 (M)	Governor Pressure Not Equal to Target @ 15-20 PSI	Governor sensor input not between 10 and 25 psi when requested (4-speed auto. trans. only).
P1757	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear (Zero Pressure Malfunction)
P1757 (M)	Governor Pressure Above 3 PSI In Gear With 0 MPH	Governor pressure greater than 3 psi when requested to be 0 psi (4-speed auto. trans. only).
P1762 (M)	Gov Press Sen Offset Volts Too Lo or High	The Governor Pressure Sensor input is greater than a calibration limit or is less than a calibration limit for 3 consecutive park/neutral calibrations.
P1762 (M)	Governor Press Sen Offset Volts Too Low or High	Sensor input greater or less than calibration for 3 consecutive Neutral/Park occurrences (4-speed auto. trans. only).
P1763	Governor Pressure Sensor Volts Too Hi	The Governor Pressure Sensor input is above an acceptable voltage level.
P1763 (M)	Governor Pressure Sensor Volts Too HI	Voltage greater than 4.89 volts (4-speed auto. trans. only).
P1764 (M)	Governor Pressure Sensor Volts Too Low	The Governor Pressure Sensor input is below an acceptable voltage level.
P1764 (M)	Governor Pressure Sensor Volts Too Low	Voltage less than.10 volts (4-speed auto. trans. only).
P1765 (M)	Trans 12 Volt Supply Relay CTRL Circuit	An open or shorted condition is detected in the Transmission Relay control circuit. This relay supplies power to the TCC
P1765 (M)	Trans 12 Volt Supply Relay Ctrl Circuit	Current state of solenoid output port is different than expected (4-speed auto. trans. only).
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch.
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch (3 or 4-speed auto. trans. only).

TASK MANAGER—GASOLINE POWERED ENGINES ONLY

DESCRIPTION

The PCM is responsible for efficiently coordinating the operation of all the emissions-related components. The PCM is also responsible for determining if the diagnostic systems are operating properly. The software designed to carry out these responsibilities is call the 'Task Manager'.

OPERATION

The Task Manager determines which tests happen when and which functions occur when. Many of the diagnostic steps required by OBD II must be performed under specific operating conditions. The Task Manager software organizes and prioritizes the diagnostic procedures. The job of the Task Manager is to determine if conditions are appropriate for tests to be run, monitor the parameters for a trip for each test, and record the results of the test. Following are the responsibilities of the Task Manager software:

- Test Sequence
- MIL Illumination
- Diagnostic Trouble Codes (DTCs)
- Trip Indicator
- Freeze Frame Data Storage
- Similar Conditions Window

Test Sequence

In many instances, emissions systems must fail diagnostic tests more than once before the PCM illuminates the MIL. These tests are know as 'two trip monitors.' Other tests that turn the MIL lamp on after a single failure are known as 'one trip monitors.' A trip is defined as 'start the vehicle and operate it to meet the criteria necessary to run the given monitor.'

Many of the diagnostic tests must be performed under certain operating conditions. However, there are times when tests cannot be run because another test is in progress (conflict), another test has failed (pending) or the Task Manager has set a fault that may cause a failure of the test (suspend).

- Pending

Under some situations the Task Manager will not run a monitor if the MIL is illuminated and a fault is stored from another monitor. In these situations, the Task Manager postpones monitors **pending** resolution of the original fault. The Task Manager does not run the test until the problem is remedied.

For example, when the MIL is illuminated for an Oxygen Sensor fault, the Task Manager does not run the Catalyst Monitor until the Oxygen Sensor fault is remedied. Since the Catalyst Monitor is based on signals from the Oxygen Sensor, running the test would produce inaccurate results.

- Conflict

There are situations when the Task Manager does not run a test if another monitor is in progress. In these situations, the effects of another monitor running could result in an erroneous failure. If this **conflict** is present, the monitor is not run until the conflicting condition passes. Most likely the monitor will run later after the conflicting monitor has passed.

For example, if the Fuel System Monitor is in progress, the Task Manager does not run the EGR Monitor. Since both tests monitor changes in air/fuel ratio and adaptive fuel compensation, the monitors will conflict with each other.

- Suspend

Occasionally the Task Manager may not allow a two trip fault to mature. The Task Manager will **suspend** the maturing of a fault if a condition exists that may induce an erroneous failure. This prevents illuminating the MIL for the wrong fault and allows more precis diagnosis.

For example, if the PCM is storing a one trip fault for the Oxygen Sensor and the EGR monitor, the Task Manager may still run the EGR Monitor but will suspend the results until the Oxygen Sensor Monitor either passes or fails. At that point the Task Manager can determine if the EGR system is actually failing or if an Oxygen Sensor is failing.

MIL Illumination

The PCM Task Manager carries out the illumination of the MIL. The Task Manager triggers MIL illumination upon test failure, depending on monitor failure criteria.

The Task Manager Screen shows both a Requested MIL state and an Actual MIL state. When the MIL is illuminated upon completion of a test for a third trip, the Requested MIL state changes to OFF. However, the MIL remains illuminated until the next key cycle. (On some vehicles, the MIL will actually turn OFF during the third key cycle) During the key cycle for the third good trip, the Requested MIL state is OFF, while the Actual MILL state is ON. After the next key cycle, the MIL is not illuminated and both MIL states read OFF.

Diagnostic Trouble Codes (DTCs)

With OBD II, different DTC faults have different priorities according to regulations. As a result, the priorities determine MIL illumination and DTC erasure. DTCs are entered according to individual priority. DTCs with a higher priority overwrite lower priority DTCs.

DESCRIPTION AND OPERATION (Continued)

Priorities

- Priority 0 —Non-emissions related trouble codes
- Priority 1 — One trip failure of a two trip fault for non-fuel system and non-misfire.
- Priority 2 — One trip failure of a two trip fault for fuel system (rich/lean) or misfire.
- Priority 3 — Two trip failure for a non-fuel system and non-misfire or matured one trip comprehensive component fault.
- Priority 4 — Two trip failure or matured fault for fuel system (rich/lean) and misfire or one trip catalyst damaging misfire.

Non-emissions related failures have no priority. One trip failures of two trip faults have low priority. Two trip failures or matured faults have higher priority. One and two trip failures of fuel system and misfire monitor take precedence over non-fuel system and non-misfire failures.

DTC Self Erasure

With one trip components or systems, the MIL is illuminated upon test failure and DTCs are stored.

Two trip monitors are components requiring failure in two consecutive trips for MIL illumination. Upon failure of the first test, the Task Manager enters a maturing code. If the component fails the test for a second time the code matures and a DTC is set.

After three good trips the MIL is extinguished and the Task Manager automatically switches the trip counter to a warm-up cycle counter. DTCs are automatically erased following 40 warm-up cycles if the component does not fail again.

For misfire and fuel system monitors, the component must pass the test under a Similar Conditions Window in order to record a good trip. A Similar Conditions Window is when engine RPM is within ±375 RPM and load is within ±10% of when the fault occurred.

NOTE: It is important to understand that a component does not have to fail under a similar window of operation to mature. It must pass the test under a Similar Conditions Window when it failed to record a Good Trip for DTC erasure for misfire and fuel system monitors.

DTCs can be erased anytime with a DRB III. Erasing the DTC with the DRB III erases all OBD II information. The DRB III automatically displays a warning that erasing the DTC will also erase all OBD II monitor data. This includes all counter information for warm-up cycles, trips and Freeze Frame.

Trip Indicator

The **Trip** is essential for running monitors and extinguishing the MIL. In OBD II terms, a trip is a set of vehicle operating conditions that must be met for a specific monitor to run. All trips begin with a key cycle.

Good Trip

The Good Trip counters are as follows:

- Specific Good Trip
- Fuel System Good Trip
- Misfire Good Trip
- Alternate Good Trip (appears as a Global Good Trip on DRB III)
- Comprehensive Components
- Major Monitor
- Warm-Up Cycles

Specific Good Trip

The term Good Trip has different meanings depending on the circumstances:

- If the MIL is OFF, a trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.
- If the MIL is ON and a DTC was set by the Fuel Monitor or Misfire Monitor (both continuous monitors), the vehicle must be operated in the Similar Condition Window for a specified amount of time.
- If the MIL is ON and a DTC was set by a Task Manager commanded once-per-trip monitor (such as the Oxygen Sensor Monitor, Catalyst Monitor, Purge Flow Monitor, Leak Detection Pump Monitor, EGR Monitor or Oxygen Sensor Heater Monitor), a good trip is when the monitor is passed on the next start-up.
- If the MIL is ON and any other emissions DTC was set (not an OBD II monitor), a good trip occurs when the Oxygen Sensor Monitor and Catalyst Monitor have been completed, or two minutes of engine run time if the Oxygen Sensor Monitor and Catalyst Monitor have been stopped from running.

Fuel System Good Trip

To count a good trip (three required) and turn off the MIL, the following conditions must occur:

- Engine in closed loop
- Operating in Similar Conditions Window
- Short Term multiplied by Long Term less than threshold
- Less than threshold for a predetermined time

If all of the previous criteria are met, the PCM will count a good trip (three required) and turn off the MIL.

Misfire Good Trip

If the following conditions are met the PCM will count one good trip (three required) in order to turn off the MIL:

- Operating in Similar Condition Window
- 1000 engine revolutions with no misfire

DESCRIPTION AND OPERATION (Continued)

Warm-Up Cycles

Once the MIL has been extinguished by the Good Trip Counter, the PCM automatically switches to a Warm-Up Cycle Counter that can be viewed on the DRB III. Warm-Up Cycles are used to erase DTCs and Freeze Frames. Forty Warm-Up cycles must occur in order for the PCM to self-erase a DTC and Freeze Frame. A Warm-Up Cycle is defined as follows:

- Engine coolant temperature must start below and rise above 160° F
- Engine coolant temperature must rise by 40° F
- No further faults occur

Freeze Frame Data Storage

Once a failure occurs, the Task Manager records several engine operating conditions and stores it in a Freeze Frame. The Freeze Frame is considered one frame of information taken by an on-board data recorder. When a fault occurs, the PCM stores the input data from various sensors so that technicians can determine under what vehicle operating conditions the failure occurred.

The data stored in Freeze Frame is usually recorded when a system fails the first time for two trip faults. Freeze Frame data will only be overwritten by a different fault with a higher priority.

CAUTION: Erasing DTCs, either with the DRB III or by disconnecting the battery, also clears all Freeze Frame data.

Similar Conditions Window

The Similar Conditions Window displays information about engine operation during a monitor. Absolute MAP (engine load) and Engine RPM are stored in this window when a failure occurs. There are two different Similar conditions Windows: Fuel System and Misfire.

FUEL SYSTEM

- **Fuel System Similar Conditions Window** — An indicator that 'Absolute MAP When Fuel Sys Fail' and 'RPM When Fuel Sys Failed' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Fuel Sys Fail** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Fuel Sys Fail** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **Upstream O2S Volts** — A live reading of the Oxygen Sensor to indicate its performance. For example, stuck lean, stuck rich, etc.
- **SCW Time in Window (Similar Conditions Window Time in Window)** — A timer used by the PCM that indicates that, after all Similar Conditions have been met, if there has been enough good engine running time in the SCW without failure detected. This timer is used to increment a Good Trip.
- **Fuel System Good Trip Counter** — A Trip Counter used to turn OFF the MIL for Fuel System DTCs. To increment a Fuel System Good Trip, the engine must be in the Similar Conditions Window, Adaptive Memory Factor must be less than calibrated threshold and the Adaptive Memory Factor must stay below that threshold for a calibrated amount of time.
- **Test Done This Trip** — Indicates that the monitor has already been run and completed during the current trip.

MISFIRE

- **Same Misfire Warm-Up State** — Indicates if the misfire occurred when the engine was warmed up (above 160° F).
- **In Similar Misfire Window** — An indicator that 'Absolute MAP When Misfire Occurred' and 'RPM When Misfire Occurred' are all in the same range when the failure occurred. Indicated by switching from 'NO' to 'YES'.
- **Absolute MAP When Misfire Occurred** — The stored MAP reading at the time of failure. Informs the user at what engine load the failure occurred.
- **Absolute MAP** — A live reading of engine load to aid the user in accessing the Similar Conditions Window.
- **RPM When Misfire Occurred** — The stored RPM reading at the time of failure. Informs the user at what engine RPM the failure occurred.
- **Engine RPM** — A live reading of engine RPM to aid the user in accessing the Similar Conditions Window.
- **Adaptive Memory Factor** — The PCM utilizes both Short Term Compensation and Long Term Adaptive to calculate the Adaptive Memory Factor for total fuel correction.
- **200 Rev Counter** — Counts 0–100 720 degree cycles.

DESCRIPTION AND OPERATION (Continued)

- **SCW Cat 200 Rev Counter** — Counts when in similar conditions.
- **SCW FTP 1000 Rev Counter** — Counts 0–4 when in similar conditions.
- **Misfire Good Trip Counter** — Counts up to three to turn OFF the MIL.
- **Misfire Data** — Data collected during test.
- **Test Done This Trip** — Indicates YES when the test is done.

MONITORED SYSTEMS

OPERATION

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator Lamp (MIL) will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the MIL or a scan tool.

The following is a list of the system monitors:

- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Leak Detection Pump Monitor (if equipped)

All these system monitors require two consecutive trips with the malfunction present to set a fault.

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

The following is an operation and description of each system monitor :

OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the Catalyst and Fuel Monitors.

The O2S can fail in any or all of the following manners:

- slow response rate
- reduced output voltage
- dynamic shift
- shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) shorted to voltage DTC, as well as a O2S heater DTC, the O2S fault MUST be repaired first. Before checking the O2S fault, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572 ° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S sensor are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S sensor is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S sensor must be tested to ensure that it is heating the sensor properly.

The O2S sensor circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S sensor output voltage from the other effects.

DESCRIPTION AND OPERATION (Continued)

LEAK DETECTION PUMP MONITOR (IF EQUIPPED)

The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

Pump Mode: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

Test Mode: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5” H20. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently set at.040” orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP’s solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the Air Fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S sensor output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual fuel-air ratio with the O2S sensor (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

DESCRIPTION AND OPERATION (Continued)

Normal vehicle miles or engine misfire can cause a catalyst to decay. A meltdown of the ceramic core can cause a reduction of the exhaust passage. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S's sensor strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL will be illuminated.

TRIP DEFINITION

OPERATION

The term "Trip" has different meanings depending on what the circumstances are. If the MIL (Malfunction Indicator Lamp) is OFF, a Trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.

When any Emission DTC is set, the MIL on the dash is turned ON. When the MIL is ON, it takes 3 good trips to turn the MIL OFF. In this case, it depends on what type of DTC is set to know what a "Trip" is.

For the Fuel Monitor or Mis-Fire Monitor (continuous monitor), the vehicle must be operated in the "Similar Condition Window" for a specified amount of time to be considered a Good Trip.

If a Non-Contiuous OBDII Monitor, such as:

- Oxygen Sensor
- Catalyst Monitor
- Purge Flow Monitor
- Leak Detection Pump Monitor (if equipped)
- EGR Monitor (if equipped)
- Oxygen Sensor Heater Monitor

fails twice in a row and turns ON the MIL, re-running that monitor which previously failed, on the next start-up and passing the monitor is considered to be a Good Trip.

If any other Emission DTC is set (not an OBDII Monitor), a Good Trip is considered to be when the Oxygen Sensor Monitor and Catalyst Monitor have been completed; or 2 Minutes of engine run time if the Oxygen Sensor Monitor or Catalyst Monitor have been stopped from running.

It can take up to 2 Failures in a row to turn on the MIL. After the MIL is ON, it takes 3 Good Trips to turn the MIL OFF. After the MIL is OFF, the PCM will self-erase the DTC after 40 Warm-up cycles. A Warm-up cycle is counted when the ECT (Engine Coolant Temperature Sensor) has crossed 160°F and has risen by at least 40°F since the engine has been started.

COMPONENT MONITORS

OPERATION

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (MIL) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum if the TPS indicates a small throttle opening.

DESCRIPTION AND OPERATION (Continued)

All open/short circuit checks or any component that has an associated limp in will set a fault after 1 trip with the malfunction present. Components without an associated limp in will take two trips to illuminate the MIL.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code

OPERATION

FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system, although it may set a fuel system fault.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

THROTTLE BODY AIR FLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

HIGH AND LOW LIMITS

OPERATION

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

LOAD VALUE

OPERATION

ENGINE	IDLE/NEUTRAL	2500 RPM/ NEUTRAL
All Engines	2% to 8% of Maximum Load	9% to 17% of Maximum Load

EVAPORATIVE EMISSION CONTROLS

TABLE OF CONTENTS

page

DESCRIPTION AND OPERATION
EVAPORATION CONTROL SYSTEM 23
ROLLOVER VALVE(S) 24
EVAPORATION (EVAP) CANISTER 24
DUTY CYCLE EVAP CANISTER PURGE SOLENOID 25
LEAK DETECTION PUMP (LDP). 25
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—3.9/5.2/5.9L ENGINE. 26
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—4.7L ENGINE 27
CRANKCASE VENTILATION (CCV) SYSTEM—2.5L ENGINE. 29
CRANKCASE BREATHER/FILTER 29
VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL 29

page

DIAGNOSIS AND TESTING
PCV VALVE TEST—3.9/5.2/5.9L ENGINE 30
PCV VALVE/PCV SYSTEM TEST—4.7L V-8 ENGINE 31
VACUUM SCHEMATICS. 32
LEAK DETECTION PUMP (LDP). 32
REMOVAL AND INSTALLATION
PCV VALVE—4.7L V-8 ENGINE 32
EVAPORATION (EVAP) CANISTER 33
DUTY CYCLE EVAP CANISTER PURGE SOLENOID 33
ROLLOVER VALVE(S) 34
LEAK DETECTION PUMP (LDP). 34
SPECIFICATIONS
TORQUE CHART 35

DESCRIPTION AND OPERATION

EVAPORATION CONTROL SYSTEM

OPERATION

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to a charcoal filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

All engines use a duty cycle purge system. The PCM controls vapor flow by operating the duty cycle EVAP purge solenoid. Refer to Duty Cycle EVAP Canister Purge Solenoid.

When equipped with certain emissions packages, a Leak Detection Pump (LDP) will be used as part of the evaporative system for OBD II requirements. Also refer to Leak Detection Pump.

NOTE: The evaporative system uses specially manufactured lines/hoses. If replacement becomes necessary, only use fuel resistant hose.

DESCRIPTION AND OPERATION (Continued)

ROLLOVER VALVE(S)

DESCRIPTION

The fuel tank on 2-door models is equipped with 1 rollover valve. This valve is located on the top of the fuel tank (Fig. 1). The fuel tank on 4-door models is equipped with 2 rollover valves. These valves are also located on the top of the fuel tank (Fig. 2).

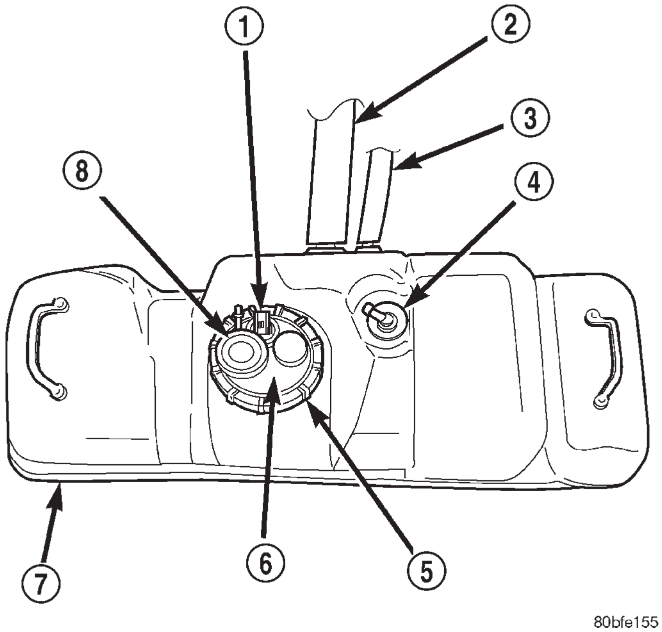


Fig. 1 Rollover Valve Location (2–Door Models)

1 – MODULE ELECTRICAL CONNECTOR
2 – FILL HOSE
3 – VENT HOSE
4 – ROLLOVER VALVE
5 – LOCKNUT
6 – FUEL PUMP MODULE
7 – FUEL TANK
8 – FUEL FILTER/FUEL PRESSURE REGULATOR

OPERATION

The rollover valve(s) will prevent fuel flow through the fuel tank vent (EVAP) hoses in the event of an accidental vehicle rollover. The EVAP canister draws fuel vapors from the fuel tank through this valve(s).

The valve(s) cannot be serviced separately. If replacement is necessary, the fuel tank must be replaced. Refer to Fuel Tank Removal/Installation in Fuel System.

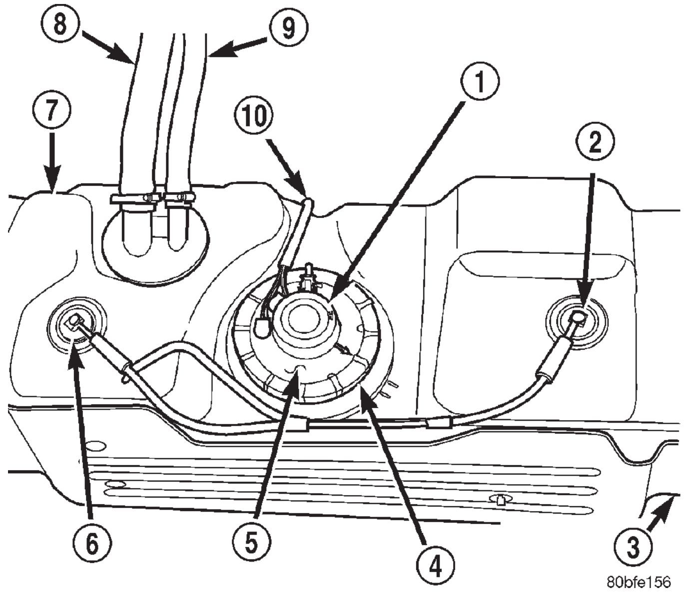


Fig. 2 Rollover Valve Locations (4–Door Models)

1 – FUEL FILTER/FUEL PRESSURE REGULATOR
2 – ROLLOVER VALVE
3 – FUEL TANK SHIELD
4 – LOCKNUT
5 – FUEL PUMP MODULE
6 – ROLLOVER VALVE
7 – FUEL TANK
8 – FILL HOSE
9 – VENT HOSE
10 – PIGTAIL HARNESS

EVAPORATION (EVAP) CANISTER

DESCRIPTION

A maintenance free, EVAP canister is used on all vehicles. The EVAP canister is located under the vehicle, inside the left frame rail, in front of the fuel tank (Fig. 3).

OPERATION

The EVAP canister is filled with granules of an activated carbon mixture. Fuel vapors entering the EVAP canister are absorbed by the charcoal granules.

Fuel tank pressure vents into the EVAP canister. Fuel vapors are temporarily held in the canister until they can be drawn into the intake manifold. The duty cycle EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

DESCRIPTION AND OPERATION (Continued)

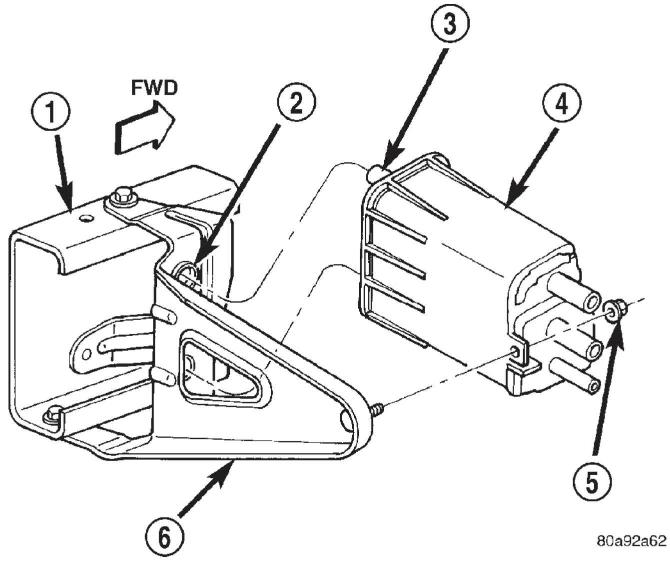


Fig. 3 EVAP Canister Location

1 – LEFT FRAME RAIL
2 – RUBBER GROMMETS (2)
3 – LOCATING PINS (2)
4 – EVAP CANISTER
5 – MOUNTING NUT
6 – MOUNTING BRACKET

DUTY CYCLE EVAP CANISTER PURGE SOLENOID

OPERATION

The duty cycle EVAP canister purge solenoid (DCP) regulates the rate of vapor flow from the EVAP canister to the intake manifold. The Powertrain Control Module (PCM) operates the solenoid.

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged. The PCM de-energizes the solenoid during open loop operation.

The engine enters closed loop operation after it reaches a specified temperature and the time delay ends. During closed loop operation, the PCM cycles (energizes and de-energizes) the solenoid 5 or 10 times per second, depending upon operating conditions. The PCM varies the vapor flow rate by changing solenoid pulse width. Pulse width is the amount of time that the solenoid is energized. The PCM adjusts solenoid pulse width based on engine operating condition.

LEAK DETECTION PUMP (LDP)

OPERATION

The Leak Detection Pump (LDP) is used only with certain emission packages.

The LDP is a device used to detect a leak in the evaporative system.

The pump contains a 3 port solenoid, a pump that contains a switch, a spring loaded canister vent valve seal, 2 check valves and a spring/diaphragm.

Immediately after a cold start, engine temperature between 40°F and 86°F, the 3 port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non-test test conditions, the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling. This is due to the operation of the 3 port solenoid which prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized, allowing atmospheric pressure to enter the pump cavity. This permits the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de-energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

PUMP MODE: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test time.

TEST MODE: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5 inches of water.

When the pump starts, the cycle rate is quite high. As the system becomes pressurized pump rate drops. If there is no leak the pump will quit. If there is a leak, the test is terminated at the end of the test mode.

If there is no leak, the purge monitor is run. If the cycle rate increases due to the flow through the purge system, the test is passed and the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

A typical system schematic is shown in (Fig. 4).

DESCRIPTION AND OPERATION (Continued)

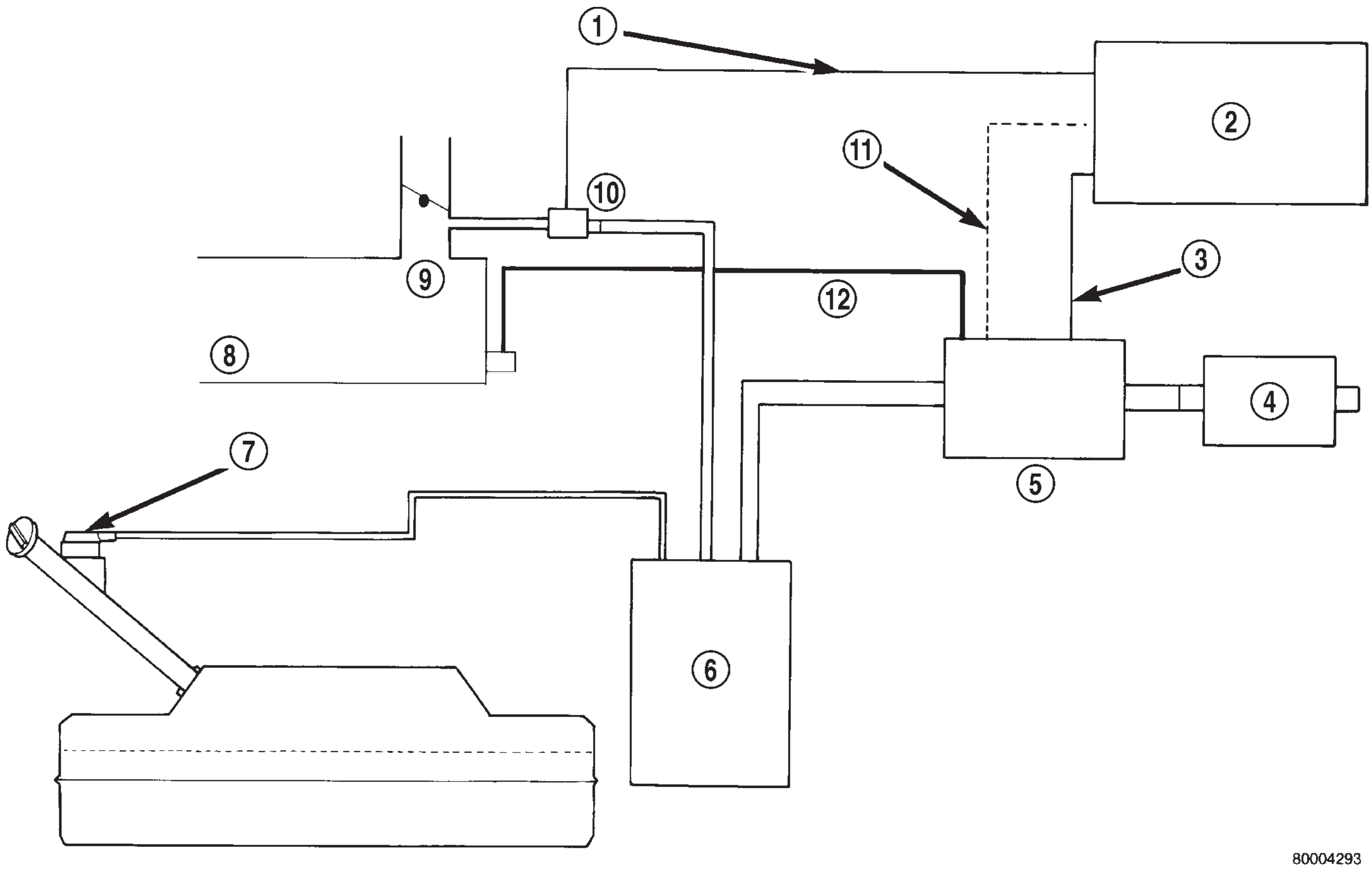


Fig. 4 Evaporative System Monitor Schematic—Typical

1 – DUTY CYCLE PURGE SOLENOID (DCPS) DRIVER
2 – POWERTRAIN CONTROL MODULE (PCM)
3 – 3-PORT SOLENOID DRIVER
4 – REMOTE FILTER
5 – COMBINED CANISTER VENT VALVE & LEAK DETECTION PUMP
6 – CANISTER
7 – TANK ROLLOVER VALVE & VAPOR FLOW CONTROL ORIFICE
8 – INTAKE MANIFOLD
9 – THROTTLE BODY
10 – DCPS
11 – SWITCH SIGNAL INPUT TO THE PCM
12 – ENGINE VACUUM LINE

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—3.9/5.2/5.9L ENGINE

DESCRIPTION

All 3.9L V-6 and 5.2/5.9L V-8 are equipped with a closed crankcase ventilation system and a positive crankcase ventilation (PCV) valve. The 2.5L 4–cylinder engine is not equipped with a PCV valve. Refer to Crankcase Ventilation System—2.5L Engine for information.

This system consists of a PCV valve mounted on the cylinder head (valve) cover with a hose extending from the valve to the intake manifold. Another hose connects the opposite cylinder head (valve) cover to the air cleaner housing to provide a source of clean air for the system. A separate crankcase breather/filter is not used.

OPERATION

The PCV system operates by engine intake manifold vacuum (Fig. 6). Filtered air is routed into the crankcase through the air cleaner hose. The metered air, along with crankcase vapors, are drawn through the PCV valve and into a passage in the intake manifold. The PCV system manages crankcase pressure and meters blow by gases to the intake system, reducing engine sludge formation.

The PCV valve contains a spring loaded plunger. This plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

When the engine is not operating or during an engine pop-back, the spring forces the plunger back against the seat. This will prevent vapors from flowing through the valve.

DESCRIPTION AND OPERATION (Continued)

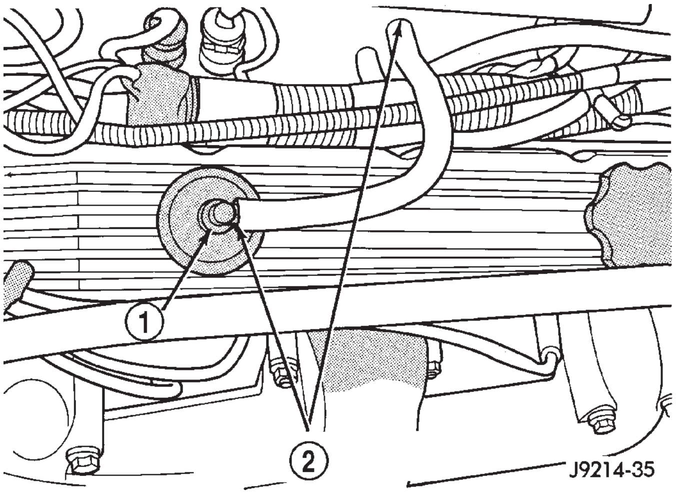


Fig. 5 PCV Valve/Hose—Typical

1 – PCV VALVE
2 – PCV VALVE HOSE CONNECTIONS

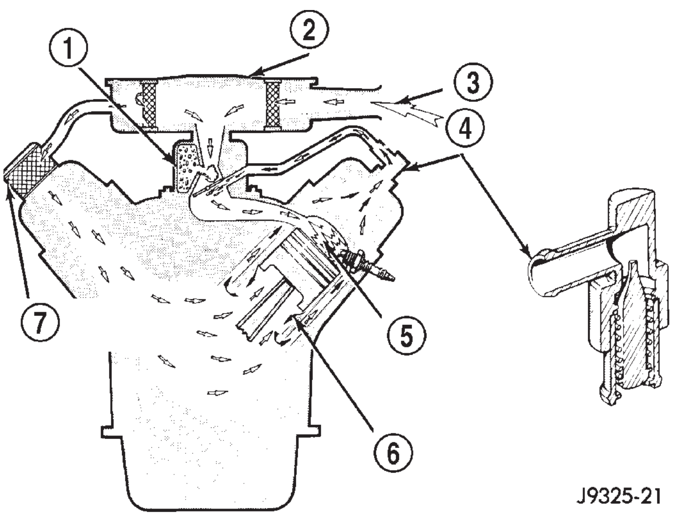


Fig. 6 Typical Closed Crankcase Ventilation System

1 – THROTTLE BODY
2 – AIR CLEANER
3 – AIR INTAKE
4 – PCV VALVE
5 – COMBUSTION CHAMBER
6 – BLOW-BY GASES
7 – CRANKCASE BREATHER/FILTER

During periods of high manifold vacuum, such as idle or cruising speeds, vacuum is sufficient to completely compress spring. It will then pull the plunger to the top of the valve (Fig. 8). In this position there is minimal vapor flow through the valve.

During periods of moderate manifold vacuum, the plunger is only pulled part way back from inlet. This results in maximum vapor flow through the valve (Fig. 9).

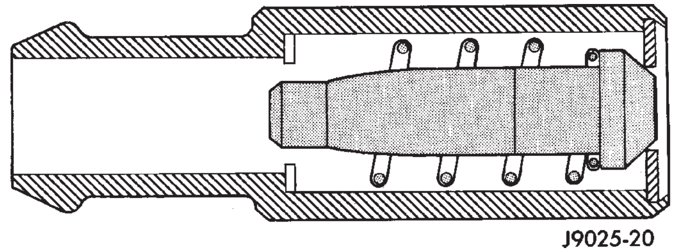


Fig. 7 Engine Off or Engine Pop-Back—No Vapor Flow

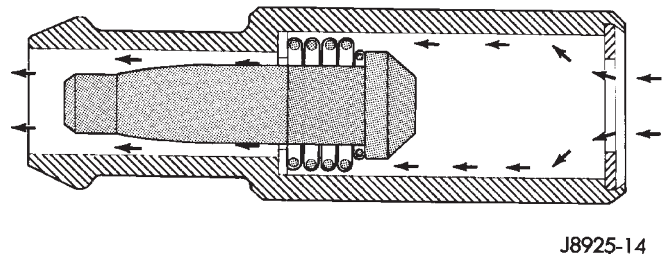


Fig. 8 High Intake Manifold Vacuum—Minimal Vapor Flow

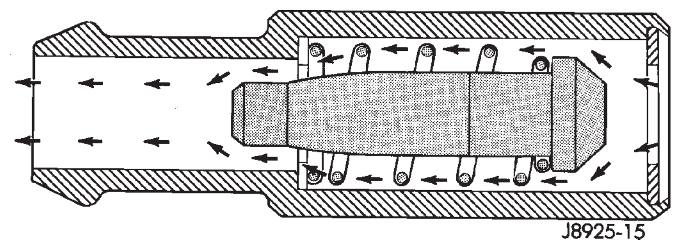


Fig. 9 Moderate Intake Manifold Vacuum—Maximum Vapor Flow

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—4.7L ENGINE

DESCRIPTION

The 4.7L V-8 engine is equipped with a closed crankcase ventilation system and a Positive Crankcase Ventilation (PCV) valve.

This system consists of:

• a PCV valve mounted to the oil filler housing (Fig. 10). The PCV valve is sealed to the oil filler housing with an o-ring.

• the air cleaner housing

• two interconnected breathers threaded into the rear of each cylinder head (Fig. 11).

• tubes and hose to connect the system components.

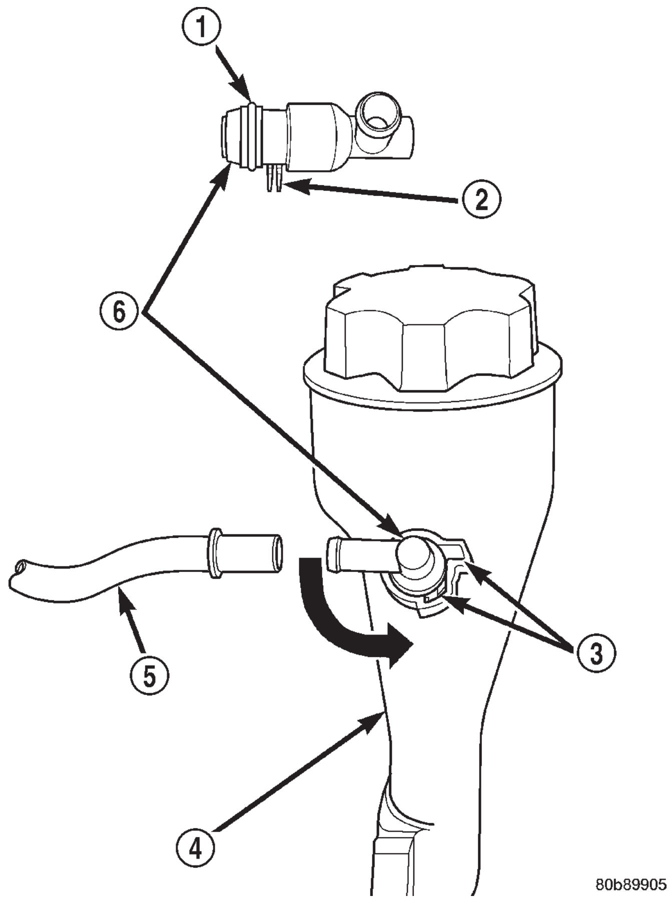


Fig. 10 PCV Valve/Oil Filler Tube (Housing)—4.7L Engine

1 – O-RING
2 – LOCATING TABS
3 – CAM LOCK
4 – OIL FILLER TUBE
5 – PCV LINE/HOSE
6 – PCV VALVE

OPERATION

The PCV system operates by engine intake manifold vacuum. Filtered air is routed into the crankcase through the air cleaner hose and crankcase breathers. The metered air, along with crankcase vapors, are drawn through the PCV valve and into a passage in the intake manifold. The PCV system manages crankcase pressure and meters blow-by gases to the intake system, reducing engine sludge formation.

The PCV valve contains a spring loaded plunger. This plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

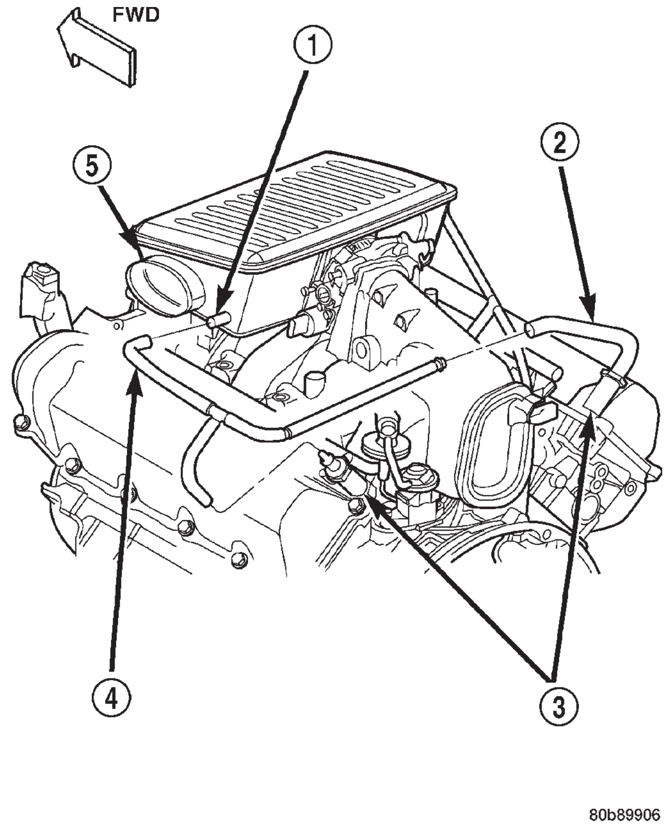


Fig. 11 PCV System Hoses/Tubes—4.7L Engine

1 – FRESH AIR FITTING
2 – CONNECTING TUBES/HOSES
3 – CRANKCASE BREATHERS (2)
4 – RUBBER HOSE
5 – AIR CLEANER RESONATOR

TYPICAL PCV valves are shown in (Fig. 12), (Fig. 13) and (Fig. 14).

When the engine is not operating, or during an engine pop-back, the spring forces the plunger back against the seat (Fig. 12). This will prevent vapors from flowing through the valve.

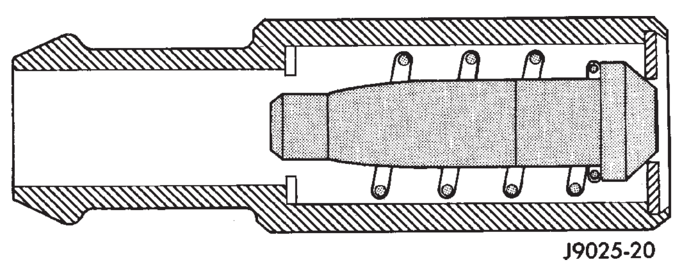


Fig. 12 Engine Off or Engine Pop-Back—No Vapor Flow

During periods of high manifold vacuum, such as idle or cruising speeds, vacuum is sufficient to completely compress spring. It will then pull the plunger to the top of the valve (Fig. 13). In this position there is minimal vapor flow through the valve.

DESCRIPTION AND OPERATION (Continued)

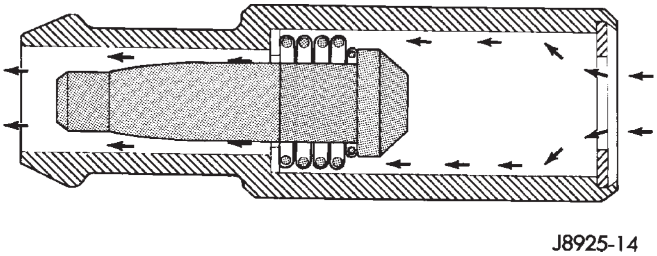


Fig. 13 High Intake Manifold Vacuum—Minimal Vapor Flow

During periods of moderate manifold vacuum, the plunger is only pulled part way back from inlet. This results in maximum vapor flow through the valve (Fig. 14).

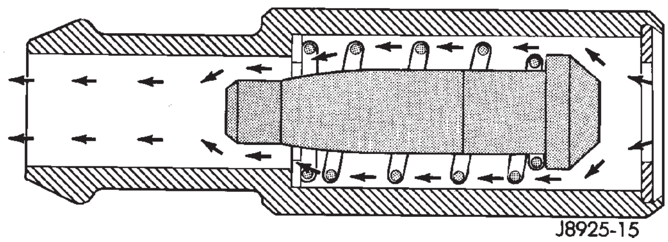


Fig. 14 Moderate Intake Manifold Vacuum—Maximum Vapor Flow

CRANKCASE VENTILATION (CCV) SYSTEM—2.5L ENGINE

DESCRIPTION

2.5L 4–cylinder engines are equipped with a Crankcase Ventilation (CCV) system. The CCV system performs the same function as a conventional PCV system, but does not use a vacuum controlled valve.

OPERATION

A molded vacuum tube connects a fitting on the intake manifold to a fixed orifice fitting of a calibrated size. This fitting meters the amount of crankcase vapors drawn out of the engine. The fixed orifice fitting is located on the side of cylinder head (valve) cover (Fig. 15).

A fresh air supply hose from the air cleaner housing is connected to a fitting at the top/rear of cylinder head cover (Fig. 15).

When the engine is operating, fresh air enters the engine and mixes with crankcase vapors. Engine vacuum draws the vapor/air mixture through the fixed orifice and into the intake manifold. The vapors are then consumed during engine combustion.

CRANKCASE BREATHER/FILTER

DESCRIPTION

The crankcase breather/filter is no longer used with the 2.5L, 3.9L, 5.2L or 5.9L engine.

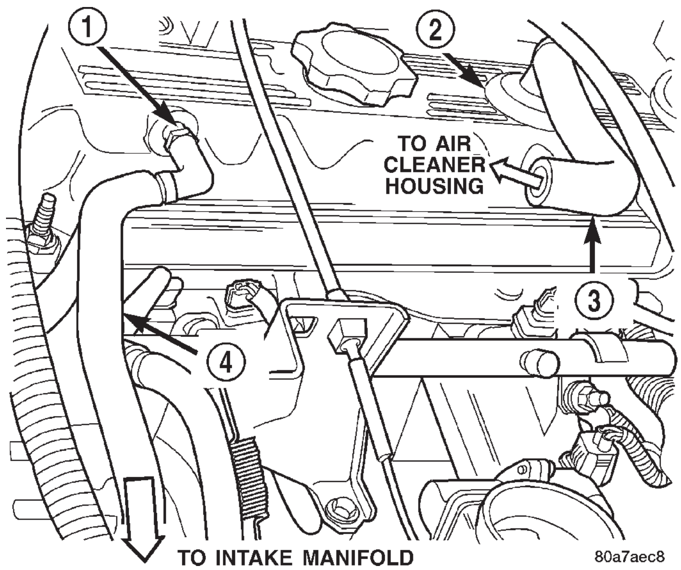


Fig. 15 CCV System—2.5L Engine

1 – FIXED ORIFICE FITTING
2 – AIR INLET FITTING
3 – CCV TUBE
4 – CCV TUBE

VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

DESCRIPTION

All vehicles are equipped with a combined VECI label. This label is located in the engine compartment (Fig. 16).

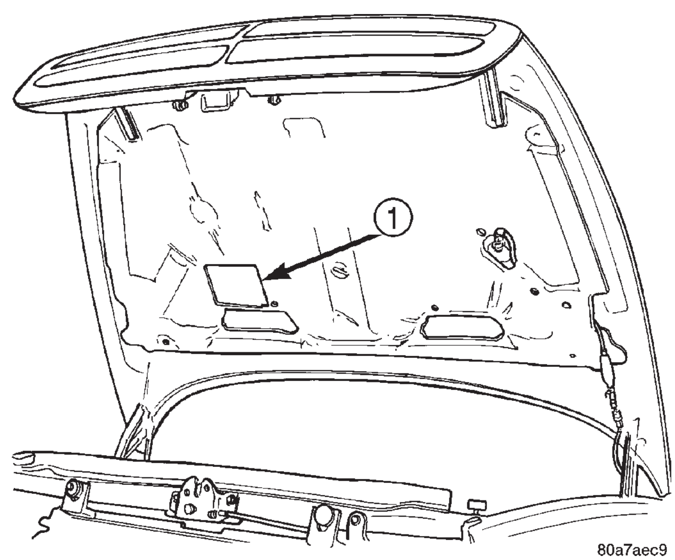


Fig. 16 VECI Label Location

1 – VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

DESCRIPTION AND OPERATION (Continued)

OPERATION

The VECI label contains the following:

- Engine family and displacement
- Evaporative family
- Emission control system schematic
- Certification application
- Engine timing specifications (if adjustable)
- Idle speeds (if adjustable)
- Spark plug and gap

The label also contains an engine vacuum schematic. There are unique labels for vehicles built for sale in the state of California and the country of Canada. Canadian labels are written in both the English and French languages. These labels are permanently attached and cannot be removed without defacing information and destroying label.

DIAGNOSIS AND TESTING

PCV VALVE TEST—3.9/5.2/5.9L ENGINE

(1) With engine idling, remove the PCV valve from cylinder head (valve) cover. If the valve is not plugged, a hissing noise will be heard as air passes through the valve. Also, a strong vacuum should be felt at the valve inlet (Fig. 17).

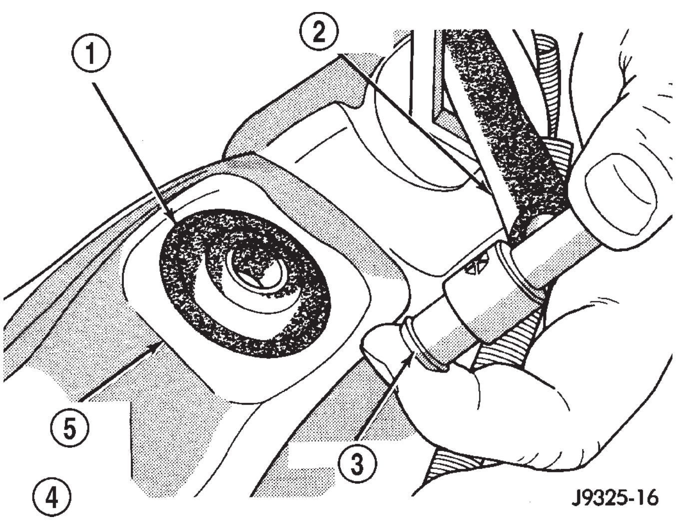


Fig. 17 Vacuum Check at PCV Valve—Typical

1 – PCV VALVE GROMMET
2 – PCV HOSE
3 – PCV VALVE
4 – VACUUM MUST BE FELT AGAINST FINGER
5 – ENGINE VALVE COVER

(2) Return the PCV valve into the valve cover. Remove the fitting and air hose at the opposite valve cover. Loosely hold a piece of stiff paper, such as a parts tag, over the opening (rubber grommet) at the valve cover (Fig. 18).

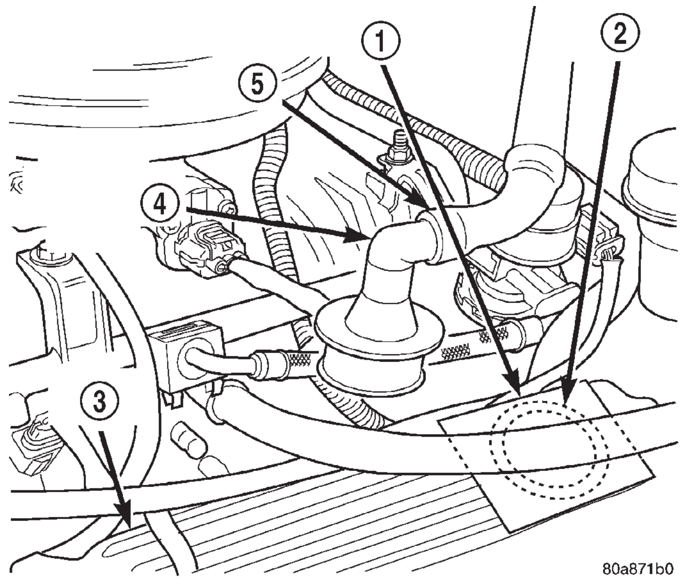


Fig. 18 Vacuum Check at Valve Cover Opening

1 – STIFF PAPER PLACED OVER RUBBER GROMMET
2 – RUBBER GROMMET
3 – VALVE COVER
4 – FITTING REMOVED FROM VALVE COVER
5 – AIR TUBE

(3) The paper should be drawn against the opening in the valve cover with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.

(4) Turn engine off and remove PCV valve from valve cover. The valve should rattle when shaken (Fig. 19).

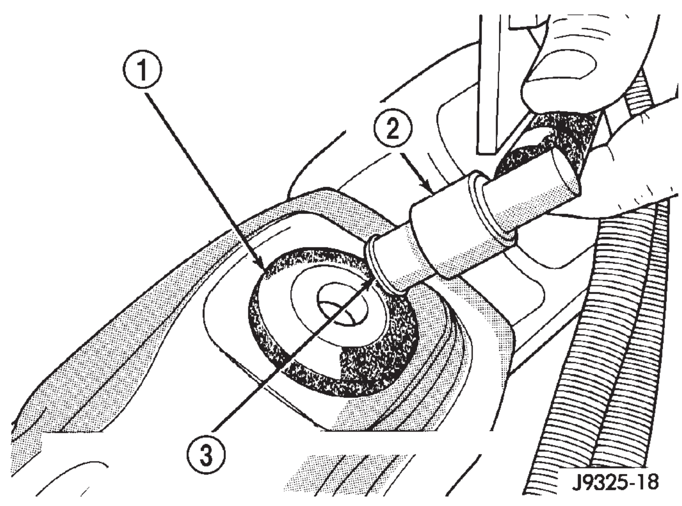


Fig. 19 Shake PCV Valve—Typical

1 – PCV VALVE GROMMET
2 – PCV VALVE
3 – PCV VALVE MUST RATTLE WHEN SHAKEN

DIAGNOSIS AND TESTING (Continued)

(5) Replace the PCV valve and retest the system if it does not operate as described in the preceding tests. **Do not attempt to clean the old PCV valve.**

(6) If the paper is not held against the opening in valve cover after new valve is installed, the PCV valve hose may be restricted and must be replaced. The passage in the intake manifold must also be checked and cleaned.

(7) To clean the intake manifold fitting, turn a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

PCV VALVE/PCV SYSTEM TEST—4.7L V-8 ENGINE

(1) Disconnect PCV line/hose (Fig. 20) by disconnecting rubber connecting hose at PCV valve fitting.

(2) Remove PCV valve at oil filler tube by rotating PCV valve downward until locating tabs have been freed at cam lock (Fig. 20). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**

(3) After valve is removed, check condition of valve o-ring (Fig. 20). Also, PCV valve should rattle when shaken.

(4) Reconnect PCV valve to its connecting line/hose.

(5) Start engine and bring to idle speed.

(6) If valve is not plugged, a hissing noise will be heard as air passes through valve. Also, a strong vacuum should be felt with a finger placed at valve inlet.

(7) If vacuum is not felt at valve inlet, check line/hose for kinks or for obstruction. If necessary, clean out intake manifold fitting at rear of manifold. Do this by turning a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

(8) **Do not attempt to clean the old PCV valve.**

(9) Return PCV valve back to oil filler tube by placing valve locating tabs (Fig. 20) into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.

(10) Connect PCV line/hose and connecting rubber hose to PCV valve.

(11) Disconnect rubber hose from fresh air fitting at left side of air cleaner resonator box (Fig. 21). Start engine and bring to idle speed. Hold a piece of stiff paper (such as a parts tag) loosely over the opening of the disconnected rubber hose.

(12) The paper should be drawn against the hose opening with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.

(13) If vacuum is not present, disconnect each PCV system hose at top of each breather (Fig. 21). Check for obstructions or restrictions.

(14) If vacuum is still not present, remove each PCV system breather (Fig. 21) from each cylinder head. Check for obstructions or restrictions. If plugged, replace breather. Tighten breather to 12 N·m (106 in. lbs.) torque. Do not attempt to clean breather

(15) If vacuum is still not present, disconnect each PCV system hose at each fitting and check for obstructions or restrictions.

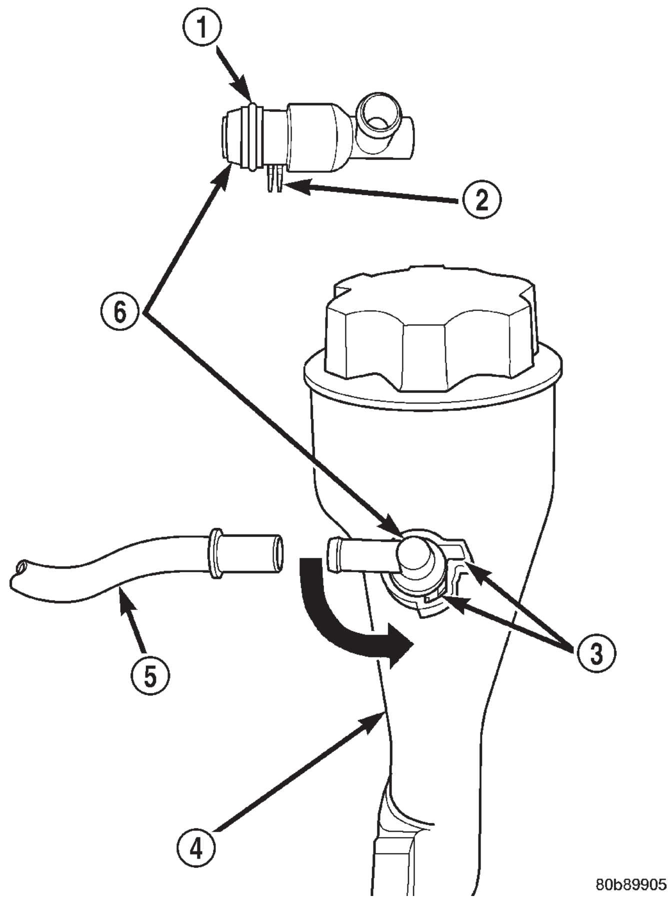


Fig. 20 PCV Valve/Oil Filler Tube—4.7L V-8 Engine

1 – O-RING
2 – LOCATING TABS
3 – CAM LOCK
4 – OIL FILLER TUBE
5 – PCV LINE/HOSE
6 – PCV VALVE

DIAGNOSIS AND TESTING (Continued)

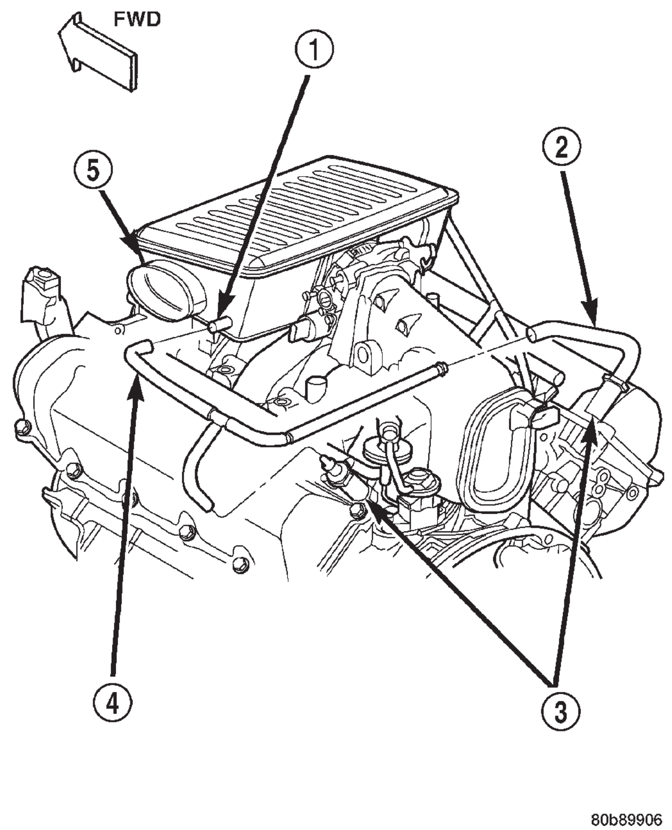


Fig. 21 PCV Breathers/Tubes/Hoses—4.7L V-8 Engine

1 – FRESH AIR FITTING
2 – CONNECTING TUBES/HOSES
3 – CRANKCASE BREATHERS (2)
4 – RUBBER HOSE
5 – AIR CLEANER RESONATOR

VACUUM SCHEMATICS

A vacuum schematic for emission related items can be found on the Vehicle Emission Control Information (VECI) label. For label location, refer to Vehicle Emission Control Information (VECI) Label.

LEAK DETECTION PUMP (LDP)

Refer to the appropriate Powertrain Diagnostic Procedures service manual for LDP testing procedures.

REMOVAL AND INSTALLATION

PCV VALVE—4.7L V-8 ENGINE

The PCV valve is located on the oil filler tube (Fig. 22). Two locating tabs are located on the side of the valve (Fig. 22). These 2 tabs fit into a cam lock in the oil filler tube. An o-ring seals the valve to the filler tube.

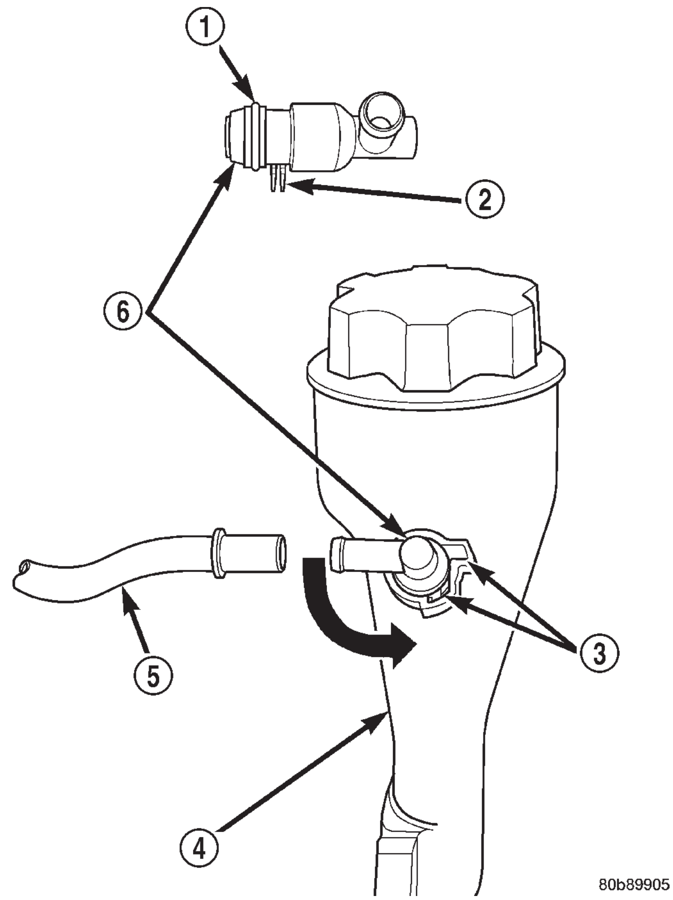


Fig. 22 PCV Valve/Oil Filler Tube Location

1 – O-RING
2 – LOCATING TABS
3 – CAM LOCK
4 – OIL FILLER TUBE
5 – PCV LINE/HOSE
6 – PCV VALVE

REMOVAL

(1) Disconnect PCV line/hose (Fig. 22) by disconnecting rubber hose at PCV valve fitting.

(2) Remove PCV valve at oil filler tube by rotating PCV valve downward (counter-clockwise) until locating tabs have been freed at cam lock (Fig. 22). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**

(3) After valve is removed, check condition of valve o-ring (Fig. 22).

INSTALLATION

(1) Return PCV valve back to oil filler tube by placing valve locating tabs (Fig. 22) into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.

REMOVAL AND INSTALLATION (Continued)

(2) Connect PCV line/hose and rubber hose to PCV valve.

EVAPORATION (EVAP) CANISTER

The EVAP canister is located below the vehicle, inside the left frame rail, in front of the fuel tank (Fig. 23).

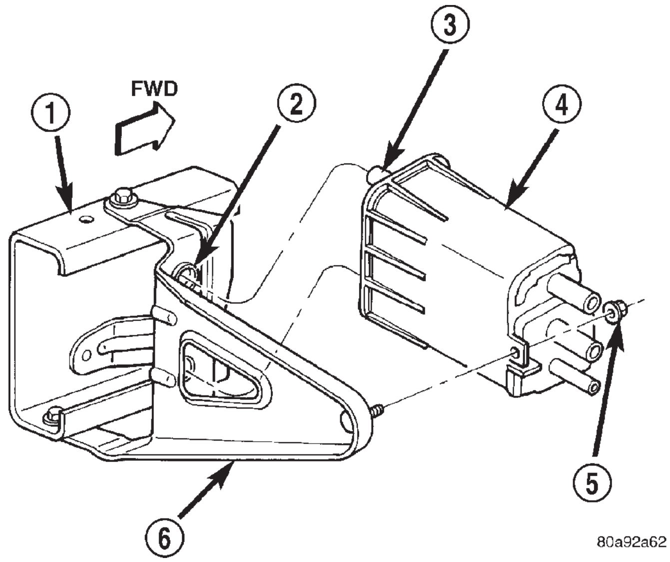


Fig. 23 EVAP Canister Location

1 – LEFT FRAME RAIL
2 – RUBBER GROMMETS (2)
3 – LOCATING PINS (2)
4 – EVAP CANISTER
5 – MOUNTING NUT
6 – MOUNTING BRACKET

REMOVAL

(1) Raise vehicle.
(2) Disconnect vacuum lines at EVAP canister. Note location of lines before removal.
(3) Remove canister mounting nut.
(4) Remove canister from mounting bracket.

INSTALLATION

(1) Position canister locating pins into mounting bracket grommets (Fig. 23) and install mounting nut.
(2) Tighten mounting nut to 17–24 N·m (150–210 in. lbs.) torque.
(3) Connect vacuum lines at canister.
(4) Lower vehicle.

DUTY CYCLE EVAP CANISTER PURGE SOLENOID

3.9/5.2/5.9L Engines: The duty cycle EVAP canister purge solenoid is located at left-rear side of engine compartment near power brake vacuum unit (Fig. 24).

2.5L Engine: The solenoid is located at right-rear side of engine compartment (Fig. 25).

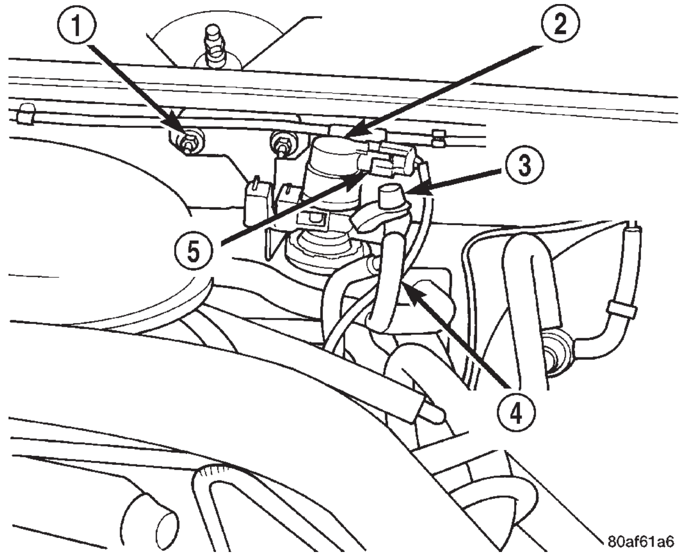


Fig. 24 Duty Cycle EVAP Canister Purge Solenoid—3.9/5.2/5.9L Engines

1 – BRACKET NUTS (2)
2 – EVAP CANISTER PURGE SOLENOID
3 – EVAP SYSTEM TEST PORT (IF EQUIPPED)
4 – VACUUM LINES
5 – ELECTRICAL CONNECTOR

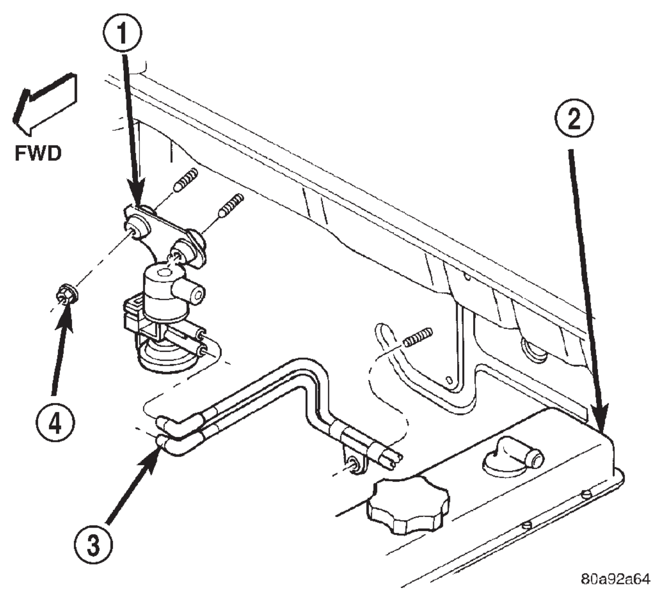


Fig. 25 Duty Cycle EVAP Canister Purge Solenoid—2.5L Engine

1 – DUTY CYCLE SOLENOID
2 – CYLINDER HEAD COVER
3 – VACUUM HOSES
4 – BRACKET NUTS (2)

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect electrical wiring connector at solenoid

(2) Disconnect vacuum harness at solenoid.

(3) Remove 2 support bracket mounting nuts.

(4) Remove solenoid and its support bracket from vehicle.

INSTALLATION

(1) Position EVAP canister purge solenoid and its mounting bracket.

(2) Install mounting nuts and tighten to 8 N·m (75 in. lbs.) torque.

(3) Connect vacuum harness and wiring connector.

ROLLOVER VALVE(S)

The rollover valves(s) are/is molded into the fuel tank and are not serviced separately. If replacement is necessary, the fuel tank must be replaced. Refer to Fuel Tank Removal/Installation.

LEAK DETECTION PUMP (LDP)

The LDP is located in the engine compartment under the battery tray and Power Distribution Center (PDC) (Fig. 26). The LDP filter is attached to the outside of battery tray (Fig. 27). The LDP and LDP filter are replaced (serviced) as one unit.

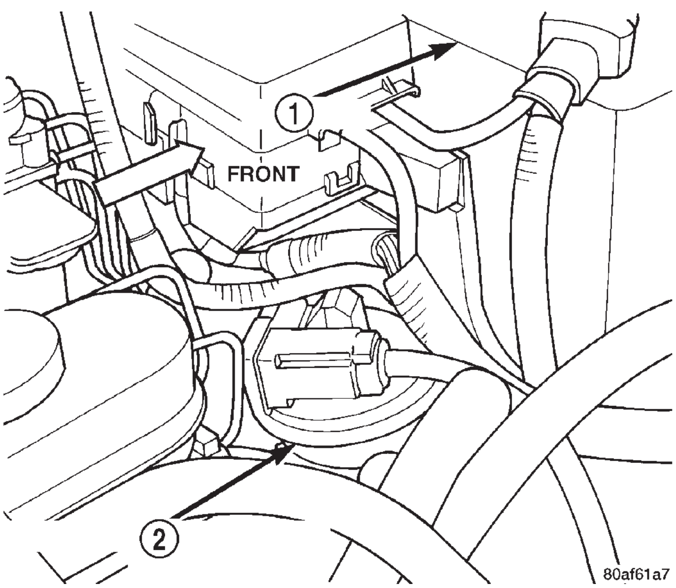


Fig. 26 Leak Detection Pump (LDP) Location

1 – BATTERY
2 – LEAK DETECTION PUMP (LDP)

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Remove battery. Refer to Group 8A, Battery for procedures.

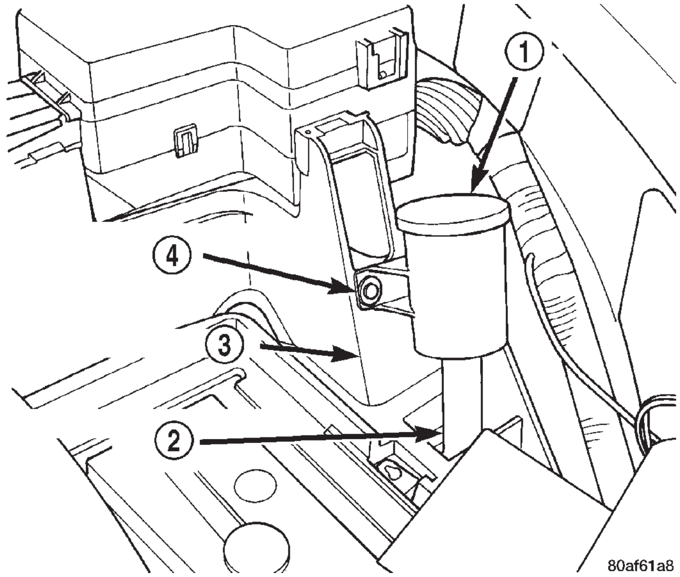


Fig. 27 LDP Filter Location

1 – LDP FILTER
2 – LDP FILTER-TO-LDP HOSE
3 – BATTERY TRAY
4 – LDP MOUNTING CLIP

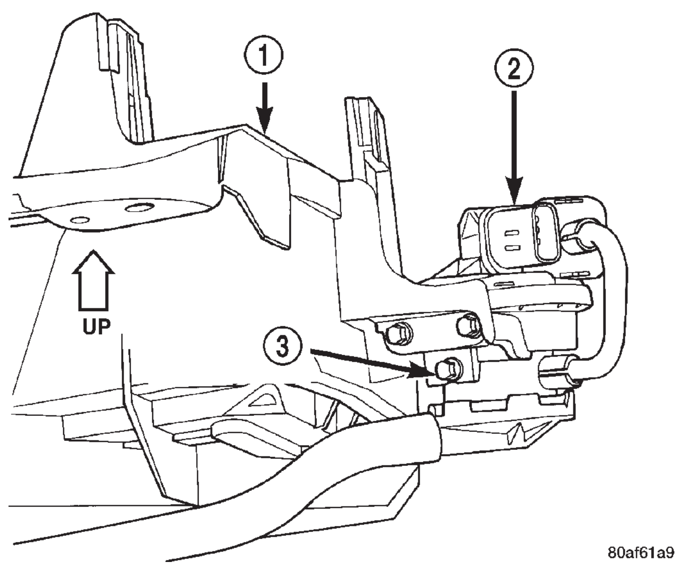


Fig. 28 Leak Detection Pump (LDP) Mounting Screws

1 – BATTERY TRAY
2 – LDP
3 – LDP MOUNTING SCREWS (3)

(3) Carefully disconnect rubber hose from bottom of LDP filter (Fig. 27).

(4) Remove clip retaining LDP filter to battery tray (Fig. 27) and remove filter from tray.

(5) Disconnect battery temperature sensor pigtail wiring harness at bottom of battery tray.

REMOVAL AND INSTALLATION (Continued)

(6) To gain access to LDP, the PDC must be partially removed. Remove PDC-to-fender mounting screw at rear of PDC. Unsnap PDC from battery tray. To prevent damage to PDC wiring, carefully position PDC to gain access to LDP.

(7) Remove battery tray. Refer to Group 8A, Battery for procedures.

(8) Carefully remove vapor/vacuum lines at LDP.

(9) Disconnect electrical connector at LDP.

(10) Remove 3 LDP mounting screws (Fig. 28) and remove LDP from vehicle.

INSTALLATION

(1) Install LDP to bottom of battery tray. Tighten screws to 1 N·m (11 in. lbs.) torque.

(2) Carefully install vapor/vacuum lines to LDP. **The vapor/vacuum lines and hoses must be firmly connected. Check the vapor/vacuum lines at the LDP, LDP filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**

(3) Connect electrical connector to LDP.

(4) Install battery tray. Refer to Group 8A, Battery for procedures.

(5) Install PDC to fender and battery tray (snaps on to battery tray).

(6) Install LDP filter to battery tray (one clip).

(7) Install connecting hose to bottom of LDP filter.

(8) Connect battery temperature sensor pigtail wiring harness.

(9) Install battery. Refer to Group 8A, Battery for procedures.

(10) Connect negative battery cable to battery.

SPECIFICATIONS

TORQUE CHART

Description	Torque
EVAP Canister Mounting Nut	17–24 N·m (150–210 in. lbs.)
EVAP Canister Purge Solenoid Mounting Bolt—3.9L/5.2L Engines	11 N·m (95 in. lbs.)
EVAP Canister Purge Solenoid Mounting Nuts—2.5L Engine	8 N·m (75 in. lbs.)
Leak Detection Pump (LDP) Mounting Screws	1 N·m (11 in. lbs.)

Description	Group-Page
ABS BRAKE SYSTEM, BLEEDING	5-43
ABS WARNING LAMP	5-43
ABSOLUTE PRESSURE (MAP) SENSOR—2.5L ENGINE, MANIFOLD	14-58
ABSOLUTE PRESSURE (MAP) SENSOR—3.9/5.2/5.9L ENGINES, MANIFOLD	14-57
ABSOLUTE PRESSURE (MAP) SENSOR—4.7L V–8 ENGINE, MANIFOLD	14-58
ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT, MANIFOLD	14-36
ABSORBER, SHOCK	2-16,2-24,2-8
ABSORBERS, SHOCK	2-14,2-23,2-6
A/C APPLICATION TABLE	24-55
A/C, IDLER PULLEY—4.7L ENGINE NON	7-52
A/C PERFORMANCE	24-10
ACCELERATION, CLUNKING NOISE DURING	3-20
ACCELERATION, SHUDDER OR VIBRATION DURING	3-20
ACCELERATOR PEDAL	14-24
ACCESSORY BELT REPLACEMENT—4.7L ENGINE	7-48
ACCESSORY DRIVE BELT DIAGNOSIS	7-24
ACCESSORY DRIVE BELT TENSIONER—2.5L	7-50
ACCESSORY DRIVE BELT TENSION—2.5L ENGINE	7-56
ACCESSORY DRIVE BELT—2.5L ENGINE	7-47
ACCESSORY DRIVE BELT—3.9L/5.9L ENGINES	7-49
ACCESSORY DRIVE BELTS, ENGINE	7-5
ACCUMULATOR; HEATING AND AIR CONDITIONING	24-2,24-23
ACCUMULATOR; TRANSMISSION AND TRANSFER CASE	21-117,21-223, 21-278,21-392,21-481
ACTUATION TEST MODE, CIRCUIT	25-2
ACTUATOR, FRONT DOOR INSIDE HANDLE	23-34
ACTUATOR, MODE DOOR VACUUM	24-44
ACTUATOR, REAR DOOR INSIDE HANDLE	23-40
ADAPTER HOUSING SEAL	21-453
ADDITIONAL, COOLANT—ADDING	7-28
ADDITIVES, COOLANT SELECTION	7-30
ADHESIVE LOCATIONS, STRUCTURAL	23-89
ADJUSTER AND MOTORS, POWER SEAT	8R-1, 8R-2,8R-3
ADJUSTER, HYDRAULIC LASH	9-123,9-164
ADJUSTER NOISE DIAGNOSIS, HYDRAULIC LASH	9-131
ADJUSTMENT AT AXLE WITH LEAF SPRINGS	3-17
ADJUSTMENT, CENTER BEARING	3-17
ADJUSTMENT, COMPASS VARIATION	8V-6
ADJUSTMENT, FRONT BAND	21-396
ADJUSTMENT, REAR BAND	21-396
ADJUSTMENT, REAR DOOR	23-61
ADJUSTMENT, SHIFTER	21-530,21-560
ADJUSTMENT, TRANSMISSION THROTTLE VALVE CABLE	21-226,21-394
ADJUSTMENTS, BAND	21-228
AERATION, COOLANT—LOW LEVEL	7-27
AFTERMARKET REPAIR PRODUCTS	23-2
AIR CLEANER ELEMENT (FILTER)	14-62
AIR CONDITIONER CONTROL, HEATER	24-6
AIR CONDITIONER, HEATER	24-5
AIR CONDITIONING/HEATER, 8W-42	8W-1
AIR CONTROL (IAC) MOTOR—2.5L ENGINE, IDLE	14-56
AIR CONTROL (IAC) MOTOR—3.9/5.2/5.9L ENGINES, IDLE	14-56
AIR CONTROL (IAC) MOTOR—4.7L V–8 ENGINE, IDLE	14-56
AIR CONTROL (IAC) MOTOR—PCM OUTPUT, IDLE	14-41
AIR EXHAUSTER	23-44
AIR EXHAUSTER—CAB	23-44
AIR FLOW CHECK PROCEDURE, THROTTLE BODY MINIMUM	14-50,14-51
AIR TEMPERATURE SENSOR—2.5L ENGINE, INTAKE MANIFOLD	14-64
AIR TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES, INTAKE MANIFOLD	14-64
AIR TEMPERATURE SENSOR—4.7L V-8 ENGINE, INTAKE MANIFOLD	14-64
AIR TEMPERATURE SENSOR—PCM INPUT, INTAKE MANIFOLD	14-35
AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION	21-134,21-296
AIR TESTING TRANSMISSION CLUTCH OPERATION	21-444
AIRBAG CONTROL MODULE	8M-12,8M-3
AIRBAG MODULE, DRIVER SIDE	8M-2,8M-6
AIRBAG MODULE, PASSENGER SIDE	8M-3,8M-9
AIRBAG MODULE TRIM COVER, DRIVER SIDE	8M-8
AIRBAG ON/OFF SWITCH, PASSENGER SIDE	8M-12,8M-3
AIRBAG SYSTEM	8M-1,8M-4,8M-5
AIRBAG SYSTEM, 8W-43	8W-1
AJAR SWITCH, DOOR	8Q-3,8Q-4
AJAR SWITCH, DRIVER DOOR	8U-2,8U-3
ALERT, TAMPER	8Q-2
ALIGNMENT	2-1,2-5
ALIGNMENT, FOG LAMP	8L-9
ALIGNMENT, HEADLAMP	8L-10,8L-7
ALIGNMENT SCREEN PREPARATION, LAMP	8L-7
ALIGNMENT, VEHICLE PREPARATION FOR HEADLAMP	8L-7
ALIGNMENT, WHEEL	2-1,2-4
ALL-WHEEL ANTI-LOCK BRAKES, 8W-35	8W-1
ALUMINUM THREAD REPAIR	21-150,21-312, 21-448
AMBIENT TEMPERATURE SENSOR	8V-13,8V-4, 8V-5
AMPERAGE TEST, FUEL PUMP	14-9
AMPLIFIER, POWER	8F-14,8F-3,8F-8
ANALYSIS, GEAR CONTACT PATTERN	3-53,3-97
ANALYZING ROAD TEST	21-131,21-293
ANGLE MEASUREMENT PREPARATION, DRIVELINE	3-7
ANGLE MEASUREMENT, PROPELLER SHAFT	3-7
ANGLE, PROPELLER SHAFT JOINT	3-4
ANTENNA	8F-15,8F-4,8F-8
ANTILOCK BRAKE BLEEDING, REAR WHEEL	5-37
ANTILOCK BRAKE SYSTEM	5-40
ANTILOCK BRAKES	5-43
ANTI-LOCK BRAKES, 8W-34 REAR WHEEL	8W-1
ANTI-LOCK BRAKES, 8W-35 ALL-WHEEL	8W-1
ANTILOCK BRAKES, CONTROLLER	5-41,5-44
ANTILOCK BRAKES, CONTROLLER REAR WHEEL	5-33
ANTILOCK BRAKES, FOUR WHEEL	5-40
ANTILOCK BRAKES, REAR WHEEL	5-32
ANTILOCK CONTROL ASSEMBLY	5-44
ANTILOCK, REAR WHEEL	5-32,5-36
A-PILLAR TRIM	23-50
APPLICATION, BULB	8L-19
APPLICATION, CLUTCH DISC	6-4
APPLICATION TABLE, A/C	24-55
AREA LEAKS—INSPECTION, REAR SEAL	9-12, 9-131,9-217,9-71
ARM AND BLADE, WIPER	8K-2
ARM, LOWER SUSPENSION	2-10,2-18
ARM, ROCKER	9-124
ARM, UPPER SUSPENSION	2-10,2-19
ARM, WIPER	8K-8
ARMING	8Q-1
ARMREST UPPER INERTIA LATCH COVER, CENTER	23-13
ARMREST/CONSOLE LATCH, CENTER	23-12
ARMS AND PUSH RODS, ROCKER	9-235,9-34, 9-51
ARMS, ROCKER	9-157
ARMS, SUSPENSION	2-15,2-7
ASD AND FUEL PUMP RELAYS	14-49
ASH RECEIVER, INSTRUMENT PANEL	8E-20
ASSEMBLY, ANTILOCK CONTROL	5-44
ASSEMBLY, CYLINDER HEAD	9-251
ASSEMBLY, ENGINE	9-148,9-231,9-88
ASSEMBLY, FINAL	3-46,3-81
ASSEMBLY, INPUT CLUTCH	21-470
ASSEMBLY, INSTRUMENT PANEL	8E-27
ASSEMBLY, LOW/REVERSE CLUTCH	21-481
ASSEMBLY, PARK BRAKE PEDAL	5-22
ASSEMBLY, PISTON AND CONNECTING ROD	9-102,9-245,9-252
ASSEMBLY, SOLENOID AND PRESSURE SWITCH	21-438,21-450
ASSIST HANDLE, QUAD CAB	23-59
AUDIO SYSTEM	8F-1,8F-4
AUDIO SYSTEM, 8W-47	8W-1
AUDIO SYSTEMS	8F-21
AUTO SHUTDOWN (ASD) RELAY—PCM OUTPUT	14-40
AUTOMATIC BELT TENSIONER	7-8
AUTOMATIC BELT TENSIONER 3.9L/5.9L ENGINES	7-50
AUTOMATIC BELT TENSIONER—4.7L ENGINE	7-51
AUTOMATIC DAY/NIGHT MIRROR	8T-5,8T-6
AUTOMATIC DAY/NIGHT MIRROR SYSTEM	8T-5
AUTOMATIC SHUTDOWN (ASD) RELAY	14-51
AUTOMATIC SHUTDOWN (ASD) RELAY SENSE—PCM INPUT	14-34
AUTOMATIC TRANSMISSION, 42RE	21-84,21-85
AUTOMATIC TRANSMISSION, 45RFE	21-416, 21-417
AUTOMATIC TRANSMISSION, 46RE	21-247
AUTOMATIC TRANSMISSION DIAGNOSIS	21-129,21-291
AUTOMATIC TRANSMISSION GENERAL DIAGNOSIS, 45RFE	21-441
AUTOMATIC TRANSMISSION OIL COOLERS	7-8
AXLE, 8 1/4	3-59
AXLE, 8 1/4 AND 9 1/4	3-59
AXLE, 8 1/4 AND 9 1/4 INCH	3-100
AXLE, 8 1/4 INCH	3-99
AXLE, 9 1/4 INCH	3-99
AXLE, C205F	3-31,3-55
AXLE COMPONENTS	3-48
AXLE DRIVESHAFTS, FRONT	3-18
AXLE, FRONT	3-36
AXLE PINION GEAR DEPTH, 8 1/4	3-92
AXLE PINION GEAR DEPTH, 9 1/4	3-93
AXLE, REAR	3-69
AXLE SEAL AND BEARING, 8 1/4 AND 9 1/4	3-71
AXLE SHAFT	3-39,3-70
AXLE SHAFT SEAL AND BEARING	3-39
AXLE SKID PLATE, FRONT	13-8
AXLE WITH LEAF SPRINGS, ADJUSTMENT AT	3-17
AXLES, 8 1/4 AND 9 1/4	3-100,3-91
AXLES, 9 1/4	3-61
BACK, BENCH SEAT	23-9
BACK, BUCKET SEAT	23-11
BACK, CONSOLE LID/SEAT	23-13
BACK PAD/COVER, BENCH SEAT	23-10
BACK PAD/COVER, BUCKET SEAT	23-11
BACK PANEL TRIM, REAR CAB	23-51
BACKLASH, DIFFERENTIAL BEARING PRELOAD AND GEAR	3-50,3-96
BACKLITE	23-6
BACKLITE SLIDING VENT GLASS	23-52
BACK—CLUB CAB, REAR SEAT	23-14
BACK-UP LAMP BULBS, TAIL, BRAKE, TURN SIGNAL	8L-12
BACK-UP LAMP, TAIL, STOP, TURN SIGNAL	8L-16
BALANCE, TIRE AND WHEEL	22-9
BALL JOINT, LOWER	2-15,2-7
BALL JOINT, UPPER	2-15,2-8
BAND ADJUSTMENT, FRONT	21-396
BAND ADJUSTMENT, REAR	21-396
BAND ADJUSTMENTS	21-228
BAND OPERATION, AIR TESTING TRANSMISSION CLUTCH	21-134,21-296
BANDS	21-123,21-285
BAR, STABILIZER	2-11,2-15,2-20,2-23,2-24,2-7
BAR, TORSION	2-17
BARS, TORSION	2-15
BASE BRAKE BLEEDING	5-11
BASE BRAKE SYSTEM	5-1,5-5
BASE BRAKES	5-31
BASE COAT/CLEAR COAT FINISH	23-1
BATTERY	8A-1,8A-19,8A-21,8A-22,8A-5
BATTERY CABLES	8A-14,8A-3
BATTERY CHARGING	8A-16
BATTERY FEED (TCM)	21-438
BATTERY HOLD DOWNS	8A-18,8A-4
BATTERY REPLACEMENT, REMOTE KEYLESS ENTRY TRANSMITTER	8P-8
BATTERY TEMPERATURE SENSOR	8C-2,8C-5
BATTERY TRAY	8A-20,8A-4

Description	Group-Page
BATTERY VOLTAGE—PCM INPUT	14-34
BEARING, 8 1/4 AND 9 1/4 AXLE SEAL	3-71
BEARING ADJUSTMENT, CENTER	3-17
BEARING, AXLE SHAFT SEAL	3-39
BEARING, CENTER	3-11,3-2
BEARING, CLUTCH RELEASE	6-3
BEARING NOISE	3-35,3-68
BEARING, OUTPUT SHAFT FRONT	21-159, 21-322
BEARING, OUTPUT SHAFT REAR	21-159,21-321
BEARING, PILOT	6-14
BEARING PRELOAD AND GEAR BACKLASH, DIFFERENTIAL	3-50,3-96
BEARING, RELEASE	6-14
BEARINGS, CAMSHAFT	9-100,9-242,9-45
BEARINGS, CRANKSHAFT MAIN	9-100,9-144, 9-180,9-210,9-243,9-45,9-5,9-65
BEARINGS, DIFFERENTIAL SIDE	3-41,3-75
BEARINGS—FITTING, CONNECTING ROD	9-142, 9-22,9-227,9-81
BEARINGS—FITTING, CRANKSHAFT MAIN	9-227,9-25,9-82
BELT BUCKLE, SEAT	23-53
BELT DIAGNOSIS, ACCESSORY DRIVE	7-24
BELT REPLACEMENT—4.7L ENGINE, ACCESSORY	7-48
BELT RETRACTOR, FRONT SEAT	23-52
BELT RETRACTOR—CLUB CAB, REAR SEAT	23-54
BELT RETRACTOR—QUAD CAB, SEAT	23-52
BELT SWITCH, DRIVER SEAT	8U-2,8U-5
BELT TENSIONER 3.9L/5.9L ENGINES, AUTOMATIC	7-50
BELT TENSIONER, AUTOMATIC	7-8
BELT TENSIONER—2.5L, ACCESSORY DRIVE	7-50
BELT TENSIONER—4.7L ENGINE, AUTOMATIC	7-51
BELT TENSION—2.5L ENGINE, ACCESSORY DRIVE	7-56
BELT WEATHERSTRIP, FRONT DOOR INNER	23-34
BELT WEATHERSTRIP, FRONT DOOR OUTER	23-34
BELT WEATHERSTRIP, REAR DOOR INNER	23-40
BELT WEATHERSTRIP, REAR DOOR OUTER	23-41
BELT/BUCKLE—CLUB CAB, REAR SEAT	23-53
BELT—2.5L ENGINE, ACCESSORY DRIVE	7-47
BELT—3.9L/5.9L ENGINES, ACCESSORY DRIVE	7-49
BELTS, ENGINE ACCESSORY DRIVE	7-5
BENCH SEAT	23-8
BENCH SEAT BACK	23-9
BENCH SEAT BACK PAD/COVER	23-10
BENCH SEAT CUSHION/COVER	23-10
BENCH SEAT TRACK	23-9
BETTS CONNECTORS, TERMINAL/ CONNECTOR REPAIR—THOMAS	8W-10
BEZEL, CLUSTER	8E-12
BEZEL, INSTRUMENT PANEL LOWER	8E-21
BEZEL, SHIFT	23-55
BIN DOOR, GARAGE DOOR OPENER STORAGE	8V-12
BIN, GARAGE DOOR OPENER STORAGE	8V-3
BIN, SUNGLASSES STORAGE	8V-12,8V-4
BLADE, FAN	7-55
BLADE, WIPER	8K-8
BLADE, WIPER ARM	8K-2
BLEEDING ABS BRAKE SYSTEM	5-43
BLEEDING, BASE BRAKE	5-11
BLEEDING, MASTER CYLINDER	5-11
BLEEDING, REAR WHEEL ANTILOCK BRAKE	5-37
BLOCK, 8W-11 FUSE/RELAY	8W-1
BLOCK, 8W-12 JUNCTION	8W-1
BLOCK, CYLINDER	9-110,9-122,9-195,9-254, 9-52
BLOCK HEATER	7-9
BLOCK HEATER, ENGINE	7-46
BLOCK, JUNCTION	8O-2,8O-6
BLOCK, RELAY AND FUSE	8O-4,8O-8
BLOWER MOTOR	24-13,24-2,24-24
BLOWER MOTOR RELAY	24-13,24-2,24-25
BLOWER MOTOR RESISTOR	24-14,24-25,24-3
BLOWER MOTOR SWITCH	24-15,24-3
BODY	23-116
BODY CODE PLATE	Intro.-2
BODY COMPONENT SERVICE	23-17
BODY COMPONENTS	23-18
BODY GAP AND FLUSH MEASUREMENTS	23-106
BODY LUBRICATION	23-20
BODY MINIMUM AIR FLOW CHECK PROCEDURE, THROTTLE	14-50,14-51
BODY OPENING DIMENSIONS	23-113
BODY SIDE MOLDINGS	23-45
BODY, THROTTLE	14-42
BODY, VALVE	21-155,21-160,21-222,21-229, 21-261,21-317,21-322,21-388,21-396,21-424, 21-449,21-464,21-479,21-98
BODY—2.5L ENGINE, THROTTLE	14-53
BODY—3.9/5.2/5.9L ENGINES, THROTTLE	14-52
BODY—4.7L V-8 ENGINE, THROTTLE	14-53
BOOSTER, MASTER CYLINDER/POWER	5-8
BOOSTER, POWER BRAKE	5-15,5-3
BOOT, FLOOR SHIFT	23-54
BOOT SEAL	19-14
BOOTS, C/V JOINT	3-22,3-30
BORE—HONING, CYLINDER	9-135,9-16,9-221, 9-76
BOX, CARGO	23-48
BOX COMPONENTS, GLOVE	8E-25
BOX, GLOVE	8E-24
BOX LAMP AND SWITCH, GLOVE	8E-23
BOX LATCH STRIKER, GLOVE	8E-23
BOX, REAR STORAGE	23-56
BOX SEAL, CARGO	23-49
B-PILLAR TRIM	23-50
BRACKET, INSTRUMENT PANEL CENTER SUPPORT	8E-19
BRACKET, REARVIEW MIRROR SUPPORT	23-57
BRAKE BLEEDING, BASE	5-11
BRAKE BLEEDING, REAR WHEEL ANTILOCK	5-37
BRAKE BOOSTER, POWER	5-15,5-3
BRAKE CABLE, FRONT PARK	5-21
BRAKE CABLE TENSIONER, PARK	5-29
BRAKE CABLES, REAR PARK	5-22
BRAKE CALIPER, DISC	5-16,5-24
BRAKE DRUM	5-10
BRAKE DRUM MACHINING	5-12
BRAKE FLUID	5-30
BRAKE FLUID CONTAMINATION	5-10
BRAKE FLUID LEVEL	5-11
BRAKE HOSES AND LINES	5-5
BRAKE LAMP SWITCH; BRAKES	5-13,5-36,5-8
BRAKE LAMP SWITCH; SPEED CONTROL SYSTEM	8H-3
BRAKE LINE AND HOSES	5-10
BRAKE PEDAL	5-14,5-2
BRAKE PEDAL ASSEMBLY, PARK	5-22
BRAKE, REAR DRUM	5-27,5-28
BRAKE RELEASE HANDLE, PARK	8E-18
BRAKE ROTOR, DISC	5-19,5-9
BRAKE SHOES, DISC	5-17
BRAKE SHOES, REAR	5-19
BRAKE SUPPORT PLATE	5-21
BRAKE SWITCH—PCM INPUT	14-34
BRAKE SYSTEM	5-2
BRAKE SYSTEM, ANTILOCK	5-40
BRAKE SYSTEM, BASE	5-1,5-5
BRAKE SYSTEM, BLEEDING ABS	5-43
BRAKE TUBE FLARING	5-12
BRAKE, TURN SIGNAL AND BACK-UP LAMP BULBS, TAIL	8L-12
BRAKE WARNING LAMP, RED	5-3,5-8
BRAKE WARNING LAMPS	5-35
BRAKES, 8W-34 REAR WHEEL ANTI-LOCK	8W-1
BRAKES, 8W-35 ALL-WHEEL ANTI-LOCK	8W-1
BRAKES, ANTILOCK	5-43
BRAKES, BASE	5-31
BRAKES, CONTROLLER ANTILOCK	5-41,5-44
BRAKES, CONTROLLER REAR WHEEL ANTILOCK	5-33
BRAKES, DRUM	5-4
BRAKES, FOUR WHEEL ANTILOCK	5-40
BRAKES, FRONT DISC	5-4
BRAKES, PARKING	5-5
BRAKES, REAR WHEEL ANTILOCK	5-32
BREAKER, CIRCUIT; POWER SEAT SYSTEMS	8R-2
BREAKER, CIRCUIT; POWER WINDOW SYSTEMS	8S-2,8S-3
BREATHER/FILTER, CRANKCASE	25-29
BUCKET SEAT	23-10
BUCKET SEAT BACK	23-11
BUCKET SEAT BACK PAD/COVER	23-11
BUCKET SEAT CUSHION/COVER	23-11
BUCKET SEAT TRACK	23-11
BUCKLE, SEAT BELT	23-53
BUFFING, AND POLISHING, FINESSE SANDING	23-1
BULB APPLICATION	8L-19
BULB, CARGO LAMP	8L-12
BULB, CENTER HIGH MOUNTED STOP LAMP (CHMSL)	8L-12
BULB, DOME LAMP	8L-13
BULB, FOG LAMP	8L-11
BULB, FRONT SIDE MARKER LAMP	8L-12
BULB, HEADLAMP	8L-11
BULB, LICENSE PLATE LAMP	8L-13
BULB, OVERHEAD CONSOLE READING LAMP	8L-13
BULB SERVICE, LAMP	8L-11
BULB, UNDERHOOD LAMP	8L-13
BULBS, PARK AND TURN SIGNAL LAMP	8L-12
BULBS, TAIL, BRAKE, TURN SIGNAL AND BACK-UP LAMP	8L-12
BUMPER FASCIA, FRONT	13-1
BUMPER, FRONT	13-1
BUMPER, REAR	13-2
BUMPERS	13-1
BURNT FLUID, CAUSES OF	21-129,21-291, 21-441
BUS (+/-) CIRCUITS-PCM OUTPUTS, CCD	14-40
BUSHING AND SEAL, REAR RETAINER	21-509, 21-536
BUSHING, DISTRIBUTOR DRIVE SHAFT	9-242, 9-94
BUSHING, OUTPUT SHAFT	21-6
BUSHING, OVERDRIVE HOUSING	21-159,21-321
BUSHING, REAR HOUSING YOKE	21-43
BYPASS HOSE—3.9/5.9L ENGINES, WATER PUMP	7-37
BYPASS—3.9/5.9L ENGINES, WATER PUMP	7-6
BYPASS—4.7L, WATER PUMP	7-6
C205F AXLE	3-31,3-55
CAB ASSIST HANDLE, QUAD	23-59
CAB BACK PANEL TRIM, REAR	23-51
CAB, REAR SEAT BACK—CLUB	23-14
CAB, REAR SEAT BELT RETRACTOR—CLUB	23-54
CAB, REAR SEAT BELT/BUCKLE—CLUB	23-53
CAB REAR SEAT CUSHION COVER, QUAD	23-16
CAB, REAR SEAT CUSHION—CLUB	23-15
CAB, REAR SEAT QUAD	23-16
CAB, SEAT BELT RETRACTOR—QUAD	23-52
CABLE ADJUSTMENT, TRANSMISSION THROTTLE VALVE	21-226,21-394
CABLE (EXCEPT 4.7L ENGINE), SERVO	8H-6
CABLE, FRONT PARK BRAKE	5-21
CABLE, GEARSHIFT	21-130,21-153,21-227, 21-292,21-316,21-395,21-442,21-454,21-482
CABLE, HOOD RELEASE	23-23
CABLE RESISTANCE, SPARK PLUG	8D-28
CABLE, SERVO	8H-3
CABLE, TAILGATE CHECK	23-46
CABLE, TEMPERATURE CONTROL	24-47,24-55
CABLE TENSIONER, PARK BRAKE	5-29
CABLE, THROTTLE	14-25
CABLE—4.7L V-8 ENGINE, SERVO	8H-6
CABLE—4.7L V-8 ENGINE, THROTTLE	14-27
CABLES, BATTERY	8A-14,8A-3
CABLES, REAR PARK BRAKE	5-22
CABLES, SPARK PLUG	8D-12,8D-2,8D-8
CALIBRATION, COMPASS	8V-6
CALIPER	5-27
CALIPER, DISC BRAKE	5-16,5-24
CAM, TURN SIGNAL CANCELLING	8J-2
CAM/OVERDRIVE PISTON RETAINER, OVERRUNNING CLUTCH	21-189,21-355
CAMSHAFT	9-124,9-240,9-42,9-98
CAMSHAFT BEARINGS	9-100,9-242,9-45
CAMSHAFT PIN REPLACEMENT	9-43
CAMSHAFT PLUGS, ENGINE CORE OIL	9-106, 9-250
CAMSHAFT POSITION SENSOR	8D-17,8D-5

Description	Group-Page
CAMSHAFT POSITION SENSOR—4.7L ENGINE	8D-18,8D-6
CAMSHAFTS—IN VEHICLE	9-173
CANCELLING CAM, TURN SIGNAL	8J-2
CANISTER, EVAPORATION (EVAP)	25-24,25-33
CANISTER PURGE SOLENOID, DUTY CYCLE EVAP	25-25,25-33
CAP, DISTRIBUTOR	8D-7
CAP, FUEL TANK FILLER TUBE	14-24,14-7
CAP, RADIATOR	7-55
CAP, RADIATOR PRESSURE	7-10
CAPACITIES, COOLING SYSTEM	7-56
CAPACITIES, FLUID	0-2
CAPACITIES, LUBRICANTS	0-1
CAPACITY, FUEL TANK	14-27
CAPACITY TEST, FUEL PUMP	14-8
CAP—PRESSURE TESTING, RADIATOR	7-26
CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF CHECK, RADIATOR	7-26
CARDAN JOINT, DOUBLE	3-13
CARDAN UNIVERSAL JOINT, SINGLE	3-11
CARGO BOX	23-48
CARGO BOX SEAL	23-49
CARGO LAMP	8L-16
CARGO LAMP BULB	8L-12
CARPET OR MAT, FLOOR	23-57
CARTRIDGE FUSE, GENERATOR	8O-2,8O-6
CASE COVER OIL SEAL, TIMING	9-39
CASE COVER, TIMING	9-40
CASE, NV231 TRANSFER	21-506,21-511,21-527
CASE, NV242 TRANSFER	21-533,21-538,21-558
CASE SHIFTER, TRANSFER	21-509,21-535
CASE SKID PLATE, TRANSFER	13-9
CASE, TRANSFER	21-508,21-535
CATALYTIC CONVERTER	11-1,11-10,11-5
CAUTIONS, AND WARNINGS, NOTES	8W-7
CAUTIONS, SERVICE WARNINGS &	5-2
CCD BUS (+/-) CIRCUITS-PCM OUTPUTS	14-40
CENTER ARMREST UPPER INERTIA LATCH COVER	23-13
CENTER ARMREST/CONSOLE LATCH	23-12
CENTER BEARING	3-11,3-2
CENTER BEARING ADJUSTMENT	3-17
CENTER HIGH MOUNTED STOP LAMP (CHMSL)	8L-15
CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB	8L-12
CENTER, POWER DISTRIBUTION	8O-1,8O-4
CENTER SEAT CUSHION/COVER	23-13
CENTER SEAT/CONSOLE	23-12
CENTER SUPPORT BRACKET, INSTRUMENT PANEL	8E-19
CENTERING, CLOCKSPRING	8M-15
CENTRAL TIMER MODULE; CHIME/ BUZZER WARNING SYSTEMS	8U-1,8U-3
CENTRAL TIMER MODULE; INSTRUMENT PANEL SYSTEMS	8E-25,8E-4
CENTRAL TIMER MODULE; POWER LOCK SYSTEMS	8P-2,8P-6
CENTRAL TIMER MODULE; VEHICLE THEFT/SECURITY SYSTEMS	8Q-2
CENTRAL TIMER MODULE; WIPER AND WASHER SYSTEMS	8K-3
CENTRAL TIMER MODULE, 8W-45	8W-1
CHAIN AND SPROCKETS, TIMING	9-166,9-40
CHAIN AND TENSIONER, TIMING	9-97
CHAIN COVER, TIMING	9-165,9-238,9-96
CHAIN STRETCH, MEASURING TIMING	9-225
CHAIN STRETCH—MEASURING, TIMING	9-79
CHAIN TENSIONER, TIMING	9-64
CHAIN, TIMING	9-240
CHAIN—MEASURING WEAR, TIMING	9-139
CHANGE, LUBRICANT	3-36,3-69
CHANNELS, FRONT DOOR LOWER GLASS RUN	23-36
CHANNELS, REAR DOOR GLASS RUN	23-40
CHARGE, REFRIGERANT SYSTEM	24-20
CHARGING, BATTERY	8A-16
CHARGING SYSTEM	8C-1,8C-2
CHARGING SYSTEM, 8W-20	8W-1
CHARGING SYSTEM, ON-BOARD DIAGNOSTIC TEST	8C-3
CHART, TORQUE; BRAKES	5-31,5-39,5-47
CHART, TORQUE; CHARGING SYSTEM	8C-6
CHART, TORQUE; EMISSION CONTROL SYSTEMS	25-35
CHART, TORQUE; FUEL SYSTEM	14-29,14-66
CHART, TORQUE; IGNITION SYSTEM	8D-28
CHART, TORQUE; SPEED CONTROL SYSTEM	8H-9
CHART, TORQUE; STEERING	19-10,19-14,19-19
CHART, TORQUE; SUSPENSION	2-12,2-22,2-26
CHART, TORQUE; TIRES AND WHEELS	22-11
CHARTS, CLUTCH DIAGNOSIS	6-8
CHARTS—RE TRANSMISSION, DIAGNOSIS TABLES	21-136,21-298
CHECK CABLE, TAILGATE	23-46
CHECK, COOLANT LEVEL	7-28
CHECK, COOLANT—ROUTINE LEVEL	7-27
CHECK, FLUID LEVEL	21-147,21-309,21-445
CHECK, OIL PUMP VOLUME	21-149,21-311, 21-447
CHECK PROCEDURE, THROTTLE BODY MINIMUM AIR FLOW	14-50,14-51
CHECK, RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF	7-26
CHECK, RADIATOR COOLANT FLOW	7-21
CHECK VALVE SERVICE, CONVERTER DRAINBACK	21-148,21-310
CHECK VALVE, VACUUM	24-48,24-9
CHECKING ENGINE OIL PRESSURE	9-132
CHECKS, PRELIMINARY	7-14
CHIME WARNING SYSTEM	8U-1
CHIME WARNING SYSTEM SWITCHES	8U-5
CIGAR LIGHTER	8E-11,8E-4
CIGAR LIGHTER AND POWER OUTLET	8E-22
CIRCUIT ACTUATION TEST MODE	25-2
CIRCUIT BREAKER; POWER SEAT SYSTEMS	8R-2
CIRCUIT BREAKER; POWER WINDOW SYSTEMS	8S-2,8S-3
CIRCUIT FUNCTIONS	8W-4
CIRCUIT INFORMATION	8W-4
CIRCUIT SENSE—PCM INPUT, IGNITION	14-35
CIRCUITS, NON-MONITORED	25-22
CIRCUITS, SPEED CONTROL SOLENOID	8H-2
CIRCUITS-PCM OUTPUTS, CCD BUS (+/-)	14-40
CLAMPS, FUEL TUBES/LINES/HOSES	14-7
CLAMPS, HOSE	7-10
CLASSIFICATION OF LUBRICANTS	0-1
CLEANER ELEMENT (FILTER), AIR	14-62
CLEANING TIRES	22-6
CLEARANCE, SIDE GEAR	3-99
CLOCKSPRING	8M-13,8M-4
CLOCKSPRING CENTERING	8M-15
CLUNKING NOISE DURING ACCELERATION	3-20
CLUSTER, 8W-40 INSTRUMENT	8W-1
CLUSTER BEZEL	8E-12
CLUSTER COMPONENTS, INSTRUMENT	8E-14
CLUSTER, INSTRUMENT; CHIME/BUZZER WARNING SYSTEMS	8U-2,8U-5
CLUSTER, INSTRUMENT; INSTRUMENT PANEL SYSTEMS	8E-13,8E-2,8E-6
CLUTCH	6-1
CLUTCH AND BAND OPERATION, AIR TESTING TRANSMISSION	21-134,21-296
CLUTCH ASSEMBLY, INPUT	21-470
CLUTCH ASSEMBLY, LOW/REVERSE	21-481
CLUTCH CAM/OVERDRIVE PISTON RETAINER, OVERRUNNING	21-189,21-355
CLUTCH COIL, COMPRESSOR	24-16
CLUTCH COMPONENT LUBRICATION	6-10
CLUTCH, COMPRESSOR	24-27,24-4
CLUTCH CONTAMINATION	6-5
CLUTCH COVER AND DISC	6-12
CLUTCH COVER AND DISC RUNOUT	6-7
CLUTCH DIAGNOSIS CHARTS	6-8
CLUTCH DIAGNOSTIC INFORMATION	6-5
CLUTCH DISC	6-2
CLUTCH DISC APPLICATION	6-4
CLUTCH ENGAGEMENT, ELECTRONICALLY MODULATED CONVERTER	21-423
CLUTCH FLUID LEVEL	6-11
CLUTCH FLYWHEEL RUNOUT	6-7
CLUTCH, FRONT	21-119,21-195,21-225,21-281, 21-362,21-393
CLUTCH HOUSING MISALIGNMENT	6-7
CLUTCH HOUSING REPLACEMENT	6-13
CLUTCH HYDRAULIC FLUID	6-11
CLUTCH HYDRAULIC LINKAGE	6-15
CLUTCH LINKAGE, HYDRAULIC	6-4
CLUTCH, LOW/REVERSE	21-478
CLUTCH MISALIGNMENT	6-7
CLUTCH OPERATION, AIR TESTING TRANSMISSION	21-444
CLUTCH, OVERDRIVE	21-122,21-284
CLUTCH, OVERRUNNING	21-122,21-284
CLUTCH PEDAL	6-16
CLUTCH PEDAL POSITION SWITCH	6-5
CLUTCH PRESSURE PLATE	6-2
CLUTCH, REAR	21-120,21-197,21-225,21-282, 21-364,21-393
CLUTCH RELAY, COMPRESSOR	24-16,24-30, 24-4
CLUTCH RELEASE BEARING	6-3
CLUTCH RELEASE OR ENGAGEMENT, IMPROPER	6-7
CLUTCH SWITCH, LOW PRESSURE CYCLING	24-18,24-43,24-7
CLUTCHES, HOLDING	21-431
CLUTCHES, INPUT	21-428
CLUTCH/LOW-REVERSE DRUM/ OVERDRIVE PISTON RETAINER, OVERRUNNING	21-223,21-391
COAT FINISH, BASE COAT/CLEAR	23-1
COAT HOOK	23-58
COAT/CLEAR COAT FINISH, BASE	23-1
CODE DESCRIPTIONS, DIAGNOSTIC TROUBLE	25-3
CODE, PAINT	23-1
CODE PLATE, BODY	Intro.-2
CODES, DIAGNOSTIC TROUBLE	25-2
COIL, COMPRESSOR CLUTCH	24-16
COIL, EVAPORATOR	24-34,24-5
COIL (EXCEPT 4.7L ENGINE), IGNITION	8D-2
COIL RESISTANCE—4.7L V-8 ENGINE, IGNITION	8D-28
COIL RESISTANCE—EXCEPT 4.7L ENGINE, IGNITION	8D-28
COIL SPRING	2-8
COIL SPRINGS	2-7
COIL—2.5L ENGINE, IGNITION	8D-14
COIL—3.9/5.2/5.9L ENGINES, IGNITION	8D-14
COIL—4.7L ENGINE, IGNITION	8D-15,8D-3
COLUMN OPENING COVER, STEERING	8E-16
COLUMN SHIFT INTERLOCK	8D-26
COLUMN, STEERING	19-15,19-16
COMBINATION FLASHER	8J-3,8J-5
COMBINATION VALVE	5-14,5-3,5-9
COMBUSTION PRESSURE LEAKAGE TEST, CYLINDER	9-10,9-129,9-216,9-70
COMPASS CALIBRATION	8V-6
COMPASS DEMAGNETIZING	8V-7
COMPASS MINI-TRIP COMPUTER	8V-11,8V-2, 8V-5
COMPASS VARIATION ADJUSTMENT	8V-6
COMPONENTS—IN VEHICLE SERVICE, CYLINDER HEAD	9-89
COMPRESSION PRESSURE TEST, CYLINDER	9-128,9-215,9-70,9-9
COMPRESSOR	24-15,24-26,24-4
COMPRESSOR CLUTCH	24-27,24-4
COMPRESSOR CLUTCH COIL	24-16
COMPRESSOR CLUTCH RELAY	24-16,24-30,24-4
COMPUTER, COMPASS MINI-TRIP	8V-11,8V-2, 8V-5
CONDENSER	24-31,24-5
CONDITIONER CONTROL, HEATER AND AIR	24-6
CONDITIONER, HEATER AND AIR	24-5
CONDITIONING/HEATER, 8W-42 AIR	8W-1
CONDITIONS, SPARK PLUG	8D-9
CONNECTING ROD ASSEMBLY, PISTON	9-102, 9-245,9-252
CONNECTING ROD BEARINGS—FITTING	9-142, 9-22,9-227,9-81
CONNECTING ROD INSPECTION, PISTON	9-108
CONNECTING ROD, PISTON	9-123,9-182,9-193, 9-210,9-49,9-64
CONNECTIONS, INTERMITTENT AND POOR	8W-8
CONNECTOR AND TERMINAL REPLACEMENT	8W-12
CONNECTOR INFORMATION	8W-7
CONNECTOR LOCATIONS, 8W-90	8W-1
CONNECTOR PIN-OUTS, 8W-80	8W-1
CONNECTOR REPLACEMENT	8W-11
CONNECTOR/GROUND LOCATIONS	8W-1
CONNECTOR—PCM INPUT AND OUTPUT, DATA LINK	14-40

Description	Group-Page
CONNECTORS, TERMINAL/CONNECTOR REPAIR-MOLEX	8W-10
CONNECTORS, TERMINAL/CONNECTOR REPAIR—THOMAS AND BETTS	8W-10
CONSOLE, 8W-49 OVERHEAD	8W-1
CONSOLE, FLOOR	23-56
CONSOLE LID/SEAT BACK	23-13
CONSOLE, OVERHEAD	8V-1,8V-9
CONSOLE READING AND COURTESY LAMP HOUSING, OVERHEAD	8V-11
CONSOLE READING AND COURTESY LAMP LENS, OVERHEAD	8V-8
CONSOLE READING AND COURTESY LAMP, OVERHEAD	8V-3
CONSOLE READING LAMP BULB, OVERHEAD	8L-13
CONSOLE READING LAMP, OVERHEAD	8L-17
CONSOLE SYSTEM, OVERHEAD	8V-1
CONSOLE SYSTEMS, OVERHEAD	8V-13
CONTACT PATTERN ANALYSIS, GEAR	3-53,3-97
CONTAMINATION, BRAKE FLUID	5-10
CONTAMINATION, CLUTCH	6-5
CONTAMINATION, FLUID	21-129,21-291,21-441
CONTROL, 8W-33 VEHICLE SPEED	8W-1
CONTROL ASSEMBLY, ANTILOCK	5-44
CONTROL CABLE, TEMPERATURE	24-47,24-55
CONTROL, HEATER AND AIR CONDITIONER	24-6
CONTROL, HEATER-A/C	24-17,24-35
CONTROL (IAC) MOTOR—2.5L ENGINE, IDLE AIR	14-56
CONTROL (IAC) MOTOR—3.9/5.2/5.9L ENGINES, IDLE AIR	14-56
CONTROL (IAC) MOTOR—4.7L V–8 ENGINE, IDLE AIR	14-56
CONTROL (IAC) MOTOR—PCM OUTPUT, IDLE AIR	14-41
CONTROL INFORMATION (VECI) LABEL, VEHICLE EMISSION	25-29
CONTROL, LINE PRESSURE	21-439
CONTROL MODULE, AIRBAG	8M-12,8M-3
CONTROL MODULE (PCM), POWERTRAIN; FUEL SYSTEM	14-31,14-59
CONTROL MODULE (PCM), POWERTRAIN; TRANSMISSION AND TRANSFER CASE	21-125,21-287
CONTROL MODULE, TRANSMISSION	21-435
CONTROL RELAY, TRANSMISSION	21-438
CONTROL SERVO, SPEED	8H-2,8H-4
CONTROL SOLENOID CIRCUITS, SPEED	8H-2
CONTROL SWITCHES, SPEED	8H-2,8H-5
CONTROL SYSTEM, 8W-31 TRANSMISSION	8W-1
CONTROL SYSTEM, EVAPORATION	25-23
CONTROL SYSTEM, SPEED	8H-1
CONTROL UNIT, HYDRAULIC	5-41
CONTROLLER	5-37
CONTROLLER ANTILOCK BRAKES	5-41,5-44
CONTROLLER REAR WHEEL ANTILOCK BRAKES	5-33
CONTROLS, EVAPORATIVE EMISSION	25-23
CONTROLS, OVERDRIVE ELECTRICAL	21-130, 21-292
CONVERTER, CATALYTIC	11-1,11-10,11-5
CONVERTER CLUTCH ENGAGEMENT, ELECTRONICALLY MODULATED	21-423
CONVERTER DRAINBACK CHECK VALVE SERVICE	21-148,21-310
CONVERTER DRAINBACK VALVE	21-125,21-287
CONVERTER HOUSING FLUID LEAK DIAGNOSIS	21-135,21-297,21-444
CONVERTER, TORQUE	21-152,21-256,21-314, 21-418,21-453,21-93
COOLANT	7-30
COOLANT FLOW CHECK, RADIATOR	7-21
COOLANT LEVEL CHECK	7-28
COOLANT RESERVE/OVERFLOW SYSTEM	7-5
COOLANT RESERVE/OVERFLOW TANK	7-30
COOLANT SELECTION AND ADDITIVES	7-30
COOLANT SERVICE	7-27
COOLANT TEMPERATURE SENSOR—2.5L ENGINE, ENGINE	14-63
COOLANT TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES, ENGINE	14-62
COOLANT TEMPERATURE SENSOR—4.7L V-8 ENGINE, ENGINE	14-63
COOLANT TEMPERATURE SENSOR—PCM INPUT, ENGINE	14-35
COOLANT—ADDING ADDITIONAL	7-28
COOLANT—LOW LEVEL AERATION	7-27
COOLANT—ROUTINE LEVEL CHECK	7-27
COOLER LINES, TRANSMISSION OIL	7-44
COOLERS AND TUBES, FLUSHING	21-149, 21-311,21-447
COOLERS, AUTOMATIC TRANSMISSION OIL	7-8
COOLING	7-57
COOLING FAN, ELECTRIC	7-20
COOLING FAN RELAY—PCM OUTPUT, RADIATOR	14-42
COOLING SYSTEM	7-15,7-2
COOLING SYSTEM CAPACITIES	7-56
COOLING SYSTEM FAN	7-11
COOLING SYSTEM—CLEANING/REVERSE FLUSHING	7-29
COOLING SYSTEM—DEAERATION	7-27
COOLING SYSTEM—DRAINING AND FILLING	7-28
COOLING SYSTEM—TESTING FOR LEAKS	7-21
CORE, HEATER	24-41,24-7
CORE OIL AND CAMSHAFT PLUGS, ENGINE	9-106,9-250
CORE PLUGS, ENGINE	9-191
COUPLER, REFRIGERANT LINE	24-45
COUPLERS, REFRIGERANT LINE	24-8
COURTESY LAMP HOUSING, OVERHEAD CONSOLE READING	8V-11
COURTESY LAMP LENS, OVERHEAD CONSOLE READING	8V-8
COURTESY LAMP, OVERHEAD CONSOLE READING	8V-3
COVER AND DISC, CLUTCH	6-12
COVER AND DISC RUNOUT, CLUTCH	6-7
COVER, CENTER ARMREST UPPER INERTIA LATCH	23-13
COVER, COWL TRIM	23-49
COVER, CYLINDER HEAD	9-108,9-124,9-155, 9-235,9-251,9-33,9-89
COVER, DOOR SILL TRIM	23-50
COVER, DRIVER SIDE AIRBAG MODULE TRIM	8M-8
COVER GASKET, CYLINDER HEAD	9-209,9-63
COVER, INSTRUMENT PANEL TOP	8E-30
COVER OIL SEAL, TIMING CASE	9-39
COVER, QUAD CAB REAR SEAT CUSHION	23-16
COVER, STEERING COLUMN OPENING	8E-16
COVER, STRUCTURAL	9-147
COVER, STRUCTURAL DUST	9-124
COVER, TIMING CASE	9-40
COVER, TIMING CHAIN	9-165,9-238,9-96
COWL GRILLE	23-23
COWL SEAL	23-24
COWL TRIM COVER	23-49
CRANKCASE BREATHER/FILTER	25-29
CRANKCASE VENTILATION (CCV) SYSTEM—2.5L ENGINE	25-29
CRANKCASE VENTILATION (PCV) SYSTEM—3.9/5.2/5.9L ENGINE, POSITIVE	25-26
CRANKCASE VENTILATION (PCV) SYSTEM—4.7L ENGINE, POSITIVE	25-27
CRANKSHAFT	9-103,9-122,9-185,9-210,9-246, 9-3,9-64
CRANKSHAFT DAMPER	9-164
CRANKSHAFT FRONT OIL SEAL	9-103
CRANKSHAFT MAIN BEARINGS	9-100,9-144, 9-180,9-210,9-243,9-45,9-5,9-65
CRANKSHAFT MAIN BEARINGS—FITTING	9-227,9-25,9-82
CRANKSHAFT OIL SEAL—FRONT	9-189,9-247
CRANKSHAFT OIL SEAL—REAR	9-191
CRANKSHAFT OIL SEALS	9-209,9-5,9-65
CRANKSHAFT OIL SEALS—REAR	9-248
CRANKSHAFT POSITION SENSOR—2.5L ENGINE	8D-16,8D-3
CRANKSHAFT POSITION SENSOR—3.9/5.2/5.9L ENGINES	8D-16
CRANKSHAFT POSITION SENSOR—3.9L V-6 ENGINE	8D-4
CRANKSHAFT POSITION SENSOR—4.7L ENGINE	8D-5
CRANKSHAFT POSITION SENSOR—4.7L V-8 ENGINE	8D-17
CRANKSHAFT POSITION SENSOR—5.2/5.9L V-8 ENGINE	8D-4
CRANKSHAFT REAR OIL SEALS	9-104
CURVES, GOVERNOR PRESSURE	21-128,21-290
CUSHION COVER, QUAD CAB REAR SEAT	23-16
CUSHION/COVER, BENCH SEAT	23-10
CUSHION/COVER, BUCKET SEAT	23-11
CUSHION/COVER, CENTER SEAT	23-13
CUSHION—CLUB CAB, REAR SEAT	23-15
CUT-OFF SWITCH, DUAL FUNCTION HIGH PRESSURE SWITCH/HIGH PRESSURE	24-18
CUT-OFF SWITCH, HIGH PRESSURE	24-42,24-7
C/V JOINT	3-28
C/V JOINT BOOTS	3-22,3-30
C/V JOINT DRIVESHAFT	3-30
C/V JOINT, INNER	3-23
C/V JOINT, OUTER	3-24
CYCLE EVAP CANISTER PURGE SOLENOID, DUTY	25-25,25-33
CYCLING CLUTCH SWITCH, LOW PRESSURE	24-18,24-43,24-7
CYLINDER BLEEDING, MASTER	5-11
CYLINDER BLOCK	9-110,9-122,9-195,9-254,9-52
CYLINDER BORE—HONING	9-135,9-16,9-221, 9-76
CYLINDER COMBUSTION PRESSURE LEAKAGE TEST	9-10,9-129,9-216,9-70
CYLINDER COMPRESSION PRESSURE TEST	9-128,9-215,9-70,9-9
CYLINDER, FRONT DOOR LOCK	23-33
CYLINDER HEAD	9-108,9-123,9-209,9-236,9-3, 9-36,9-51,9-64
CYLINDER HEAD ASSEMBLY	9-251
CYLINDER HEAD COMPONENTS—IN VEHICLE SERVICE	9-89
CYLINDER HEAD COVER	9-108,9-124,9-155, 9-235,9-251,9-33,9-89
CYLINDER HEAD COVER GASKET	9-209,9-63
CYLINDER HEAD, ENGINE	9-52
CYLINDER HEAD GASKET FAILURE DIAGNOSIS	9-10,9-129,9-215,9-70
CYLINDER HEADS	9-158,9-193,9-90
CYLINDER, IGNITION SWITCH AND KEY	8D-23
CYLINDER, IGNITION SWITCH AND KEY LOCK	8D-11,8D-6
CYLINDER, MASTER	5-15,5-3
CYLINDER RESERVOIR, MASTER	5-23
CYLINDER SWITCH, DOOR LOCK	8Q-3,8Q-4
CYLINDER, WHEEL	5-21,5-25,5-28
CYLINDER/POWER BOOSTER, MASTER	5-8
CYLINDERS, LOCK	23-33
DAMAGED OR WORN THREADS, REPAIR	9-135, 9-16,9-221,9-76
DAMPER, CRANKSHAFT	9-164
DAMPER, VIBRATION	9-238,9-39,9-95
DAMPER—2.5L ENGINE, FUEL INJECTOR RAIL/FUEL	14-19,14-6
DATA LINK CONNECTOR—PCM INPUT AND OUTPUT	14-40
DAY/NIGHT MIRROR, AUTOMATIC	8T-5,8T-6
DAY/NIGHT MIRROR SYSTEM, AUTOMATIC	8T-5
DAYTIME RUNNING LAMP MODULE (DRLM)	8L-18
DEFINITION, TRIP	25-21
DEFOGGER SWITCH	8N-2,8N-3,8N-5
DEFOGGER SYSTEM	8N-2
DEFOGGER SYSTEM, REAR WINDOW	8N-1
DELIVERY SYSTEM, FUEL	14-1
DEMAGNETIZING, COMPASS	8V-7
DEPTH, 8 1/4 AXLE PINION GEAR	3-92
DEPTH, 9 1/4 AXLE PINION GEAR	3-93
DEPTH, PINION GEAR	3-48
DESCRIPTION	0-1
DESCRIPTIONS, DIAGNOSTIC TROUBLE CODE	25-3
DETECTION PUMP (LDP), LEAK	25-25,25-32, 25-34
DEVICES, ELECTROSTATIC DISCHARGE (ESD) SENSITIVE	8W-8
DIAGNOSIS, 45RFE AUTOMATIC TRANSMISSION GENERAL	21-441
DIAGNOSIS, ACCESSORY DRIVE BELT	7-24
DIAGNOSIS, AUTOMATIC TRANSMISSION	21-129,21-291
DIAGNOSIS CHARTS, CLUTCH	6-8

Description	Group-Page

DIAGNOSIS, CONVERTER HOUSING FLUID LEAK . . . 21-135,21-297,21-444
DIAGNOSIS, CYLINDER HEAD GASKET FAILURE . . . 9-10,9-129,9-215,9-70
DIAGNOSIS, EXHAUST SYSTEM . . . 11-3
DIAGNOSIS, HYDRAULIC LASH ADJUSTER NOISE . . . 9-131
DIAGNOSIS, INTAKE MANIFOLD LEAKAGE . . . 9-128,9-215,9-70,9-9
DIAGNOSIS, LAMP . . . 8L-3
DIAGNOSIS, NV231 . . . 21-507
DIAGNOSIS, NV242 . . . 21-534
DIAGNOSIS, PRELIMINARY . . . 21-130,21-292, 21-441
DIAGNOSIS, SHOCK . . . 2-16,2-8
DIAGNOSIS, SYSTEM . . . 8L-3
DIAGNOSIS TABLES AND CHARTS—RE TRANSMISSION . . . 21-136,21-298
DIAGNOSIS—GASOLINE ENGINES, SERVICE . . . 9-211,9-66
DIAGNOSIS—INTRODUCTION, ENGINE . . . 9-125, 9-210,9-6,9-65
DIAGNOSIS—LUBRICATION, SERVICE . . . 9-128,9-9
DIAGNOSIS—MECHANICAL, SERVICE . . . 9-127,9-8
DIAGNOSIS—PERFORMANCE, SERVICE . . . 9-125, 9-6
DIAGNOSTIC INFORMATION, CLUTCH . . . 6-5
DIAGNOSTIC TEST FOR CHARGING SYSTEM, ON-BOARD . . . 8C-3
DIAGNOSTIC TROUBLE CODE DESCRIPTIONS . . . 25-3
DIAGNOSTIC TROUBLE CODES . . . 25-2
DIAGNOSTICS (OBD), ON-BOARD . . . 7-12
DIAGNOSTICS, ON-BOARD . . . 25-1
DIFFERENTIAL . . . 3-40,3-74
DIFFERENTIAL, 8 1/4 TRAC-LOK™ . . . 3-82
DIFFERENTIAL, 9 1/4 TRAC-LOK™ . . . 3-87
DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH . . . 3-50,3-96
DIFFERENTIAL NOISE, TRAC–LOK™ . . . 3-68
DIFFERENTIAL SIDE BEARINGS . . . 3-41,3-75
DIFFERENTIAL, STANDARD . . . 3-32,3-47,3-64,3-82
DIMENSIONS, BODY OPENING . . . 23-113
DIMENSIONS, FRAME . . . 13-11
DIODE REPLACEMENT . . . 8W-14
DISARMING . . . 8Q-2
DISC APPLICATION, CLUTCH . . . 6-4
DISC BRAKE CALIPER . . . 5-16,5-24
DISC BRAKE ROTOR . . . 5-19,5-9
DISC BRAKE SHOES . . . 5-17
DISC BRAKES, FRONT . . . 5-4
DISC, CLUTCH . . . 6-2
DISC, CLUTCH COVER . . . 6-12
DISC ROTOR MACHINING . . . 5-12
DISC RUNOUT, CLUTCH COVER . . . 6-7
DISCHARGE (ESD) SENSITIVE DEVICES, ELECTROSTATIC . . . 8W-8
DISCHARGE LINE, SUCTION . . . 24-46
DISPLAY TEST MODE, STATE . . . 25-2
DISTANCE—PCM INPUT, VEHICLE SPEED . . . 14-40
DISTRIBUTION, 8W-10 POWER . . . 8W-1
DISTRIBUTION, 8W-15 GROUND . . . 8W-1
DISTRIBUTION CENTER, POWER . . . 8O-1,8O-4
DISTRIBUTION SYSTEM, POWER . . . 8O-1
DISTRIBUTOR . . . 8D-2
DISTRIBUTOR CAP . . . 8D-7
DISTRIBUTOR DRIVE SHAFT BUSHING . . . 9-242, 9-94
DISTRIBUTOR ROTOR . . . 8D-7
DISTRIBUTOR—2.5L ENGINE . . . 8D-18
DISTRIBUTORS—3.9/5.2/5.9L ENGINES . . . 8D-21
DOME LAMP . . . 8L-17
DOME LAMP BULB . . . 8L-13
DOOR ADJUSTMENT, REAR . . . 23-61
DOOR AJAR SWITCH . . . 8Q-3,8Q-4
DOOR AJAR SWITCH, DRIVER . . . 8U-2,8U-3
DOOR, FRONT . . . 23-31
DOOR, FUEL FILLER . . . 23-45
DOOR, GARAGE DOOR OPENER STORAGE BIN . . . 8V-12
DOOR GLASS, FRONT . . . 23-34
DOOR GLASS, REAR . . . 23-41
DOOR GLASS RUN CHANNELS, REAR . . . 23-40
DOOR GLASS RUN WEATHERSTRIP, FRONT . . . 23-36
DOOR GLASS RUN WEATHERSTRIP, REAR . . . 23-40
DOOR, HEATER-A/C HOUSING . . . 24-40
DOOR HINGE, FRONT . . . 23-31
DOOR HINGE, REAR . . . 23-37
DOOR INNER BELT WEATHERSTRIP, FRONT . . . 23-34
DOOR INNER BELT WEATHERSTRIP, REAR . . . 23-40
DOOR IN/OUT, FRONT . . . 23-60
DOOR INSIDE HANDLE ACTUATOR, FRONT . . . 23-34
DOOR INSIDE HANDLE ACTUATOR, REAR . . . 23-40
DOOR LATCH, FRONT . . . 23-33,23-60
DOOR LATCH, REAR . . . 23-39
DOOR LATCH STRIKER, FRONT . . . 23-34
DOOR LATCH STRIKER, REAR . . . 23-39
DOOR LOCK CYLINDER, FRONT . . . 23-33
DOOR LOCK CYLINDER SWITCH . . . 8Q-3,8Q-4
DOOR LOCKS, 8W-61 POWER . . . 8W-1
DOOR LOWER GLASS RUN CHANNELS, FRONT . . . 23-36
DOOR OPENER STORAGE BIN DOOR, GARAGE . . . 8V-12
DOOR OPENER STORAGE BIN, GARAGE . . . 8V-3
DOOR OPENING WEATHERSTRIP, REAR . . . 23-41
DOOR OUTER BELT WEATHERSTRIP, FRONT . . . 23-34
DOOR OUTER BELT WEATHERSTRIP, REAR . . . 23-41
DOOR OUTSIDE HANDLE, FRONT . . . 23-32
DOOR OUTSIDE HANDLE, REAR . . . 23-39
DOOR QUARTER GLASS, REAR . . . 23-42
DOOR, REAR . . . 23-37
DOOR SEAL, FRONT . . . 23-36
DOOR SECONDARY SEAL, FRONT . . . 23-37
DOOR SECONDARY SEAL, REAR . . . 23-41
DOOR SILL TRIM COVER . . . 23-50
DOOR TRIM PANEL, FRONT . . . 23-29
DOOR TRIM PANEL, REAR . . . 23-37
DOOR UP/DOWN, FRONT . . . 23-61
DOOR VACUUM ACTUATOR, MODE . . . 24-44
DOOR WATERDAM, FRONT . . . 23-30
DOOR WATERDAM, REAR . . . 23-38
DOOR WINDOW REGULATOR, FRONT . . . 23-35
DOOR WINDOW REGULATOR, REAR . . . 23-42
DOUBLE CARDAN JOINT . . . 3-13
DOWNS, BATTERY HOLD . . . 8A-18,8A-4
DRAINBACK CHECK VALVE SERVICE, CONVERTER . . . 21-148,21-310
DRAINBACK VALVE, CONVERTER . . . 21-125,21-287
DRAINCOCK, RADIATOR . . . 7-52
DRAW FUSE, IGNITION-OFF . . . 8O-3,8O-7
DRB SCAN TOOL . . . 7-13
DRIVE BELT DIAGNOSIS, ACCESSORY . . . 7-24
DRIVE BELT TENSIONER—2.5L, ACCESSORY . . . 7-50
DRIVE BELT TENSION—2.5L ENGINE, ACCESSORY . . . 7-56
DRIVE BELT—2.5L ENGINE, ACCESSORY . . . 7-47
DRIVE BELT—3.9L/5.9L ENGINES, ACCESSORY . . . 7-49
DRIVE BELTS, ENGINE ACCESSORY . . . 7-5
DRIVE, IDLER SHAFT—TIMING . . . 9-172
DRIVE SHAFT BUSHING, DISTRIBUTOR . . . 9-242, 9-94
DRIVE SYSTEM, TIMING . . . 9-123
DRIVE VEHICLE TOWING, TWO WHEEL . . . 0-12
DRIVE, VISCOUS FAN . . . 7-11,7-53
DRIVELINE ANGLE MEASUREMENT PREPARATION . . . 3-7
DRIVELINE SNAP . . . 3-36,3-68
DRIVE—3.9L/4.7L AND 5.9L ENGINES, VISCOUS FAN . . . 7-23
DRIVER DOOR AJAR SWITCH . . . 8U-2,8U-3
DRIVER SEAT BELT SWITCH . . . 8U-2,8U-5
DRIVER SIDE AIRBAG MODULE . . . 8M-2,8M-6
DRIVER SIDE AIRBAG MODULE TRIM COVER . . . 8M-8
DRIVER UNLOCK RELAY . . . 8P-10,8P-4
DRIVESHAFT, C/V JOINT . . . 3-30
DRIVESHAFT, FRONT . . . 3-21
DRIVESHAFTS, FRONT AXLE . . . 3-18
DRUM, BRAKE . . . 5-10
DRUM BRAKE, REAR . . . 5-27,5-28
DRUM BRAKES . . . 5-4
DRUM MACHINING, BRAKE . . . 5-12
DRUM/OVERDRIVE PISTON RETAINER, OVERRUNNING CLUTCH/LOW-REVERSE . . . 21-223,21-391
DUAL FUNCTION HIGH PRESSURE SWITCH/HIGH PRESSURE CUT-OFF SWITCH . . . 24-18
DUCTS AND OUTLETS . . . 24-32
DUST COVER, STRUCTURAL . . . 9-124
DUTY CYCLE EVAP CANISTER PURGE SOLENOID . . . 25-25,25-33
EFFECTS OF INCORRECT FLUID LEVEL . . . 21-129, 21-291,21-440
ELECTRIC COOLING FAN . . . 7-20
ELECTRIC FAN . . . 7-54
ELECTRICAL CONTROLS, OVERDRIVE . . . 21-130, 21-292
ELECTRONIC GOVERNOR . . . 21-126,21-288
ELECTRONIC VOLTAGE REGULATOR . . . 8C-2
ELECTRONICALLY MODULATED CONVERTER CLUTCH ENGAGEMENT . . . 21-423
ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES . . . 8W-8
ELEMENT (FILTER), AIR CLEANER . . . 14-62
EMISSION CONTROL INFORMATION (VECI) LABEL, VEHICLE . . . 25-29
EMISSION CONTROLS, EVAPORATIVE . . . 25-23
EMISSION SYSTEM . . . 25-1
ENABLING . . . 8Q-1
END, TIE ROD . . . 19-11
ENGAGEMENT, ELECTRONICALLY MODULATED CONVERTER CLUTCH . . . 21-423
ENGAGEMENT, IMPROPER CLUTCH RELEASE OR . . . 6-7
ENGINE . . . 9-119,9-2,9-205,9-29,9-60
ENGINE, 2.5L . . . 9-1,9-57
ENGINE, 3.9L . . . 9-116,9-59
ENGINE, 4.7L . . . 9-118,9-196,9-200
ENGINE, 5.9L . . . 9-204,9-259
ENGINE, ACCESSORY BELT REPLACEMENT—4.7L . . . 7-48
ENGINE, ACCESSORY DRIVE BELT TENSION—2.5L . . . 7-56
ENGINE, ACCESSORY DRIVE BELT—2.5L . . . 7-47
ENGINE ACCESSORY DRIVE BELTS . . . 7-5
ENGINE ASSEMBLY . . . 9-148,9-231,9-88
ENGINE, AUTOMATIC BELT TENSIONER—4.7L . . . 7-51
ENGINE BLOCK HEATER . . . 7-46
ENGINE, CAMSHAFT POSITION SENSOR—4.7L . . . 8D-18,8D-6
ENGINE COOLANT TEMPERATURE SENSOR—2.5L ENGINE . . . 14-63
ENGINE COOLANT TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES . . . 14-62
ENGINE COOLANT TEMPERATURE SENSOR—4.7L V-8 ENGINE . . . 14-63
ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT . . . 14-35
ENGINE CORE OIL AND CAMSHAFT PLUGS . . . 9-106,9-250
ENGINE CORE PLUGS . . . 9-191
ENGINE, CRANKCASE VENTILATION (CCV) SYSTEM—2.5L . . . 25-29
ENGINE, CRANKSHAFT POSITION SENSOR—2.5L . . . 8D-16,8D-3
ENGINE, CRANKSHAFT POSITION SENSOR—3.9L V-6 . . . 8D-4
ENGINE, CRANKSHAFT POSITION SENSOR—4.7L . . . 8D-5
ENGINE, CRANKSHAFT POSITION SENSOR—4.7L V-8 . . . 8D-17
ENGINE, CRANKSHAFT POSITION SENSOR—5.2/5.9L V-8 . . . 8D-4
ENGINE CYLINDER HEAD . . . 9-52
ENGINE DIAGNOSIS—INTRODUCTION . . . 9-125, 9-210,9-6,9-65
ENGINE, DISTRIBUTOR—2.5L . . . 8D-18
ENGINE, ENGINE COOLANT TEMPERATURE SENSOR—2.5L . . . 14-63
ENGINE, ENGINE COOLANT TEMPERATURE SENSOR—4.7L V-8 . . . 14-63
ENGINE, ENGINE FIRING ORDER—2.5L 4-CYLINDER . . . 8D-27
ENGINE, ENGINE FIRING ORDER—3.9L V-6 . . . 8D-27
ENGINE, ENGINE FIRING ORDER—4.7L V-8 . . . 8D-27

Description	Group-Page
ENGINE FIRING ORDER—2.5L 4-CYLINDER ENGINE	8D-27
ENGINE FIRING ORDER—3.9L V-6 ENGINE	8D-27
ENGINE FIRING ORDER—4.7L V-8 ENGINE	8D-27
ENGINE FIRING ORDER—5.2L/5.9L V-8 ENGINES	8D-27
ENGINE FRONT MOUNTS	9-228,9-82
ENGINE, FUEL INJECTOR RAIL/FUEL DAMPER—2.5L	14-19,14-6
ENGINE, FUEL INJECTOR RAIL—4.7L	14-5
ENGINE, FUEL INJECTOR RAIL—4.7L V–8	14-20
ENGINE, IDLE AIR CONTROL (IAC) MOTOR—2.5L	14-56
ENGINE, IDLE AIR CONTROL (IAC) MOTOR—4.7L V–8	14-56
ENGINE, IGNITION COIL RESISTANCE—4.7L V-8	8D-28
ENGINE, IGNITION COIL RESISTANCE—EXCEPT 4.7L	8D-28
ENGINE, IGNITION COIL—2.5L	8D-14
ENGINE, IGNITION COIL—4.7L	8D-15,8D-3
ENGINE, INTAKE MANIFOLD AIR TEMPERATURE SENSOR—2.5L	14-64
ENGINE, INTAKE MANIFOLD AIR TEMPERATURE SENSOR—4.7L V-8	14-64
ENGINE LUBRICATION SYSTEM	9-120,9-205, 9-60
ENGINE, MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—2.5L	14-58
ENGINE, MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—4.7L V–8	14-58
ENGINE MOUNT—REAR	9-146
ENGINE MOUNTS—FRONT	9-28
ENGINE MOUNTS—LEFT AND RIGHT	9-145
ENGINE NON A/C, IDLER PULLEY—4.7L	7-52
ENGINE OIL	9-133,9-14,9-219,9-74
ENGINE OIL LEAK INSPECTION	9-11,9-130
ENGINE OIL PAN	9-209
ENGINE OIL PRESSURE	9-13,9-218,9-73
ENGINE OIL PRESSURE, CHECKING	9-132
ENGINE OIL PRESSURE SENDING UNIT	9-188
ENGINE, OXYGEN SENSOR—2.5L	14-61
ENGINE, OXYGEN SENSOR—EXCEPT 2.5L	14-59
ENGINE, PCV VALVE TEST—3.9/5.2/5.9L	25-30
ENGINE, PCV VALVE—4.7L V-8	25-32
ENGINE, PCV VALVE/PCV SYSTEM TEST—4.7L V-8	25-31
ENGINE PERFORMANCE	9-219
ENGINE, POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—3.9/5.2/5.9L	25-26
ENGINE, POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—4.7L	25-27
ENGINE, PUMP RESERVOIR - 2.5L	19-8
ENGINE REAR SUPPORT	9-230,9-29,9-84
ENGINE, SERVO CABLE—4.7L V-8	8H-6
ENGINE SPECIFICATIONS	9-53
ENGINE SPECIFICATIONS, 3.9L	9-111
ENGINE SPECIFICATIONS, 5.9L	9-255
ENGINE, THERMOSTAT— 4.7L	7-43
ENGINE, THERMOSTAT—2.5L	7-42
ENGINE, THERMOSTAT—4.7L	7-7
ENGINE, THROTTLE BODY—2.5L	14-53
ENGINE, THROTTLE BODY—4.7L V-8	14-53
ENGINE, THROTTLE CABLE—4.7L V-8	14-27
ENGINE, THROTTLE POSITION SENSOR (TPS)—4.7L V-8	14-54
ENGINE, THROTTLE POSITION SENSOR—2.5L	14-55
ENGINE TIMING—VERIFICATION	9-137
ENGINE, VISUAL INSPECTION—2.5L	14-46
ENGINE, WATER PUMP—2.5L	7-30
ENGINES, ACCESSORY DRIVE BELT—3.9L/5.9L	7-49
ENGINES, AUTOMATIC BELT TENSIONER 3.9L/5.9L	7-50
ENGINES, CRANKSHAFT POSITION SENSOR—3.9/5.2/5.9L	8D-16
ENGINES, DISTRIBUTORS—3.9/5.2/5.9L	8D-21
ENGINES, ENGINE COOLANT TEMPERATURE SENSOR—3.9/5.2/5.9L	14-62
ENGINES, ENGINE FIRING ORDER—5.2L/5.9L V-8	8D-27
ENGINES, FUEL INJECTOR RAIL—3.9/5.2/5.9L	14-18
ENGINES, FUEL RAIL—3.9/5.2/5.9L	14-5
ENGINES, IDLE AIR CONTROL (IAC) MOTOR—3.9/5.2/5.9L	14-56
ENGINES, IDLER PULLEY—2.5L/3.9L/5.9L	7-51
ENGINES, IGNITION COIL—3.9/5.2/5.9L	8D-14
ENGINES, INTAKE MANIFOLD AIR TEMPERATURE SENSOR—3.9/5.2/5.9L	14-64
ENGINES, MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—3.9/5.2/5.9L	14-57
ENGINES ONLY, TASK MANAGER—GASOLINE POWERED	25-16
ENGINES, POWER STEERING PUMP - 3.9L & 5.9L	19-8
ENGINES, SERVICE DIAGNOSIS—GASOLINE	9-211,9-66
ENGINES, THERMOSTAT—3.9L/5.9L	7-39,7-7
ENGINES, THROTTLE BODY—3.9/5.2/5.9L	14-52
ENGINES, THROTTLE POSITION SENSOR (TPS)—3.9/5.2/5.9L	14-54
ENGINES, VISCOUS FAN DRIVE—3.9L/4.7L AND 5.9L	7-23
ENGINES, VISUAL INSPECTION—3.9/5.2/5.9L	14-42
ENGINES, WATER PUMP 4.7L	7-35
ENGINES, WATER PUMP BYPASS HOSE—3.9/5.9L	7-37
ENGINES, WATER PUMP BYPASS—3.9/5.9L	7-6
ENGINES, WATER PUMP—3.9L/5.9L	7-32
ENTRY RECEIVER, REMOTE KEYLESS	8P-4
ENTRY SYSTEM, POWER LOCK SYSTEM AND REMOTE KEYLESS	8P-4
ENTRY SYSTEM, REMOTE KEYLESS	8P-1
ENTRY TRANSMITTER BATTERY REPLACEMENT, REMOTE KEYLESS	8P-8
ENTRY TRANSMITTER PROGRAMMING, REMOTE KEYLESS	8P-9
ENTRY TRANSMITTER, REMOTE KEYLESS	8P-3,8P-8
EQUIPMENT IDENTIFICATION PLATE	Intro.-3
EQUIPMENT, REFRIGERANT SYSTEM SERVICE	24-20
EVACUATE, REFRIGERANT SYSTEM	24-20
EVAP CANISTER PURGE SOLENOID, DUTY CYCLE	25-25,25-33
EVAPORATION CONTROL SYSTEM	25-23
EVAPORATION (EVAP) CANISTER	25-24,25-33
EVAPORATIVE EMISSION CONTROLS	25-23
EVAPORATOR COIL	24-34,24-5
EXCITER RING	5-39,5-47
EXCITER RING, REAR WHEEL SPEED SENSOR	5-34
EXCITER RING, RING GEAR	3-75
EXHAUST HEAT SHIELDS	11-1
EXHAUST MANIFOLD	9-111,9-124,9-193,9-208, 9-234,9-254,9-3,9-33,9-53,9-63,9-87
EXHAUST MANIFOLDS	9-153
EXHAUST PIPE	11-10,11-3
EXHAUST SYSTEM	11-1
EXHAUST SYSTEM DIAGNOSIS	11-3
EXHAUSTER, AIR	23-44
EXHAUSTER—CAB, AIR	23-44
EXTENSION PIPE	11-6
EXTERIOR LAMPS	8L-19
EXTERIOR MIRRORS	8T-1
EXTERIOR NAMEPLATES	23-27
FAILURE DIAGNOSIS, CYLINDER HEAD GASKET	9-10,9-129,9-215,9-70
FAN BLADE	7-55
FAN, COOLING SYSTEM	7-11
FAN DRIVE, VISCOUS	7-11,7-53
FAN DRIVE—3.9L/4.7L AND 5.9L ENGINES, VISCOUS	7-23
FAN, ELECTRIC	7-54
FAN, ELECTRIC COOLING	7-20
FAN RELAY—PCM OUTPUT, RADIATOR COOLING	14-42
FASCIA, FRONT BUMPER	13-1
FASTENER IDENTIFICATION	Intro.-4
FASTENER USAGE	Intro.-7
FEED (TCM), BATTERY	21-438
FENDER, LEFT FRONT	23-24
FENDER, RIGHT FRONT	23-26
FILL LEVEL, LUBRICANT	21-507,21-534
FILL PROCEDURE, TRANSMISSION	21-148, 21-310,21-446
FILLER DOOR, FUEL	23-45
FILLER TUBE CAP, FUEL TANK	14-24,14-7
FILLING, COOLING SYSTEM—DRAINING	7-28
FILTER, FUEL PUMP INLET	14-16
FILTER REPLACEMENT, FLUID	21-147,21-309, 21-445
FILTER/FUEL PRESSURE REGULATOR, FUEL	14-4
FINAL ASSEMBLY	3-46,3-81
FINESSE SANDING, BUFFING, AND POLISHING	23-1
FINISH, BASE COAT/CLEAR COAT	23-1
FIRING ORDER—2.5L 4-CYLINDER ENGINE, ENGINE	8D-27
FIRING ORDER—3.9L V-6 ENGINE, ENGINE	8D-27
FIRING ORDER—4.7L V-8 ENGINE, ENGINE	8D-27
FIRING ORDER—5.2L/5.9L V-8 ENGINES, ENGINE	8D-27
FITTINGS, QUICK-CONNECT	14-11,14-7
FIVE VOLT SENSOR SUPPLIES—PRIMARY AND SECONDARY	14-35
FIXED ORIFICE TUBE	24-35,24-5
FLARING, BRAKE TUBE	5-12
FLASHER, COMBINATION	8J-3,8J-5
FLEXPLATE	9-187
FLOOR CARPET OR MAT	23-57
FLOOR CONSOLE	23-56
FLOOR SHIFT BOOT	23-54
FLOW AND PRESSURE, POWER STEERING	19-4
FLOW CHECK PROCEDURE, THROTTLE BODY MINIMUM AIR	14-50,14-51
FLOW CHECK, RADIATOR COOLANT	7-21
FLUID	21-255,21-418,21-92
FLUID AND FILTER REPLACEMENT	21-147, 21-309,21-445
FLUID, BRAKE	5-30
FLUID CAPACITIES	0-2
FLUID, CAUSES OF BURNT	21-129,21-291, 21-441
FLUID, CLUTCH HYDRAULIC	6-11
FLUID CONTAMINATION	21-129,21-291,21-441
FLUID CONTAMINATION, BRAKE	5-10
FLUID LEAK DIAGNOSIS, CONVERTER HOUSING	21-135,21-297,21-444
FLUID LEVEL, BRAKE	5-11
FLUID LEVEL CHECK	21-147,21-309,21-445
FLUID LEVEL, CLUTCH	6-11
FLUID LEVEL, EFFECTS OF INCORRECT	21-129, 21-291,21-440
FLUID LEVEL SENSOR, WASHER	8K-4
FLUSH MEASUREMENTS, BODY GAP	23-106
FLUSHING COOLERS AND TUBES	21-149, 21-311,21-447
FLUSHING, COOLING SYSTEM—CLEANING/REVERSE	7-29
FLYWHEEL	6-11,6-2
FLYWHEEL RUNOUT, CLUTCH	6-7
FOG LAMP	8L-14
FOG LAMP ALIGNMENT	8L-9
FOG LAMP BULB	8L-11
FORM-IN-PLACE GASKETS	9-132,9-14,9-218, 9-73
FOUR WHEEL ANTILOCK BRAKES	5-40
FOUR-WHEEL-DRIVE VEHICLE TOWING	0-12
FRAME	13-4
FRAME DIMENSIONS	13-11
FRAME SERVICE	13-7
FREQUENCY INTERFERENCE, RADIO	8F-9
FRONT AXLE	3-36
FRONT AXLE DRIVESHAFTS	3-18
FRONT AXLE SKID PLATE	13-8
FRONT BAND ADJUSTMENT	21-396
FRONT BEARING, OUTPUT SHAFT	21-159, 21-322
FRONT BUMPER	13-1
FRONT BUMPER FASCIA	13-1
FRONT CLUTCH	21-119,21-195,21-225,21-281, 21-362,21-393
FRONT DISC BRAKES	5-4
FRONT DOOR	23-31
FRONT DOOR GLASS	23-34

Description	Group-Page
FRONT DOOR GLASS RUN WEATHERSTRIP	23-36
FRONT DOOR HINGE	23-31
FRONT DOOR INNER BELT WEATHERSTRIP	23-34
FRONT DOOR IN/OUT	23-60
FRONT DOOR INSIDE HANDLE ACTUATOR	23-34
FRONT DOOR LATCH	23-33,23-60
FRONT DOOR LATCH STRIKER	23-34
FRONT DOOR LOCK CYLINDER	23-33
FRONT DOOR LOWER GLASS RUN CHANNELS	23-36
FRONT DOOR OUTER BELT WEATHERSTRIP	23-34
FRONT DOOR OUTSIDE HANDLE	23-32
FRONT DOOR SEAL	23-36
FRONT DOOR SECONDARY SEAL	23-37
FRONT DOOR TRIM PANEL	23-29
FRONT DOOR UP/DOWN	23-61
FRONT DOOR WATERDAM	23-30
FRONT DOOR WINDOW REGULATOR	23-35
FRONT DRIVESHAFT	3-21
FRONT FENDER, LEFT	23-24
FRONT FENDER, RIGHT	23-26
FRONT LIGHTING, 8W-50	8W-1
FRONT MOUNTS, ENGINE	9-228,9-82
FRONT OIL SEAL, CRANKSHAFT	9-103
FRONT OUTPUT SHAFT SEAL	21-509,21-536
FRONT PARK BRAKE CABLE	5-21
FRONT PROPELLER SHAFT	3-10
FRONT SEAL, OIL PUMP	21-453
FRONT SEAT BELT RETRACTOR	23-52
FRONT SERVO	21-224,21-392
FRONT SERVO PISTON	21-191,21-357
FRONT SIDE MARKER LAMP BULB	8L-12
FRONT SUSPENSION	2-13,2-22
FRONT SUSPENSION - 4X2	2-6
FRONT SUSPENSION - 4X4	2-14
FRONT WHEEL SPEED SENSOR - 4X2	5-45
FRONT WHEEL SPEED SENSOR - 4X4	5-46
FRONT WHEELHOUSE LINER	23-24
FUEL DELIVERY SYSTEM	14-1
FUEL FILLER DOOR	23-45
FUEL FILTER/FUEL PRESSURE REGULATOR	14-4
FUEL GAUGE SENDING UNIT	14-10,14-16,14-3
FUEL INJECTION SYSTEM	14-30
FUEL INJECTOR RAIL/FUEL DAMPER—2.5L ENGINE	14-19,14-6
FUEL INJECTOR RAIL—3.9/5.2/5.9L ENGINES	14-18
FUEL INJECTOR RAIL—4.7L ENGINE	14-5
FUEL INJECTOR RAIL—4.7L V–8 ENGINE	14-20
FUEL INJECTOR TEST	14-11
FUEL INJECTOR(S)	14-22
FUEL INJECTORS	14-4
FUEL INJECTORS—PCM OUTPUT	14-40
FUEL LEVEL SENSOR—PCM INPUT	14-35
FUEL PRESSURE LEAK DOWN TEST	14-8
FUEL PUMP	14-2
FUEL PUMP AMPERAGE TEST	14-9
FUEL PUMP CAPACITY TEST	14-8
FUEL PUMP INLET FILTER	14-16
FUEL PUMP MODULE	14-14,14-2
FUEL PUMP PRESSURE TEST	14-7
FUEL PUMP RELAY	14-52
FUEL PUMP RELAY-PCM OUTPUT	14-40
FUEL PUMP RELAYS, ASD	14-49
FUEL RAIL—3.9/5.2/5.9L ENGINES	14-5
FUEL REQUIREMENTS	14-27
FUEL SYSTEM	14-66
FUEL SYSTEM PRESSURE	14-27
FUEL SYSTEM PRESSURE RELEASE PROCEDURE	14-11
FUEL TANK	14-22,14-4
FUEL TANK CAPACITY	14-27
FUEL TANK FILLER TUBE CAP	14-24,14-7
FUEL TANK SKID PLATE—4WD VEHICLES	13-9
FUEL TUBES/LINES/HOSES AND CLAMPS	14-7
FUEL/IGNITION SYSTEMS, 8W-30	8W-1
FUNCTION HIGH PRESSURE SWITCH/ HIGH PRESSURE CUT-OFF SWITCH, DUAL	24-18
FUNCTIONS, CIRCUIT	8W-4
FUSE BLOCK, RELAY	8O-4,8O-8
FUSE, GENERATOR CARTRIDGE	8O-2,8O-6
FUSE, IGNITION-OFF DRAW	8O-3,8O-7
FUSE/RELAY BLOCK, 8W-11	8W-1
GAP AND FLUSH MEASUREMENTS, BODY	23-106
GARAGE DOOR OPENER STORAGE BIN	8V-3
GARAGE DOOR OPENER STORAGE BIN DOOR	8V-12
GASKET, CYLINDER HEAD COVER	9-209,9-63
GASKET FAILURE DIAGNOSIS, CYLINDER HEAD	9-10,9-129,9-215,9-70
GASKETS, FORM-IN-PLACE	9-132,9-14,9-218, 9-73
GAUGE SENDING UNIT, FUEL	14-10,14-16,14-3
GAUGES, PRESSURE	22-3
GEAR - 4X2, RACK & PINION STEERING	19-12
GEAR - 4X4, RACK & PINION STEERING	19-13
GEAR AND EXCITER RING, RING	3-75
GEAR BACKLASH, DIFFERENTIAL BEARING PRELOAD	3-50,3-96
GEAR CLEARANCE, SIDE	3-99
GEAR CONTACT PATTERN ANALYSIS	3-53,3-97
GEAR DEPTH, 8 1/4 AXLE PINION	3-92
GEAR DEPTH, 9 1/4 AXLE PINION	3-93
GEAR DEPTH, PINION	3-48
GEAR NOISE	3-35,3-67
GEAR, PINION	3-42,3-77
GEAR, RACK & PINION STEERING	19-11,19-14
GEAR, RING	3-41
GEAR SELECTOR INDICATOR	8E-17,8E-5
GEAR SET, PLANETARY	21-476
GEAR SHIFT LEVER	19-18
GEARSET, PLANETARY	21-123,21-285
GEARSHIFT CABLE	21-130,21-153,21-227, 21-292,21-316,21-395,21-442,21-454,21-482
GEARSHIFT MECHANISM	21-125,21-287,21-435
GEARTRAIN, PLANETARY	21-225,21-433,21-481
GEARTRAIN/OUTPUT SHAFT, PLANETARY	21-200,21-368,21-393
GENERAL DIAGNOSIS, 45RFE AUTOMATIC TRANSMISSION	21-441
GENERAL INFORMATION	3-32,3-65
GENERAL INFORMATION, 8W-01	8W-1
GENERATOR	8C-1,8C-3
GENERATOR CARTRIDGE FUSE	8O-2,8O-6
GENERATOR RATINGS	8C-6
GLASS, BACKLITE SLIDING VENT	23-52
GLASS, FRONT DOOR	23-34
GLASS HEATING GRID, REAR	8N-2,8N-3
GLASS HEATING GRID REPAIR, REAR	8N-4
GLASS, REAR DOOR	23-41
GLASS, REAR DOOR QUARTER	23-42
GLASS RUN CHANNELS, FRONT DOOR LOWER	23-36
GLASS RUN CHANNELS, REAR DOOR	23-40
GLASS RUN WEATHERSTRIP, FRONT DOOR	23-36
GLASS RUN WEATHERSTRIP, REAR DOOR	23-40
GLASS, STATIONARY	23-4
GLOVE BOX	8E-24
GLOVE BOX COMPONENTS	8E-25
GLOVE BOX LAMP AND SWITCH	8E-23
GLOVE BOX LATCH STRIKER	8E-23
GOVERNOR, ELECTRONIC	21-126,21-288
GOVERNOR PRESSURE CURVES	21-128,21-290
GOVERNOR SOLENOID AND PRESSURE SENSOR	21-154,21-317
GRID, OUTSIDE MIRROR HEATING	8N-2
GRID, REAR GLASS HEATING	8N-2,8N-3
GRID REPAIR, REAR GLASS HEATING	8N-4
GRILLE	23-20
GRILLE, COWL	23-23
GROUND DISTRIBUTION, 8W-15	8W-1
GROUND—PCM INPUT, SIGNAL	14-39
GROUNDS, POWER	14-38
GUIDE AND SEAL, VALVE	9-17
GUIDES AND SPRINGS, VALVES	9-77
GUIDES, VALVE	9-123
HANDLE ACTUATOR, FRONT DOOR INSIDE	23-34
HANDLE ACTUATOR, REAR DOOR INSIDE	23-40
HANDLE, FRONT DOOR OUTSIDE	23-32
HANDLE, PARK BRAKE RELEASE	8E-18
HANDLE, QUAD CAB ASSIST	23-59
HANDLE, REAR DOOR OUTSIDE	23-39
HANDLE, TAILGATE LATCH RELEASE	23-47
HARD SHIFTING	21-39,21-4
HAZARD WARNING SWITCH, TURN SIGNAL SWITCH	8J-2,8J-5,8J-6
HAZARD WARNING SYSTEM	8J-1
HAZARD WARNING SYSTEMS, TURN SIGNAL	8J-4
HEAD ASSEMBLY, CYLINDER	9-251
HEAD COMPONENTS—IN VEHICLE SERVICE, CYLINDER	9-89
HEAD COVER, CYLINDER	9-108,9-124,9-155, 9-235,9-251,9-33,9-89
HEAD COVER GASKET, CYLINDER	9-209,9-63
HEAD, CYLINDER	9-108,9-123,9-209,9-236,9-3, 9-36,9-51,9-64
HEAD, ENGINE CYLINDER	9-52
HEAD GASKET FAILURE DIAGNOSIS, CYLINDER	9-10,9-129,9-215,9-70
HEAD REMOVED, VALVES AND VALVE SPRINGS—CYLINDER	9-91
HEADLAMP	8L-14
HEADLAMP ALIGNMENT	8L-10,8L-7
HEADLAMP ALIGNMENT, VEHICLE PREPARATION	8L-7
HEADLAMP BULB	8L-11
HEADLAMP RELAY; POWER LOCK SYSTEMS	8P-10,8P-4
HEADLAMP RELAY; VEHICLE THEFT/ SECURITY SYSTEMS	8Q-3,8Q-5
HEADLAMP SWITCH; CHIME/BUZZER WARNING SYSTEMS	8U-2,8U-4
HEADLAMP SWITCH; INSTRUMENT PANEL SYSTEMS	8E-13
HEADLINER	23-59
HEADS, CYLINDER	9-158,9-193,9-90
HEAT SHIELDS	11-7
HEAT SHIELDS, EXHAUST	11-1
HEAT STAKING	23-20
HEATED MIRROR SYSTEM	8N-1
HEATER AND AIR CONDITIONER	24-5
HEATER AND AIR CONDITIONER CONTROL	24-6
HEATER, BLOCK	7-9
HEATER CORE	24-41,24-7
HEATER, ENGINE BLOCK	7-46
HEATER PERFORMANCE	24-17
HEATER RELAYS, OXYGEN SENSOR	14-52
HEATER RELAYS—PCM OUTPUT, OXYGEN SENSOR	14-41
HEATER-A/C CONTROL	24-17,24-35
HEATER-A/C HOUSING	24-36
HEATER-A/C HOUSING DOOR	24-40
HEATING GRID, OUTSIDE MIRROR	8N-2
HEATING GRID, REAR GLASS	8N-2,8N-3
HEATING GRID REPAIR, REAR GLASS	8N-4
HEIGHT- 4X4, SUSPENSION	2-3
HIGH AND LOW LIMITS	25-22
HIGH MOUNTED STOP LAMP (CHMSL) BULB, CENTER	8L-12
HIGH MOUNTED STOP LAMP (CHMSL), CENTER	8L-15
HIGH PRESSURE CUT-OFF SWITCH	24-42,24-7
HIGH PRESSURE RELIEF VALVE	24-7
HIGH PRESSURE SWITCH/HIGH PRESSURE CUT-OFF SWITCH, DUAL FUNCTION	24-18
HIGH SPEED, TIRE PRESSURE	22-3
HIGHWAY SPEEDS, VIBRATION AT	3-20
HINGE, FRONT DOOR	23-31
HINGE, HOOD	23-21
HINGE, REAR DOOR	23-37
HITCH, TRAILER	13-10
HOISTING, JUMP STARTING, TOWING	0-10
HOISTING RECOMMENDATIONS	0-13
HOLD DOWNS, BATTERY	8A-18,8A-4
HOLDING CLUTCHES	21-431
HOLE REPAIR, THREADED	Intro.-7
HOOD	23-21,23-59
HOOD HINGE	23-21
HOOD LATCH	23-22,23-60
HOOD LATCH STRIKER	23-22,23-59
HOOD RELEASE CABLE	23-23
HOOD SAFETY LATCH	23-22
HOOD SEAL	23-24
HOOD SILENCER PAD	23-21
HOOK, COAT	23-58
HORN	8G-1,8G-4,8G-5
HORN RELAY; HORN SYSTEMS	8G-2,8G-3,8G-4
HORN RELAY; POWER LOCK SYSTEMS	8P-10,8P-4

Description	Group-Page
HORN RELAY; VEHICLE THEFT/SECURITY SYSTEMS	8Q-3,8Q-6
HORN SWITCH	8G-2,8G-4
HORN SYSTEM	8G-1
HORN/CIGAR LIGHTER/POWER OUTLET, 8W-41	8W-1
HOSE CLAMPS	7-10
HOSE—3.9/5.9L ENGINES, WATER PUMP BYPASS	7-37
HOSES AND LINES, BRAKE	5-5
HOSES, BRAKE LINE	5-10
HOUSING BUSHING, OVERDRIVE	21-159,21-321
HOUSING DOOR, HEATER-A/C	24-40
HOUSING FLUID LEAK DIAGNOSIS, CONVERTER	21-135,21-297,21-444
HOUSING, HEATER-A/C	24-36
HOUSING MISALIGNMENT, CLUTCH	6-7
HOUSING, OVERHEAD CONSOLE READING AND COURTESY LAMP	8V-11
HOUSING REPLACEMENT, CLUTCH	6-13
HOUSING SEAL, ADAPTER	21-453
HOUSING YOKE BUSHING, REAR	21-43
HUB/BEARING	2-11,2-21
HYDRAULIC CLUTCH LINKAGE	6-4
HYDRAULIC CONTROL UNIT	5-41
HYDRAULIC FLUID, CLUTCH	6-11
HYDRAULIC LASH ADJUSTER	9-123,9-164
HYDRAULIC LASH ADJUSTER NOISE DIAGNOSIS	9-131
HYDRAULIC LINKAGE, CLUTCH	6-15
HYDRAULIC PRESSURE TEST	21-132,21-294, 21-443
HYDRAULIC SCHEMATICS	21-229,21-397,21-482
HYDRAULIC TAPPETS	9-12,9-217,9-237,9-38, 9-51,9-72,9-92
HYDROSTATIC LOCK	9-136,9-17,9-222,9-76
IDENTIFICATION, FASTENER	Intro.-4
IDENTIFICATION NUMBER (VIN) PLATE, VEHICLE	Intro.-1
IDENTIFICATION PLATE, EQUIPMENT	Intro.-3
IDENTIFICATION, SECTION	8W-5
IDLE AIR CONTROL (IAC) MOTOR—2.5L ENGINE	14-56
IDLE AIR CONTROL (IAC) MOTOR—3.9/5.2/5.9L ENGINES	14-56
IDLE AIR CONTROL (IAC) MOTOR—4.7L V–8 ENGINE	14-56
IDLE AIR CONTROL (IAC) MOTOR—PCM OUTPUT	14-41
IDLER PULLEY—2.5L/3.9L/5.9L ENGINES	7-51
IDLER PULLEY—4.7L ENGINE NON A/C	7-52
IDLER SHAFT—TIMING DRIVE	9-172
IGNITION CIRCUIT SENSE—PCM INPUT	14-35
IGNITION COIL (EXCEPT 4.7L ENGINE)	8D-2
IGNITION COIL RESISTANCE—4.7L V-8 ENGINE	8D-28
IGNITION COIL RESISTANCE—EXCEPT 4.7L ENGINE	8D-28
IGNITION COIL—2.5L ENGINE	8D-14
IGNITION COIL—3.9/5.2/5.9L ENGINES	8D-14
IGNITION COIL—4.7L ENGINE	8D-15,8D-3
IGNITION SWITCH	19-16
IGNITION SWITCH AND KEY CYLINDER	8D-23
IGNITION SWITCH AND KEY LOCK CYLINDER	8D-11,8D-6
IGNITION SWITCH, KEY-IN	8U-2,8U-4
IGNITION SYSTEM	8D-1
IGNITION TIMING	8D-27
IGNITION-OFF DRAW FUSE	8O-3,8O-7
IMPROPER CLUTCH RELEASE OR ENGAGEMENT	6-7
INCORRECT FLUID LEVEL, EFFECTS OF	21-129, 21-291,21-440
INDEX, 8W-02 COMPONENT	8W-1
INDICATOR, GEAR SELECTOR	8E-17,8E-5
INDICATOR LAMP (MIL), MALFUNCTION	25-2
INDICATORS, TREAD WEAR	22-3
INERTIA LATCH COVER, CENTER ARMREST UPPER	23-13
INFLATION PRESSURES, TIRE	22-2
INITIAL OPERATION, POWER STEERING PUMP -	19-7
INJECTION SYSTEM, FUEL	14-30
INJECTOR RAIL/FUEL DAMPER—2.5L ENGINE, FUEL	14-19,14-6
INJECTOR RAIL—3.9/5.2/5.9L ENGINES, FUEL	14-18
INJECTOR RAIL—4.7L ENGINE, FUEL	14-5
INJECTOR RAIL—4.7L V–8 ENGINE, FUEL	14-20
INJECTOR TEST, FUEL	14-11
INJECTOR(S), FUEL	14-22
INJECTORS, FUEL	14-4
INJECTORS—PCM OUTPUT, FUEL	14-40
INLET FILTER, FUEL PUMP	14-16
INNER BELT WEATHERSTRIP, FRONT DOOR	23-34
INNER BELT WEATHERSTRIP, REAR DOOR	23-40
INNER C/V JOINT	3-23
IN/OUT, FRONT DOOR	23-60
INPUT AND OUTPUT, DATA LINK CONNECTOR—PCM	14-40
INPUT AND OUTPUT SPEED SENSORS	21-439
INPUT, AUTOMATIC SHUTDOWN (ASD) RELAY SENSE—PCM	14-34
INPUT, BATTERY VOLTAGE—PCM	14-34
INPUT, BRAKE SWITCH—PCM	14-34
INPUT CLUTCH ASSEMBLY	21-470
INPUT CLUTCHES	21-428
INPUT, ENGINE COOLANT TEMPERATURE SENSOR—PCM	14-35
INPUT, FUEL LEVEL SENSOR—PCM	14-35
INPUT, IGNITION CIRCUIT SENSE—PCM	14-35
INPUT, INTAKE MANIFOLD AIR TEMPERATURE SENSOR—PCM	14-35
INPUT, MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM	14-36
INPUT, OIL PRESSURE SENSOR—PCM	14-37
INPUT, OXYGEN SENSOR (O2S)—PCM	14-37
INPUT, POWER STEERING PRESSURE SWITCH—PCM	14-38
INPUT, SENSOR RETURN—PCM	14-39
INPUT, SIGNAL GROUND—PCM	14-39
INPUT SPEED SENSOR	21-448
INPUT, THROTTLE POSITION SENSOR (TPS)—PCM	14-39
INPUT, VEHICLE SPEED	8H-3
INPUT, VEHICLE SPEED AND DISTANCE—PCM	14-40
INSIDE HANDLE ACTUATOR, FRONT DOOR	23-34
INSIDE HANDLE ACTUATOR, REAR DOOR	23-40
INSPECTION, ENGINE OIL LEAK	9-11,9-130
INSPECTION (ENGINE OIL LEAKS IN GENERAL)	9-216,9-71
INSPECTION, PISTON AND CONNECTING ROD	9-108
INSPECTION, PRE-ALIGNMENT	2-2
INSPECTION, VEHICLE	3-20
INSPECTION, WHEEL	22-7
INSPECTION—2.5L ENGINE, VISUAL	14-46
INSPECTION—3.9/5.2/5.9L ENGINES, VISUAL	14-42
INSTALLATION METHODS AND PARTS USAGE	6-5
INSTALLATION, WHEEL	22-8
INSTRUMENT CLUSTER; CHIME/BUZZER WARNING SYSTEMS	8U-2,8U-5
INSTRUMENT CLUSTER; INSTRUMENT PANEL SYSTEMS	8E-13,8E-2,8E-6
INSTRUMENT CLUSTER, 8W-40	8W-1
INSTRUMENT CLUSTER COMPONENTS	8E-14
INSTRUMENT PANEL	8E-1
INSTRUMENT PANEL ASH RECEIVER	8E-20
INSTRUMENT PANEL ASSEMBLY	8E-27
INSTRUMENT PANEL CENTER SUPPORT BRACKET	8E-19
INSTRUMENT PANEL LOWER BEZEL	8E-21
INSTRUMENT PANEL LOWER REINFORCEMENT	8E-19
INSTRUMENT PANEL SYSTEM	8E-1
INSTRUMENT PANEL TOP COVER	8E-30
INTAKE MANIFOLD	9-110,9-124,9-152,9-192, 9-208,9-232,9-254,9-3,9-31,9-52,9-63,9-92
INTAKE MANIFOLD AIR TEMPERATURE SENSOR—2.5L ENGINE	14-64
INTAKE MANIFOLD AIR TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES	14-64
INTAKE MANIFOLD AIR TEMPERATURE SENSOR—4.7L V-8 ENGINE	14-64
INTAKE MANIFOLD AIR TEMPERATURE SENSOR—PCM INPUT	14-35
INTAKE MANIFOLD LEAKAGE DIAGNOSIS	9-128, 9-215,9-70,9-9
INTERFERENCE, RADIO FREQUENCY	8F-9
INTERIOR LAMPS	8L-19
INTERIOR LIGHTING, 8W-44	8W-1
INTERIOR MIRRORS	8T-5
INTERIOR TRIM PANELS	23-18
INTERLOCK, COLUMN SHIFT	8D-26
INTERMITTENT AND POOR CONNECTIONS	8W-8
INTERMITTENT WIPE RELAY	8K-11,8K-3,8K-7
INTERNATIONAL SYMBOLS; INTRODUCTION	Intro.-3
INTERNATIONAL SYMBOLS; LUBRICATION AND MAINTENANCE	0-1
INTRODUCTION; CHIME/BUZZER WARNING SYSTEMS	8U-1
INTRODUCTION; ELECTRICALLY HEATED SYSTEMS	8N-1
INTRODUCTION; POWER LOCK SYSTEMS	8P-1
INTRODUCTION; POWER MIRROR SYSTEMS	8T-1,8T-5
INTRODUCTION; POWER SEAT SYSTEMS	8R-1
INTRODUCTION; POWER WINDOW SYSTEMS	8S-1
INTRODUCTION; VEHICLE THEFT/ SECURITY SYSTEMS	8Q-1
INTRODUCTION; WIPER AND WASHER SYSTEMS	8K-1
INTRODUCTION; WIRING DIAGRAMS	8W-1
JOINT ANGLE, PROPELLER SHAFT	3-4
JOINT BOOTS, C/V	3-22,3-30
JOINT, C/V	3-28
JOINT, DOUBLE CARDAN	3-13
JOINT DRIVESHAFT, C/V	3-30
JOINT, INNER C/V	3-23
JOINT, LOWER BALL	2-15,2-7
JOINT MOLDING, ROOF	23-43
JOINT, OUTER C/V	3-24
JOINT, SINGLE CARDAN UNIVERSAL	3-11
JOINT, UPPER BALL	2-15,2-8
JOINTS, PROPELLER SHAFT	3-4
JUMP STARTING PROCEDURE	0-10
JUMP STARTING, TOWING AND HOISTING	0-10
JUNCTION BLOCK	8O-2,8O-6
JUNCTION BLOCK, 8W-12	8W-1
KEY CYLINDER, IGNITION SWITCH	8D-23
KEY LOCK CYLINDER, IGNITION SWITCH	8D-11, 8D-6
KEY-IN IGNITION SWITCH	8U-2,8U-4
KEYLESS ENTRY RECEIVER, REMOTE	8P-4
KEYLESS ENTRY SYSTEM, POWER LOCK SYSTEM AND REMOTE	8P-4
KEYLESS ENTRY SYSTEM, REMOTE	8P-1
KEYLESS ENTRY TRANSMITTER BATTERY REPLACEMENT, REMOTE	8P-8
KEYLESS ENTRY TRANSMITTER PROGRAMMING, REMOTE	8P-9
KEYLESS ENTRY TRANSMITTER, REMOTE	8P-3,8P-8
KNOCK, LOW SPEED	3-35,3-68
KNUCKLE, STEERING	2-15,2-17,2-7,2-9
LABEL, VEHICLE EMISSION CONTROL INFORMATION (VECI)	25-29
LAMP, ABS WARNING	5-43
LAMP ALIGNMENT, FOG	8L-9
LAMP ALIGNMENT SCREEN PREPARATION	8L-7
LAMP AND SWITCH, GLOVE BOX	8E-23
LAMP BULB, CARGO	8L-12
LAMP BULB, DOME	8L-13
LAMP BULB, FOG	8L-11
LAMP BULB, FRONT SIDE MARKER	8L-12
LAMP BULB, LICENSE PLATE	8L-13
LAMP BULB, OVERHEAD CONSOLE READING	8L-13
LAMP BULB SERVICE	8L-11
LAMP BULB, UNDERHOOD	8L-13
LAMP BULBS, PARK AND TURN SIGNAL	8L-12
LAMP BULBS, TAIL, BRAKE, TURN SIGNAL AND BACK-UP	8L-12
LAMP, CARGO	8L-16
LAMP (CHMSL) BULB, CENTER HIGH MOUNTED STOP	8L-12

Description	Group-Page
LAMP (CHMSL), CENTER HIGH MOUNTED STOP	8L-15
LAMP DIAGNOSIS	8L-3
LAMP, DOME	8L-17
LAMP, FOG	8L-14
LAMP HOUSING, OVERHEAD CONSOLE READING AND COURTESY	8V-11
LAMP LENS, OVERHEAD CONSOLE READING AND COURTESY	8V-8
LAMP, LICENSE PLATE	8L-16
LAMP (MIL), MALFUNCTION INDICATOR	25-2
LAMP MODULE (DRLM), DAYTIME RUNNING	8L-18
LAMP, OVERHEAD CONSOLE READING	8L-17
LAMP, OVERHEAD CONSOLE READING AND COURTESY	8V-3
LAMP, PARK, TURN SIGNAL AND SIDE MARKER	8L-14
LAMP, RED BRAKE WARNING	5-3,5-8
LAMP, SECURITY	8Q-3
LAMP SERVICE	8L-14
LAMP SWITCH, BRAKE; BRAKES	5-13,5-36,5-8
LAMP SWITCH, BRAKE; SPEED CONTROL SYSTEM	8H-3
LAMP SWITCH, STOP	5-2
LAMP SYSTEMS	8L-1,8L-18
LAMP, TAIL, STOP, TURN SIGNAL AND BACK-UP	8L-16
LAMP, UNDERHOOD	8L-16
LAMPS, BRAKE WARNING	5-35
LAMPS, EXTERIOR	8L-19
LAMPS, INTERIOR	8L-19
LASH ADJUSTER, HYDRAULIC	9-123,9-164
LASH ADJUSTER NOISE DIAGNOSIS, HYDRAULIC	9-131
LATCH, CENTER ARMREST/CONSOLE	23-12
LATCH COVER, CENTER ARMREST UPPER INERTIA	23-13
LATCH, FRONT DOOR	23-33,23-60
LATCH, HOOD	23-22,23-60
LATCH, HOOD SAFETY	23-22
LATCH, REAR DOOR	23-39
LATCH RELEASE HANDLE, TAILGATE	23-47
LATCH STRIKER, FRONT DOOR	23-34
LATCH STRIKER, GLOVE BOX	8E-23
LATCH STRIKER, HOOD	23-22,23-59
LATCH STRIKER, REAR DOOR	23-39
LATCH STRIKER, TAILGATE	23-48
LATCH, TAILGATE	23-48
LEAF SPRINGS	2-23,2-25
LEAF SPRINGS, ADJUSTMENT AT AXLE WITH	3-17
LEAK DETECTION PUMP (LDP)	25-25,25-32, 25-34
LEAK DIAGNOSIS, CONVERTER HOUSING FLUID	21-135,21-297,21-444
LEAK DOWN TEST, FUEL PRESSURE	14-8
LEAK INSPECTION, ENGINE OIL	9-11,9-130
LEAKAGE DIAGNOSIS, INTAKE MANIFOLD	9-128,9-215,9-70,9-9
LEAKAGE, PUMP	19-7
LEAKAGE TEST, CYLINDER COMBUSTION PRESSURE	9-10,9-129,9-216,9-70
LEAKS, COOLING SYSTEM—TESTING	7-21
LEAKS, REFRIGERANT SYSTEM	24-19
LEAKS, REPAIRING	22-5
LEAKS, WATER	23-18
LEAKS—INSPECTION, REAR SEAL AREA	9-12, 9-131,9-217,9-71
LEARN PROCEDURE, TRANSMISSION QUICK	21-447
LEFT FRONT FENDER	23-24
LENS, OVERHEAD CONSOLE READING AND COURTESY LAMP	8V-8
LEVEL AERATION, COOLANT—LOW	7-27
LEVEL, BRAKE FLUID	5-11
LEVEL CHECK, COOLANT	7-28
LEVEL CHECK, COOLANT—ROUTINE	7-27
LEVEL CHECK, FLUID	21-147,21-309,21-445
LEVEL, CLUTCH FLUID	6-11
LEVEL, EFFECTS OF INCORRECT FLUID	21-129, 21-291,21-440
LEVEL, LOW LUBRICANT	21-3,21-39
LEVEL, LUBRICANT AND FILL	21-507,21-534
LEVEL, REFRIGERANT OIL	24-19
LEVEL SENSOR, WASHER FLUID	8K-4
LEVEL SENSOR—PCM INPUT, FUEL	14-35
LEVER, GEAR SHIFT	19-18
LICENSE PLATE LAMP	8L-16
LICENSE PLATE LAMP BULB	8L-13
LID/SEAT BACK, CONSOLE	23-13
LIGHTER AND POWER OUTLET, CIGAR	8E-22
LIGHTER, CIGAR	8E-11,8E-4
LIGHTER/POWER OUTLET, 8W-41 HORN/CIGAR	8W-1
LIGHTING, 8W-44 INTERIOR	8W-1
LIGHTING, 8W-50 FRONT	8W-1
LIGHTING, 8W-51 REAR	8W-1
LIMITS, HIGH AND LOW	25-22
LINE AND HOSES, BRAKE	5-10
LINE COUPLER, REFRIGERANT	24-45
LINE COUPLERS, REFRIGERANT	24-8
LINE, LIQUID	24-43
LINE PRESSURE CONTROL	21-439
LINE PRESSURE SENSOR	21-449
LINE, SUCTION AND DISCHARGE	24-46
LINER, FRONT WHEELHOUSE	23-24
LINES, BRAKE HOSES	5-5
LINES, REFRIGERANT	24-8
LINES, TRANSMISSION OIL COOLER	7-44
LINK CONNECTOR—PCM INPUT AND OUTPUT, DATA	14-40
LINKAGE AND PIVOT, WIPER	8K-2,8K-9
LINKAGE, CLUTCH HYDRAULIC	6-15
LINKAGE, HYDRAULIC CLUTCH	6-4
LIQUID LINE	24-43
LOAD VALUE	25-22
LOCATION, RWAL COMPONENT	5-33
LOCATIONS, 8W-90 CONNECTOR	8W-1
LOCATIONS, 8W-95 SPLICE	8W-1
LOCATIONS, CONNECTOR/GROUND	8W-1
LOCATIONS, SEALER	23-94
LOCATIONS, SPLICE	8W-1,8W-7
LOCATIONS, STRUCTURAL ADHESIVE	23-89
LOCATIONS, WELD	23-62
LOCK CYLINDER, FRONT DOOR	23-33
LOCK CYLINDER, IGNITION SWITCH AND KEY	8D-11,8D-6
LOCK CYLINDER SWITCH, DOOR	8Q-3,8Q-4
LOCK CYLINDERS	23-33
LOCK, HYDROSTATIC	9-136,9-17,9-222,9-76
LOCK MOTOR, POWER	8P-3,8P-7,8P-9
LOCK SWITCH, POWER	8P-3,8P-5,8P-9
LOCK SYSTEM AND REMOTE KEYLESS ENTRY SYSTEM, POWER	8P-4
LOCK SYSTEM, POWER	8P-1
LOCKS, 8W-61 POWER DOOR	8W-1
LOW LIMITS, HIGH	25-22
LOW LUBRICANT LEVEL	21-3,21-39
LOW PRESSURE CYCLING CLUTCH SWITCH	24-18,24-43,24-7
LOW SPEED KNOCK	3-35,3-68
LOWER BALL JOINT	2-15,2-7
LOWER BEZEL, INSTRUMENT PANEL	8E-21
LOWER GLASS RUN CHANNELS, FRONT DOOR	23-36
LOWER REINFORCEMENT, INSTRUMENT PANEL	8E-19
LOWER SUSPENSION ARM	2-10,2-18
LOW/REVERSE CLUTCH	21-478
LOW/REVERSE CLUTCH ASSEMBLY	21-481
LUBRICANT; DIFFERENTIAL AND DRIVELINE	3-31,3-63
LUBRICANT; TRANSMISSION AND TRANSFER CASE	21-3,21-39
LUBRICANT AND FILL LEVEL	21-507,21-534
LUBRICANT CHANGE	3-36,3-69
LUBRICANT LEVEL, LOW	21-3,21-39
LUBRICANT RECOMMENDATIONS, PARTS	0-1
LUBRICANTS AND CAPACITIES	0-1
LUBRICANTS, CLASSIFICATION OF	0-1
LUBRICATION	2-16
LUBRICATION, BODY	23-20
LUBRICATION, CLUTCH COMPONENT	6-10
LUBRICATION SYSTEM	9-2
LUBRICATION SYSTEM, ENGINE	9-120,9-205, 9-60
MACHINING, BRAKE DRUM	5-12
MACHINING, DISC ROTOR	5-12
MAIN BEARINGS, CRANKSHAFT	9-100,9-144, 9-180,9-210,9-243,9-45,9-5,9-65
MAIN BEARINGS—FITTING, CRANKSHAFT	9-227,9-25,9-82
MAIN OIL SEAL, REAR	9-50
MAINTENANCE SCHEDULES	0-4
MALFUNCTION INDICATOR LAMP (MIL)	25-2
MANAGER—GASOLINE POWERED ENGINES ONLY, TASK	25-16
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—2.5L ENGINE	14-58
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—3.9/5.2/5.9L ENGINES	14-57
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—4.7L V–8 ENGINE	14-58
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT	14-36
MANIFOLD AIR TEMPERATURE SENSOR—2.5L ENGINE, INTAKE	14-64
MANIFOLD AIR TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES, INTAKE	14-64
MANIFOLD AIR TEMPERATURE SENSOR—4.7L V-8 ENGINE, INTAKE	14-64
MANIFOLD AIR TEMPERATURE SENSOR—PCM INPUT, INTAKE	14-35
MANIFOLD, EXHAUST	9-111,9-124,9-193,9-208, 9-234,9-254,9-3,9-33,9-53,9-63,9-87
MANIFOLD, INTAKE	9-110,9-124,9-152,9-192, 9-208,9-232,9-254,9-3,9-31,9-52,9-63,9-92
MANIFOLD LEAKAGE DIAGNOSIS, INTAKE	9-128,9-215,9-70,9-9
MANIFOLDS, EXHAUST	9-153
MANUAL TRANSMISSION, NV1500	21-1,21-34
MANUAL TRANSMISSION, NV3500	21-36,21-81
MARKER LAMP BULB, FRONT SIDE	8L-12
MARKER LAMP, PARK, TURN SIGNAL AND SIDE	8L-14
MASTER CYLINDER	5-15,5-3
MASTER CYLINDER BLEEDING	5-11
MASTER CYLINDER RESERVOIR	5-23
MASTER CYLINDER/POWER BOOSTER	5-8
MAT, FLOOR CARPET OR	23-57
MATCH MOUNTING	22-4
MEASUREMENT PREPARATION, DRIVELINE ANGLE	3-7
MEASUREMENT, PROPELLER SHAFT ANGLE	3-7
MEASUREMENTS, BODY GAP AND FLUSH	23-106
MEASURING TIMING CHAIN STRETCH	9-225
MECHANISM, GEARSHIFT	21-125,21-287,21-435
METRIC SYSTEM	Intro.-7
MILE, TIRE REVOLUTION PER	22-6
MINIMUM AIR FLOW CHECK PROCEDURE, THROTTLE BODY	14-50,14-51
MINI-TRIP COMPUTER, COMPASS	8V-11,8V-2, 8V-5
MIRROR, AUTOMATIC DAY/NIGHT	8T-5,8T-6
MIRROR HEATING GRID, OUTSIDE	8N-2
MIRROR, POWER	8T-1,8T-4
MIRROR, REARVIEW	23-57
MIRROR, SIDE VIEW	23-28
MIRROR SUPPORT BRACKET, REARVIEW	23-57
MIRROR SWITCH, POWER	8T-2,8T-3
MIRROR SYSTEM, AUTOMATIC DAY/NIGHT	8T-5
MIRROR SYSTEM, HEATED	8N-1
MIRROR SYSTEM, POWER	8T-1,8T-2
MIRRORS, 8W-62 POWER	8W-1
MIRRORS, EXTERIOR	8T-1
MIRRORS, INTERIOR	8T-5
MISALIGNMENT, CLUTCH	6-7
MISALIGNMENT, CLUTCH HOUSING	6-7
MODE, CIRCUIT ACTUATION TEST	25-2
MODE DOOR VACUUM ACTUATOR	24-44
MODE, POWER-UP	8Q-2
MODE, STATE DISPLAY TEST	25-2
MODES OF OPERATION	14-32
MODULATED CONVERTER CLUTCH ENGAGEMENT, ELECTRONICALLY	21-423
MODULE, 8W-45 CENTRAL TIMER	8W-1
MODULE, AIRBAG CONTROL	8M-12,8M-3
MODULE, CENTRAL TIMER; CHIME/ BUZZER WARNING SYSTEMS	8U-1,8U-3
MODULE, CENTRAL TIMER; INSTRUMENT PANEL SYSTEMS	8E-25,8E-4
MODULE, CENTRAL TIMER; POWER LOCK SYSTEMS	8P-2,8P-6
MODULE, CENTRAL TIMER; VEHICLE THEFT/SECURITY SYSTEMS	8Q-2

Description	Group-Page
MODULE, CENTRAL TIMER; WIPER AND WASHER SYSTEMS	8K-3
MODULE, DRIVER SIDE AIRBAG	8M-2,8M-6
MODULE (DRLM), DAYTIME RUNNING LAMP	8L-18
MODULE, FUEL PUMP	14-14,14-2
MODULE, PASSENGER SIDE AIRBAG	8M-3,8M-9
MODULE (PCM), POWERTRAIN CONTROL; FUEL SYSTEM	14-31,14-59
MODULE (PCM), POWERTRAIN CONTROL; TRANSMISSION AND TRANSFER CASE	21-125,21-287
MODULE, TRANSMISSION CONTROL	21-435
MODULE TRIM COVER, DRIVER SIDE AIRBAG	8M-8
MOLDING, ROOF JOINT	23-43
MOLDING, WHEEL OPENING	23-45
MOLDINGS, BODY SIDE	23-45
MONITORED SYSTEMS	25-19
MONITORS, COMPONENT	25-21
MOTOR, BLOWER	24-13,24-2,24-24
MOTOR, POWER LOCK	8P-3,8P-7,8P-9
MOTOR, POWER WINDOW	8S-2,8S-4,8S-6
MOTOR RELAY, BLOWER	24-13,24-2,24-25
MOTOR RESISTOR, BLOWER	24-14,24-25,24-3
MOTOR, STARTER	8B-10,8B-2,8B-8
MOTOR SWITCH, BLOWER	24-15,24-3
MOTOR, WIPER	8K-2,8K-9
MOTOR—2.5L ENGINE, IDLE AIR CONTROL (IAC)	14-56
MOTOR—3.9/5.2/5.9L ENGINES, IDLE AIR CONTROL (IAC)	14-56
MOTOR—4.7L V–8 ENGINE, IDLE AIR CONTROL (IAC)	14-56
MOTOR—PCM OUTPUT, IDLE AIR CONTROL (IAC)	14-41
MOTORS, POWER SEAT ADJUSTER	8R-1,8R-2, 8R-3
MOUNTED STOP LAMP (CHMSL) BULB, CENTER HIGH	8L-12
MOUNTED STOP LAMP (CHMSL), CENTER HIGH	8L-15
MOUNTING, MATCH	22-4
MOUNTING STUDS, WHEEL	2-12,2-21
MOUNT—REAR, ENGINE	9-146
MOUNTS, ENGINE FRONT	9-228,9-82
MOUNTS—FRONT, ENGINE	9-28
MOUNTS—LEFT AND RIGHT, ENGINE	9-145
MUFFLER	11-1,11-6
NAMEPLATES, EXTERIOR	23-27
NECK SEAL—PRESSURE RELIEF CHECK, RADIATOR CAP-TO-FILLER	7-26
NOISE AND/OR VIBRATION IN TURNS	3-20
NOISE, BEARING	3-35,3-68
NOISE DIAGNOSIS, HYDRAULIC LASH ADJUSTER	9-131
NOISE DURING ACCELERATION, CLUNKING	3-20
NOISE, GEAR	3-35,3-67
NOISE OR VIBRATION, TIRE	22-4
NOISE SUPPRESSION COMPONENTS, RADIO	8F-18
NOISE SUPPRESSION, RADIO	8F-4
NOISE, TRAC–LOK™ DIFFERENTIAL	3-68
NOISE, TRANSMISSION	21-4,21-40
NOISE, WIND	23-19
NON A/C, IDLER PULLEY—4.7L ENGINE	7-52
NON-MONITORED CIRCUITS	25-22
NOTES, CAUTIONS, AND WARNINGS	8W-7
NOZZLE AND PLUMBING, WASHER	8K-4
NUMBER (VIN) PLATE, VEHICLE IDENTIFICATION	Intro.-1
NV1500 MANUAL TRANSMISSION	21-1,21-34
NV231	21-531
NV231 DIAGNOSIS	21-507
NV231 TRANSFER CASE	21-506,21-511,21-527
NV242	21-561
NV242 DIAGNOSIS	21-534
NV242 TRANSFER CASE	21-533,21-538,21-558
NV3500 MANUAL TRANSMISSION	21-36,21-81
(O2S)—PCM INPUT, OXYGEN SENSOR	14-37
OFF SWITCH, OVERDRIVE	21-129,21-291,21-435
OIL AND CAMSHAFT PLUGS, ENGINE CORE	9-106,9-250
OIL COOLER LINES, TRANSMISSION	7-44
OIL COOLERS, AUTOMATIC TRANSMISSION	7-8
OIL, ENGINE	9-133,9-14,9-219,9-74
OIL LEAK INSPECTION, ENGINE	9-11,9-130
OIL LEVEL, REFRIGERANT	24-19
OIL PAN	9-100,9-109,9-124,9-193,9-244,9-252, 9-47
OIL PAN 4X2 VEHICLE	9-180
OIL PAN 4X4 VEHICLE	9-182
OIL PAN, ENGINE	9-209
OIL PRESSURE, CHECKING ENGINE	9-132
OIL PRESSURE, ENGINE	9-13,9-218,9-73
OIL PRESSURE SENDING UNIT, ENGINE	9-188
OIL PRESSURE SENSOR—PCM INPUT	14-37
OIL PUMP; ENGINE	9-102,9-107,9-108,9-187, 9-192,9-194,9-247,9-250,9-252,9-48
OIL PUMP; TRANSMISSION AND TRANSFER CASE	21-261,21-423,21-467,21-97
OIL PUMP AND REACTION SHAFT SUPPORT	21-192,21-224,21-358,21-392,21-481
OIL PUMP FRONT SEAL	21-453
OIL PUMP VOLUME CHECK	21-149,21-311, 21-447
OIL, REFRIGERANT	24-8
OIL SEAL, CRANKSHAFT FRONT	9-103
OIL SEAL, REAR MAIN	9-50
OIL SEAL, TIMING CASE COVER	9-39
OIL SEAL—FRONT, CRANKSHAFT	9-189,9-247
OIL SEAL—REAR, CRANKSHAFT	9-191
OIL SEALS, CRANKSHAFT	9-209,9-5,9-65
OIL SEALS, CRANKSHAFT REAR	9-104
OIL SEALS—REAR, CRANKSHAFT	9-248
ON-BOARD DIAGNOSTIC TEST FOR CHARGING SYSTEM	8C-3
ON-BOARD DIAGNOSTICS	25-1
ON-BOARD DIAGNOSTICS (OBD)	7-12
ON/OFF SWITCH, PASSENGER SIDE AIRBAG	8M-12,8M-3
OPENER STORAGE BIN DOOR, GARAGE DOOR	8V-12
OPENER STORAGE BIN, GARAGE DOOR	8V-3
OPENING COVER, STEERING COLUMN	8E-16
OPENING DIMENSIONS, BODY	23-113
OPENING MOLDING, WHEEL	23-45
OPENING WEATHERSTRIP, REAR DOOR	23-41
OPERATION, AIR TESTING TRANSMISSION CLUTCH	21-444
OPERATION, AIR TESTING TRANSMISSION CLUTCH AND BAND	21-134, 21-296
OPERATION, MODES OF	14-32
OPERATION, POWER STEERING PUMP - INITIAL	19-7
OPERATION, TRAC-LOK™	3-64
ORDER—2.5L 4-CYLINDER ENGINE, ENGINE FIRING	8D-27
ORDER—3.9L V-6 ENGINE, ENGINE FIRING	8D-27
ORDER—4.7L V-8 ENGINE, ENGINE FIRING	8D-27
ORDER—5.2L/5.9L V-8 ENGINES, ENGINE FIRING	8D-27
ORIFICE TUBE, FIXED	24-35,24-5
OUTER BELT WEATHERSTRIP, FRONT DOOR	23-34
OUTER BELT WEATHERSTRIP, REAR DOOR	23-41
OUTER C/V JOINT	3-24
OUTLET, 8W-41 HORN/CIGAR LIGHTER/POWER	8W-1
OUTLET, CIGAR LIGHTER AND POWER	8E-22
OUTLET, POWER	8E-12,8E-5
OUTLETS, DUCTS	24-32
OUTPUT, AUTO SHUTDOWN (ASD) RELAY—PCM	14-40
OUTPUT, DATA LINK CONNECTOR—PCM INPUT	14-40
OUTPUT, FUEL INJECTORS—PCM	14-40
OUTPUT, FUEL PUMP RELAY-PCM	14-40
OUTPUT, IDLE AIR CONTROL (IAC) MOTOR—PCM	14-41
OUTPUT, OXYGEN SENSOR HEATER RELAYS—PCM	14-41
OUTPUT, RADIATOR COOLING FAN RELAY—PCM	14-42
OUTPUT SHAFT BUSHING	21-6
OUTPUT SHAFT FRONT BEARING	21-159,21-322
OUTPUT SHAFT REAR BEARING	21-159,21-321
OUTPUT SHAFT SEAL	21-6
OUTPUT SHAFT SEAL, FRONT	21-509,21-536
OUTPUT SPEED SENSOR	21-448
OUTPUT SPEED SENSORS, INPUT	21-439
OUTPUTS, CCD BUS (+/-) CIRCUITS-PCM	14-40
OUTSIDE HANDLE, FRONT DOOR	23-32
OUTSIDE HANDLE, REAR DOOR	23-39
OUTSIDE MIRROR HEATING GRID	8N-2
OVERDRIVE CLUTCH	21-122,21-284
OVERDRIVE ELECTRICAL CONTROLS	21-130, 21-292
OVERDRIVE HOUSING BUSHING	21-159,21-321
OVERDRIVE OFF SWITCH	21-129,21-291,21-435
OVERDRIVE UNIT	21-157,21-206,21-226,21-319, 21-372,21-394
OVERHEAD CONSOLE	8V-1,8V-9
OVERHEAD CONSOLE, 8W-49	8W-1
OVERHEAD CONSOLE READING AND COURTESY LAMP	8V-3
OVERHEAD CONSOLE READING AND COURTESY LAMP HOUSING	8V-11
OVERHEAD CONSOLE READING AND COURTESY LAMP LENS	8V-8
OVERHEAD CONSOLE READING LAMP	8L-17
OVERHEAD CONSOLE READING LAMP BULB	8L-13
OVERHEAD CONSOLE SYSTEM	8V-1
OVERHEAD CONSOLE SYSTEMS	8V-13
OVERRUNNING CLUTCH	21-122,21-284
OVERRUNNING CLUTCH CAM/ OVERDRIVE PISTON RETAINER	21-189,21-355
OVERRUNNING CLUTCH/LOW-REVERSE DRUM/OVERDRIVE PISTON RETAINER	21-223, 21-391
OXYGEN SENSOR HEATER RELAYS	14-52
OXYGEN SENSOR HEATER RELAYS—PCM OUTPUT	14-41
OXYGEN SENSOR (O2S)—PCM INPUT	14-37
OXYGEN SENSOR—2.5L ENGINE	14-61
OXYGEN SENSOR—EXCEPT 2.5L ENGINE	14-59
PAD, HOOD SILENCER	23-21
PAD/COVER, BENCH SEAT BACK	23-10
PAD/COVER, BUCKET SEAT BACK	23-11
PAINT	23-1
PAINT CODE	23-1
PAINTED SURFACE TOUCH-UP	23-2
PAN 4X2 VEHICLE, OIL	9-180
PAN 4X4 VEHICLE, OIL	9-182
PAN, ENGINE OIL	9-209
PAN, OIL	9-100,9-109,9-124,9-193,9-244,9-252, 9-47
PANEL ASH RECEIVER, INSTRUMENT	8E-20
PANEL ASSEMBLY, INSTRUMENT	8E-27
PANEL CENTER SUPPORT BRACKET, INSTRUMENT	8E-19
PANEL, FRONT DOOR TRIM	23-29
PANEL, INSTRUMENT	8E-1
PANEL LOWER BEZEL, INSTRUMENT	8E-21
PANEL LOWER REINFORCEMENT, INSTRUMENT	8E-19
PANEL, QUARTER TRIM	23-51
PANEL, REAR DOOR TRIM	23-37
PANEL SYSTEM, INSTRUMENT	8E-1
PANEL TOP COVER, INSTRUMENT	8E-30
PANEL TRIM, REAR CAB BACK	23-51
PANEL, VALANCE	13-3
PANELS, INTERIOR TRIM	23-18
PAPERCLIP	8V-10,8V-4
PARK AND TURN SIGNAL LAMP BULBS	8L-12
PARK BRAKE CABLE, FRONT	5-21
PARK BRAKE CABLE TENSIONER	5-29
PARK BRAKE CABLES, REAR	5-22
PARK BRAKE PEDAL ASSEMBLY	5-22
PARK BRAKE RELEASE HANDLE	8E-18
PARK, TURN SIGNAL AND SIDE MARKER LAMP	8L-14
PARKING BRAKES	5-5
PARK/NEUTRAL POSITION SWITCH	21-130, 21-153,21-292,21-315
PARTS AND LUBRICANT RECOMMENDATIONS	0-1
PARTS USAGE, INSTALLATION METHODS	6-5
PASSENGER SIDE AIRBAG MODULE	8M-3,8M-9
PASSENGER SIDE AIRBAG ON/OFF SWITCH	8M-12,8M-3
PASSIVE RESTRAINT SYSTEMS	8M-16
PATTERN ANALYSIS, GEAR CONTACT	3-53,3-97
PATTERNS, TIRE WEAR	22-3

Description	Group-Page
PCM VIN REPROGRAMMING	14-1
PCV VALVE TEST—3.9/5.2/5.9L ENGINE	25-30
PCV VALVE—4.7L V-8 ENGINE	25-32
PCV VALVE/PCV SYSTEM TEST—4.7L V-8 ENGINE	25-31
PEDAL, ACCELERATOR	14-24
PEDAL ASSEMBLY, PARK BRAKE	5-22
PEDAL, BRAKE	5-14,5-2
PEDAL, CLUTCH	6-16
PEDAL POSITION SWITCH, CLUTCH	6-5
PER MILE, TIRE REVOLUTION	22-6
PERFORMANCE, A/C	24-10
PERFORMANCE, ENGINE	9-219
PERFORMANCE, HEATER	24-17
PILOT BEARING	6-14
PIN REPLACEMENT, CAMSHAFT	9-43
PINION GEAR	3-42,3-77
PINION GEAR DEPTH	3-48
PINION GEAR DEPTH, 8 1/4 AXLE	3-92
PINION GEAR DEPTH, 9 1/4 AXLE	3-93
PINION SEAL	3-72
PINION SHAFT SEAL	3-37
PINION STEERING GEAR - 4X2, RACK &	19-12
PINION STEERING GEAR - 4X4, RACK &	19-13
PINION STEERING GEAR, RACK &	19-11,19-14
PIN-OUTS, 8W-80 CONNECTOR	8W-1
PIPE, EXHAUST	11-10,11-3
PIPE, EXTENSION	11-6
PISTON AND CONNECTING ROD	9-123,9-182, 9-193,9-210,9-49,9-64
PISTON AND CONNECTING ROD ASSEMBLY	9-102,9-245,9-252
PISTON AND CONNECTING ROD INSPECTION	9-108
PISTON, FRONT SERVO	21-191,21-357
PISTON, REAR SERVO	21-192,21-358
PISTON RETAINER, OVERRUNNING CLUTCH CAM/OVERDRIVE	21-189,21-355
PISTON RETAINER, OVERRUNNING CLUTCH/LOW-REVERSE DRUM/ OVERDRIVE	21-223,21-391
PISTON RING—FITTING	9-20
PISTON RINGS—FITTING	9-140,9-226,9-80
PISTON—FITTING	9-19,9-79
PISTONS	21-117,21-280,21-427
PISTONS—FITTING	9-139,9-225
PIVOT, WIPER LINKAGE	8K-2,8K-9
PLANETARY GEAR SET	21-476
PLANETARY GEARSET	21-123,21-285
PLANETARY GEARTRAIN	21-225,21-433,21-481
PLANETARY GEARTRAIN/OUTPUT SHAFT	21-200,21-368,21-393
PLATE, BODY CODE	Intro.-2
PLATE, BRAKE SUPPORT	5-21
PLATE, CLUTCH PRESSURE	6-2
PLATE, EQUIPMENT IDENTIFICATION	Intro.-3
PLATE, FRONT AXLE SKID	13-8
PLATE LAMP BULB, LICENSE	8L-13
PLATE LAMP, LICENSE	8L-16
PLATE, TRANSFER CASE SKID	13-9
PLATE, VEHICLE IDENTIFICATION NUMBER (VIN)	Intro.-1
PLATE—4WD VEHICLES, FUEL TANK SKID	13-9
PLUG CABLE RESISTANCE, SPARK	8D-28
PLUG CABLES, SPARK	8D-12,8D-2,8D-8
PLUG CONDITIONS, SPARK	8D-9
PLUGS, ENGINE CORE	9-191
PLUGS, ENGINE CORE OIL AND CAMSHAFT	9-106,9-250
PLUGS, SPARK	8D-13,8D-2,8D-28
PLUMBING, WASHER NOZZLE	8K-4
POLISHING, FINESSE SANDING, BUFFING	23-1
POOR CONNECTIONS, INTERMITTENT	8W-8
PORTS, REFRIGERANT SYSTEM SERVICE	24-9
POSITION SENSOR, CAMSHAFT	8D-17,8D-5
POSITION SENSOR, THROTTLE	21-439
POSITION SENSOR (TPS)—3.9/5.2/5.9L ENGINES, THROTTLE	14-54
POSITION SENSOR (TPS)—4.7L V-8 ENGINE, THROTTLE	14-54
POSITION SENSOR (TPS)—PCM INPUT, THROTTLE	14-39
POSITION SENSOR—2.5L ENGINE, CRANKSHAFT	8D-16,8D-3
POSITION SENSOR—2.5L ENGINE, THROTTLE	14-55
POSITION SENSOR—3.9/5.2/5.9L ENGINES, CRANKSHAFT	8D-16
POSITION SENSOR—3.9L V-6 ENGINE, CRANKSHAFT	8D-4
POSITION SENSOR—4.7L ENGINE, CAMSHAFT	8D-18,8D-6
POSITION SENSOR—4.7L ENGINE, CRANKSHAFT	8D-5
POSITION SENSOR—4.7L V-8 ENGINE, CRANKSHAFT	8D-17
POSITION SENSOR—5.2/5.9L V-8 ENGINE, CRANKSHAFT	8D-4
POSITION SWITCH, CLUTCH PEDAL	6-5
POSITION SWITCH, PARK/NEUTRAL	21-130, 21-153,21-292,21-315
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—3.9/5.2/5.9L ENGINE	25-26
POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—4.7L ENGINE	25-27
POWER AMPLIFIER	8F-14,8F-3,8F-8
POWER BRAKE BOOSTER	5-15,5-3
POWER DISTRIBUTION, 8W-10	8W-1
POWER DISTRIBUTION CENTER	8O-1,8O-4
POWER DISTRIBUTION SYSTEM	8O-1
POWER DOOR LOCKS, 8W-61	8W-1
POWER GROUNDS	14-38
POWER LOCK MOTOR	8P-3,8P-7,8P-9
POWER LOCK SWITCH	8P-3,8P-5,8P-9
POWER LOCK SYSTEM	8P-1
POWER LOCK SYSTEM AND REMOTE KEYLESS ENTRY SYSTEM	8P-4
POWER MIRROR	8T-1,8T-4
POWER MIRROR SWITCH	8T-2,8T-3
POWER MIRROR SYSTEM	8T-1,8T-2
POWER MIRRORS, 8W-62	8W-1
POWER OUTLET	8E-12,8E-5
POWER OUTLET, CIGAR LIGHTER	8E-22
POWER SEAT, 8W-63	8W-1
POWER SEAT ADJUSTER AND MOTORS	8R-1, 8R-2,8R-3
POWER SEAT SWITCH	8R-1,8R-2
POWER SEAT SYSTEM	8R-1,8R-2
POWER STEERING	19-1
POWER STEERING FLOW AND PRESSURE	19-4
POWER STEERING PRESSURE SWITCH	14-65
POWER STEERING PRESSURE SWITCH—PCM INPUT	14-38
POWER STEERING PUMP	19-10,19-6
POWER STEERING PUMP - 2.5L	19-7
POWER STEERING PUMP - 3.9L & 5.9L ENGINES	19-8
POWER STEERING PUMP - 4.7L	19-9
POWER STEERING PUMP - INITIAL OPERATION	19-7
POWER STEERING SYSTEM	19-2
POWER WINDOW MOTOR	8S-2,8S-4,8S-6
POWER WINDOW SWITCH	8S-1,8S-3,8S-5
POWER WINDOW SYSTEM	8S-1,8S-2
POWER WINDOWS, 8W-60	8W-1
POWERED ENGINES ONLY, TASK MANAGER—GASOLINE	25-16
POWERTRAIN CONTROL MODULE (PCM); FUEL SYSTEM	14-31,14-59
POWERTRAIN CONTROL MODULE (PCM); TRANSMISSION AND TRANSFER CASE	21-125,21-287
POWER-UP MODE	8Q-2
PRE-ALIGNMENT INSPECTION	2-2
PRECAUTIONS, RWAL SERVICE	5-36
PRECAUTIONS, SAFETY; CLUTCH	6-5
PRECAUTIONS, SAFETY; LAMPS	8L-2
PRECAUTIONS, SERVICE WARNINGS	24-22
PRECAUTIONS, WINDSHIELD SAFETY	23-4
PRELIMINARY CHECKS	7-14
PRELIMINARY DIAGNOSIS	21-130,21-292, 21-441
PRELOAD AND GEAR BACKLASH, DIFFERENTIAL BEARING	3-50,3-96
PREPARATION, DRIVELINE ANGLE MEASUREMENT	3-7
PREPARATION FOR HEADLAMP ALIGNMENT, VEHICLE	8L-7
PREPARATION, LAMP ALIGNMENT SCREEN	8L-7
PRESSURE CAP, RADIATOR	7-10
PRESSURE, CHECKING ENGINE OIL	9-132
PRESSURE CONTROL, LINE	21-439
PRESSURE CURVES, GOVERNOR	21-128,21-290
PRESSURE CUT-OFF SWITCH, DUAL FUNCTION HIGH PRESSURE SWITCH/HIGH	24-18
PRESSURE CUT-OFF SWITCH, HIGH	24-42,24-7
PRESSURE CYCLING CLUTCH SWITCH, LOW	24-18,24-43,24-7
PRESSURE, ENGINE OIL	9-13,9-218,9-73
PRESSURE FOR HIGH SPEED, TIRE	22-3
PRESSURE, FUEL SYSTEM	14-27
PRESSURE GAUGES	22-3
PRESSURE LEAK DOWN TEST, FUEL	14-8
PRESSURE LEAKAGE TEST, CYLINDER COMBUSTION	9-10,9-129,9-216,9-70
PRESSURE (MAP) SENSOR—2.5L ENGINE, MANIFOLD ABSOLUTE	14-58
PRESSURE (MAP) SENSOR—3.9/5.2/ 5.9L ENGINES, MANIFOLD ABSOLUTE	14-57
PRESSURE (MAP) SENSOR—4.7L V–8 ENGINE, MANIFOLD ABSOLUTE	14-58
PRESSURE (MAP) SENSOR—PCM INPUT, MANIFOLD ABSOLUTE	14-36
PRESSURE PLATE, CLUTCH	6-2
PRESSURE, POWER STEERING FLOW	19-4
PRESSURE REGULATOR, FUEL FILTER/FUEL	14-4
PRESSURE RELEASE PROCEDURE, FUEL SYSTEM	14-11
PRESSURE RELIEF VALVE, HIGH	24-7
PRESSURE SENDING UNIT, ENGINE OIL	9-188
PRESSURE SENSOR, GOVERNOR SOLENOID	21-154,21-317
PRESSURE SENSOR, LINE	21-449
PRESSURE SENSOR—PCM INPUT, OIL	14-37
PRESSURE SWITCH ASSEMBLY, SOLENOID	21-438,21-450
PRESSURE SWITCH, POWER STEERING	14-65
PRESSURE SWITCHES	21-438
PRESSURE SWITCH/HIGH PRESSURE CUT-OFF SWITCH, DUAL FUNCTION HIGH	24-18
PRESSURE SWITCH—PCM INPUT, POWER STEERING	14-38
PRESSURE TEST, CYLINDER COMPRESSION	9-128,9-215,9-70,9-9
PRESSURE TEST, FUEL PUMP	14-7
PRESSURE TEST, HYDRAULIC	21-132,21-294, 21-443
PRESSURES, TIRE INFLATION	22-2
PROBLEMS, TROUBLESHOOTING WIRING	8W-9
PRODUCTS, AFTERMARKET REPAIR	23-2
PROGRAMMING, REMOTE KEYLESS ENTRY TRANSMITTER	8P-9
PROPELLER SHAFT	3-1,3-17
PROPELLER SHAFT ANGLE MEASUREMENT	3-7
PROPELLER SHAFT, FRONT	3-10
PROPELLER SHAFT JOINT ANGLE	3-4
PROPELLER SHAFT JOINTS	3-4
PROPELLER SHAFT, REAR	3-10
PROPELLER SHAFTS	3-1
PULLEY, PUMP	19-9
PULLEY—2.5L/3.9L/5.9L ENGINES, IDLER	7-51
PULLEY—4.7L ENGINE NON A/C, IDLER	7-52
PUMP - 2.5L, POWER STEERING	19-7
PUMP - 3.9L & 5.9L ENGINES, POWER STEERING	19-8
PUMP - 4.7L, POWER STEERING	19-9
PUMP - INITIAL OPERATION, POWER STEERING	19-7
PUMP 4.7L ENGINES, WATER	7-35
PUMP AMPERAGE TEST, FUEL	14-9
PUMP AND REACTION SHAFT SUPPORT, OIL	21-192,21-224,21-358,21-392,21-481
PUMP BYPASS HOSE—3.9/5.9L ENGINES, WATER	7-37
PUMP BYPASS—3.9/5.9L ENGINES, WATER	7-6
PUMP BYPASS—4.7L, WATER	7-6
PUMP CAPACITY TEST, FUEL	14-8
PUMP FRONT SEAL, OIL	21-453
PUMP, FUEL	14-2
PUMP INLET FILTER, FUEL	14-16
PUMP (LDP), LEAK DETECTION	25-25,25-32, 25-34
PUMP LEAKAGE	19-7

Description	Group-Page
PUMP MODULE, FUEL	14-14,14-2
PUMP, OIL; ENGINE	9-102,9-107,9-108,9-187, 9-192,9-194,9-247,9-250,9-252,9-48
PUMP, OIL; TRANSMISSION AND TRANSFER CASE	21-261,21-423,21-467,21-97
PUMP, POWER STEERING	19-10,19-6
PUMP PRESSURE TEST, FUEL	14-7
PUMP PULLEY	19-9
PUMP RELAY, FUEL	14-52
PUMP RELAY-PCM OUTPUT, FUEL	14-40
PUMP RELAYS, ASD AND FUEL	14-49
PUMP RESERVOIR - 2.5L ENGINE	19-8
PUMP TESTS, WATER	7-13
PUMP VOLUME CHECK, OIL	21-149,21-311, 21-447
PUMP, WASHER	8K-4
PUMP, WATER	7-55,7-6
PUMP—2.5L ENGINE, WATER	7-30
PUMP—3.9L/5.9L ENGINES, WATER	7-32
PURGE SOLENOID, DUTY CYCLE EVAP CANISTER	25-25,25-33
PUSH RODS, ROCKER ARMS	9-235,9-34,9-51
QUAD CAB ASSIST HANDLE	23-59
QUAD CAB, REAR SEAT	23-16
QUAD CAB REAR SEAT CUSHION COVER	23-16
QUARTER GLASS, REAR DOOR	23-42
QUARTER TRIM PANEL	23-51
QUARTER VENT WINDOW	23-43
QUARTER VENT WINDOW WEATHERSTRIP	23-44
QUICK LEARN PROCEDURE, TRANSMISSION	21-447
QUICK-CONNECT FITTINGS	14-11,14-7
RACK & PINION STEERING GEAR	19-11,19-14
RACK & PINION STEERING GEAR - 4X2	19-12
RACK & PINION STEERING GEAR - 4X4	19-13
RADIAL-PLY TIRES	22-2
RADIATOR	7-44,7-5,7-55
RADIATOR CAP	7-55
RADIATOR CAP—PRESSURE TESTING	7-26
RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE RELIEF CHECK	7-26
RADIATOR COOLANT FLOW CHECK	7-21
RADIATOR COOLING FAN RELAY—PCM OUTPUT	14-42
RADIATOR DRAINCOCK	7-52
RADIATOR PRESSURE CAP	7-10
RADIO FREQUENCY INTERFERENCE	8F-9
RADIO NOISE SUPPRESSION	8F-4
RADIO NOISE SUPPRESSION COMPONENTS	8F-18
RADIO RECEIVER	8F-10,8F-2,8F-5
RADIO SWITCH, REMOTE	8F-11,8F-2,8F-6
RAIL WEATHERSTRIP AND RETAINER, ROOF	23-43
RAIL/FUEL DAMPER—2.5L ENGINE, FUEL INJECTOR	14-19,14-6
RAIL—3.9/5.2/5.9L ENGINES, FUEL	14-5
RAIL—3.9/5.2/5.9L ENGINES, FUEL INJECTOR	14-18
RAIL—4.7L ENGINE, FUEL INJECTOR	14-5
RAIL—4.7L V–8 ENGINE, FUEL INJECTOR	14-20
RANGE SENSOR, TRANSMISSION	21-439
RATINGS, GENERATOR	8C-6
RE TRANSMISSION	21-410,21-412
RE TRANSMISSIONS	21-243
REACTION SHAFT SUPPORT, OIL PUMP	21-192, 21-224,21-358,21-392,21-481
READING AND COURTESY LAMP HOUSING, OVERHEAD CONSOLE	8V-11
READING AND COURTESY LAMP LENS, OVERHEAD CONSOLE	8V-8
READING AND COURTESY LAMP, OVERHEAD CONSOLE	8V-3
READING LAMP BULB, OVERHEAD CONSOLE	8L-13
READING LAMP, OVERHEAD CONSOLE	8L-17
REAR AXLE	3-69
REAR BAND ADJUSTMENT	21-396
REAR BEARING, OUTPUT SHAFT	21-159,21-321
REAR BRAKE SHOES	5-19
REAR BUMPER	13-2
REAR CAB BACK PANEL TRIM	23-51
REAR CLUTCH	21-120,21-197,21-225,21-282, 21-364,21-393
REAR DOOR	23-37
REAR DOOR ADJUSTMENT	23-61
REAR DOOR GLASS	23-41
REAR DOOR GLASS RUN CHANNELS	23-40
REAR DOOR GLASS RUN WEATHERSTRIP	23-40
REAR DOOR HINGE	23-37
REAR DOOR INNER BELT WEATHERSTRIP	23-40
REAR DOOR INSIDE HANDLE ACTUATOR	23-40
REAR DOOR LATCH	23-39
REAR DOOR LATCH STRIKER	23-39
REAR DOOR OPENING WEATHERSTRIP	23-41
REAR DOOR OUTER BELT WEATHERSTRIP	23-41
REAR DOOR OUTSIDE HANDLE	23-39
REAR DOOR QUARTER GLASS	23-42
REAR DOOR SECONDARY SEAL	23-41
REAR DOOR TRIM PANEL	23-37
REAR DOOR WATERDAM	23-38
REAR DOOR WINDOW REGULATOR	23-42
REAR DRUM BRAKE	5-27,5-28
REAR GLASS HEATING GRID	8N-2,8N-3
REAR GLASS HEATING GRID REPAIR	8N-4
REAR HOUSING YOKE BUSHING	21-43
REAR LIGHTING, 8W-51	8W-1
REAR MAIN OIL SEAL	9-50
REAR OIL SEALS, CRANKSHAFT	9-104
REAR PARK BRAKE CABLES	5-22
REAR PROPELLER SHAFT	3-10
REAR RETAINER BUSHING AND SEAL	21-509, 21-536
REAR SEAL AREA LEAKS—INSPECTION	9-12, 9-131,9-217,9-71
REAR SEAT BACK—CLUB CAB	23-14
REAR SEAT BELT RETRACTOR—CLUB CAB	23-54
REAR SEAT BELT/BUCKLE—CLUB CAB	23-53
REAR SEAT CUSHION COVER, QUAD CAB	23-16
REAR SEAT CUSHION—CLUB CAB	23-15
REAR SEAT QUAD CAB	23-16
REAR SERVO	21-224,21-392
REAR SERVO PISTON	21-192,21-358
REAR SPLASH SHIELD	23-46
REAR STORAGE BOX	23-56
REAR SUPPORT, ENGINE	9-230,9-29,9-84
REAR SUSPENSION	2-23
REAR WHEEL ANTILOCK	5-32,5-36
REAR WHEEL ANTILOCK BRAKE BLEEDING	5-37
REAR WHEEL ANTILOCK BRAKES	5-32
REAR WHEEL ANTI-LOCK BRAKES, 8W-34	8W-1
REAR WHEEL ANTILOCK BRAKES, CONTROLLER	5-33
REAR WHEEL SPEED SENSOR	5-38,5-47
REAR WHEEL SPEED SENSOR AND EXCITER RING	5-34
REAR WINDOW DEFOGGER SYSTEM	8N-1
REARVIEW MIRROR	23-57
REARVIEW MIRROR SUPPORT BRACKET	23-57
RECEIVER, INSTRUMENT PANEL ASH	8E-20
RECEIVER, RADIO	8F-10,8F-2,8F-5
RECEIVER, REMOTE KEYLESS ENTRY	8P-4
RECOMMENDATIONS, HOISTING	0-13
RECOMMENDATIONS, PARTS AND LUBRICANT	0-1
RECOMMENDATIONS, TOWING	0-11
RECOVERY, REFRIGERANT	24-20
RED BRAKE WARNING LAMP	5-3,5-8
REFERENCES, TORQUE	Intro.-7
REFRIGERANT	24-8
REFRIGERANT LINE COUPLER	24-45
REFRIGERANT LINE COUPLERS	24-8
REFRIGERANT LINES	24-8
REFRIGERANT OIL	24-8
REFRIGERANT OIL LEVEL	24-19
REFRIGERANT RECOVERY	24-20
REFRIGERANT SYSTEM CHARGE	24-20
REFRIGERANT SYSTEM EVACUATE	24-20
REFRIGERANT SYSTEM LEAKS	24-19
REFRIGERANT SYSTEM SERVICE EQUIPMENT	24-20
REFRIGERANT SYSTEM SERVICE PORTS	24-9
REGULATOR, ELECTRONIC VOLTAGE	8C-2
REGULATOR, FRONT DOOR WINDOW	23-35
REGULATOR, FUEL FILTER/FUEL PRESSURE	14-4
REGULATOR, REAR DOOR WINDOW	23-42
REINFORCEMENT, INSTRUMENT PANEL LOWER	8E-19
RELAY AND FUSE BLOCK	8O-4,8O-8
RELAY, AUTOMATIC SHUTDOWN (ASD)	14-51
RELAY, BLOWER MOTOR	24-13,24-2,24-25
RELAY, COMPRESSOR CLUTCH	24-16,24-30, 24-4
RELAY, DRIVER UNLOCK	8P-10,8P-4
RELAY, FUEL PUMP	14-52
RELAY, HEADLAMP; POWER LOCK SYSTEMS	8P-10,8P-4
RELAY, HEADLAMP; VEHICLE THEFT/ SECURITY SYSTEMS	8Q-3,8Q-5
RELAY, HORN; HORN SYSTEMS	8G-2,8G-3,8G-4
RELAY, HORN; POWER LOCK SYSTEMS	8P-10, 8P-4
RELAY, HORN; VEHICLE THEFT/ SECURITY SYSTEMS	8Q-3,8Q-6
RELAY, INTERMITTENT WIPE	8K-11,8K-3,8K-7
RELAY SENSE—PCM INPUT, AUTOMATIC SHUTDOWN (ASD)	14-34
RELAY, STARTER	8B-12,8B-3,8B-8
RELAY, TRANSMISSION CONTROL	21-438
RELAY—PCM OUTPUT, AUTO SHUTDOWN (ASD)	14-40
RELAY—PCM OUTPUT, RADIATOR COOLING FAN	14-42
RELAY-PCM OUTPUT, FUEL PUMP	14-40
RELAYS; POWER LOCK SYSTEMS	8P-8
RELAYS; VEHICLE THEFT/SECURITY SYSTEMS	8Q-4
RELAYS, ASD AND FUEL PUMP	14-49
RELAYS, OXYGEN SENSOR HEATER	14-52
RELAYS—PCM OUTPUT, OXYGEN SENSOR HEATER	14-41
RELEASE BEARING	6-14
RELEASE BEARING, CLUTCH	6-3
RELEASE CABLE, HOOD	23-23
RELEASE HANDLE, PARK BRAKE	8E-18
RELEASE HANDLE, TAILGATE LATCH	23-47
RELEASE OR ENGAGEMENT, IMPROPER CLUTCH	6-7
RELEASE PROCEDURE, FUEL SYSTEM PRESSURE	14-11
RELIEF CHECK, RADIATOR CAP-TO-FILLER NECK SEAL—PRESSURE	7-26
RELIEF VALVE, HIGH PRESSURE	24-7
REMOTE KEYLESS ENTRY RECEIVER	8P-4
REMOTE KEYLESS ENTRY SYSTEM	8P-1
REMOTE KEYLESS ENTRY SYSTEM, POWER LOCK SYSTEM	8P-4
REMOTE KEYLESS ENTRY TRANSMITTER	8P-3,8P-8
REMOTE KEYLESS ENTRY TRANSMITTER BATTERY REPLACEMENT	8P-8
REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING	8P-9
REMOTE RADIO SWITCH	8F-11,8F-2,8F-6
REPAIR, ALUMINUM THREAD	21-150,21-312, 21-448
REPAIR DAMAGED OR WORN THREADS	9-135, 9-16,9-221,9-76
REPAIR PRODUCTS, AFTERMARKET	23-2
REPAIR, REAR GLASS HEATING GRID	8N-4
REPAIR, THREADED HOLE	Intro.-7
REPAIR, WIRING	8W-10
REPAIRING LEAKS	22-5
REPAIR-MOLEX CONNECTORS, TERMINAL/CONNECTOR	8W-10
REPAIR—THOMAS AND BETTS CONNECTORS, TERMINAL/CONNECTOR	8W-10
REPLACEMENT-IN VEHICLE, VALVE SPRING AND STEM SEAL	9-236
REPLACEMENT—4.7L ENGINE, ACCESSORY BELT	7-48
REPROGRAMMING, PCM VIN	14-1
REQUIREMENTS, FUEL	14-27
RESERVE/OVERFLOW SYSTEM, COOLANT	7-5
RESERVE/OVERFLOW TANK, COOLANT	7-30
RESERVOIR - 2.5L ENGINE, PUMP	19-8
RESERVOIR, MASTER CYLINDER	5-23
RESERVOIR, VACUUM; HEATING AND AIR CONDITIONING	24-48,24-9
RESERVOIR, VACUUM; SPEED CONTROL SYSTEM	8H-3,8H-8
RESERVOIR, WASHER	8K-4

Description	Group-Page
RESISTANCE, SPARK PLUG CABLE	8D-28
RESISTANCE—4.7L V-8 ENGINE, IGNITION COIL	8D-28
RESISTANCE—EXCEPT 4.7L ENGINE, IGNITION COIL	8D-28
RESISTOR, BLOWER MOTOR	24-14,24-25,24-3
RESTRAINT SYSTEMS, PASSIVE	8M-16
RETAINER BUSHING AND SEAL, REAR	21-509, 21-536
RETAINER, OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON	21-189,21-355
RETAINER, OVERRUNNING CLUTCH/ LOW-REVERSE DRUM/OVERDRIVE PISTON	21-223,21-391
RETAINER, ROOF RAIL WEATHERSTRIP	23-43
RETAINER/BULKHEAD, 4C	21-474
RETRACTOR, FRONT SEAT BELT	23-52
RETRACTOR—CLUB CAB, REAR SEAT BELT	23-54
RETRACTOR—QUAD CAB, SEAT BELT	23-52
RETURN—PCM INPUT, SENSOR	14-39
REVOLUTION PER MILE, TIRE	22-6
RIGHT, ENGINE MOUNTS—LEFT	9-145
RIGHT FRONT FENDER	23-26
RING, EXCITER	5-39,5-47
RING GEAR	3-41
RING GEAR AND EXCITER RING	3-75
RING, REAR WHEEL SPEED SENSOR AND EXCITER	5-34
RING, RING GEAR AND EXCITER	3-75
RING—FITTING, PISTON	9-20
RINGS—FITTING, PISTON	9-140,9-226,9-80
ROAD TEST	8H-4
ROAD TEST, ANALYZING	21-131,21-293
ROAD TESTING	21-131,21-293,21-442
ROCKER ARM	9-124
ROCKER ARMS	9-157
ROCKER ARMS AND PUSH RODS	9-235,9-34, 9-51
ROD ASSEMBLY, PISTON AND CONNECTING	9-102,9-245,9-252
ROD BEARINGS—FITTING, CONNECTING	9-142, 9-22,9-227,9-81
ROD END, TIE	19-11
ROD INSPECTION, PISTON AND CONNECTING	9-108
ROD, PISTON AND CONNECTING	9-123,9-182, 9-193,9-210,9-49,9-64
RODS, ROCKER ARMS AND PUSH	9-235,9-34, 9-51
ROLLOVER VALVE(S)	25-24,25-34
ROOF JOINT MOLDING	23-43
ROOF RAIL WEATHERSTRIP AND RETAINER	23-43
ROTATION	22-4
ROTOR, DISC BRAKE	5-19,5-9
ROTOR, DISTRIBUTOR	8D-7
ROTOR MACHINING, DISC	5-12
RUN CHANNELS, FRONT DOOR LOWER GLASS	23-36
RUN CHANNELS, REAR DOOR GLASS	23-40
RUN WEATHERSTRIP, FRONT DOOR GLASS	23-36
RUN WEATHERSTRIP, REAR DOOR GLASS	23-40
RUNNING LAMP MODULE (DRLM), DAYTIME	8L-18
RUNOUT	3-6
RUNOUT, CLUTCH COVER AND DISC	6-7
RUNOUT, CLUTCH FLYWHEEL	6-7
RUNOUT, TIRE AND WHEEL	22-7
RWAL COMPONENT LOCATION	5-33
RWAL SERVICE PRECAUTIONS	5-36
RWAL VALVE	5-34,5-38
SAFETY LATCH, HOOD	23-22
SAFETY PRECAUTIONS; CLUTCH	6-5
SAFETY PRECAUTIONS; LAMPS	8L-2
SAFETY PRECAUTIONS, WINDSHIELD	23-4
SANDING, BUFFING, AND POLISHING, FINESSE	23-1
SCAN TOOL, DRB	7-13
SCHEDULES, MAINTENANCE	0-4
SCHEMATICS, HYDRAULIC	21-229,21-397, 21-482
SCHEMATICS, VACUUM	25-32
SCREEN PREPARATION, LAMP ALIGNMENT	8L-7
SEAL, ADAPTER HOUSING	21-453
SEAL AND BEARING, 8 1/4 AND 9 1/4 AXLE	3-71
SEAL AND BEARING, AXLE SHAFT	3-39
SEAL AREA LEAKS—INSPECTION, REAR	9-12, 9-131,9-217,9-71
SEAL, BOOT	19-14
SEAL, CARGO BOX	23-49
SEAL, COWL	23-24
SEAL, CRANKSHAFT FRONT OIL	9-103
SEAL, FRONT DOOR	23-36
SEAL, FRONT DOOR SECONDARY	23-37
SEAL, FRONT OUTPUT SHAFT	21-509,21-536
SEAL, HOOD	23-24
SEAL, OIL PUMP FRONT	21-453
SEAL, OUTPUT SHAFT	21-6
SEAL, PINION	3-72
SEAL, PINION SHAFT	3-37
SEAL, REAR DOOR SECONDARY	23-41
SEAL, REAR MAIN OIL	9-50
SEAL, REAR RETAINER BUSHING	21-509,21-536
SEAL REPLACEMENT, YOKE	21-152,21-315
SEAL REPLACEMENT-IN VEHICLE, VALVE SPRING AND STEM	9-236
SEAL, TIMING CASE COVER OIL	9-39
SEAL, VALVE, GUIDE	9-17
SEAL, VALVE SPRING	9-35
SEAL, VALVE STEM	9-123
SEALER LOCATIONS	23-94
SEAL—2WD, YOKE	21-43
SEAL—FRONT, CRANKSHAFT OIL	9-189,9-247
SEAL—PRESSURE RELIEF CHECK, RADIATOR CAP-TO-FILLER NECK	7-26
SEAL—REAR, CRANKSHAFT OIL	9-191
SEALS, CRANKSHAFT OIL	9-209,9-5,9-65
SEALS, CRANKSHAFT REAR OIL	9-104
SEALS, VALVE SPRINGS	9-163
SEALS—REAR, CRANKSHAFT OIL	9-248
SEAT, 8W-63 POWER	8W-1
SEAT ADJUSTER AND MOTORS, POWER	8R-1, 8R-2,8R-3
SEAT BACK, BENCH	23-9
SEAT BACK, BUCKET	23-11
SEAT BACK PAD/COVER, BENCH	23-10
SEAT BACK PAD/COVER, BUCKET	23-11
SEAT BACK—CLUB CAB, REAR	23-14
SEAT BELT BUCKLE	23-53
SEAT BELT RETRACTOR, FRONT	23-52
SEAT BELT RETRACTOR—CLUB CAB, REAR	23-54
SEAT BELT RETRACTOR—QUAD CAB	23-52
SEAT BELT SWITCH, DRIVER	8U-2,8U-5
SEAT BELT/BUCKLE—CLUB CAB, REAR	23-53
SEAT, BENCH	23-8
SEAT, BUCKET	23-10
SEAT CUSHION COVER, QUAD CAB REAR	23-16
SEAT CUSHION/COVER, BENCH	23-10
SEAT CUSHION/COVER, BUCKET	23-11
SEAT CUSHION/COVER, CENTER	23-13
SEAT CUSHION—CLUB CAB, REAR	23-15
SEAT QUAD CAB, REAR	23-16
SEAT SWITCH, POWER	8R-1,8R-2
SEAT SYSTEM, POWER	8R-1,8R-2
SEAT SYSTEMS	23-8
SEAT TRACK, BENCH	23-9
SEAT TRACK, BUCKET	23-11
SEAT/CONSOLE, CENTER	23-12
SEATS	23-8
SECONDARY, FIVE VOLT SENSOR SUPPLIES—PRIMARY	14-35
SECONDARY SEAL, FRONT DOOR	23-37
SECONDARY SEAL, REAR DOOR	23-41
SECTION IDENTIFICATION	8W-5
SECURITY LAMP	8Q-3
SECURITY SYSTEM, 8W-39 VEHICLE THEFT	8W-1
SECURITY SYSTEM, VEHICLE THEFT	8Q-1,8Q-4
SELECTION AND ADDITIVES, COOLANT	7-30
SELECTOR INDICATOR, GEAR	8E-17,8E-5
SENDING UNIT, ENGINE OIL PRESSURE	9-188
SENDING UNIT, FUEL GAUGE	14-10,14-16,14-3
SENSE—PCM INPUT, AUTOMATIC SHUTDOWN (ASD) RELAY	14-34
SENSE—PCM INPUT, IGNITION CIRCUIT	14-35
SENSITIVE DEVICES, ELECTROSTATIC DISCHARGE (ESD)	8W-8
SENSOR - 4X2, FRONT WHEEL SPEED	5-45
SENSOR - 4X4, FRONT WHEEL SPEED	5-46
SENSOR, AMBIENT TEMPERATURE	8V-13,8V-4, 8V-5
SENSOR AND EXCITER RING, REAR WHEEL SPEED	5-34
SENSOR, BATTERY TEMPERATURE	8C-2,8C-5
SENSOR, CAMSHAFT POSITION	8D-17,8D-5
SENSOR, GOVERNOR SOLENOID AND PRESSURE	21-154,21-317
SENSOR HEATER RELAYS, OXYGEN	14-52
SENSOR HEATER RELAYS—PCM OUTPUT, OXYGEN	14-41
SENSOR, INPUT SPEED	21-448
SENSOR, LINE PRESSURE	21-449
SENSOR (O2S)—PCM INPUT, OXYGEN	14-37
SENSOR, OUTPUT SPEED	21-448
SENSOR, REAR WHEEL SPEED	5-38,5-47
SENSOR RETURN—PCM INPUT	14-39
SENSOR SUPPLIES—PRIMARY AND SECONDARY, FIVE VOLT	14-35
SENSOR, THROTTLE POSITION	21-439
SENSOR (TPS)—3.9/5.2/5.9L ENGINES, THROTTLE POSITION	14-54
SENSOR (TPS)—4.7L V-8 ENGINE, THROTTLE POSITION	14-54
SENSOR (TPS)—PCM INPUT, THROTTLE POSITION	14-39
SENSOR, TRANSMISSION RANGE	21-439
SENSOR, TRANSMISSION TEMPERATURE	21-440
SENSOR, WASHER FLUID LEVEL	8K-4
SENSOR, WHEEL SPEED	5-42
SENSOR—2.5L ENGINE, CRANKSHAFT POSITION	8D-16,8D-3
SENSOR—2.5L ENGINE, ENGINE COOLANT TEMPERATURE	14-63
SENSOR—2.5L ENGINE, INTAKE MANIFOLD AIR TEMPERATURE	14-64
SENSOR—2.5L ENGINE, MANIFOLD ABSOLUTE PRESSURE (MAP)	14-58
SENSOR—2.5L ENGINE, OXYGEN	14-61
SENSOR—2.5L ENGINE, THROTTLE POSITION	14-55
SENSOR—3.9/5.2/5.9L ENGINES, CRANKSHAFT POSITION	8D-16
SENSOR—3.9/5.2/5.9L ENGINES, ENGINE COOLANT TEMPERATURE	14-62
SENSOR—3.9/5.2/5.9L ENGINES, INTAKE MANIFOLD AIR TEMPERATURE	14-64
SENSOR—3.9/5.2/5.9L ENGINES, MANIFOLD ABSOLUTE PRESSURE (MAP)	14-57
SENSOR—3.9L V-6 ENGINE, CRANKSHAFT POSITION	8D-4
SENSOR—4.7L ENGINE, CAMSHAFT POSITION	8D-18,8D-6
SENSOR—4.7L ENGINE, CRANKSHAFT POSITION	8D-5
SENSOR—4.7L V-8 ENGINE, CRANKSHAFT POSITION	8D-17
SENSOR—4.7L V-8 ENGINE, ENGINE COOLANT TEMPERATURE	14-63
SENSOR—4.7L V-8 ENGINE, INTAKE MANIFOLD AIR TEMPERATURE	14-64
SENSOR—4.7L V–8 ENGINE, MANIFOLD ABSOLUTE PRESSURE (MAP)	14-58
SENSOR—5.2/5.9L V-8 ENGINE, CRANKSHAFT POSITION	8D-4
SENSOR—EXCEPT 2.5L ENGINE, OXYGEN	14-59
SENSOR—PCM INPUT, ENGINE COOLANT TEMPERATURE	14-35
SENSOR—PCM INPUT, FUEL LEVEL	14-35
SENSOR—PCM INPUT, INTAKE MANIFOLD AIR TEMPERATURE	14-35
SENSOR—PCM INPUT, MANIFOLD ABSOLUTE PRESSURE (MAP)	14-36
SENSOR—PCM INPUT, OIL PRESSURE	14-37
SENSORS, INPUT AND OUTPUT SPEED	21-439
SERVO CABLE	8H-3
SERVO CABLE (EXCEPT 4.7L ENGINE)	8H-6
SERVO CABLE—4.7L V-8 ENGINE	8H-6
SERVO, FRONT	21-224,21-392
SERVO PISTON, FRONT	21-191,21-357
SERVO PISTON, REAR	21-192,21-358
SERVO, REAR	21-224,21-392
SERVO, SPEED CONTROL	8H-2,8H-4
SERVOS	21-124,21-286
SET, PLANETARY GEAR	21-476

Description	Group-Page
SHAFT ANGLE MEASUREMENT, PROPELLER	3-7
SHAFT, AXLE	3-39,3-70
SHAFT BUSHING, DISTRIBUTOR DRIVE	9-242, 9-94
SHAFT BUSHING, OUTPUT	21-6
SHAFT FRONT BEARING, OUTPUT	21-159, 21-322
SHAFT, FRONT PROPELLER	3-10
SHAFT JOINT ANGLE, PROPELLER	3-4
SHAFT JOINTS, PROPELLER	3-4
SHAFT, PLANETARY GEARTRAIN/ OUTPUT	21-200,21-368,21-393
SHAFT, PROPELLER	3-1,3-17
SHAFT REAR BEARING, OUTPUT	21-159,21-321
SHAFT, REAR PROPELLER	3-10
SHAFT SEAL AND BEARING, AXLE	3-39
SHAFT SEAL, FRONT OUTPUT	21-509,21-536
SHAFT SEAL, OUTPUT	21-6
SHAFT SEAL, PINION	3-37
SHAFT SUPPORT, OIL PUMP AND REACTION	21-192,21-224,21-358,21-392,21-481
SHAFT—TIMING DRIVE, IDLER	9-172
SHAFTS, PROPELLER	3-1
SHIELD, REAR SPLASH	23-46
SHIELDS, EXHAUST HEAT	11-1
SHIELDS, HEAT	11-7
SHIFT BEZEL	23-55
SHIFT BOOT, FLOOR	23-54
SHIFT INTERLOCK, COLUMN	8D-26
SHIFT LEVER, GEAR	19-18
SHIFT TOWER	21-42,21-5
SHIFTER ADJUSTMENT	21-530,21-560
SHIFTER, TRANSFER CASE	21-509,21-535
SHIFTING, HARD	21-39,21-4
SHOCK ABSORBER	2-16,2-24,2-8
SHOCK ABSORBERS	2-14,2-23,2-6
SHOCK DIAGNOSIS	2-16,2-8
SHOCK, SPRING	2-24
SHOES, DISC BRAKE	5-17
SHOES, REAR BRAKE	5-19
SHUDDER OR VIBRATION DURING ACCELERATION	3-20
SHUTDOWN (ASD) RELAY, AUTOMATIC	14-51
SHUTDOWN (ASD) RELAY SENSE—PCM INPUT, AUTOMATIC	14-34
SHUTDOWN (ASD) RELAY—PCM OUTPUT, AUTO	14-40
SIDE AIRBAG MODULE, DRIVER	8M-2,8M-6
SIDE AIRBAG MODULE, PASSENGER	8M-3,8M-9
SIDE AIRBAG MODULE TRIM COVER, DRIVER	8M-8
SIDE AIRBAG ON/OFF SWITCH, PASSENGER	8M-12,8M-3
SIDE BEARINGS, DIFFERENTIAL	3-41,3-75
SIDE GEAR CLEARANCE	3-99
SIDE MARKER LAMP BULB, FRONT	8L-12
SIDE MARKER LAMP, PARK, TURN SIGNAL	8L-14
SIDE MOLDINGS, BODY	23-45
SIDE VIEW MIRROR	23-28
SIGNAL AND BACK-UP LAMP BULBS, TAIL, BRAKE, TURN	8L-12
SIGNAL AND BACK-UP LAMP, TAIL, STOP, TURN	8L-16
SIGNAL AND HAZARD WARNING SYSTEMS, TURN	8J-4
SIGNAL AND SIDE MARKER LAMP, PARK, TURN	8L-14
SIGNAL CANCELLING CAM, TURN	8J-2
SIGNAL GROUND—PCM INPUT	14-39
SIGNAL LAMP BULBS, PARK AND TURN	8L-12
SIGNAL SWITCH AND HAZARD WARNING SWITCH, TURN	8J-2,8J-5,8J-6
SIGNAL SYSTEM, TURN	8J-1
SIGNALS, 8W-52 TURN	8W-1
SILENCER PAD, HOOD	23-21
SILL TRIM COVER, DOOR	23-50
SINGLE CARDAN UNIVERSAL JOINT	3-11
SKID PLATE, FRONT AXLE	13-8
SKID PLATE, TRANSFER CASE	13-9
SKID PLATE—4WD VEHICLES, FUEL TANK	13-9
SLIDING VENT GLASS, BACKLITE	23-52
SNAP, DRIVELINE	3-36,3-68
SOLENOID AND PRESSURE SENSOR, GOVERNOR	21-154,21-317
SOLENOID AND PRESSURE SWITCH ASSEMBLY	21-438,21-450
SOLENOID CIRCUITS, SPEED CONTROL	8H-2
SOLENOID, DUTY CYCLE EVAP CANISTER PURGE	25-25,25-33
SOLENOID SWITCH VALVE	21-440
SOLENOIDS	21-440
SPARE TIRE WINCH	13-10
SPARE TIRE–TEMPORARY	22-2
SPARK PLUG CABLE RESISTANCE	8D-28
SPARK PLUG CABLES	8D-12,8D-2,8D-8
SPARK PLUG CONDITIONS	8D-9
SPARK PLUGS	8D-13,8D-2,8D-28
SPEAKER	8F-11,8F-7
SPEAKER SYSTEM	8F-3
SPECIFICATIONS, 3.9L ENGINE	9-111
SPECIFICATIONS, 5.9L ENGINE	9-255
SPECIFICATIONS, ENGINE	9-53
SPECIFICATIONS, TORQUE; BODY	23-116
SPECIFICATIONS, TORQUE; COOLING SYSTEM	7-56
SPECIFICATIONS, TORQUE; ENGINE	9-115
SPECIFICATIONS, TORQUE; EXHAUST SYSTEM	11-10
SPECIFICATIONS, TORQUE; FRAME AND BUMPERS	13-16
SPECIFICATIONS—TORQUE	9-56
SPEED AND DISTANCE—PCM INPUT, VEHICLE	14-40
SPEED CONTROL, 8W-33 VEHICLE	8W-1
SPEED CONTROL SERVO	8H-2,8H-4
SPEED CONTROL SOLENOID CIRCUITS	8H-2
SPEED CONTROL SWITCHES	8H-2,8H-5
SPEED CONTROL SYSTEM	8H-1
SPEED INPUT, VEHICLE	8H-3
SPEED KNOCK, LOW	3-35,3-68
SPEED SENSOR - 4X2, FRONT WHEEL	5-45
SPEED SENSOR - 4X4, FRONT WHEEL	5-46
SPEED SENSOR AND EXCITER RING, REAR WHEEL	5-34
SPEED SENSOR, INPUT	21-448
SPEED SENSOR, OUTPUT	21-448
SPEED SENSOR, REAR WHEEL	5-38,5-47
SPEED SENSOR, WHEEL	5-42
SPEED SENSORS, INPUT AND OUTPUT	21-439
SPEED, TIRE PRESSURE FOR HIGH	22-3
SPEEDS, VIBRATION AT HIGHWAY	3-20
SPLASH SHIELD, REAR	23-46
SPLICE INFORMATION, 8W-70	8W-1
SPLICE LOCATIONS	8W-1,8W-7
SPLICE LOCATIONS, 8W-95	8W-1
SPRING AND SEAL, VALVE	9-35
SPRING AND SHOCK	2-24
SPRING AND STEM SEAL REPLACEMENT-IN VEHICLE, VALVE	9-236
SPRING, COIL	2-8
SPRING, VALVE	9-123
SPRINGS, ADJUSTMENT AT AXLE WITH LEAF	3-17
SPRINGS AND SEALS, VALVE	9-163
SPRINGS, COIL	2-7
SPRINGS, LEAF	2-23,2-25
SPRINGS, VALVES AND VALVE	9-209,9-237,9-64
SPRINGS, VALVES, GUIDES	9-77
SPRINGS—CYLINDER HEAD REMOVED, VALVES AND VALVE	9-91
SPROCKETS, TIMING CHAIN	9-166,9-40
STABILIZER BAR	2-11,2-15,2-20,2-23,2-24,2-7
STAKING, HEAT	23-20
STANDARD DIFFERENTIAL	3-32,3-47,3-64,3-82
STARTER MOTOR	8B-10,8B-2,8B-8
STARTER RELAY	8B-12,8B-3,8B-8
STARTING PROCEDURE, JUMP	0-10
STARTING SYSTEM	8B-1,8B-13,8B-3
STARTING SYSTEM, 8W-21	8W-1
STARTING, TOWING AND HOISTING, JUMP	0-10
STATE DISPLAY TEST MODE	25-2
STATIONARY GLASS	23-4
STEERING COLUMN	19-15,19-16
STEERING COLUMN OPENING COVER	8E-16
STEERING FLOW AND PRESSURE, POWER	19-4
STEERING GEAR - 4X2, RACK & PINION	19-12
STEERING GEAR - 4X4, RACK & PINION	19-13
STEERING GEAR, RACK & PINION	19-11,19-14
STEERING KNUCKLE	2-15,2-17,2-7,2-9
STEERING, POWER	19-1
STEERING PRESSURE SWITCH, POWER	14-65
STEERING PRESSURE SWITCH—PCM INPUT, POWER	14-38
STEERING PUMP - 2.5L, POWER	19-7
STEERING PUMP - 3.9L & 5.9L ENGINES, POWER	19-8
STEERING PUMP - 4.7L, POWER	19-9
STEERING PUMP - INITIAL OPERATION, POWER	19-7
STEERING PUMP, POWER	19-10,19-6
STEERING SYSTEM	19-1
STEERING SYSTEM, POWER	19-2
STEM SEAL REPLACEMENT-IN VEHICLE, VALVE SPRING	9-236
STEM SEAL, VALVE	9-123
STOP LAMP (CHMSL) BULB, CENTER HIGH MOUNTED	8L-12
STOP LAMP (CHMSL), CENTER HIGH MOUNTED	8L-15
STOP LAMP SWITCH	5-2
STOP, TURN SIGNAL AND BACK-UP LAMP, TAIL	8L-16
STORAGE BIN DOOR, GARAGE DOOR OPENER	8V-12
STORAGE BIN, GARAGE DOOR OPENER	8V-3
STORAGE BIN, SUNGLASSES	8V-12,8V-4
STORAGE BOX, REAR	23-56
STRETCH, MEASURING TIMING CHAIN	9-225
STRETCH—MEASURING, TIMING CHAIN	9-79
STRIKER, FRONT DOOR LATCH	23-34
STRIKER, GLOVE BOX LATCH	8E-23
STRIKER, HOOD LATCH	23-22,23-59
STRIKER, REAR DOOR LATCH	23-39
STRIKER, TAILGATE LATCH	23-48
STRUCTURAL ADHESIVE LOCATIONS	23-89
STRUCTURAL COVER	9-147
STRUCTURAL DUST COVER	9-124
STUDS, WHEEL MOUNTING	2-12,2-21
SUCTION AND DISCHARGE LINE	24-46
SUNGLASSES STORAGE BIN	8V-12,8V-4
SUNVISORS	23-58
SUPPLIES—PRIMARY AND SECONDARY, FIVE VOLT SENSOR	14-35
SUPPLY TEST, VACUUM	8H-4
SUPPORT BRACKET, INSTRUMENT PANEL CENTER	8E-19
SUPPORT BRACKET, REARVIEW MIRROR	23-57
SUPPORT, ENGINE REAR	9-230,9-29,9-84
SUPPORT, OIL PUMP AND REACTION SHAFT	21-192,21-224,21-358,21-392,21-481
SUPPORT PLATE, BRAKE	5-21
SUPPRESSION COMPONENTS, RADIO NOISE	8F-18
SUPPRESSION, RADIO NOISE	8F-4
SURFACE TOUCH-UP, PAINTED	23-2
SUSPENSION - 4X2, FRONT	2-6
SUSPENSION - 4X4, FRONT	2-14
SUSPENSION ARM, LOWER	2-10,2-18
SUSPENSION ARM, UPPER	2-10,2-19
SUSPENSION ARMS	2-15,2-7
SUSPENSION, FRONT	2-13,2-22
SUSPENSION HEIGHT- 4X4	2-3
SUSPENSION, REAR	2-23
SWITCH AND HAZARD WARNING SWITCH, TURN SIGNAL	8J-2,8J-5,8J-6
SWITCH AND KEY CYLINDER, IGNITION	8D-23
SWITCH AND KEY LOCK CYLINDER, IGNITION	8D-11,8D-6
SWITCH AND WASHER SWITCH, WIPER	8K-11, 8K-2,8K-6
SWITCH ASSEMBLY, SOLENOID AND PRESSURE	21-438,21-450
SWITCH, BLOWER MOTOR	24-15,24-3
SWITCH, BRAKE LAMP; BRAKES	5-13,5-36,5-8
SWITCH, BRAKE LAMP; SPEED CONTROL SYSTEM	8H-3
SWITCH, CLUTCH PEDAL POSITION	6-5
SWITCH, DEFOGGER	8N-2,8N-3,8N-5
SWITCH, DOOR AJAR	8Q-3,8Q-4
SWITCH, DOOR LOCK CYLINDER	8Q-3,8Q-4
SWITCH, DRIVER DOOR AJAR	8U-2,8U-3
SWITCH, DRIVER SEAT BELT	8U-2,8U-5
SWITCH, DUAL FUNCTION HIGH PRESSURE SWITCH/HIGH PRESSURE CUT-OFF	24-18
SWITCH, GLOVE BOX LAMP	8E-23
SWITCH, HEADLAMP; CHIME/BUZZER WARNING SYSTEMS	8U-2,8U-4

Description Group-Page

SWITCH, HEADLAMP; INSTRUMENT PANEL SYSTEMS 8E-13
SWITCH, HIGH PRESSURE CUT-OFF . . 24-42,24-7
SWITCH, HORN 8G-2,8G-4
SWITCH, IGNITION 19-16
SWITCH, KEY-IN IGNITION 8U-2,8U-4
SWITCH, LOW PRESSURE CYCLING CLUTCH 24-18,24-43,24-7
SWITCH, OVERDRIVE OFF . 21-129,21-291,21-435
SWITCH, PARK/NEUTRAL POSITION 21-130, 21-153,21-292,21-315
SWITCH, PASSENGER SIDE AIRBAG ON/OFF 8M-12,8M-3
SWITCH, POWER LOCK 8P-3,8P-5,8P-9
SWITCH, POWER MIRROR 8T-2,8T-3
SWITCH, POWER SEAT 8R-1,8R-2
SWITCH, POWER STEERING PRESSURE . . 14-65
SWITCH, POWER WINDOW 8S-1,8S-3,8S-5
SWITCH, REMOTE RADIO 8F-11,8F-2,8F-6
SWITCH, STOP LAMP 5-2
SWITCH, TURN SIGNAL SWITCH AND HAZARD WARNING 8J-2,8J-5,8J-6
SWITCH VALVE, SOLENOID 21-440
SWITCH, WIPER SWITCH AND WASHER . . 8K-11, 8K-2,8K-6
SWITCHES, CHIME WARNING SYSTEM 8U-5
SWITCHES, PRESSURE 21-438
SWITCHES, SPEED CONTROL 8H-2,8H-5
SWITCH/HIGH PRESSURE CUT-OFF SWITCH, DUAL FUNCTION HIGH PRESSURE 24-18
SWITCH—PCM INPUT, BRAKE 14-34
SWITCH—PCM INPUT, POWER STEERING PRESSURE 14-38
SYMBOLS 8W-5
SYMBOLS, INTERNATIONAL; INTRODUCTION Intro.-3
SYMBOLS, INTERNATIONAL; LUBRICATION AND MAINTENANCE 0-1
SYSTEM, 8W-20 CHARGING 8W-1
SYSTEM, 8W-21 STARTING 8W-1
SYSTEM, 8W-31 TRANSMISSION CONTROL 8W-1
SYSTEM, 8W-39 VEHICLE THEFT SECURITY 8W-1
SYSTEMS, 8W-43 AIRBAG 8W-1
SYSTEM, 8W-47 AUDIO 8W-1
SYSTEM, AIRBAG 8M-1,8M-4,8M-5
SYSTEM AND REMOTE KEYLESS ENTRY SYSTEM, POWER LOCK 8P-4
SYSTEM, ANTILOCK BRAKE 5-40
SYSTEM, AUDIO 8F-1,8F-4
SYSTEM, AUTOMATIC DAY/NIGHT MIRROR 8T-5
SYSTEM, BASE BRAKE 5-1,5-5
SYSTEM, BLEEDING ABS BRAKE 5-43
SYSTEM, BRAKE 5-2
SYSTEM CAPACITIES, COOLING 7-56
SYSTEM CHARGE, REFRIGERANT 24-20
SYSTEM, CHARGING 8C-1,8C-2
SYSTEM, CHIME WARNING 8U-1
SYSTEM, COOLANT RESERVE/ OVERFLOW 7-5
SYSTEM, COOLING 7-15,7-2
SYSTEM, DEFOGGER 8N-2
SYSTEM DIAGNOSIS 8L-3
SYSTEM DIAGNOSIS, EXHAUST 11-3
SYSTEM, EMISSION 25-1
SYSTEM, ENGINE LUBRICATION . . . 9-120,9-205, 9-60
SYSTEM EVACUATE, REFRIGERANT 24-20
SYSTEM, EVAPORATION CONTROL 25-23
SYSTEM, EXHAUST 11-1
SYSTEM FAN, COOLING 7-11
SYSTEM, FUEL 14-66
SYSTEM, FUEL DELIVERY 14-1
SYSTEM, FUEL INJECTION 14-30
SYSTEM, HAZARD WARNING 8J-1
SYSTEM, HEATED MIRROR 8N-1
SYSTEM, HORN 8G-1
SYSTEM, IGNITION 8D-1
SYSTEM, INSTRUMENT PANEL 8E-1
SYSTEM LEAKS, REFRIGERANT 24-19
SYSTEM, LUBRICATION 9-2
SYSTEM, METRIC Intro.-7
SYSTEM, ON-BOARD DIAGNOSTIC TEST FOR CHARGING 8C-3
SYSTEM, OVERHEAD CONSOLE 8V-1
SYSTEM, POWER DISTRIBUTION 8O-1
SYSTEM, POWER LOCK 8P-1
SYSTEM, POWER LOCK SYSTEM AND REMOTE KEYLESS ENTRY 8P-4
SYSTEM, POWER MIRROR 8T-1,8T-2
SYSTEM, POWER SEAT 8R-1,8R-2
SYSTEM, POWER STEERING 19-2
SYSTEM, POWER WINDOW 8S-1,8S-2
SYSTEM PRESSURE, FUEL 14-27
SYSTEM PRESSURE RELEASE PROCEDURE, FUEL 14-11
SYSTEM, REAR WINDOW DEFOGGER 8N-1
SYSTEM, REMOTE KEYLESS ENTRY 8P-1
SYSTEM SERVICE EQUIPMENT, REFRIGERANT 24-20
SYSTEM SERVICE PORTS, REFRIGERANT . . 24-9
SYSTEM, SPEAKER 8F-3
SYSTEM, SPEED CONTROL 8H-1
SYSTEM, STARTING 8B-1,8B-13,8B-3
SYSTEM, STEERING 19-1
SYSTEM SWITCHES, CHIME WARNING 8U-5
SYSTEM TEST—4.7L V-8 ENGINE, PCV VALVE/PCV 25-31
SYSTEM, TIMING DRIVE 9-123
SYSTEM, TURN SIGNAL 8J-1
SYSTEM, VACUUM 24-50
SYSTEM, VEHICLE THEFT SECURITY . . 8Q-1,8Q-4
SYSTEM, WASHER 8K-12,8K-5
SYSTEM, WINDSHIELD WASHER 8K-1
SYSTEM, WINDSHIELD WIPER 8K-1
SYSTEM, WIPER 8K-4
SYSTEM—2.5L ENGINE, CRANKCASE VENTILATION (CCV) 25-29
SYSTEM—3.9/5.2/5.9L ENGINE, POSITIVE CRANKCASE VENTILATION (PCV) 25-26
SYSTEM—4.7L ENGINE, POSITIVE CRANKCASE VENTILATION (PCV) 25-27
SYSTEM—CLEANING/REVERSE FLUSHING, COOLING 7-29
SYSTEM—DEAERATION, COOLING 7-27
SYSTEM—DRAINING AND FILLING, COOLING 7-28
SYSTEM—TESTING FOR LEAKS, COOLING 7-21
SYSTEMS, 8W-30 FUEL/IGNITION 8W-1
SYSTEMS, AUDIO 8F-21
SYSTEMS, LAMP 8L-1,8L-18
SYSTEMS, MONITORED 25-19
SYSTEMS, OVERHEAD CONSOLE 8V-13
SYSTEMS, PASSIVE RESTRAINT 8M-16
SYSTEMS, SEAT 23-8
SYSTEMS, TURN SIGNAL AND HAZARD WARNING 8J-4
TABLE, A/C APPLICATION 24-55
TABLES AND CHARTS—RE TRANSMISSION, DIAGNOSIS 21-136,21-298
TAIL, BRAKE, TURN SIGNAL AND BACK-UP LAMP BULBS 8L-12
TAIL, STOP, TURN SIGNAL AND BACK-UP LAMP 8L-16
TAILGATE 23-47
TAILGATE CHECK CABLE 23-46
TAILGATE LATCH 23-48
TAILGATE LATCH RELEASE HANDLE 23-47
TAILGATE LATCH STRIKER 23-48
TAILPIPE 11-1,11-7
TAKE OUTS 8W-7
TAMPER ALERT 8Q-2
TANK CAPACITY, FUEL 14-27
TANK, COOLANT RESERVE/OVERFLOW 7-30
TANK FILLER TUBE CAP, FUEL 14-24,14-7
TANK, FUEL 14-22,14-4
TANK SKID PLATE—4WD VEHICLES, FUEL 13-9
TAPPETS, HYDRAULIC . . . 9-12,9-217,9-237,9-38, 9-51,9-72,9-92
TASK MANAGER—GASOLINE POWERED ENGINES ONLY 25-16
TEMPERATURE CONTROL CABLE . . . 24-47,24-55
TEMPERATURE SENSOR, AMBIENT . . 8V-13,8V-4, 8V-5
TEMPERATURE SENSOR, BATTERY . . . 8C-2,8C-5
TEMPERATURE SENSOR, TRANSMISSION 21-440
TEMPERATURE SENSOR—2.5L ENGINE, ENGINE COOLANT 14-63
TEMPERATURE SENSOR—2.5L ENGINE, INTAKE MANIFOLD AIR 14-64
TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES, ENGINE COOLANT 14-62
TEMPERATURE SENSOR—3.9/5.2/5.9L ENGINES, INTAKE MANIFOLD AIR 14-64
TEMPERATURE SENSOR—4.7L V-8 ENGINE, ENGINE COOLANT 14-63
TEMPERATURE SENSOR—4.7L V-8 ENGINE, INTAKE MANIFOLD AIR 14-64
TEMPERATURE SENSOR—PCM INPUT, ENGINE COOLANT 14-35
TEMPERATURE SENSOR—PCM INPUT, INTAKE MANIFOLD AIR 14-35
TENSIONER 3.9L/5.9L ENGINES, AUTOMATIC BELT 7-50
TENSIONER, AUTOMATIC BELT 7-8
TENSIONER, PARK BRAKE CABLE 5-29
TENSIONER, TIMING CHAIN 9-64,9-97
TENSIONER—2.5L, ACCESSORY DRIVE BELT 7-50
TENSIONER—4.7L ENGINE, AUTOMATIC BELT 7-51
TENSION—2.5L ENGINE, ACCESSORY DRIVE BELT 7-56
TERMINAL REPLACEMENT 8W-13
TERMINAL REPLACEMENT, CONNECTOR . 8W-12
TERMINAL/CONNECTOR REPAIR-MOLEX CONNECTORS 8W-10
TERMINAL/CONNECTOR REPAIR— THOMAS AND BETTS CONNECTORS 8W-10
TEST, ANALYZING ROAD 21-131,21-293
TEST, CYLINDER COMBUSTION PRESSURE LEAKAGE 9-10,9-129,9-216,9-70
TEST, CYLINDER COMPRESSION PRESSURE 9-128,9-215,9-70,9-9
TEST FOR CHARGING SYSTEM, ON-BOARD DIAGNOSTIC 8C-3
TEST, FUEL INJECTOR 14-11
TEST, FUEL PRESSURE LEAK DOWN 14-8
TEST, FUEL PUMP AMPERAGE 14-9
TEST, FUEL PUMP CAPACITY 14-8
TEST, FUEL PUMP PRESSURE 14-7
TEST, HYDRAULIC PRESSURE . . . 21-132,21-294, 21-443
TEST MODE, CIRCUIT ACTUATION 25-2
TEST MODE, STATE DISPLAY 25-2
TEST, ROAD 8H-4
TEST, TRAC–LOK™ 3-68
TEST, VACUUM SUPPLY 8H-4
TESTING, RADIATOR CAP—PRESSURE 7-26
TESTING, ROAD 21-131,21-293,21-442
TESTING TRANSMISSION CLUTCH AND BAND OPERATION, AIR 21-134,21-296
TESTING TRANSMISSION CLUTCH OPERATION, AIR 21-444
TEST—3.9/5.2/5.9L ENGINE, PCV VALVE . . 25-30
TEST—4.7L V-8 ENGINE, PCV VALVE/PCV SYSTEM 25-31
TESTS, TROUBLESHOOTING 8W-9
TESTS, WATER PUMP 7-13
THEFT SECURITY SYSTEM, 8W-39 VEHICLE 8W-1
THEFT SECURITY SYSTEM, VEHICLE . . 8Q-1,8Q-4
THERMOSTAT 7-26
THERMOSTAT— 4.7L ENGINE 7-43
THERMOSTAT—2.5L ENGINE 7-42
THERMOSTAT—3.9L/5.9L ENGINES 7-39,7-7
THERMOSTAT—4.7L ENGINE 7-7
THREAD REPAIR, ALUMINUM . . . 21-150,21-312, 21-448
THREADED HOLE REPAIR Intro.-7
THREADS, REPAIR DAMAGED OR WORN . 9-135, 9-16,9-221,9-76
THROTTLE BODY 14-42
THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE 14-50,14-51
THROTTLE BODY—2.5L ENGINE 14-53
THROTTLE BODY—3.9/5.2/5.9L ENGINES . 14-52
THROTTLE BODY—4.7L V-8 ENGINE 14-53
THROTTLE CABLE 14-25
THROTTLE CABLE—4.7L V-8 ENGINE 14-27
THROTTLE POSITION SENSOR 21-439
THROTTLE POSITION SENSOR (TPS)—3.9/5.2/5.9L ENGINES 14-54
THROTTLE POSITION SENSOR (TPS)—4.7L V-8 ENGINE 14-54

Description	Group-Page
THROTTLE POSITION SENSOR (TPS)—PCM INPUT	14-39
THROTTLE POSITION SENSOR—2.5L ENGINE	14-55
THROTTLE VALVE CABLE ADJUSTMENT, TRANSMISSION	21-226,21-394
TIE ROD END	19-11
TIMER MODULE, 8W-45 CENTRAL	8W-1
TIMER MODULE, CENTRAL; CHIME/ BUZZER WARNING SYSTEMS	8U-1,8U-3
TIMER MODULE, CENTRAL; INSTRUMENT PANEL SYSTEMS	8E-25,8E-4
TIMER MODULE, CENTRAL; POWER LOCK SYSTEMS	8P-2,8P-6
TIMER MODULE, CENTRAL; VEHICLE THEFT/SECURITY SYSTEMS	8Q-2
TIMER MODULE, CENTRAL; WIPER AND WASHER SYSTEMS	8K-3
TIMING CASE COVER	9-40
TIMING CASE COVER OIL SEAL	9-39
TIMING CHAIN	9-240
TIMING CHAIN AND SPROCKETS	9-166,9-40
TIMING CHAIN AND TENSIONER	9-97
TIMING CHAIN COVER	9-165,9-238,9-96
TIMING CHAIN STRETCH, MEASURING	9-225
TIMING CHAIN STRETCH—MEASURING	9-79
TIMING CHAIN TENSIONER	9-64
TIMING CHAIN—MEASURING WEAR	9-139
TIMING DRIVE SYSTEM	9-123
TIMING, IGNITION	8D-27
TIMING, VALVE	9-17,9-222,9-77
TIMING—VERIFICATION, ENGINE	9-137
TIRE AND WHEEL BALANCE	22-9
TIRE AND WHEEL RUNOUT	22-7
TIRE INFLATION PRESSURES	22-2
TIRE NOISE OR VIBRATION	22-4
TIRE PRESSURE FOR HIGH SPEED	22-3
TIRE REVOLUTION PER MILE	22-6
TIRE WEAR PATTERNS	22-3
TIRE WINCH, SPARE	13-10
TIRE–TEMPORARY, SPARE	22-2
TIRES	22-1
TIRES, CLEANING	22-6
TIRES, RADIAL-PLY	22-2
TIRES, REPLACEMENT	22-3
TONE WHEEL	5-46
TOOL, DRB SCAN	7-13
TOOLS, TROUBLESHOOTING	8W-8
TOP COVER, INSTRUMENT PANEL	8E-30
TORQUE; CLUTCH	6-16
TORQUE; DIFFERENTIAL AND DRIVELINE	3-17,3-30
TORQUE; ENGINE	9-199
TORQUE; TRANSMISSION AND TRANSFER CASE	21-34,21-531,21-561,21-81
TORQUE CHART; BRAKES	5-31,5-39,5-47
TORQUE CHART; CHARGING SYSTEM	8C-6
TORQUE CHART; EMISSION CONTROL SYSTEMS	25-35
TORQUE CHART; FUEL SYSTEM	14-29,14-66
TORQUE CHART; IGNITION SYSTEM	8D-28
TORQUE CHART; SPEED CONTROL SYSTEM	8H-9
TORQUE CHART; STEERING	19-10,19-14,19-19
TORQUE CHART; SUSPENSION	2-12,2-22,2-26
TORQUE CHART; TIRES AND WHEELS	22-11
TORQUE CONVERTER	21-152,21-256,21-314, 21-418,21-453,21-93
TORQUE REFERENCES	Intro.-7
TORQUE SPECIFICATIONS; BODY	23-116
TORQUE SPECIFICATIONS; COOLING SYSTEM	7-56
TORQUE SPECIFICATIONS; ENGINE	9-115
TORQUE SPECIFICATIONS; EXHAUST SYSTEM	11-10
TORQUE SPECIFICATIONS; FRAME AND BUMPERS	13-16
TORSION BAR	2-17
TORSION BARS	2-15
TOUCH-UP, PAINTED SURFACE	23-2
TOW, 8W-54 TRAILER	8W-1
TOWER, SHIFT	21-42,21-5
TOWING AND HOISTING, JUMP STARTING	0-10
TOWING, FOUR-WHEEL-DRIVE VEHICLE	0-12
TOWING RECOMMENDATIONS	0-11
TOWING, TWO WHEEL DRIVE VEHICLE	0-12
(TPS)—3.9/5.2/5.9L ENGINES, THROTTLE POSITION SENSOR	14-54
(TPS)—4.7L V-8 ENGINE, THROTTLE POSITION SENSOR	14-54
(TPS)—PCM INPUT, THROTTLE POSITION SENSOR	14-39
TRACK, BENCH SEAT	23-9
TRACK, BUCKET SEAT	23-11
TRAC-LOK™	3-92
TRAC-LOK™ DIFFERENTIAL, 8 1/4	3-82
TRAC-LOK™ DIFFERENTIAL, 9 1/4	3-87
TRAC-LOK™ OPERATION	3-64
TRAC–LOK™ DIFFERENTIAL NOISE	3-68
TRAC–LOK™ TEST	3-68
TRAILER HITCH	13-10
TRAILER TOW, 8W-54	8W-1
TRANSFER CASE	21-508,21-535
TRANSFER CASE, NV231	21-506,21-511,21-527
TRANSFER CASE, NV242	21-533,21-538,21-558
TRANSFER CASE SHIFTER	21-509,21-535
TRANSFER CASE SKID PLATE	13-9
TRANSMISSION	21-150,21-178,21-223,21-242, 21-312,21-341,21-391,21-4,21-44,21-450,21-455, 21-480,21-502,21-7
TRANSMISSION, 42RE AUTOMATIC	21-84,21-85
TRANSMISSION, 45RFE	21-502
TRANSMISSION, 45RFE AUTOMATIC	21-416, 21-417
TRANSMISSION, 46RE	21-248
TRANSMISSION, 46RE AUTOMATIC	21-247
TRANSMISSION CLUTCH AND BAND OPERATION, AIR TESTING	21-134,21-296
TRANSMISSION CLUTCH OPERATION, AIR TESTING	21-444
TRANSMISSION COMPONENTS	21-32,21-78
TRANSMISSION CONTROL MODULE	21-435
TRANSMISSION CONTROL RELAY	21-438
TRANSMISSION CONTROL SYSTEM, 8W-31	8W-1
TRANSMISSION DIAGNOSIS, AUTOMATIC	21-129,21-291
TRANSMISSION, DIAGNOSIS TABLES AND CHARTS—RE	21-136,21-298
TRANSMISSION FILL PROCEDURE	21-148, 21-310,21-446
TRANSMISSION GENERAL DIAGNOSIS, 45RFE AUTOMATIC	21-441
TRANSMISSION NOISE	21-4,21-40
TRANSMISSION, NV1500 MANUAL	21-1,21-34
TRANSMISSION, NV3500 MANUAL	21-36,21-81
TRANSMISSION OIL COOLER LINES	7-44
TRANSMISSION OIL COOLERS, AUTOMATIC	7-8
TRANSMISSION QUICK LEARN PROCEDURE	21-447
TRANSMISSION RANGE SENSOR	21-439
TRANSMISSION, RE	21-410,21-412
TRANSMISSION TEMPERATURE SENSOR	21-440
TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT	21-226,21-394
TRANSMISSION—2WD	21-40
TRANSMISSION—4WD	21-41
TRANSMISSIONS, RE	21-243
TRANSMITTER BATTERY REPLACEMENT, REMOTE KEYLESS ENTRY	8P-8
TRANSMITTER PROGRAMMING, REMOTE KEYLESS ENTRY	8P-9
TRANSMITTER, REMOTE KEYLESS ENTRY	8P-3,8P-8
TRAY, BATTERY	8A-20,8A-4
TREAD WEAR INDICATORS	22-3
TRIM, A-PILLAR	23-50
TRIM, B-PILLAR	23-50
TRIM COVER, COWL	23-49
TRIM COVER, DOOR SILL	23-50
TRIM COVER, DRIVER SIDE AIRBAG MODULE	8M-8
TRIM PANEL, FRONT DOOR	23-29
TRIM PANEL, QUARTER	23-51
TRIM PANEL, REAR DOOR	23-37
TRIM PANELS, INTERIOR	23-18
TRIM, REAR CAB BACK PANEL	23-51
TRIP DEFINITION	25-21
TROUBLE CODE DESCRIPTIONS, DIAGNOSTIC	25-3
TROUBLE CODES, DIAGNOSTIC	25-2
TROUBLESHOOTING TESTS	8W-9
TROUBLESHOOTING TOOLS	8W-8
TROUBLESHOOTING WIRING PROBLEMS	8W-9
TUBE CAP, FUEL TANK FILLER	14-24,14-7
TUBE, FIXED ORIFICE	24-35,24-5
TUBE FLARING, BRAKE	5-12
TUBES, FLUSHING COOLERS	21-149,21-311, 21-447
TUBES/LINES/HOSES AND CLAMPS, FUEL	14-7
TURN SIGNAL AND BACK-UP LAMP BULBS, TAIL, BRAKE	8L-12
TURN SIGNAL AND BACK-UP LAMP, TAIL, STOP	8L-16
TURN SIGNAL AND HAZARD WARNING SYSTEMS	8J-4
TURN SIGNAL AND SIDE MARKER LAMP, PARK	8L-14
TURN SIGNAL CANCELLING CAM	8J-2
TURN SIGNAL LAMP BULBS, PARK	8L-12
TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH	8J-2,8J-5,8J-6
TURN SIGNAL SYSTEM	8J-1
TURN SIGNALS, 8W-52	8W-1
TURNS, NOISE AND/OR VIBRATION IN	3-20
TWO WHEEL DRIVE VEHICLE TOWING	0-12
UNBALANCE	3-6
UNDERHOOD LAMP	8L-16
UNDERHOOD LAMP BULB	8L-13
UNIT, ENGINE OIL PRESSURE SENDING	9-188
UNIT, FUEL GAUGE SENDING	14-10,14-16,14-3
UNIT, HYDRAULIC CONTROL	5-41
UNIT, OVERDRIVE	21-157,21-206,21-226, 21-319,21-372,21-394
UNIVERSAL JOINT, SINGLE CARDAN	3-11
UNLOCK RELAY, DRIVER	8P-10,8P-4
UP/DOWN, FRONT DOOR	23-61
UPPER BALL JOINT	2-15,2-8
UPPER INERTIA LATCH COVER, CENTER ARMREST	23-13
UPPER SUSPENSION ARM	2-10,2-19
USAGE, FASTENER	Intro.-7
USAGE, INSTALLATION METHODS AND PARTS	6-5
V-6 ENGINE, CRANKSHAFT POSITION SENSOR—3.9L	8D-4
V-6 ENGINE, ENGINE FIRING ORDER—3.9L	8D-27
V-8 ENGINE, CRANKSHAFT POSITION SENSOR—4.7L	8D-17
V-8 ENGINE, CRANKSHAFT POSITION SENSOR—5.2/5.9L	8D-4
V-8 ENGINE, ENGINE COOLANT TEMPERATURE SENSOR—4.7L	14-63
V-8 ENGINE, ENGINE FIRING ORDER—4.7L	8D-27
V-8 ENGINE, IGNITION COIL RESISTANCE—4.7L	8D-28
V-8 ENGINE, INTAKE MANIFOLD AIR TEMPERATURE SENSOR—4.7L	14-64
V-8 ENGINE, PCV VALVE—4.7L	25-32
V-8 ENGINE, PCV VALVE/PCV SYSTEM TEST—4.7L	25-31
V-8 ENGINE, SERVO CABLE—4.7L	8H-6
V-8 ENGINE, THROTTLE BODY—4.7L	14-53
V-8 ENGINE, THROTTLE CABLE—4.7L	14-27
V-8 ENGINE, THROTTLE POSITION SENSOR (TPS)—4.7L	14-54
V-8 ENGINES, ENGINE FIRING ORDER—5.2L/5.9L	8D-27
VACUUM ACTUATOR, MODE DOOR	24-44
VACUUM CHECK VALVE	24-48,24-9
VACUUM RESERVOIR; HEATING AND AIR CONDITIONING	24-48,24-9
VACUUM RESERVOIR; SPEED CONTROL SYSTEM	8H-3,8H-8
VACUUM SCHEMATICS	25-32
VACUUM SUPPLY TEST	8H-4
VACUUM SYSTEM	24-50
VALANCE PANEL	13-3
VALUE, LOAD	25-22
VALVE BODY	21-155,21-160,21-222,21-229, 21-261,21-317,21-322,21-388,21-396,21-424, 21-449,21-464,21-479,21-98
VALVE CABLE ADJUSTMENT, TRANSMISSION THROTTLE	21-226,21-394
VALVE, COMBINATION	5-14,5-3,5-9
VALVE, CONVERTER DRAINBACK	21-125,21-287
VALVE, GUIDE AND SEAL	9-17
VALVE GUIDES	9-123

Description	Group-Page

VALVE, HIGH PRESSURE RELIEF 24-7
VALVE, RWAL 5-34,5-38
VALVE SERVICE 9-136,9-223
VALVE SERVICE, CONVERTER DRAINBACK CHECK 21-148,21-310
VALVE, SOLENOID SWITCH 21-440
VALVE SPRING 9-123
VALVE SPRING AND SEAL 9-35
VALVE SPRING AND STEM SEAL REPLACEMENT-IN VEHICLE 9-236
VALVE SPRINGS AND SEALS 9-163
VALVE SPRINGS, VALVES 9-209,9-237,9-64
VALVE SPRINGS—CYLINDER HEAD REMOVED, VALVES 9-91
VALVE STEM SEAL 9-123
VALVE TEST—3.9/5.2/5.9L ENGINE, PCV . . 25-30
VALVE TIMING 9-17,9-222,9-77
VALVE, VACUUM CHECK 24-48,24-9
VALVE—4.7L V-8 ENGINE, PCV 25-32
VALVE/PCV SYSTEM TEST—4.7L V-8 ENGINE, PCV 25-31
VALVES 9-123
VALVES AND VALVE SPRINGS . 9-209,9-237,9-64
VALVES AND VALVE SPRINGS— CYLINDER HEAD REMOVED 9-91
VALVES, GUIDES AND SPRINGS 9-77
VALVE(S), ROLLOVER 25-24,25-34
VARIATION ADJUSTMENT, COMPASS 8V-6
VEHICLE, CAMSHAFTS—IN 9-173
VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL 25-29
VEHICLE IDENTIFICATION NUMBER (VIN) PLATE Intro.-1
VEHICLE INSPECTION 3-20
VEHICLE, OIL PAN 4X2 9-180
VEHICLE, OIL PAN 4X4 9-182
VEHICLE PREPARATION FOR HEADLAMP ALIGNMENT 8L-7
VEHICLE SERVICE, CYLINDER HEAD COMPONENTS—IN 9-89
VEHICLE SPEED AND DISTANCE—PCM INPUT 14-40
VEHICLE SPEED CONTROL, 8W-33 . . . . 8W-1
VEHICLE SPEED INPUT 8H-3
VEHICLE THEFT SECURITY SYSTEM . . 8Q-1,8Q-4
VEHICLE THEFT SECURITY SYSTEM, 8W-39 . . . . 8W-1
VEHICLE TOWING, FOUR-WHEEL-DRIVE . . . 0-12
VEHICLE TOWING, TWO WHEEL DRIVE 0-12
VEHICLE, VALVE SPRING AND STEM SEAL REPLACEMENT-IN 9-236
VENT GLASS, BACKLITE SLIDING 23-52
VENT WINDOW, QUARTER 23-43
VENT WINDOW WEATHERSTRIP, QUARTER 23-44
VENTILATION (CCV) SYSTEM—2.5L ENGINE, CRANKCASE 25-29
VENTILATION (PCV) SYSTEM—3.9/5.2/ 5.9L ENGINE, POSITIVE CRANKCASE 25-26
VENTILATION (PCV) SYSTEM—4.7L ENGINE, POSITIVE CRANKCASE 25-27
VIBRATION 3-35,3-5,3-68
VIBRATION AT HIGHWAY SPEEDS 3-20
VIBRATION DAMPER 9-238,9-39,9-95
VIBRATION DURING ACCELERATION, SHUDDER OR 3-20
VIBRATION IN TURNS, NOISE AND/OR 3-20
VIBRATION, TIRE NOISE OR 22-4
VIEW MIRROR, SIDE 23-28
VIN REPROGRAMMING, PCM 14-1
VISCOUS FAN DRIVE 7-11,7-53
VISCOUS FAN DRIVE—3.9L/4.7L AND 5.9L ENGINES 7-23
VISUAL INSPECTION—2.5L ENGINE 14-46
VISUAL INSPECTION—3.9/5.2/5.9L ENGINES 14-42
V–8 ENGINE, FUEL INJECTOR RAIL—4.7L 14-20
V–8 ENGINE, IDLE AIR CONTROL (IAC) MOTOR—4.7L 14-56
V–8 ENGINE, MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—4.7L 14-58
VOLT SENSOR SUPPLIES—PRIMARY AND SECONDARY, FIVE 14-35
VOLTAGE REGULATOR, ELECTRONIC 8C-2
VOLTAGE—PCM INPUT, BATTERY 14-34
VOLUME CHECK, OIL PUMP 21-149,21-311, 21-447
WARNING LAMP, ABS 5-43
WARNING LAMP, RED BRAKE 5-3,5-8
WARNING LAMPS, BRAKE 5-35
WARNING SWITCH, TURN SIGNAL SWITCH AND HAZARD 8J-2,8J-5,8J-6
WARNING SYSTEM, CHIME 8U-1
WARNING SYSTEM, HAZARD 8J-1
WARNING SYSTEM SWITCHES, CHIME 8U-5
WARNING SYSTEMS, TURN SIGNAL AND HAZARD 8J-4
WARNINGS & CAUTIONS, SERVICE 5-2
WARNINGS AND PRECAUTIONS, SERVICE 24-22
WARNINGS, NOTES, CAUTIONS 8W-7
WASHER FLUID LEVEL SENSOR 8K-4
WASHER NOZZLE AND PLUMBING 8K-4
WASHER PUMP 8K-4
WASHER RESERVOIR 8K-4
WASHER SWITCH, WIPER SWITCH . 8K-11,8K-2, 8K-6
WASHER SYSTEM 8K-12,8K-5
WASHER SYSTEM, WINDSHIELD 8K-1
WATER LEAKS 23-18
WATER PUMP 7-55,7-6
WATER PUMP 4.7L ENGINES 7-35
WATER PUMP BYPASS HOSE—3.9/5.9L ENGINES 7-37
WATER PUMP BYPASS—3.9/5.9L ENGINES 7-6
WATER PUMP BYPASS—4.7L 7-6
WATER PUMP TESTS 7-13
WATER PUMP—2.5L ENGINE 7-30
WATER PUMP—3.9L/5.9L ENGINES 7-32
WATERDAM, FRONT DOOR 23-30
WATERDAM, REAR DOOR 23-38
WEAR INDICATORS, TREAD 22-3
WEAR PATTERNS, TIRE 22-3
WEAR, TIMING CHAIN—MEASURING 9-139
WEATHERSTRIP AND RETAINER, ROOF RAIL 23-43
WEATHERSTRIP, FRONT DOOR GLASS RUN 23-36
WEATHERSTRIP, FRONT DOOR INNER BELT 23-34
WEATHERSTRIP, FRONT DOOR OUTER BELT 23-34
WEATHERSTRIP, QUARTER VENT WINDOW 23-44
WEATHERSTRIP, REAR DOOR GLASS RUN 23-40
WEATHERSTRIP, REAR DOOR INNER BELT 23-40
WEATHERSTRIP, REAR DOOR OPENING . . . 23-41
WEATHERSTRIP, REAR DOOR OUTER BELT 23-41
WELD LOCATIONS 23-62
WHEEL 22-7
WHEEL ALIGNMENT 2-1,2-4
WHEEL ANTILOCK BRAKE BLEEDING, REAR 5-37
WHEEL ANTI-LOCK BRAKES, 8W-34 REAR 8W-1
WHEEL ANTILOCK BRAKES, CONTROLLER REAR 5-33
WHEEL ANTILOCK BRAKES, FOUR 5-40
WHEEL ANTILOCK BRAKES, REAR 5-32
WHEEL ANTILOCK, REAR 5-32,5-36
WHEEL BALANCE, TIRE 22-9
WHEEL CYLINDER 5-21,5-25,5-28
WHEEL DRIVE VEHICLE TOWING, TWO 0-12
WHEEL INSPECTION 22-7
WHEEL INSTALLATION 22-8
WHEEL MOUNTING STUDS 2-12,2-21
WHEEL OPENING MOLDING 23-45
WHEEL RUNOUT, TIRE 22-7
WHEEL SPEED SENSOR 5-42
WHEEL SPEED SENSOR - 4X2, FRONT 5-45
WHEEL SPEED SENSOR - 4X4, FRONT 5-46
WHEEL SPEED SENSOR AND EXCITER RING, REAR 5-34
WHEEL SPEED SENSOR, REAR 5-38,5-47
WHEEL, TONE 5-46
WHEELHOUSE LINER, FRONT 23-24
WHEELS 22-7
WINCH, SPARE TIRE 13-10
WIND NOISE 23-19
WINDOW DEFOGGER SYSTEM, REAR 8N-1
WINDOW MOTOR, POWER 8S-2,8S-4,8S-6
WINDOW, QUARTER VENT 23-43
WINDOW REGULATOR, FRONT DOOR 23-35
WINDOW REGULATOR, REAR DOOR 23-42
WINDOW SWITCH, POWER 8S-1,8S-3,8S-5
WINDOW SYSTEM, POWER 8S-1,8S-2
WINDOW WEATHERSTRIP, QUARTER VENT 23-44
WINDOWS, 8W-60 POWER 8W-1
WINDSHIELD 23-4
WINDSHIELD SAFETY PRECAUTIONS 23-4
WINDSHIELD WASHER SYSTEM 8K-1
WINDSHIELD WIPER SYSTEM 8K-1
WIPE RELAY, INTERMITTENT . . . 8K-11,8K-3,8K-7
WIPER ARM 8K-8
WIPER ARM AND BLADE 8K-2
WIPER BLADE 8K-8
WIPER LINKAGE AND PIVOT 8K-2,8K-9
WIPER MOTOR 8K-2,8K-9
WIPER SWITCH AND WASHER SWITCH . . 8K-11, 8K-2,8K-6
WIPER SYSTEM 8K-4
WIPER SYSTEM, WINDSHIELD 8K-1
WIPERS, 8W-53 . . . . 8W-1
WIRING PROBLEMS, TROUBLESHOOTING 8W-9
WIRING REPAIR 8W-10
WIRING/TERMINAL 8W-15
WORN THREADS, REPAIR DAMAGED OR . 9-135, 9-16,9-221,9-76
YOKE BUSHING, REAR HOUSING 21-43
YOKE SEAL REPLACEMENT 21-152,21-315
YOKE SEAL—2WD 21-43